UN–HABITAT City Prosperity Index
A Comparison of 29 World Cities

CITY PROSPERITY INITIATIVE (CPI)
2022

Methodology and Results of a Comparative Analysis of Cities

26.01.2022

CITY PROSPERITY INITIATIVE

This document is issued without formal editing and should not be interpreted as final; a final full version of the report will be published on March 31, 2022.

February, 2022

UN-HABITAT
FOR A BETTER URBAN FUTURE

CentroEure
Estudios Territoriales y Políticas Públicas

DISCLAIMER

For the purposes of public disclosure and analysis of the position of each city in the general ranking, as well as in each dimension and sub-dimension rankings, the following have to be taken into consideration:

There are no perfect city rankings. All present limitations. It is not only the absence of data in some cities, but also the sources of the data, the methodologies used in cities to make the measurements and even the scales and location of cities in the regions of the planet.

For this reason, UN-Habitat has proposed to the UN Statistical Commission the adoption of a Global Urban Monitoring Framework to homologate urban statistics, methodologies of data collection and analysis, and to ensure a high degree of comparability of results across cities from different countries and regions. It is expected that the Statistical Commission will endorse this framework in the forthcoming meeting early in 2022.

Due to the above, it is suggested that, for the purposes of public dissemination and analysis of the ranking, the conditions of the information for each indicator and for each dimension of prosperity be taken into account. There are limitations regarding data coverage, temporal and geographic scope and, in some cases, accuracy of the measurements at the source; creating distortions of the results. Hence, relative positions of the cities within the dimensions may vary.

CONTENTS

1. CITY PROSPERITY INDEX

As a tool to measure sustainable urban development using a unique and holistic view, the City Prosperity Initiative (CPI) articulates the different components that are fundamental for a city to be more prosperous and the different levels of information that are useful to improve the process of decision making.

This section presents how the CPI is structured, and how the methodology of measurement reflects UN-Habitat's vision of urban prosperity. This section also shows the Index' flexibility and comprehensiveness features, showcasing the CPI as a multipurpose, multilevel and multiscale decision-making tool, which contains the distinctive uniqueness of integrating the spatial dimensions of a city.

1.1 The City Prosperity Index

The City Prosperity Index was developed after UN-Habitat conducted surveys in 54 cities from the developing world, in order to conceptualize prosperity and identify its most critical components. Prosperity, in this sense, is identified with success, wealth, thriving conditions, well-being as well as confidence in the future and opportunities for all. Additionally, some key contributions about the elements and/or manifestations of a prosperous city[1] were included in the survey to develop the six dimensions of the City Prosperity Index which are conceptualized as follows:

Productivity (P) – a prosperous city contributes to economic growth and development, generating income, employment and equal opportunities that further provide adequate living standards for the entire population.

Infrastructure Development (ID) – a prosperous city deploys the infrastructure, physical assets, and amenities – adequate water, sanitation, power supply, road network, information and communications technology, etc. – required to sustain both the population and the economy and provide better quality of life.

Quality of Life (QOL) – prosperous cities provide amenities such as social services, education, health, recreation, safety, and security required for improved living standards, enabling the population to maximize individual potential and to lead fulfilling lives.

Equity and Social Inclusion (ESI) – a city is only prosperous to the extent that poverty and inequalities are minimal. No city can claim to be prosperous when large segments of the population live in abject poverty and deprivation. This involves reducing the incidence of slums and new forms of poverty and marginalization.

[1] Some key contributions have been published in the Journal of Human Development and Capabilities or presented at the annual meetings of the Human Development and Capabilities Association. See, for example, Anand and Sen (2000), Chatterjee (2005), Foster, López-Calva and Székely (2005), Gaertner and Xu (2006), and Klasen, Nguefack, and Zucchini.

Environmental Sustainability (ES) – the growth of cities and their economic development do not destroy or degrade the environment; instead, the city's natural assets are preserved for the sake of sustainable urbanization.

Urban Governance and Legislation (UGL) – Cities are best able to combine sustainability and shared prosperity through effective urban governance and transformational leadership, deploying appropriate and effective policies, laws and regulations, and creating adequate institutional frameworks with strong local institutions and sound institutional arrangements.

Source: UN-Habitat 2019.

Furthermore, balanced and shared development is a crucial feature of prosperity. None of the previous manifestations of prosperity should prevail over the others and all must be kept in balance, for the sake of a «*journey*» without setbacks on the road to prosperity. The World Urban Forum 6 "Prosperity of Cities: Balancing Ecology, Economy and Equity" endorsed the idea that all of these components describing city prosperity forms, are interlinked.[2]

Similarly, the transformative commitments for sustainable urban development in the New Urban Agenda are structured around the elements of prosperity (governance, social inclusion, spatial development, environmental sustainability, etc.). Since sustainable urban development and the prosperity of a city depend on these elements and they are interconnected and interdependent, progress or stagnation in one dimension can affect others. Therefore, cities should aim to advance in all manifestations of prosperity perceiving them as equally important, given that imbalance in any of these dimensions can threaten the system as a whole.

The multiple challenges that urban areas face (social, economic, environmental, demographic and climatic), are closely interconnected. Therefore, sustainable urban development requires a comprehensive approach, which combines city design with economic development promotion practices, social inclusion and environmental protection. Additionally, the Report of the Sustainable Development Solutions Network that supports the Sustainable Development Goals indicates that "data and metrics are essential for development goals to be met".[3] They enable cities to make decisions regarding the best policies to adopt and assist in tracking changes, while systematically documenting their performance at the outcome level. This is fundamental towards achieving higher levels of urban prosperity and sustainable urban development for all.

[2] UN-Habitat (2013).
[3] SDSN (2015).

1.2 Comparative Advantages of the CPI as a City Monitoring Framework

The use of the CPI as a tool for measuring urban development features four comparative advantages over other indexes: its flexibility of contextualization and global comparability, its comprehensive perspective, the inclusion of the spatial dimension and its capacity to be a multilevel and multiscale decision-making tool. By implementing the CPI, governments and citizens benefit from a tool composed by the characteristics described in the following sections.

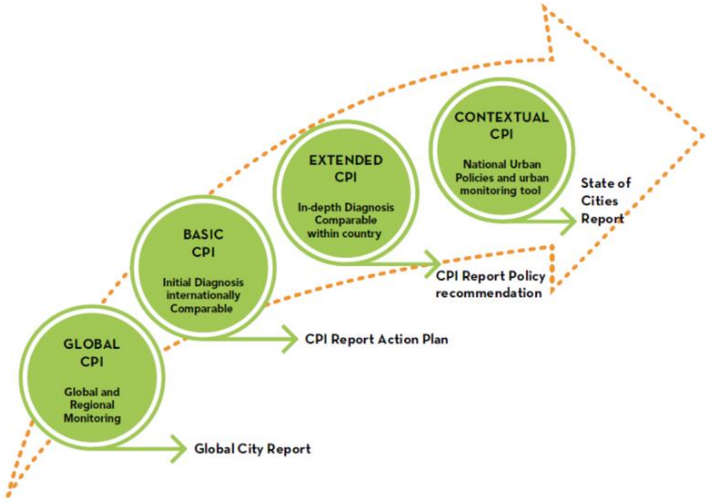
A global comparable platform that allows for local adaptation

The CPI was not designed as a rigid blueprint, but rather as a living framework; one that intentionally leaves room for cities to respond to contextual needs and move creatively according to their challenges and opportunities, while promoting a new universal urbanization model (cities that are compact, integrated, connected, resilient and sustainable), as indicated in the global urban development agendas.

The CPI is adaptable to different city and country circumstances according to diverse urbanization challenges and opportunities, simultaneously serving as a measurement tool which allows for the comparison of cities around the world. Local specificity allows for an in-depth analysis of contextualized circumstances, while the international comparability broadens the policy dialogue to global good practices. The global comparability provides wider knowledge, allowing for statistical analyses on how cities of different sizes or levels of development improve the quality of life of its inhabitants, gaining critical insights into which programs and policies function properly and the possible impacts these actions may have.

For this purpose, the CPI has been designed as an incremental tool. At the global or basic levels of the index, it offers regional and/or international comparison, while offering a more in-depth analysis at both the extended and contextual levels, providing the possibility to integrate local aspects of the city. This incremental approach (FIGURE 1) allows for the understanding and measuring of city comparative advantages, as well as local policies and actions which the CPI is intended to assess, while maintaining a global relevance.

FIGURE 1: The Incremental Approach of the CPI



Source: UN-Habitat 2019.

The implementation of the 29 global cities comparison, as described in this report, uses the basic the extended, and contextual levels of the City Prosperity Index.

The Basic City Prosperity Index. This index is useful for cities that want to compare their level of development and overall performance with regards to prosperity ratings, with other cities in the regional and global arena. The Basic City Prosperity Index uses a set of commonly available indicators that exist amongst all cities, acting as a platform for regional/global benchmarking and for comparison purposes.

The Extended City Prosperity Index. This index is a more advanced version of the basic model. Its main function is the integration of more indicators that are not commonly available in all cities, hence comparability is not its primary objective. The availability of local information and the particular characteristics of the city determine the profusion of the indicators to use. Most of the indicators are strictly urban in nature and various have a spatial component, such as the use of public space, the economic agglomeration index and the urban form index. The Extended Index allows for a more detailed political and technical dialogue that is essential for the development of more informed public policies. This version of the index allows to document performance of the cities at the outcome level.

The Contextual City Prosperity Index. This index is an enhancement of the extended CPI model and represents the most advanced and matured stage of the process. In addition to the basic and extended indicators, a certain number of variables are integrated, including indicators that are derived from the policies and actions recently or currently implemented in the city. From this perspective, the Contextual Index plays a role as a performance measurement. Its primary functions is to monitor local initiatives and projects that are needed to implement the city's vision in order to achieve shared prosperity and sustainable development.

Source: UN-Habitat 2019.

A framework that promotes policy integration

When deploying efforts towards the improvement of economic productivity or providing infrastructure, some cities may further exacerbate inequalities or negatively impact environmental conditions. The CPI analyses these interactions and measures inter-sectoral relationships, attempting to reinforce them. The holistic vision of prosperity promoted by the CPI is reflected on the integration of diverse indicators to the index, representing the environmental, social and economic objectives of sustainability, further providing an integral approach for the implementation of a more sustainable urbanization model. This integration looks at the mutually reinforcing aspects of the different components of the urbanization process.

The integrated framework provided by the CPI allows for analysis of the impact of specific policies on urban prosperity as a whole. The interrelation of policies and actions is well-captured by the CPI, providing strong statistical information to measure impacts and results and inferring likelihoods of possible development outcomes.

Integrating spatial analysis as part of a strategy to leave no one behind

The form, planning and structure of the city may conspire against its own prosperity or cooperate to boost it. Good connectivity, adequate provision of public transport, strong economies of agglomeration, efficient land use and the efficient provision of public space can affect city growth and development. Concerned by the need to produce accurate, reliable, timely and disaggregated data, UN-Habitat included spatial indicators and analysis in the different dimensions of prosperity. Spatially disaggregated data provides relevant information for policy makers to decide on local-level allocation of resources and monitoring of equitable outcomes across and within cities and human settlements. Geospatial information combined with socio-economic indicators addresses the challenge of 'invisibility' and 'inequality' of the most underrepresented groups and urban areas. The use of spatial indicators is also based on the idea that form can become an important vector for city growth and development.

Furthermore, the spatial component of the CPI incorporates geographic information in a way that allows the understanding of the city and its urban form. Each one of the dimensions of the CPI includes spatial indicators. For example, the dimension of Productivity measures economic density, while the dimension of Urban Governance and Legislation considers land use efficiency.

If we consider the six dimensions of the CPI framework as six spokes on a wheel, we can additionally understand their meanings and outcomes through their relationship to the hub. The hub of the wheel encompasses the systems that infiltrate and impact all six spokes, namely urban planning and design. Considered in this way, approaching policy for the city through an understanding of its physical design can improve the degree of impact on each spoke of the wheel, reinforcing the development of spatial capital.

Measuring the City Prosperity Index

For the computation of the City Prosperity Index, UN-Habitat has developed the metadata and parameters for assessing the values for each indicator.[4] But amongst the most important methodological aspects of this innovative approach are the definitions for urban boundaries, needed for the calculation of spatially related indicators.

Defining Urban Boundaries

The measurement of spatial indicators requires boundaries, which are not easily defined due to the uniqueness of the urban form, the fragmented and interstitial of the urban development, the blur of the urban-rural transition areas and the 'metastases´ of urban development. All of these, generate different patterns and conditions of urban growth.

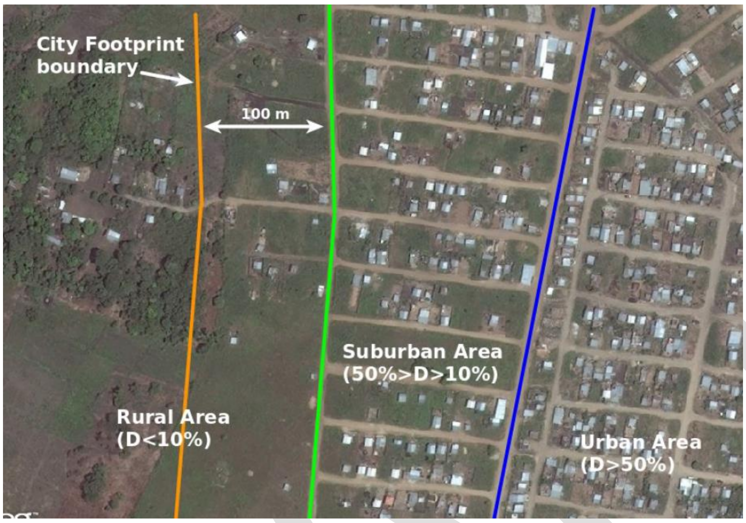
The lack of a standard international definition or delimitation of an urban area, or geospatial data that uses different geographic definitions, are among the many challenges for measuring spatial indicators.[5] Recently, the Degree of Urbanization (DEGURBA) approach was endorsed by the UN-Statistical Commission (51st Session, 2020) as the harmonized approach for city and rural areas definition for global comparisons. However, for the purposes of this document, the methodology for defining urban limits relies on the previous methodology (WCR, 2020) since there are no studies for all the selected cities that allow for the degree of urbanization to be measured.

The core of the urban form analysis for the City Prosperity Index is the built-up area of the continuous urban agglomeration. The built-up area comprises the city centre and the suburbs, forming a continuous settlement. In many cases, the metropolitan areas or administrative boundaries are larger than the built-up settlements and therefore comprise rural parts with very low densities; while in other cases, the administrative boundaries are smaller than the actual urban agglomerations.[6] Both cases create distortions in the measurements that may hinder their comparability. UN-Habitat defines the 'built-up area' of a city as the contiguous area occupied by buildings and other impervious surfaces, including the vacant areas in and around them but excluding rural areas beyond the urban fringe.

[4] UN-Habitat (2019).
[5] IEAG (2014).
[6] UN-Habitat (2004).

The delimitation of the built-up areas distinguishes urban, suburban, and rural areas based on the built-up densities. According to this definition, the concept of 'urban' is considered as the area with more than 50 per cent built-up density (or plot coverage); suburban is defined as areas that have plot coverage between 50 and 10 per cent; and rural areas have less than 10 per cent of built-up density (FIGURE 2).

FIGURE 2: Built-up Area Categories (urban, suburban and rural areas) and City Footprint Boundary



Source: Shlomo, Parent & Civco (2005).

- **Rivers:** urban and suburban areas separated from the main urban area by a river must be considered contiguous.
- **Subdivided land** count as suburban area regardless of its built-up density. Therefore, urban and suburban built-up areas separated from the main urban area by unbuilt subdivided land are considered contiguous.

1.3 Computation of the Index

The CPI, as an aggregate measurement of the six dimensions, underscores the fact that urban prosperity, well-being, and human development are greater than mere economic growth and are multidimensional concepts in nature that can be measured more accurately using a composite index[7].

The index structure involves the following steps: i) indicator standardization/ normalization using globally established reference values or standards; ii) construction of a nested weighting scheme; and iii) aggregation of the composite index.

[7] The detailed methodology for the standardization of each indicator can be found at UN-Habitat (2019).

After the indicators have been standardized on a scale from 0 to 100, 100 being the maximum value, as it is a common practice in building multidimensional indices,[8] the CPI follows a nested weighting scheme with the following principles: i) dimensions have equal weight in the index; ii) sub-dimensions have equal weight within dimensions; and iii) variables have equal weight within sub-dimensions.

This weighting scheme clearly reveals the systemic conception of prosperity, in which balanced and shared development is a crucial feature. All the variables in the index are interconnected; for example, bad performance in Environmental Sustainability will have an impact on health indicators; or bad performance in Governance may have an impact on Equity and Social Inclusion. These interconnections between variables imply that a change in a variable will generate direct and indirect effects on the other variables; thereby, creating a multiplier effect that changes depending on how critical the impacted variable is.

[8] Alkire & Foster (2011); Alkire & Santos (2010); United Nations Development Program 1990-2013.

2. METHODOLOGY FOR COMPARATIVE ANALYSIS OF CITIES

2.1. Criteria for the selection of cities

The estimation of the Index for 29 cities and the comparison across dimensions and sub-dimensions enable local authorities, stakeholders, and citizens to identify challenges and opportunities for moving towards the prosperity path. It also provides information on how to improve ratings and measurements for each dimension, helping define targets and goals that can support the formulation of evidence-based policies, including the definition of cities' long-term visions and plans that are both ambitious, as well as measurable.

The criteria for the selection of cities are the following:

- To be a global city.
- To represent different world regions and cultures.
- To have different expected levels of prosperity.
- To have regional or global influence.

Additionally, it was considered the availability of information for all (or most of the) 46 indicators.

From a bulk of world cities, the selection aimed at maintaining an acceptable degree of equilibrium across world regions, and across expected levels of prosperity. Finally, the availability and reliability of information was key to decide on the viability of including a city or not.

The 29 selected cities represent all continents and a diversity of social, economic, cultural and urban realities. Consequently, the comparison portraits their differences, as well as their similarities, despite their levels of prosperity or locations in the world.

2.2. List of cities

The cities that are included in the comparison are the following:

Bangkok, Beijing, Bogota, Buenos Aires, Dar Es Salaam, Delhi, Ho Chi Minh, Hong Kong, Jakarta, Lagos, Lima, London, Madrid, Mexico City, Moscow, Nairobi, New York City, Osaka, Paris, Riyadh, Santiago, Sao Paulo, Seoul, Shanghai, Singapore, Sydney, Tokyo, Toronto, and Wuhan.

MAP 1. Selected World Cities for Comparative Index

Source: Centro EURE, 2022.

2.3. Methodology for constructing the updated comparative index

The construction of an up-to-date contextual urban prosperity index for 29 global cities that allows for comparisons with each other, was carried out following the UN-Habitat methodology for the CPI and structured in its six dimensions. Each of them is correspondingly divided in sub-dimensions, under which are a set of indicators that allow the calculation of the index.

For the purposes of comparative analysis between global cities, in addition of the CPI indicators, new ones were defined in order to cover topics that were not considered before, but that help providing a wider reality of the world cities. Once the topics/subjects for measurement were determined, it was necessary to identify the indicators for each topic, and reliable data sources for them.

The final list of indicators was made up of two types: those of UN Habitat CPI -basic, extended, and contextual- and the specific ones designed to measure relevant topics and phenomena in the set of the selected global cities.

With this, it was possible to build a ranking of cities for many topics of interest for urban development, allowing the battery of the UN-Habitat CPI indicators to be substantially expanded.

Technically, the construction of the ranking of cities followed the steps of UN-Habitat CPI methodology. As such, the calculation process was made through the following tasks:

a) Statistical data collection.
b) Variable standardization.
c) Cconstruction of the weighting scheme.
d) Aggregation of the composite index (see UN-Habitat, 2019. City Prosperity Index. Methodology and Metadata).

The assessment of the relationships among the selected indicators for a comparative analysis, and the construction of a ranking of global cities for the Sustainable Development Goals (SDGs) and the Environmental, Social and Governance (ESG) criteria is presented in the table below.

The indicators for the comparative index were organized within the structure of UN-Habitat CPI´s dimensions and sub-dimensions. Seven new sub-dimensions were added to the original CPI structure to incorporate the new indicators. The complete list of indicators is as follows:

TABLE 1: Indicators for Comparative Analysis of Cities

Dimension	Sub-dimension	Indicator	CPI	SDG	Global City	ESG
01 PRODUCTIVITY (P)	1. Economic Strength (ES)	1.1 City Product per Capita	X	X		
	2. Economic Agglomeration (EA)	2.1 Economic Density	X			
	3. Employment (Em)	3.1 Unemployment Rate	X	X		X
	4. Innovative Development (ID)*	4.1 Tech Adoption Rate			X**	
02 INFRASTRUCTURE DEVELOPMENT (ID)	1. Housing Infrastructure (HI)	1.1 Access to Improved Water	X	X		
		1.2 Access to Improved Sanitation	X	X		
		1.3 Access to Electricity	X	X		
	2. Social Infrastructure (SI)	2.1 Physicians Density	X	X		
	3. Information and Communications Technology (ICT)	3.1 Internet Access	X	X		
	4. Urban Mobility (UM)	4.1 Access of Public Transport	X			
		4.2 Length of Mass Transport Network	X			
		4.3 Traffic Fatalities	X			
		4.4 Change in Transport Mode			X**	
		4.5 Congestion Level			X**	
	5. Global Connectivity (GC)*	5.1 Flight Destinations			X**	
	6. Urban Form (UF)	6.1 Built-Up Area per Capita 2015	X	X		
		6.2 Change in Total Built-Up Area 2000 - 2015	X	X		
	1. Health (H)	1.1 Life Expectancy at Birth	X			
		1.2 Vaccination Coverage	X	X		
	2. Education (Ed)	2.1 Mean Years of Schooling	X			

Dimension	Sub-dimension	Indicator	CPI	SDG	Global City	ESG
03 QUALITY OF LIFE (QOL)		2.2 Share of Students in Higher Education			X**	
	3. Science and Technology (ST)*	3.1 Scientists			X**	
		3.2 Science Impact Index			X**	
	4. Culture and Recreation (CR)*	4.1 Museums			X**	
		4.2 Accommodation Affordability			X**	
	5. Safety and Security (SS)	5.1 Homicide Rate	X	X		
		5.2 Crime Index Rank			X**	
	6. Public Space (PS)	6.1 Green Area per Capita	X	X		
		6.2 Land Allocated to Open Public Space			X**	
		6.3 Land Allocated to Streets			X**	
		6.4 Accessibility to Open Public Space	X	X	X	
04 EQUITY AND SOCIAL INCLUSION (ESI)	1. Economic & Social Equity (ESE)*	1.1 Property Affordability			X**	
		1.2 Urban Transit Price Index			X**	
		1.3 Affordability of Mass Public Transport			X**	
		1.4 Affordability of Non-Massive Public Transport			X**	
		1.5 Gini Coefficient	X			
	2. Gender Inclusion (GI)*	2.1 Women in Local Government	X	X		X
05 ENVIRONMENTAL SUSTAINABILITY (ES)	1. Air Quality (AQ)	1.1 $PM_{2.5}$ Concentration	X	X		X
	2. Waste Management (WM)	2.1 Wastewater Treatment	X	X		X
		2.2 Waste Generation per Capita				X
		2.3 City Diversion Rate (recycling)				X
	3. Natural Protected Areas*	3.1 Natural Protected Areas				
06 URBAN GOVERNANCE AND LEGISLATION (UGL)	1. Participation and Institutional Capacity (PIC)	1.1 Voter Turnout	X			
		1.2 Days to Start a Business	X			
	2. Governance of Urbanization (GU)	2.1 Ratio of Land Consumption Rate to Population Growth Rate	X	X		X
	3. Development of e-Government (DEG)*	3.1 Local Online Service Index (LOSI)			X**	

*Note: * Sub-dimensions added to CPI original structure. ** Indicators added to CPI original structure.*

2.4. Data collection

For the data collection, two tasks were especially demanding. The identification of sources of information for the new sub-dimensions and indicators, that is, those added to the original UN-Habitat CPI structure, as well as the collection of statistical and geographic data and information about the 29 selected world cities to be included in the CPI´s comparative index (see ANNEX 3).

3. RESULTS OF THE ANALYSIS

The standardized data of the ranking of 29 cities show, on one hand, the general results, indicating the global ranking of cities, and on the other, the specific results for each of the six dimensions and 46 selected indicators of UN-Habitat City Prosperity Index.

As stated in the CPI methodology and metadata, the City Prosperity Index metrics support and encourage policy dialogues, formulation of evidence-based policies, integrated strategies, and long-term plans. The index has been designed in order to serve as an instrument for measuring and monitoring the progress of the Sustainable Development Goals and the New Urban Agenda, facilitating as well, the systematic comparison among cities within a country, a world region or at a global level.

Prosperous cities offer a profusion of public goods, allowing for equitable access to the 'commons' and the development of sustainable policies, and it is from these ideas that this world cities ranking analysis should be read.

To facilitate an integral interpretation of the CPI results and their linkages to policy interventions, UN-Habitat developed a global barometer of prosperity which allows to define baselines, identifying strong areas, as well as challenges for the development of cities. The results of the CPI and its dimensions, are grouped into six categories ranging from 'very solid' to 'very weak', as shown in the table below:

TABLE 2: The Barometer of Prosperity

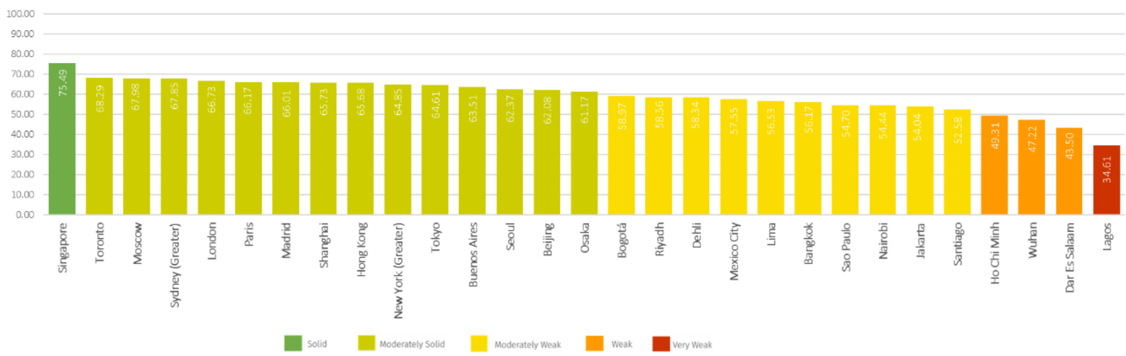
CPI RESULTS	Prosperity level	Level of intervention
80 • 100	Very Solid	Consolidate urban policies
70 • 79	Solid	
60 • 69	Moderately Solid	Reinforce urban policies
50 • 59	Moderately Weak	
40 • 49	Weak	Prioritize urban policies
10 • 39	Very Weak	

Source: UN-Habitat 2019.

With the use of the barometer as a benchmark for comparability, the analysis of the CPI results and the required level of intervention can be more easily understood. Moreover, this comprehensive framework creates the possibility for linking policy decisions across different development aspects, thus favoring the adoption of multi-sectoral and integrated actions that can increase the likelihood of achieving prosperity.

As stated in the disclaimer of this report, it is suggested that, for the purposes of public dissemination and analysis of the ranking, the conditions of the information for each indicator and for each dimension of prosperity be taken into account. There are limitations regarding data coverage, temporal and geographic scope and, in some cases, accuracy of the measurements at the source; creating distortions of the results. Hence, relative positions of the cities within the dimensions may vary.

GRAPH 1: Global Ranking for 29 World Cities



Source: Centro EURE, 2022.

TABLE 3: Global Ranking for 29 World Cities by Dimension

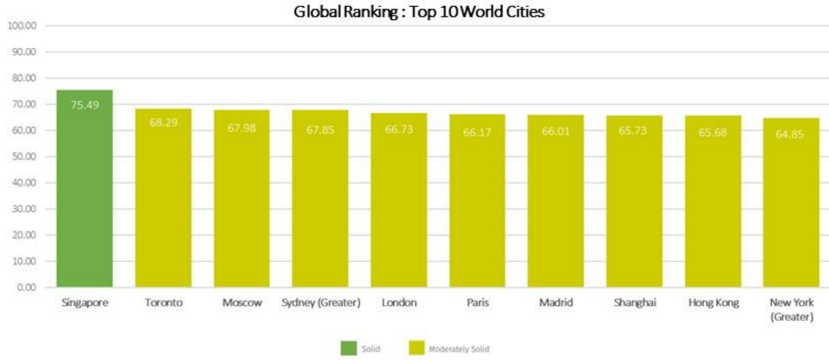
City	Ranking	CPI	PRODUCTIVITY	INFRASTRUCTURE DEVELOPMENT	QUALITY OF LIFE	EQUITY AND SOCIAL INCLUSION	ENVIRONMENTAL SUSTAINABILITY	URBAN GOVERNANCE AND LEGISLATION
Singapore	1	75.49	87.54	68.65	67.21	72.33	58.69	98.50
Toronto	2	68.29	63.31	70.36	53.26	79.60	72.16	71.02
Moscow	3	67.98	66.47	83.20	68.33	62.88	50.09	76.92
Sydney (Greater)	4	67.85	67.28	64.11	57.62	61.55	69.59	86.96
London	5	66.73	72.51	75.91	61.59	45.29	60.03	85.08
Paris	6	66.17	66.76	76.30	57.16	70.45	60.38	65.96
Madrid	7	66.01	58.86	73.78	60.43	75.42	62.75	64.81
Shanghai	8	65.73	66.53	65.04	56.05	56.55	58.93	91.27
Hong Kong	9	65.68	86.55	78.16	63.43	37.29	58.95	69.70
New York (Greater)	10	64.85	71.60	72.17	56.46	61.38	51.60	75.91
Tokyo	11	64.61	75.99	65.23	53.62	57.80	83.10	51.93
Buenos Aires	12	63.51	54.88	64.59	41.64	67.35	66.66	85.95
Seoul	13	62.37	57.91	56.64	57.62	63.44	80.48	58.11
Beijing	14	62.08	72.03	66.94	54.06	53.11	37.01	89.32
Osaka	15	61.17	68.60	65.47	48.86	70.11	64.53	49.45
Bogotá	16	58.97	60.44	69.91	48.00	51.78	47.13	76.56
Riyadh	17	58.56	73.77	64.08	51.15	71.97	31.82	58.59
Delhi	18	58.34	61.91	52.96	59.51	61.31	43.31	71.02
Mexico City	19	57.55	64.80	55.66	40.73	73.81	52.64	57.67
Lima	20	56.53	52.45	59.67	34.76	78.21	43.16	70.92
Bangkok	21	56.17	61.13	52.82	40.72	41.78	55.25	85.34
Sao Paulo	22	54.70	63.74	59.43	42.30	40.86	35.60	86.25
Nairobi	23	54.44	27.30	60.06	28.16	74.62	59.32	77.19
Jakarta	24	54.04	50.30	57.98	33.78	62.39	49.25	70.54
Santiago	25	52.58	55.25	66.29	36.09	50.04	42.62	65.17
Ho Chi Minh	26	49.31	45.47	54.89	32.84	44.30	43.76	74.62
Wuhan	27	47.22	64.81	68.48	58.37	68.39	23.26	0.00
Dar Es Salaam	28	43.50	28.80	47.99	30.30	62.76	36.82	54.31
Lagos	29	34.61	9.93	41.22	14.85	25.61	47.84	68.19

Source: Centro EURE, 2022.

Among the 29 cities, the ones that stand out in the general ranking relative to the 46 indicators are: Singapore (75.49), Toronto (68.29), Moscow (67.98), Sydney (67.85), London (66.73), Paris (66.17), Madrid (66.01), Shanghai (65.73), Hong Kong (65.68), and New York City (64.85).

Global Ranking for 29 World Cities

Global Ranking : Top 10 World Cities



Source: Centro EURE, 2022.

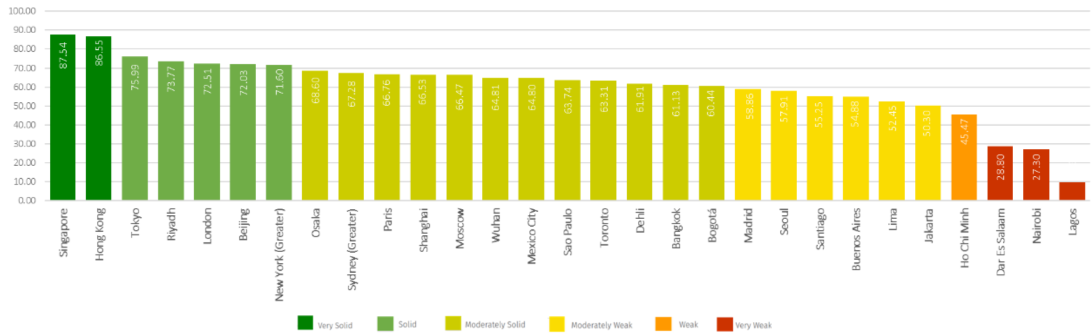
3.1 Productivity Dimension Ranking

Productivity is an economic measure of output per unit of input, that can be measured at different scales. Productivity inputs include labour and capital, while the output is typically measured in GDP components. The City Prosperity Initiative conceptualizes a prosperous city as one that fosters economic development and creates conditions necessary to provide decent jobs and equal opportunities for everyone, by implementing effective economic policies.

Urban areas contribute substantially to national productivity because they concentrate economic activities, incubate talents and nurture creativity and innovation. The concentration of economic activities leads to substantial benefits and efficiency due to economies of agglomeration and scale. Agglomeration economies give cities a competitive advantage as it makes economic productivity cheaper in the densely populated areas within cities. Therefore, productivity gains are vital to any city as it would allow the city to produce more with less. A prosperous city contributes to economic growth and development, generating income, employment and equal opportunities that further provide adequate living standards for the entire population.

The positions of the 29 cities within the productivity dimension ranking are as follows:

GRAPH 2. Productivity Ranking for 29 World Cities



Source: Centro EURE, 2022.

TABLE 4: Productivity Dimension Ranking for 29 World Cities

Ranking	Dimension	Indicators			
	PRODUCTIVITY	City Product per Capita ($ ppp)	Economic Density (GDP $ ppp/ km² built-up area in core land area)*	Unemployment Rate, % (15+ unemployed/labour force 15+)	Tech Adoption Rate (%)
1	Singapore	New York (Greater)	Seoul	Beijing	Hong Kong
2	Hong Kong	Singapore	Singapore	Moscow	Singapore
3	Tokyo	Paris	Bogotá	Singapore	New York (Greater)
4	Riyadh	London	Madrid	Mexico City	Tokyo
5	London	Moscow	Hong Kong	Wuhan	Seoul
6	Beijing	Madrid	Paris	Hong Kong	Sao Paulo
7	New York (Greater)	Tokyo	Santiago	Tokyo	Shanghai
8	Osaka	Sydney (Greater)	London	Shanghai	London
9	Sydney (Greater)	Toronto	Moscow	Osaka	Bangkok
10	Paris	Seoul	Tokyo	Sydney (Greater)	Toronto
11	Shanghai	Riyadh	Mexico City	Lima	Madrid
12	Moscow	Osaka	Wuhan	London	Beijing
13	Wuhan	Hong Kong	New York (Greater)	Dar Es Salaam	Osaka
14	Mexico City	Bangkok	Osaka	Ho Chi Minh	Paris
15	Sao Paulo	Buenos Aires	Beijing	Buenos Aires	Bogotá
16	Toronto	Wuhan	Sydney (Greater)	Riyadh	Sydney (Greater)
17	Dehli	Jakarta	Bangkok	Sao Paulo	Santiago
18	Bangkok	Santiago	Toronto	Paris	Mexico City
19	Bogotá	Mexico City	Shanghai	Bogotá	Wuhan
20	Madrid	Sao Paulo	Dehli	Jakarta	Ho Chi Minh
21	Seoul	Bogotá	Lima	Toronto	Moscow
22	Santiago	Beijing	Buenos Aires	Dehli	Lima
23	Buenos Aires	Shanghai	Jakarta	New York (Greater)	Jakarta
24	Lima	Dehli	Riyadh	Nairobi	Buenos Aires
25	Jakarta	Lima	Sao Paulo	Santiago	Dar Es Salaam
26	Ho Chi Minh	Nairobi	Ho Chi Minh	Bangkok	Lagos
27	Dar Es Salaam	Ho Chi Minh	Dar Es Salaam	Madrid	Nairobi
28	Nairobi	Lagos	Lagos	Lagos	Riyadh
29	Lagos	Dar Es Salaam	Nairobi	Seoul	Dehli

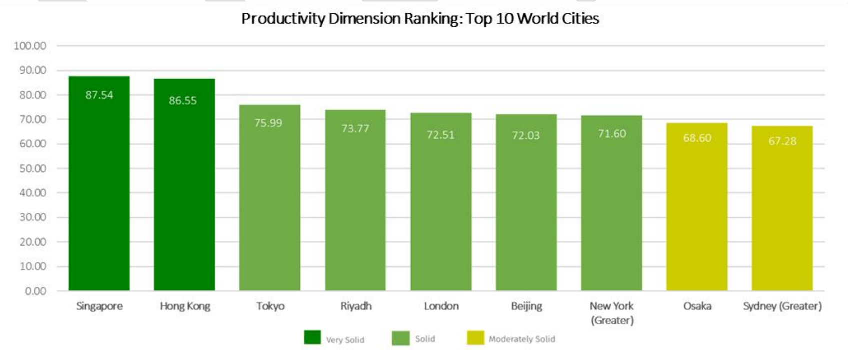
Source: Centro EURE, 2022.

Under the CPI, the Productivity Index is estimated using four sub-dimensions: Economic Strength, Economic Agglomeration, Employment, and Innovative Development. The top ten cities in this dimension are: Singapore, Hong Kong, Tokyo, Riyadh, London, Beijing, New York City, Osaka, Sydney, and Paris.

This dimension is integrated by four indicators. Beijing, Hong Kong, New York City, and Seoul, each lead in one indicator. Singapore stands out since, in addition to having the first place in the dimension, it occupies three second places and one third place. Likewise, New York City ranks first in one indicator and third in other, and Moscow ranks second in one indicator.

Cities without data by indicator: For *Economic Density:* Dar Es Salaam, Lagos, and Nairobi. For *Tech Adoption*: Delhi, and Riyad.

Productivity Dimension Ranking



Source: Centro EURE, 2022.

3.2 Infrastructure Development Dimension Ranking

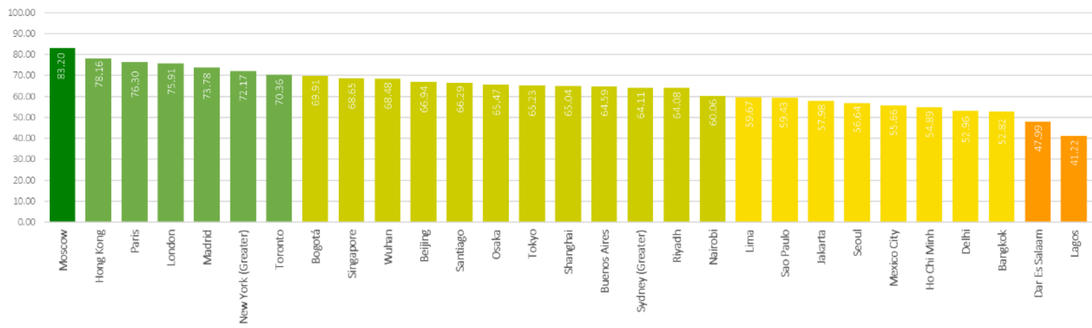
Infrastructure is defined as the set of basic physical systems, organizational structures, facilities, and installations needed for the functioning of a society, or economy. The prosperity of a city largely depends on the development of infrastructure, including transportation, communication, or provision of basice services, among others. Social infrastructure, like water supply, sanitation, and education and health facilities, have a direct impact on the quality of life and overall prosperity of the citizens.

Physical infrastructures like transportation, power and communication facilities contribute to economic development and industrialization, and encourage trade and mobility of labour. Both types of infrastructure connect people, markets, workers, and families; a connectivity process that is essential to induce economic growth and reduce poverty.

Prioritizing infrastructure development, in the long term, fosters economic and social development. A prosperous city deploys the infrastructure, physical assets and amenities –adequate water, sanitation, power supply, road network, information and communications technology, etc.– required to sustain both the population and the economy, and provide better quality of life.

The positions of the 29 cities within the infrastructure development dimension ranking are as follows:

GRAPH 3. Infrastructure Development Ranking for 29 World Cities



Source: Centro EURE, 2022.

TABLE 5: Infrastructure Development Dimension Ranking for 29 World Cities (1/2)

Ranking	Dimension	Indicators					
	INFRASTRUCTURE DEVELOPMENT	Access to Improved Water (%)	Improved Sanitation (%)	Access to Electricity (%)	Physicians Density (per 1,000 people)	Internet Access (%)	Access to Public Transport (SDG 11.2.1)
1	Moscow	Moscow	Moscow	Moscow	Moscow	Moscow	Hong Kong
2	Hong Kong	Paris	Bangkok	Paris	Madrid	Wuhan	Madrid
3	Paris	London	Singapore	London	Beijing	London	Paris
4	London	Mexico City	Sydney (Greater)	Beijing	Paris	Tokyo	London
5	Madrid	New York (Greater)	Tokyo	Madrid	Buenos Aires	Riyadh	Singapore
6	New York (Greater)	Singapore	Seoul	Mexico City	Mexico City	Toronto	Bogotá
7	Toronto	Sydney (Greater)	Osaka	New York (Greater)	Sydney (Greater)	Paris	Santiago
8	Bogotá	Santiago	Bogotá	Singapore	New York (Greater)	Osaka	Sao Paulo
9	Singapore	Hong Kong	Santiago	Sydney (Greater)	London	Madrid	Buenos Aires
10	Wuhan	Madrid	Madrid	Tokyo	Wuhan	Hong Kong	Moscow
11	Beijing	Bogotá	New York (Greater)	Seoul	Sao Paulo	Sydney (Greater)	Tokyo
12	Santiago	Sao Paulo	Ho Chi Minh	Osaka	Tokyo	Singapore	Seoul
13	Osaka	Ho Chi Minh	Jakarta	Toronto	Riyadh	New York (Greater)	New York (Greater)
14	Tokyo	Toronto	Toronto	Santiago	Osaka	Jakarta	Sydney (Greater)
15	Shanghai	Tokyo	London	Hong Kong	Hong Kong	Buenos Aires	Osaka
16	Buenos Aires	Seoul	Buenos Aires	Sao Paulo	Shanghai	Bogotá	Ho Chi Minh
17	Sydney (Greater)	Osaka	Paris	Shanghai	Singapore	Nairobi	Wuhan
18	Riyadh	Lagos	Dar Es Salaam	Wuhan	Toronto	Sao Paulo	Nairobi
19	Nairobi	Nairobi	Hong Kong	Ho Chi Minh	Ho Chi Minh	Lima	Beijing
20	Lima	Dar Es Salaam	Beijing	Riyadh	Lima	Beijing	Mexico City
21	Sao Paulo	Buenos Aires	Shanghai	Bogotá	Bangkok	Shanghai	Lagos
22	Jakarta	Beijing	Wuhan	Jakarta	Lagos	Lagos	Lima
23	Seoul	Shanghai	Lima	Lagos	Nairobi	Ho Chi Minh	Bangkok
24	Mexico City	Wuhan	Sao Paulo	Bangkok	Jakarta	Mexico City	Riyadh
25	Ho Chi Minh	Lima	Mexico City	Lima	Dar Es Salaam	Delhi	Toronto
26	Delhi	Riyadh	Nairobi	Delhi	Delhi	Bangkok	Shanghai
27	Bangkok	Delhi	Lagos	Nairobi	Seoul	Dar Es Salaam	Jakarta
28	Dar Es Salaam	Bangkok	Delhi	Buenos Aires	Bogotá	Seoul	Dar Es Salaam
29	Lagos	Jakarta	Riyadh	Dar Es Salaam	Santiago	Santiago	Delhi

Source: Centro EURE, 2022.

TABLE 6: Infrastructure Development Dimension Ranking for 29 World Cities (2/2)

Ranking	Dimension	Indicators						
	INFRASTRUCTURE DEVELOPMENT	Length of Mass Transport Network (km per million people)	Traffic Fatalities (per 100,000 people)	Change in Transport Mode (ratio)	Congestion Level (%)	Flight Destinations (number of)	Built-Up Area per Capita 2015 (m2 per capita)	Change in Total Built-Up Area per Capita 2000-2015 (%)
1	Moscow	Moscow	Lima	Hong Kong	Madrid	Moscow	Paris	Bangkok
2	Hong Kong	New York (Greater)	Hong Kong	Singapore	Riyadh	Paris	Riyadh	New York (Greater)
3	Paris	Madrid	Singapore	London	Wuhan	London	London	Hong Kong
4	London	Singapore	London	Beijing	Hong Kong	Beijing	Moscow	Moscow
5	Madrid	London	Moscow	Moscow	Shanghai	Madrid	Tokyo	Buenos Aires
6	New York (Greater)	Beijing	Wuhan	Madrid	Singapore	New York (Greater)	Shanghai	Nairobi
7	Toronto	Hong Kong	Madrid	Shanghai	Sydney (Greater)	Seoul	Wuhan	Santiago
8	Bogotá	Paris	Shanghai	Buenos Aires	Toronto	Toronto	Beijing	Sao Paulo
9	Singapore	Dar Es Salaam	Mexico City	Paris	Buenos Aires	Shanghai	Osaka	Ho Chi Minh
10	Wuhan	Nairobi	Beijing	Tokyo	Osaka	Delhi	Bangkok	Osaka
11	Beijing	Shanghai	Tokyo	New York (Greater)	Beijing	Singapore	Madrid	Delhi
12	Santiago	Riyadh	Osaka	Mexico City	New York (Greater)	Hong Kong	Buenos Aires	Sydney (Greater)
13	Osaka	Mexico City	Paris	Bangkok	London	Mexico City	Sydney (Greater)	Paris
14	Tokyo	Santiago	Sydney (Greater)	Sao Paulo	Paris	Wuhan	Nairobi	Shanghai
15	Shanghai	Seoul	Toronto	Sydney (Greater)	Tokyo	Bangkok	Santiago	London
16	Buenos Aires	Wuhan	Bogotá	Toronto	Santiago	Tokyo	Seoul	Beijing
17	Sydney (Greater)	Delhi	Ho Chi Minh	Seoul	Sao Paulo	Sao Paulo	Sao Paulo	Madrid
18	Riyadh	Sydney (Greater)	Riyadh	Osaka	Mexico City	Sydney (Greater)	Delhi	Mexico City
19	Nairobi	Toronto	New York (Greater)	Bogotá	Bangkok	Riyadh	Mexico City	Singapore
20	Lima	Osaka	Jakarta	Santiago	Jakarta	Bogotá	Ho Chi Minh	Tokyo
21	Sao Paulo	Bangkok	Buenos Aires	Jakarta	Delhi	Jakarta	New York (Greater)	Seoul
22	Jakarta	Buenos Aires	Nairobi	Dar Es Salaam	Lima	Lima	Singapore	Lagos
23	Seoul	Tokyo	Dar Es Salaam	Lagos	Moscow	Nairobi	Hong Kong	Wuhan
24	Mexico City	Lima	Lagos	Lima	Bogotá	Santiago	Lagos	Riyadh
25	Ho Chi Minh	Sao Paulo	Bangkok	Nairobi	Seoul	Buenos Aires	Bogotá	Bogotá
26	Delhi	Bogotá	Seoul	Wuhan	Dar Es Salaam	Osaka	Toronto	Toronto
27	Bangkok	Lagos	Santiago	Ho Chi Minh	Lagos	Ho Chi Minh	Jakarta	Jakarta
28	Dar Es Salaam	Ho Chi Minh	Sao Paulo	Riyadh	Nairobi	Lagos	Dar Es Salaam	Dar Es Salaam
29	Lagos	Jakarta	Delhi	Delhi	Ho Chi Minh	Dar Es Salaam	Lima	Lima

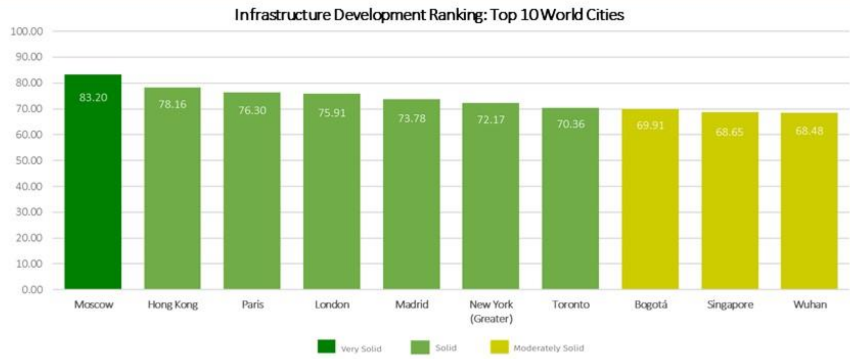
Source: Centro EURE, 2022.

Under the CPI, the Infrastructure Development Index is measured using six sub-dimensions: Housing Infrastructure, Social Infrastructure, Information and Communications Technology, Urban Mobility, Global Connectivity, and Urban Form. The top ten cities in this dimension are led by the city of Moscow followed by Hong Kong, Paris, London, Madrid, New York City, Toronto, Bogota, Singapore and Wuhan.

The city of Moscow appears first in seven of the 13 indicators that are part of this dimension. Hong Kong is first in two indicators, whereas Bangkok, Lima, Madrid, and Paris also stand out, each leading one indicator.

Cities without data by indicator: For *Physicians Density* indicator: Bogota, Santiago, and Seoul. For *Internet Access*: Santiago, and Seoul. For *Access to Public Transport*: Dar Es Salaam, Jakarta, Shanghai, and Toronto. For *Traffic Fatalities*: Santiago, Sao Paulo, and Seoul. For *Change in Transport Mode*: Bogota, Dar Es Salaam, Delhi, Ho Chi Minh, Jakarta, Lagos, Lima, Nairobi, Osaka, Riyadh, Santiago, and Wuhan. For *Congestion Level*: Dar Es Salaam, Ho Chi Minh, Lagos, Nairobi, and Seoul. For *Built-Up Area* and *Change of Built-Up Area*: Bogota, Dar Es Salaam, Jakarta, Lima, and Toronto.

Infrastructure Development Dimension Ranking



Source: Centro EURE, 2022.

3.3 Quality of Life Dimension Ranking

In the past, prosperity was only defined in terms of economic strength i.e. a person was considered more prosperous as their income or wealth increased. However, attention has shifted to other definitions of prosperity that include more components apart from just economic ability. And quality of life is one of such components, that has proven to be among the most significant aspects of prosperity.

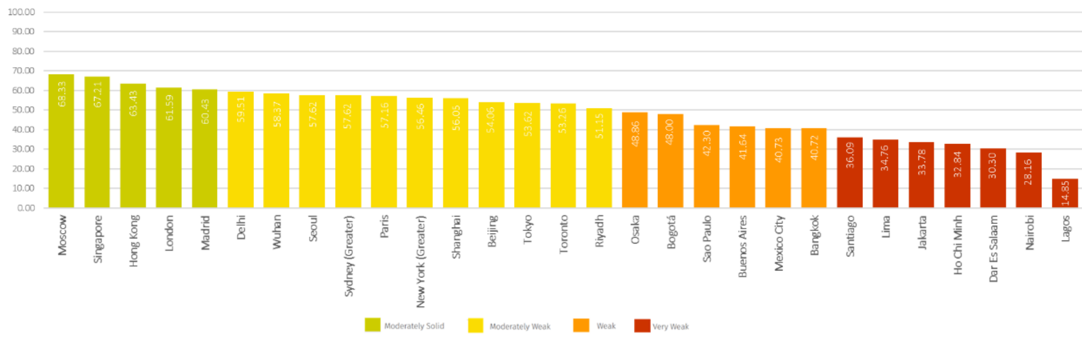
Quality of life can be understood in terms of how an individual's life or society's condition is in comparison to another person or society, i.e. how good (or bad) someone's life is compared to other individuals' lives. Therefore, this is the measurement of a city's average achievements for ensuring general well-being and satisfaction of its citizens.

Ferrell, who has carried out a large research programme on pain and quality of life, defined quality of life as well-being in terms of the physical, mental, social, and spiritual dimensions (Ferrell, 1995). Lindströ and Henriksson, (1996) present a model where quality of life is divided into four life spheres: global, external, interpersonal, and personal, where the latter is represented by the physical, mental, and spiritual dimensions. An individual is satisfied when their external (physical, apart from monetary needs) and internal (mental, social, spiritual, and emotional) needs are met. The Quality of Life dimension measures how well these needs are being addressed by the city.

Prosperous cities provide amenities such as social services, education, health, recreation, safety and security required for improved living standards, enabling the population to maximize individual potential and to lead fulfilling lives.

The positions of the 29 cities within the Quality of Life dimension ranking are as follows:

GRAPH 4. Quality of Life Ranking for 29 World Cities



Source: Centro EURE, 2022.

TABLE 7: Quality of Life Dimension Ranking for 29 World Cities (1/2)

Ranking	Dimension	Indicators						
	QUALITY OF LIFE	Life Expectancy at Birth (years)	Vaccination Coverage (%)	Mean Years of Schooling (years)	Share of Students in Higher Education (%)	Scientists (number of)	Science Impact (index score)	Museums (number per million people)
1	Moscow	Madrid	Beijing	New York (Greater)	Wuhan	New York (Greater)	Tokyo	Paris
2	Singapore	Hong Kong	Hong Kong	Toronto	Riyadh	London	Seoul	Moscow
3	Hong Kong	Paris	Shanghai	London	Sydney (Greater)	Singapore	London	London
4	London	Tokyo	Wuhan	Sydney (Greater)	Bogotá	Shanghai	Beijing	Madrid
5	Madrid	Osaka	Tokyo	Tokyo	Bangkok	Seoul	Shanghai	Beijing
6	Delhi	Singapore	Seoul	Osaka	Paris	Moscow	Paris	Shanghai
7	Wuhan	Sydney (Greater)	Osaka	Seoul	Moscow	Paris	Bangkok	Sydney (Greater)
8	Seoul	Toronto	Bangkok	Moscow	Toronto	Tokyo	Moscow	Seoul
9	Sydney (Greater)	London	Paris	Hong Kong	Beijing	Sydney (Greater)	Sydney (Greater)	Singapore
10	Paris	Wuhan	Madrid	Paris	Hong Kong	Toronto	Hong Kong	Hong Kong
11	New York (Greater)	New York (Greater)	Singapore	Singapore	Madrid	Beijing	Madrid	Tokyo
12	Shanghai	Lima	Santiago	Santiago	Mexico City	Madrid	Wuhan	Sao Paulo
13	Beijing	Bogotá	Riyadh	Buenos Aires	Buenos Aires	Wuhan	New York (Greater)	New York (Greater)
14	Tokyo	Buenos Aires	Moscow	Madrid	Ho Chi Minh	Lima	Santiago	Toronto
15	Toronto	Moscow	Sydney (Greater)	Riyadh	Delhi	Osaka	Sao Paulo	Buenos Aires
16	Riyadh	Sao Paulo	New York (Greater)	Lima	Nairobi	Mexico City	Mexico City	Mexico City
17	Osaka	Ho Chi Minh	London	Mexico City	London	Hong Kong	Singapore	Osaka
18	Bogotá	Beijing	Bogotá	Bogotá	Lima	Buenos Aires	Toronto	Wuhan
19	Sao Paulo	Shanghai	Nairobi	Ho Chi Minh	New York (Greater)	Santiago	Bogotá	Santiago
20	Buenos Aires	Mexico City	Toronto	Jakarta	Shanghai	Bangkok	Lima	Bangkok
21	Mexico City	Bangkok	Delhi	Beijing	Santiago	Ho Chi Minh	Jakarta	Lima
22	Bangkok	Riyadh	Dar Es Salaam	Sao Paulo	Jakarta	Bogotá	Nairobi	Bogotá
23	Santiago	Jakarta	Ho Chi Minh	Shanghai	Sao Paulo	Jakarta	Buenos Aires	Riyadh
24	Lima	Nairobi	Lima	Wuhan	Seoul	Nairobi	Osaka	Ho Chi Minh
25	Jakarta	Dar Es Salaam	Buenos Aires	Bangkok	Tokyo	Sao Paulo	Dar Es Salaam	Jakarta
26	Ho Chi Minh	Lagos	Jakarta	Nairobi	Singapore	Dar Es Salaam	Lagos	Nairobi
27	Dar Es Salaam	Seoul	Mexico City	Delhi	Osaka	Lagos	Ho Chi Minh	Dar Es Salaam
28	Nairobi	Santiago	Sao Paulo	Lagos	Dar Es Salaam	Riyadh	Riyadh	Lagos
29	Lagos	Delhi	Lagos	Dar Es Salaam	Lagos	Delhi	Delhi	Delhi

Source: Centro EURE, 2022.

TABLE 8: Quality of Life Dimension Ranking for 29 World Cities (2/2)

Ranking	Dimension	Indicators						
	QUALITY OF LIFE	Accommodation Affordability (% income per night)	Homicide rate (per 100,00 people)	Crime Index Rank (rank position)	Green Area per Capita (m^2/inhabitant)	Land Allocated to Open Public Space (share of urban area %)	Land Allocated to Streets (share of urban area %)	Accessibility to Open Public Space (%)
1	Moscow	Sydney (Greater)	Beijing	Singapore	Moscow	London	Hong Kong	Hong Kong
2	Singapore	Singapore	Singapore	Hong Kong	London	New York (Greater)	Bogotá	Bogotá
3	Hong Kong	Madrid	Shanghai	Moscow	Beijing	Moscow	Osaka	Moscow
4	London	Moscow	Delhi	Beijing	Madrid	Singapore	Buenos Aires	London
5	Madrid	Seoul	Madrid	Seoul	Singapore	Madrid	Tokyo	Tokyo
6	Delhi	Mexico City	Hong Kong	Osaka	Sydney (Greater)	Hong Kong	Singapore	Osaka
7	Wuhan	Sao Paulo	Tokyo	Toronto	Seoul	Bogotá	Madrid	New York (Greater)
8	Seoul	Bangkok	Jakarta	Tokyo	Toronto	Osaka	Sao Paulo	Singapore
9	Sydney (Greater)	Bogotá	Wuhan	New York (Greater)	Hong Kong	Mexico City	Moscow	Madrid
10	Paris	Buenos Aires	Osaka	Santiago	Sao Paulo	Paris	Santiago	Sao Paulo
11	New York (Greater)	Shanghai	Paris	Dar Es Salaam	Dar Es Salaam	Tokyo	Bangkok	Paris
12	Shanghai	Beijing	London	Lagos	Delhi	Beijing	Riyadh	Buenos Aires
13	Beijing	Hong Kong	Seoul	Nairobi	New York (Greater)	Seoul	Ho Chi Minh	Seoul
14	Tokyo	New York (Greater)	Ho Chi Minh	Jakarta	Wuhan	Riyadh	Lagos	Mexico City
15	Toronto	Paris	Moscow	Paris	Riyadh	Sydney (Greater)	Mexico City	Santiago
16	Riyadh	London	Toronto	Bangkok	Paris	Santiago	Seoul	Sydney (Greater)
17	Osaka	Tokyo	Santiago	Wuhan	Shanghai	Buenos Aires	Paris	Ho Chi Minh
18	Bogotá	Toronto	Riyadh	Shanghai	Mexico City	Sao Paulo	London	Beijing
19	Sao Paulo	Lagos	New York (Greater)	Bogotá	Bangkok	Nairobi	Sydney (Greater)	Nairobi
20	Buenos Aires	Osaka	Sydney (Greater)	Mexico City	Nairobi	Ho Chi Minh	Nairobi	Bangkok
21	Mexico City	Santiago	Bangkok	London	Buenos Aires	Bangkok	New York (Greater)	Riyadh
22	Bangkok	Jakarta	Buenos Aires	Sydney (Greater)	Tokyo	Lagos	Beijing	Lagos
23	Santiago	Dar Es Salaam	Nairobi	Lima	Bogotá	Toronto	Toronto	Toronto
24	Lima	Lima	Sao Paulo	Buenos Aires	Osaka	Shanghai	Shanghai	Shanghai
25	Jakarta	Nairobi	Dar Es Salaam	Ho Chi Minh	Lima	Jakarta	Jakarta	Jakarta
26	Ho Chi Minh	Wuhan	Bogotá	Madrid	Jakarta	Dar Es Salaam	Dar Es Salaam	Dar Es Salaam
27	Dar Es Salaam	Ho Chi Minh	Mexico City	Sao Paulo	Santiago	Lima	Lima	Lima
28	Nairobi	Riyadh	Lagos	Riyadh	Ho Chi Minh	Wuhan	Wuhan	Wuhan
29	Lagos	Delhi	Lima	Delhi	Lagos	Delhi	Delhi	Delhi

Source: Centro EURE, 2022.

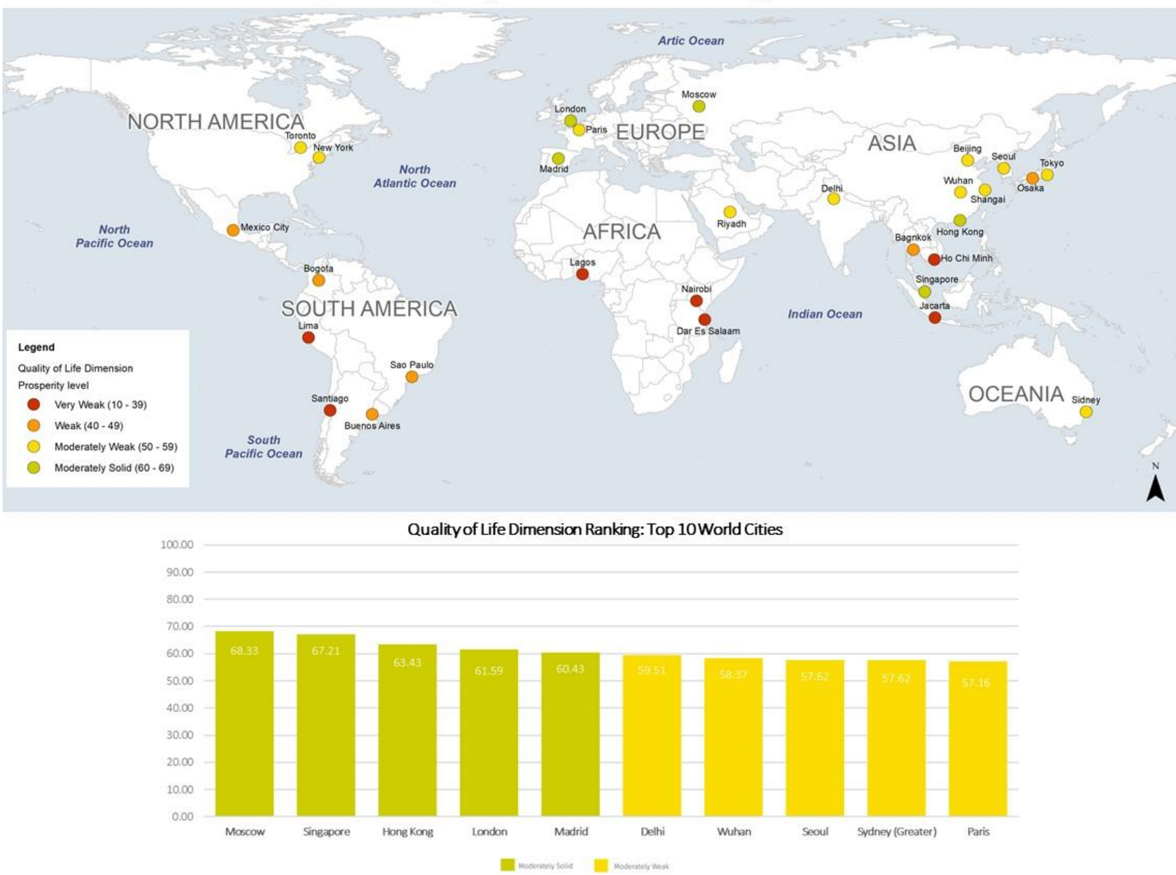
There are six sub-dimensions within this dimension: Health, Education, Science and Technology, Culture and Recreation, Safety and Security, and Public Space with a total of 14 indicators.

Moscow ranks first in this dimension followed by Singapore, Hong Kong, London, Madrid, Delhi, Wuhan, Seoul, Sydney, and Paris.

Beijing, Hong Kong, and New York City lead in two of the 14 indicators. London, Madrid, Moscow, Paris, Singapore, Sydney, Tokyo, and Wuhan, each lead one indicator within the Quality of Life dimension.

Cities without data by indicator: For *Life Expectancy at Birth*: Delhi, Santiago, and Seoul. For *Scientists and Science Impact indicators:* Delhi, and Riyadh. For *Accommodation Affordability*: Dar Es Salaam, Delhi, Ho Chi Minh, Jakarta, Lima, Nairobi, Osaka, Riyadh, Santiago, and Wuhan. For *Crime Index*: Delhi, and Riyadh. For *Land Allocated to Open Public Space, Land Allocated to Streets,* and *Accesibility to Open Public Space* indicators: Dar Es Salaam, Delhi, Jakarta, Lima, Riyadh, Shanghai, Toronto, and Wuhan.

Quality of Life Dimension Ranking



Source: Centro EURE, 2022.

3.4 Equity and Social Inclusion Dimension Ranking

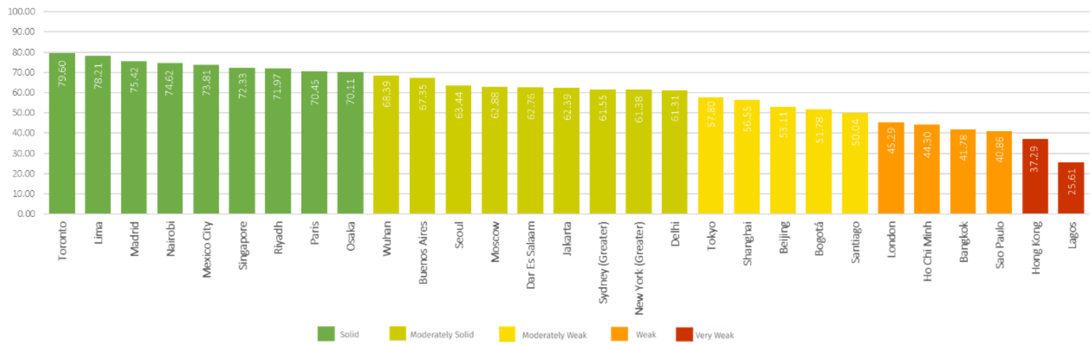
An inclusive society is one that treats people equally regardless of their race, ethnicity, age, gender, identity, sexual orientation, class, and place of origin, and ensures inclusion and equality of opportunities for all of its members. This can be achieved partly by enhancing gender equality, protecting the rights of minorities and vulnerable groups, as well as by ensuring participation on the social, political, and cultural spheres. A prosperous city seeks to acknowledge and integrate the traditionally excluded groups into the city's decision-making processes.

When inclusion and equity are embedded in decision-making, there are direct and indirect positive effects that favor the overall development of the city. For example, equity has a significant impact on economic performance by fostering each person's ability to self-develop, including skills and creative talent.

A city is only prosperous to the extent that poverty and inequalities are minimal. No city can claim to be prosperous when large segments of the population live in abject poverty and deprivation. This involves reducing the incidence of slums and new forms of poverty and marginalization.

The positions of the 29 cities within the Equity and Social Inclusion dimension ranking are as follows:

GRAPH 5. Equity and Social Inclusion Ranking for 29 World Cities



Source: Centro EURE, 2022.

TABLE 9: Equity and Social Inclusion Dimension Ranking for 29 World Cities

Ranking	Dimension	Indicators					
	EQUITY AND SOCIAL INCLUSION	Property Affordability (Price to income ratio)	Urban Transit Price Index	Affordability of Mass Public Transport (number of trips afforded)	Affordability of Non-Massive Public Transport (number of trips afforded)	Gini Coefficient (coefficient)	Women in Local Government (%)
1	Toronto	Riyadh	Delhi	Moscow	Singapore	Toronto	Paris
2	Lima	Sydney (Greater)	Bangkok	Paris	Madrid	Madrid	London
3	Madrid	New York (Greater)	Jakarta	Beijing	Moscow	Beijing	Mexico City
4	Nairobi	Toronto	Shanghai	Madrid	Seoul	Shanghai	Nairobi
5	Mexico City	Madrid	Bogotá	New York (Greater)	Paris	Lima	Buenos Aires
6	Singapore	Mexico City	Riyadh	Singapore	Jakarta	Tokyo	Lima
7	Riyadh	Lagos	Singapore	Sydney (Greater)	Bangkok	Osaka	Toronto
8	Paris	Tokyo	Ho Chi Minh	Tokyo	London	Nairobi	Madrid
9	Osaka	London	Beijing	Seoul	New York (Greater)	Paris	Bogotá
10	Wuhan	Lima	Seoul	Shanghai	Beijing	Sydney (Greater)	Riyadh
11	Buenos Aires	Sao Paulo	Hong Kong	Jakarta	Sydney (Greater)	Ho Chi Minh	Moscow
12	Seoul	Delhi	Santiago	Riyadh	Tokyo	Dar Es Salaam	Dar Es Salaam
13	Moscow	Santiago	Moscow	Bogotá	Bogotá	Bangkok	New York (Greater)
14	Dar Es Salaam	Singapore	Madrid	Delhi	Santiago	Buenos Aires	Delhi
15	Jakarta	Paris	Paris	Hong Kong	Hong Kong	New York (Greater)	Sydney (Greater)
16	Sydney (Greater)	Moscow	New York (Greater)	Santiago	Shanghai	Mexico City	Jakarta
17	New York (Greater)	Ho Chi Minh	Sydney (Greater)	London	Lagos	London	Seoul
18	Delhi	Wuhan	Lagos	Bangkok	Ho Chi Minh	Moscow	Singapore
19	Tokyo	Jakarta	Tokyo	Lagos	Riyadh	Jakarta	Sao Paulo
20	Shanghai	Buenos Aires	London	Ho Chi Minh	Delhi	Singapore	Santiago
21	Beijing	Nairobi	Buenos Aires	Buenos Aires	Buenos Aires	Hong Kong	Hong Kong
22	Bogotá	Bogotá	Mexico City	Mexico City	Mexico City	Bogotá	Lagos
23	Santiago	Bangkok	Osaka	Osaka	Osaka	Sao Paulo	Bangkok
24	London	Seoul	Toronto	Toronto	Toronto	Lagos	Shanghai
25	Ho Chi Minh	Shanghai	Sao Paulo	Sao Paulo	Sao Paulo	Seoul	Beijing
26	Bangkok	Beijing	Dar Es Salaam	Dar Es Salaam	Dar Es Salaam	Santiago	Tokyo
27	Sao Paulo	Hong Kong	Lima	Lima	Lima	Wuhan	Osaka
28	Hong Kong	Osaka	Nairobi	Nairobi	Nairobi	Riyadh	Wuhan
29	Lagos	Dar Es Salaam	Wuhan	Wuhan	Wuhan	Delhi	Ho Chi Minh

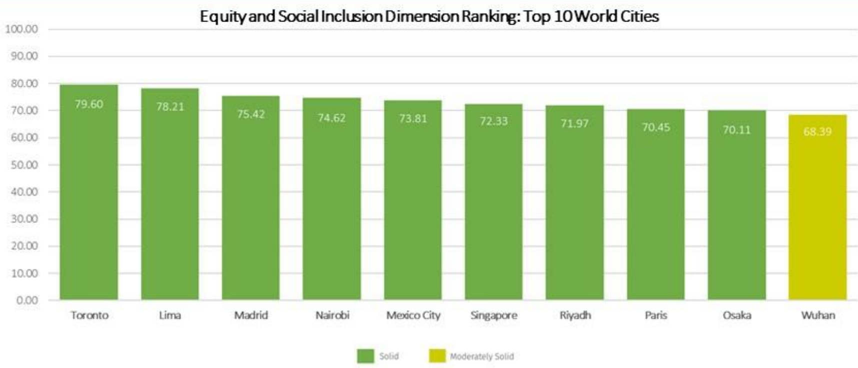
Source: UN-Habitat 2022.

There are two sub-dimensions within this dimension: Economic and Social Equity, and Gender Inclusion, comprising a total of six indicators. Toronto ranks first overall, and Delhi, Moscow, Paris, Riyadh, Singapure, and Toronto lead in one indicator each.

This dimension was complemented with three new indicators associated with affordability of housing and transportation. Lima, Mexico City, and Nairobi appear within the top ten cities, since their income to cost of living relationship is relatively higher than the rest of the rest of the cities.

Cities without data by indicator: For *Property Affordability*: Dar Es Salaam, and Osaka. For *Urban Transit Price Index:* Buenos Aires, Dar Es Salaam, Lima, Mexico City, Nairobi, Osaka, Sao Paulo, Toronto, and Wuhan. For *Affordability of Mass Public Transport* and *Affordability of Non-Massive Public Transport* indicators: Buenos Aires, Dar Es Salaam, Lima, Mexico City, Nairobi, Osaka, Sao Paulo, Toronto, and Wuhan. For *Gini Coefficient*: Delhi, Riyadh, Santiago, Seoul, and Wuhan. For *Women in Local Government*: Ho Chi Minh, Osaka, Tokyo, and Wuhan.

Equity and Social Inclusion Dimension Ranking



Source: UN-Habitat 2022.

3.5 Environmental Sustainability Dimension Ranking

Within the CPI context, environmental sustainability is considered to be the ability for maintaining and strengthening environmental quality, as well as maintaining the factors and practices that contribute to it in the long-term.

Degradation of the environment in an urban context can relate to a variety of causes, such as pollution (including generation of solid and water waste, and burning of fossil fuels), urban sprawl, loss of forest masses, and, in general, the expansion of the urban environmental footprint.

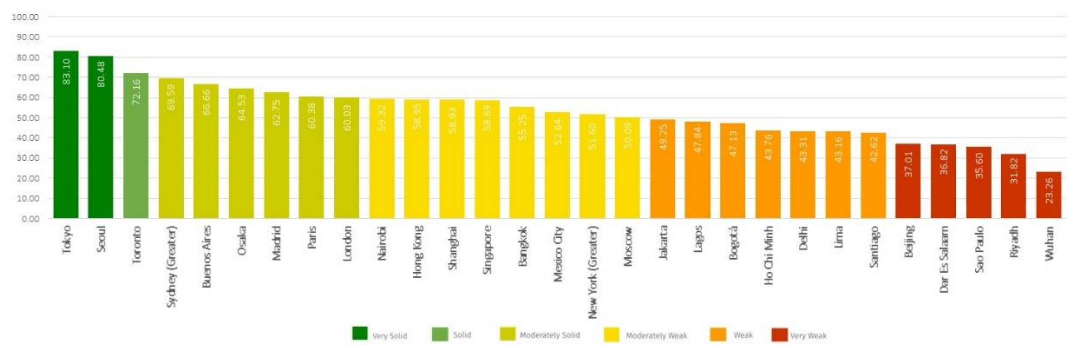
A large proportion of the negative impacts over the environment can be traced to cities. Sprawling cities consume productive land and vital green spaces, where growing numbers of city dwellers put pressure on energy generation, as well as on all kinds of environmental resources. It is estimated that city dwellers are responsible for up to 70% of the world's greenhouse gas emissions.

Therefore, to tackle climate change, avoid lasting damage to ecosystems and improve the health and well-being of billions of people, solutions to these problems must be sought at the city level. It is imperative that economic growth and urbanization are matched with appropriate policies and governance mechanisms, in order to reduce or eliminate environmental impacts. Cities must build the financial and other institutions required to achieve environmental sustainability (without which economic growth will fall short of ensuring shared prosperity). Environmentally sustainable cities are more compact, energy-efficient, clean, and accessible; but mostly, they reduce their ecological footprint by taking advantage of all the means that are at their disposal.

A prosperous city guarantees that its growth and its economic development does not destroy or degrade the environment; instead, the city's natural assets are preserved for the sake of sustainable urbanization.

The positions of the 29 cities within the Environmental Sustainability dimension ranking are as follows:

GRAPH 6. Environmental Sustainability Ranking for 29 World Cities



Source: Centro EURE 2022.

TABLE 10: Environmental Sustainability Dimension Ranking for 29 World Cities

Ranking	Dimension	Indicators				
	ENVIRONMENTAL SUSTAINABILITY	PM2.5 Concentration (µg/m3)	Wastewater Treatment (%)	Waste Generation per Capita (tonnes/year/person) (municipal solid waste)	City Diversion Rate (recycling, %)	Natural Protected Areas (%)
1	Tokyo	Sydney (Greater)	Madrid	Jakarta	Bangkok	Sydney (Greater)
2	Seoul	Toronto	New York (Greater)	Osaka	Buenos Aires	Hong Kong
3	Toronto	New York (Greater)	Singapore	Tokyo	Singapore	Seoul
4	Sydney (Greater)	Madrid	Tokyo	Paris	Tokyo	Madrid
5	Buenos Aires	Buenos Aires	Seoul	Delhi	Seoul	Beijing
6	Osaka	London	Santiago	Lagos	Toronto	Moscow
7	Madrid	Paris	Moscow	Toronto	Shanghai	Bogotá
8	Paris	Moscow	Sydney (Greater)	Nairobi	London	Mexico City
9	London	Osaka	London	Seoul	Hong Kong	Paris
10	Nairobi	Tokyo	Toronto	Buenos Aires	Sydney (Greater)	Tokyo
11	Hong Kong	Nairobi	Mexico City	Ho Chi Minh	Madrid	Osaka
12	Shanghai	Sao Paulo	Beijing	Dar Es Salaam	Ho Chi Minh	New York (Greater)
13	Singapore	Singapore	Buenos Aires	Sao Paulo	Delhi	London
14	Bangkok	Mexico City	Hong Kong	Mexico City	Paris	Delhi
15	Mexico City	Dar Es Salaam	Nairobi	Bangkok	New York (Greater)	Santiago
16	New York (Greater)	Ho Chi Minh	Shanghai	Bogotá	Bogotá	Singapore
17	Moscow	Jakarta	Delhi	Moscow	Riyadh	Toronto
18	Jakarta	Seoul	Bogotá	London	Dar Es Salaam	Buenos Aires
19	Lagos	Santiago	Lima	Beijing	Mexico City	Bangkok
20	Bogotá	Bogotá	Riyadh	Madrid	Santiago	Sao Paulo
21	Ho Chi Minh	Bangkok	Paris	New York (Greater)	Jakarta	Shanghai
22	Delhi	Hong Kong	Osaka	Singapore	Nairobi	Jakarta
23	Lima	Lima	Bangkok	Sydney (Greater)	Moscow	Dar Es Salaam
24	Santiago	Lagos	Sao Paulo	Santiago	Sao Paulo	Lagos
25	Beijing	Shanghai	Dar Es Salaam	Hong Kong	Beijing	Lima
26	Dar Es Salaam	Wuhan	Ho Chi Minh	Shanghai	Osaka	Nairobi
27	Sao Paulo	Riyadh	Wuhan	Lima	Lagos	Wuhan
28	Riyadh	Beijing	Lagos	Riyadh	Lima	Ho Chi Minh
29	Wuhan	Delhi	Jakarta	Wuhan	Wuhan	Riyadh

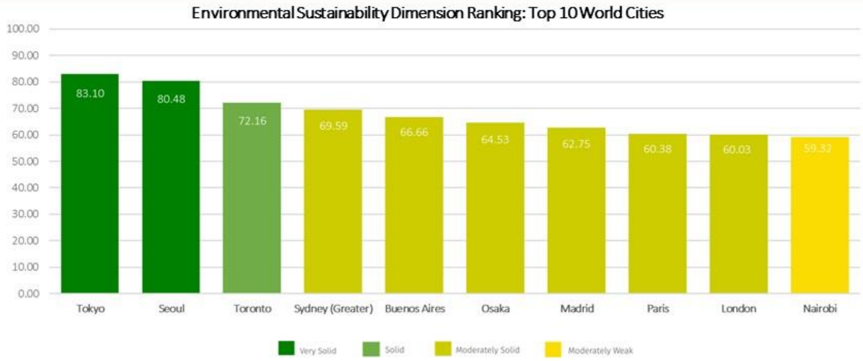
Source: Centro EURE, 2022

This dimension considers three sub-dimensions: Air Quality, Waste Management, and Natural Protected Areas. Sydney stands out by occupying the first place in two of the five indicators included in this dimension, followed by Bangkok, Jakarta, and Madrid, which occupy the first place in one indicator each.

In the overall ranking of this dimension, Tokyo occupies the first place followed by Seoul, Toronto, Sydney, Buenos Aires, Osaka, Madrid, Paris, London, and Nairobi, which make the top 10.

Cities without data by indicators: For *Waste Generation per Capita*: Wuhan. For *City Diversion Rate*: Lagos, Lima, Osaka, and Wuhan. For *Natural Protected Areas*: Bangkok, Dar Es Salaam, Ho Chi Minh, Jakarta, Lagos, Lima, Nairobi, Riyadh, Sao Paulo, Shanghai, and Wuhan.

Environmental Sustainability Dimension Ranking



Source: Centro EURE, 2022

3.6 Urban Governance and Legislation Dimension Ranking

Governance is the exercise of managing the political, economic, and administrative affairs at all levels, whilst legislation refers to a body of laws, rules, rulings, regulations, acts, bills, statutes, enactments, and ordinances that would facilitate governance. Governance and legislation comprise the complex mechanisms, processes, and institutions through which citizens and groups articulate their interests, mediate their differences, and exercise their legal rights and obligations, ensuring that administrative authorities are accountable in the use and distribution of public resources.

Good governance and legislation are participatory, transparent, accountable, effective, and equitable, and promotes the rule of law. Good governance and legislation assure that political, social, and economic priorities are based on broad consensus in society and that the voices of the poorest and the most vulnerable are heard when decisions are being made.

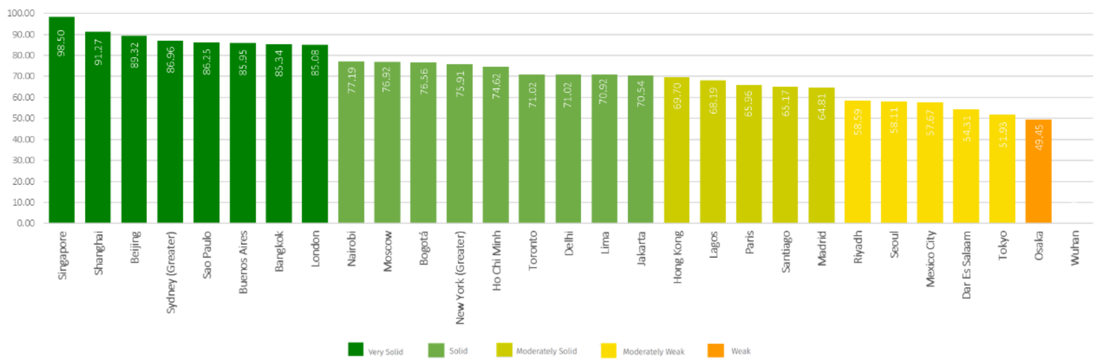
Governance and legislation includes the State but transcends it by taking in the private sector and civil society. The State creates conducive political and legal environments, while the private sector generates jobs and income, and the civil society facilitates political and social interactions by mobilizing groups to participate in economic, social, and political activities.

The increasing realization that urban governance and legislation require more prominent and measurable conditions within urban prosperity, was the driving force behind the development of this dimension. The Urban Governance and Legislation dimension has the purpose of portraying the role of adequate governance mechanisms for local action towards prosperity, including the capacity to regulate and manage responsibly the urbanization process. This dimension intends to provide assistance to local governments in making informed decisions based on evidence in order to improve their overall performance.

Cities are best able to combine sustainability and shared prosperity through effective urban governance and transformational leadership, deploying appropriate and effective policies, laws and regulations, and creating adequate institutional frameworks with strong local institutions and sound institutional arrangements.

The positions of the 29 cities within the Urban Governance and Legislation dimension ranking are as follows:

GRAPH 7. Urban Governance and Legislation Ranking for 29 World Cities



Source: Centro EURE, 2022.

TABLE 11. Governance and Legislation Dimension Ranking for 29 World Cities

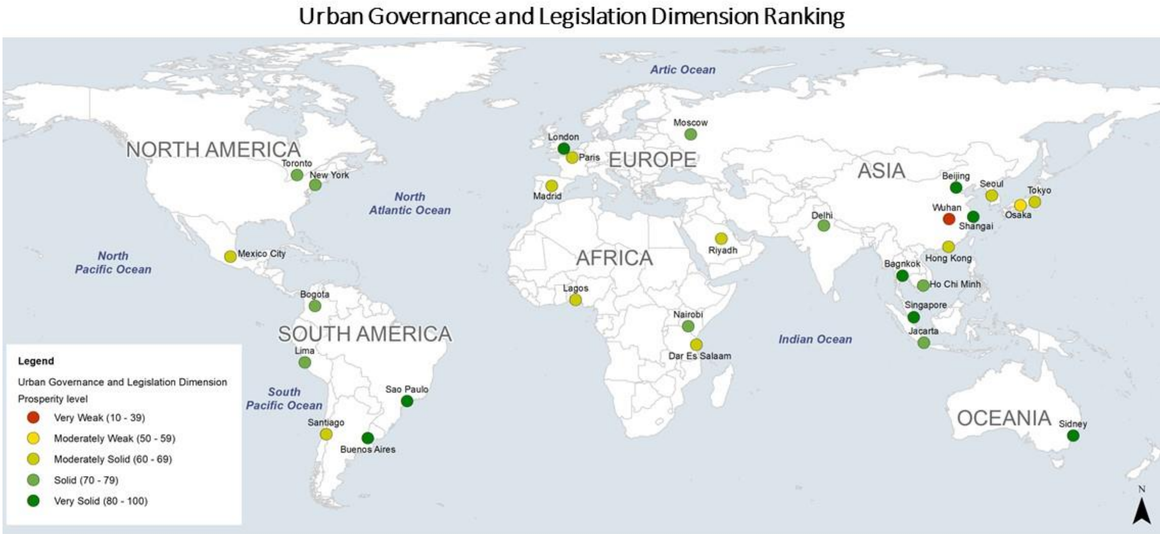
Ranking	Dimension	Indicators			
	URBAN GOVERNANCE AND LEGISLATION	Voter Turnout (%)	Days to Start a Business (days)	Ratio of Land Consumption Rate to Population Growth Rate (ratio, 2000-2015)	Local Online Service Index (LOSI, index value)
1	Singapore	Bangkok	Singapore	Moscow	Singapore
2	Shanghai	Singapore	Toronto	London	Madrid
3	Beijing	Sydney (Greater)	Hong Kong	Bangkok	New York (Greater)
4	Sydney (Greater)	Lima	Sydney (Greater)	Beijing	Paris
5	Sao Paulo	Paris	Paris	Singapore	Moscow
6	Buenos Aires	Buenos Aires	New York (Greater)	Sydney (Greater)	Buenos Aires
7	Bangkok	Jakarta	Santiago	Sao Paulo	Bogotá
8	London	Sao Paulo	London	Shanghai	Seoul
9	Nairobi	Nairobi	Bangkok	Lagos	Shanghai
10	Moscow	Beijing	Lagos	Nairobi	London
11	Bogotá	Hong Kong	Beijing	Delhi	Sao Paulo
12	New York (Greater)	Mexico City	Seoul	New York (Greater)	Toronto
13	Ho Chi Minh	Madrid	Mexico City	Ho Chi Minh	Mexico City
14	Toronto	London	Shanghai	Buenos Aires	Sydney (Greater)
15	Delhi	Seoul	Bogotá	Santiago	Tokyo
16	Lima	Delhi	Jakarta	Riyadh	Riyadh
17	Jakarta	Tokyo	Osaka	Hong Kong	Nairobi
18	Hong Kong	Bogotá	Moscow	Paris	Bangkok
19	Lagos	Osaka	Riyadh	Madrid	Lima
20	Paris	Santiago	Buenos Aires	Mexico City	Santiago
21	Santiago	Toronto	Tokyo	Tokyo	Lagos
22	Madrid	Lagos	Madrid	Seoul	Ho Chi Minh
23	Riyadh	Moscow	Sao Paulo	Osaka	Jakarta
24	Seoul	Riyadh	Ho Chi Minh	Wuhan	Delhi
25	Mexico City	New York (Greater)	Delhi	Bogotá	Dar Es Salaam
26	Dar Es Salaam	Shanghai	Nairobi	Toronto	Beijing
27	Tokyo	Dar Es Salaam	Lima	Jakarta	Osaka
28	Osaka	Wuhan	Dar Es Salaam	Dar Es Salaam	Hong Kong
29	Wuhan	Ho Chi Minh	Wuhan	Lima	Wuhan

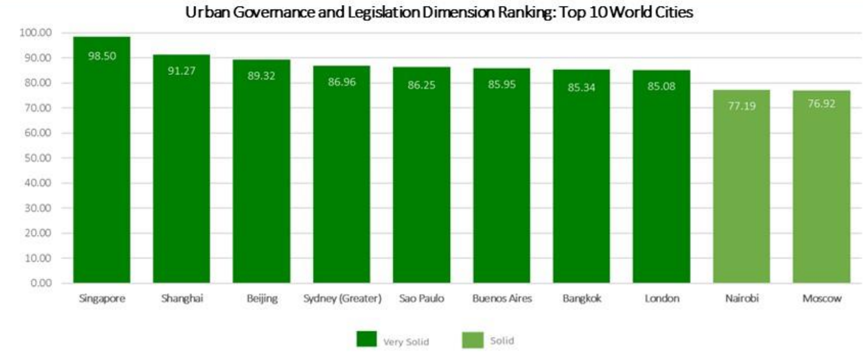
Source: Centro EURE, 2022.

This dimension is made up by three sub-dimensions: Participation and Institutional Capacity, Governance of Urbanization, and Development of e-Government. Singapore stands out by ranking first in two of the four indicators included in this dimension, followed by Bangkok, and Moscow, which rank first in one indicator each.

The top 10 cities of this dimension are Singapore, Shanghai, Beijing, Sydney, Sao Paulo, Buenos Aires, Bangkok, London, Nairobi, and Moscow.

Cities without data by indicator: For *Voter Turnout*: Dar Es Salaam, Ho Chi Minh, Shanghai, and Wuhan. For *Days to Start a Business*: Wuhan. For *Ratio of Land Consumption Rate to Population Growth Rate*: Bogota, Dar Es Salaam, Jakarta, Lima, and Toronto. For *Local Online Service Index*: Beijing, Hong Kong, Osaka, and Wuhan.





Source: Centro EURE, 2022

ANNEX 1: STANDARIZED DATA TABLES

This Annex shows the standardized data of each of the 46 indicators analyzed in this document.

Table 1: Comparative Analysis of Cities: Standardized Values by Dimension

City	CPI	PRODUCTIVITY	INFRASTRUCTURE DEVELOPMENT	QUALITY OF LIFE	EQUITY AND SOCIAL INCLUSION	ENVIRONMENTAL SUSTAINABILITY	URBAN GOVERNANCE AND LEGISLATION
Bangkok	56.17	61.13	52.82	40.72	41.78	55.25	85.34
Beijing	62.08	72.03	66.94	54.06	53.11	37.01	89.32
Bogotá	58.97	60.44	69.91	48.00	51.78	47.13	76.56
Buenos Aires	63.51	54.88	64.59	41.64	67.35	66.66	85.95
Dar Es Salaam	43.50	28.80	47.99	30.30	62.76	36.82	54.31
Delhi	58.34	61.91	52.96	59.51	61.31	43.31	71.02
Ho Chi Minh	49.31	45.47	54.89	32.84	44.30	43.76	74.62
Hong Kong	65.68	86.55	78.16	63.43	37.29	58.95	69.70
Jakarta	54.04	50.30	57.98	33.78	62.39	49.25	70.54
Lagos	34.61	9.93	41.22	14.85	25.61	47.84	68.19
Lima	56.53	52.45	59.67	34.76	78.21	43.16	70.92
London	66.73	72.51	75.91	61.59	45.29	60.03	85.08
Madrid	66.01	58.86	73.78	60.43	75.42	62.75	64.81
Mexico City	57.55	64.80	55.66	40.73	73.81	52.64	57.67
Moscow	67.98	66.47	83.20	68.33	62.88	50.09	76.92
Nairobi	54.44	27.30	60.06	28.16	74.62	59.32	77.19
New York (Greater)	64.85	71.60	72.17	56.46	61.38	51.60	75.91
Osaka	61.17	68.60	65.47	48.86	70.11	64.53	49.45

City	CPI	PRODUCTIVITY	INFRASTRUCTURE DEVELOPMENT	QUALITY OF LIFE	EQUITY AND SOCIAL INCLUSION	ENVIRONMENTAL SUSTAINABILITY	URBAN GOVERNANCE AND LEGISLATION
Paris	66.17	66.76	76.30	57.16	70.45	60.38	65.96
Riyadh	58.56	73.77	64.08	51.15	71.97	31.82	58.59
Santiago	52.58	55.25	66.29	36.09	50.04	42.62	65.17
Sao Paulo	54.70	63.74	59.43	42.30	40.86	35.60	86.25
Seoul	62.37	57.91	56.64	57.62	63.44	80.48	58.11
Shanghai	65.73	66.53	65.04	56.05	56.55	58.93	91.27
Singapore	75.49	87.54	68.65	67.21	72.33	58.69	98.50
Sydney (Greater)	67.85	67.28	64.11	57.62	61.55	69.59	86.96
Tokyo	64.61	75.99	65.23	53.62	57.80	83.10	51.93
Toronto	68.29	63.31	70.36	53.26	79.60	72.16	71.02
Wuhan	47.22	64.81	68.48	58.37	68.39	23.26	0.00

Source: Centro EURE, 2022.

Table 2: Comparative Analysis of Cities. Productivity Dimension. Standardized Values

City	PRODUCTIVITY	City Product per Capita ($ ppp)	Economic Density (GDP $ ppp/ km² built-up area in core land area)*	Unemployment Rate, % (15+ unemployed/labour force 15+)	Tech Adoption Rate (%)
Bangkok	61.13	74.51	92.49	31.97	45.56
Beijing	72.03	59.86	93.07	96.26	38.95
Bogotá	60.44	64.39	99.13	45.38	32.87
Buenos Aires	54.88	72.41	89.48	56.18	1.45
Dar Es Salaam	28.80	28.19		58.21	0.00
Delhi	61.91	54.36	90.50	40.88	
Ho Chi Minh	45.47	35.85	81.08	57.28	7.66
Hong Kong	86.55	75.71	97.94	72.56	100.00
Jakarta	50.30	68.51	88.70	42.14	1.85
Lagos	9.93	28.85		0.95	0.00
Lima	52.45	53.10	90.00	61.85	4.83
London	72.51	86.49	96.99	60.90	45.65
Madrid	58.86	81.18	98.23	16.61	39.42
Mexico City	64.80	67.94	95.51	76.53	19.21
Moscow	66.47	84.93	96.39	79.31	5.25
Nairobi	27.30	45.79		36.11	0.00
New York (Greater)	71.60	92.17	94.70	38.99	60.55
Osaka	68.60	76.10	94.60	67.57	36.12
Paris	66.76	87.49	97.59	46.93	35.01
Riyadh	73.77	77.49	88.51	55.30	
Santiago	55.25	68.27	97.13	35.80	19.79
Sao Paulo	63.74	66.29	86.79	49.75	52.13

City	PRODUCTIVITY	City Product per Capita ($ ppp)	Economic Density (GDP $ ppp/ km² built-up area in core land area)*	Unemployment Rate, % (15+ unemployed/labour force 15+)	Tech Adoption Rate (%)
Seoul	57.91	78.49	99.94	0.00	53.22
Shanghai	66.53	59.30	91.00	68.38	47.42
Singapore	87.54	89.86	99.75	78.39	82.18
Sydney (Greater)	67.28	80.04	92.61	66.27	30.20
Tokyo	75.99	80.65	96.22	71.80	55.30
Toronto	63.31	79.38	92.15	41.72	40.00
Wuhan	64.81	71.01	95.41	75.10	17.71

Source: Centro EURE, 2022.

Table 3: Comparative Analysis of Cities. Infrastructure Development Dimension. Standardized Values (1/2)

City	INFRASTRUCTURE DEVELOPMENT	Access to Improved Water (%)	Improved Sanitation (%)	Access to Electricity (%)	Physicians Density (per 1,000 people)	Internet Access (%)	Access to Public Transport (SDG 11.2.1)	Length of Mass Transport Network (km per million people)	Traffic Fatalities (per 100,000 people)
Bangkok	52.82	71.97	100.00	99.54	35.28	22.22	22.69	9.94	36.24
Beijing	66.94	96.72	94.77	100.00	80.57	45.80	45.00	46.75	93.70
Bogotá	69.91	99.77	100.00	99.88		51.50	91.12	3.23	89.16
Buenos Aires	64.59	97.29	98.69	88.37	67.90	59.90	86.81	9.90	80.50
Dar Es Salaam	47.99	97.63	98.04	72.72	5.08	4.40		34.35	64.86
Delhi	52.96	92.77	87.26	99.19	2.85	31.10		15.08	
Ho Chi Minh	54.89	99.66	99.46	100.00	42.38	33.96	67.29	1.76	86.07
Hong Kong	78.16	100.00	96.19	100.00	49.09	74.50	98.86	36.87	97.86
Jakarta	57.98	69.71	99.24	99.65	14.69	63.44		0.21	81.28
Lagos	41.22	98.30	91.62	99.65	21.19	38.00	35.32	2.18	47.83
Lima	59.67	96.50	94.34	99.31	37.26	48.20	31.18	4.87	98.87
London	75.91	100.00	98.91	100.00	63.76	89.70	94.66	48.19	95.67
Madrid	73.78	99.89	99.89	100.00	80.87	75.30	98.48	52.46	94.43
Mexico City	55.66	100.00	93.36	100.00	67.90	31.24	37.74	26.98	93.90
Moscow	83.20	100.00	100.00	100.00	85.97	94.20	85.36	83.46	95.40
Nairobi	60.06	98.19	92.05	97.58	15.08	50.33	56.17	33.48	67.65
New York (Greater)	72.17	100.00	99.78	100.00	64.70	68.00	68.53	67.61	83.59
Osaka	65.47	98.42	100.00	100.00	53.44	78.50	68.10	12.12	93.65
Paris	76.30	100.00	98.48	100.00	69.49	81.30	97.67	34.86	92.11
Riyadh	64.08	95.48	84.76	100.00	55.11	84.47	4.45	31.93	84.92

City	INFRASTRUCTURE DEVELOPMENT	Access to Improved Water (%)	Improved Sanitation (%)	Access to Electricity (%)	Physicians Density (per 1,000 people)	Internet Access (%)	Access to Public Transport (SDG 11.2.1)	Length of Mass Transport Network (km per million people)	Traffic Fatalities (per 100,000 people)
Santiago	66.29	100.00	100.00	100.00			90.07	24.64	
Sao Paulo	59.43	99.77	93.58	100.00	58.21	48.71	87.89	4.45	
Seoul	56.64	98.42	100.00	100.00			69.29	17.17	
Shanghai	65.04	96.72	94.77	100.00	49.09	45.80		33.23	94.15
Singapore	68.65	100.00	100.00	100.00	48.60	73.00	94.04	48.30	96.75
Sydney (Greater)	64.11	100.00	100.00	100.00	64.80	74.00	68.28	14.14	92.11
Tokyo	65.23	98.42	100.00	100.00	55.98	86.00	72.92	6.73	93.65
Toronto	70.36	99.21	99.02	100.00	46.57	83.30		12.92	90.56
Wuhan	68.48	96.72	94.77	100.00	60.75	90.00	58.29	16.54	95.00

Source: Centro EURE, 2022.

Table 4: Comparative Analysis of Cities. Infrastructure Development Dimension. Standardized Values (2/2)

City	INFRASTRUCTURE DEVELOPMENT	Change in Transport Mode (ratio)	Congestion Level (%)	Flight Destinations (number of)	Built-Up Area per Capita 2015 (m2 per capita)	Change in Total Built-Up Area per Capita 2000-2015 (%)
Bangkok	52.82	12.92	47.00	86.36	42.50	100.00
Beijing	66.94	56.46	63.00	100.00	47.50	0.00
Bogotá	69.91		32.00	62.50		
Buenos Aires	64.59	40.52	65.00	28.41	35.83	80.58
Dar Es Salaam	47.99			6.82		
Delhi	52.96		44.00	100.00	18.33	39.02
Ho Chi Minh	54.89			21.59	0.83	50.82
Hong Kong	78.16	99.38	69.00	94.32	0.00	100.00
Jakarta	57.98		47.00	46.59		
Lagos	41.22			19.32	0.00	0.00
Lima	59.67		43.00	43.18		
London	75.91	56.46	62.00	100.00	77.50	0.00
Madrid	73.78	43.28	77.00	100.00	37.50	0.00
Mexico City	55.66	19.09	48.00	88.64	16.67	0.00
Moscow	83.20	43.82	41.00	100.00	66.67	85.71
Nairobi	60.06			42.05	29.17	78.95
New York (Greater)	72.17	22.93	63.00	100.00	0.00	100.00
Osaka	65.47		64.00	25.00	45.00	47.37
Paris	76.30	37.36	61.00	100.00	98.33	21.35
Riyadh	64.08		76.00	69.32	82.50	0.00
Santiago	66.29		56.00	30.68	27.50	67.74

City	INFRASTRUCTURE DEVELOPMENT	Change in Transport Mode (ratio)	Congestion Level (%)	Flight Destinations (number of)	Built-Up Area per Capita 2015 (m2 per capita)	Change in Total Built-Up Area per Capita 2000-2015 (%)
Sao Paulo	59.43	11.95	55.00	78.41	21.67	53.49
Seoul	56.64	3.18		100.00	21.67	0.00
Shanghai	65.04	41.12	69.00	100.00	53.33	3.23
Singapore	68.65	67.24	68.00	96.59	0.00	0.00
Sydney (Greater)	64.11	10.92	67.00	70.45	33.33	38.46
Tokyo	65.23	33.88	58.00	84.09	58.33	0.00
Toronto	70.36	5.02	67.00	100.00		
Wuhan	68.48		73.00	87.50	49.17	0.00

Source: Centro EURE, 2022.

Table 5: Comparative Analysis of Cities. Quality of Life Dimension. Standardized Values (1/2)

City	QUALITY OF LIFE	Life Expectancy at Birth (years)	Vaccination Coverage (%)	Mean Years of Schooling (years)	Share of Students in Higher Education (%)	Scientists (number of)	Science Impact (index score)
Bangkok	40.72	66.41	97.00	54.29	54.17	7.12	62.57
Beijing	54.06	69.40	99.00	55.71	41.94	30.08	69.95
Bogotá	48.00	77.77	92.00	59.29	74.90	4.93	39.45
Buenos Aires	41.64	75.12	86.00	70.71	32.06	7.93	21.42
Dar Es Salaam	30.30	25.84	89.00	41.43	0.00	0.00	15.90
Delhi	59.51		91.00	45.71	30.00		
Ho Chi Minh	32.84	70.81	89.00	58.57	30.29	6.09	15.90
Hong Kong	63.43	95.82	99.00	85.71	41.43	11.93	59.27
Jakarta	33.78	55.15	85.00	57.14	15.79	2.32	28.17
Lagos	14.85	0.00	63.00	44.29	0.00	0.00	15.90
Lima	34.76	82.29	88.00	65.71	22.87	21.64	28.91
London	61.59	88.43	93.00	92.14	23.31	72.71	77.06
Madrid	60.43	96.60	96.00	70.00	38.70	25.56	57.56
Mexico City	40.73	68.64	82.00	61.43	34.84	12.50	46.68
Moscow	68.33	72.07	95.70	85.71	49.36	57.48	62.11
Nairobi	28.16	26.47	92.00	46.43	27.95	1.16	25.02
New York (Greater)	56.46	85.60	94.00	95.71	21.95	100.00	51.62
Osaka	48.86	92.52	98.00	91.43	5.78	18.86	15.90
Paris	57.16	95.35	96.00	82.14	52.36	53.06	63.48
Riyadh	51.15	59.81	96.00	67.86	87.78		
Santiago	36.09		96.00	73.57	17.21	7.14	51.52
Sao Paulo	42.30	71.82	73.00	55.71	15.18	0.00	47.33

City	QUALITY OF LIFE	Life Expectancy at Birth (years)	Vaccination Coverage (%)	Mean Years of Schooling (years)	Share of Students in Higher Education (%)	Scientists (number of)	Science Impact (index score)
Seoul	57.62		98.00	86.43	12.56	62.88	84.81
Shanghai	56.05	69.40	99.00	55.71	21.54	65.93	64.83
Singapore	67.21	90.63	96.00	82.14	9.15	69.60	42.17
Sydney (Greater)	57.62	90.31	95.00	92.14	84.15	40.96	59.27
Tokyo	53.62	93.46	98.00	91.43	9.44	47.56	98.07
Toronto	53.26	89.68	91.00	95.00	48.97	31.31	41.04
Wuhan	58.37	85.75	99.00	55.71	100.00	22.85	53.63

Source: Centro EURE, 2022.

Table 6: Comparative Analysis of Cities. Quality of Life Dimension. Standardized Values (2/2)

City	QUALITY OF LIFE	Museums (number per million people)	Accommodation Affordability (% income per night)	Homicide rate (per 100,00 people)	Crime Index Rank (rank position)	Green Area per Capita (m²/inhabitant)	Land Allocated to Open Public Space (share of urban area %)	Land Allocated to Streets (share of urban area %)	Accessibility to Open Public Space (%)
Bangkok	40.72	5.94	64.28	45.06	4.54	46.00	3.65	47.33	11.77
Beijing	54.06	37.87	49.16	100.00	38.05	100.00	15.55	24.03	26.13
Bogotá	48.00	5.32	62.84	23.32	3.27	33.13	31.55	76.70	87.50
Buenos Aires	41.64	14.03	62.47	40.84	1.10	40.53	9.15	72.03	49.55
Dar Es Salaam	30.30	0.00		24.24	6.54	100.00			
Delhi	59.51	0.00		90.33		100.00			
Ho Chi Minh	32.84	0.46		63.78	0.89	10.67	3.80	46.20	30.40
Hong Kong	63.43	20.95	46.76	75.77	46.38	100.00	32.55	83.27	89.11
Jakarta	33.78	0.41		73.06	5.47	15.33			
Lagos	14.85	0.00	0.00	16.53	6.21	6.67	2.50	45.87	6.95

City	QUALITY OF LIFE	Museums (number per million people)	Accommodation Affordability (% income per night)	Homicide rate (per 100,00 people)	Crime Index Rank (rank position)	Green Area per Capita (m^2/inhabitant)	Land Allocated to Open Public Space (share of urban area %)	Land Allocated to Streets (share of urban area %)	Accessibility to Open Public Space (%)
Lima	34.76	5.91		11.99	2.17	18.07			
London	61.59	49.33	13.79	63.78	2.92	100.00	64.70	39.83	81.29
Madrid	60.43	39.25	87.32	80.30	0.62	100.00	33.50	57.50	63.13
Mexico City	40.73	10.42	72.71	20.60	3.04	50.27	18.55	42.33	46.26
Moscow	68.33	72.05	85.76	58.16	39.11	100.00	41.70	54.07	83.31
Nairobi	28.16	0.01		37.06	6.11	43.73	5.10	37.10	17.93
New York (Greater)	56.46	15.20	30.65	47.68	8.60	90.43	45.50	32.53	71.03
Osaka	48.86	10.03		68.32	31.87	30.00	23.70	76.53	72.21
Paris	57.16	79.35	26.07	65.17	5.38	70.53	18.25	41.53	51.58
Riyadh	51.15	0.50		49.27		81.67	11.90	46.37	10.35
Santiago	36.09	9.31		49.91	8.33	15.13	11.10	50.33	43.47
Sao Paulo	42.30	15.21	67.79	26.55	0.42	100.00	8.40	57.07	53.76
Seoul	57.62	25.09	76.71	63.78	32.58	100.00	15.15	42.33	48.75
Shanghai	56.05	28.95	51.05	100.00	3.51	56.67			
Singapore	67.21	24.94	87.50	100.00	66.54	100.00	37.30	64.73	70.26
Sydney (Greater)	57.62	25.99	87.99	46.17	2.46	100.00	11.40	37.40	33.38
Tokyo	53.62	17.75	7.20	74.48	17.26	38.20	17.45	65.53	74.82
Toronto	53.26	14.54	0.00	55.49	18.85	100.00			
Wuhan	58.37	9.72		69.76	3.96	83.33			

Source: Centro EURE, 2022.

Table 7: Comparative Analysis of Cities. Equity and Social Inclusion Dimension. Standardized Values

City	EQUITY AND SOCIAL INCLUSION	Property Affordability (Price to income ratio)	Affordability of Mass Public Transport (number of trips afforded)	Affordability of Non-Massive Public Transport (number of trips afforded)	Beer Price (US$)	Gini Coefficient (coefficient)	Women in Local Government (%)
Bangkok	41.78	58.86	98.36	0.00	15.71	46.98	30.76
Beijing	53.11	39.33	87.75	100.00	0.00	76.16	15.40
Bogotá	51.78	63.20	93.50	72.28	0.00	10.68	71.00
Buenos Aires	67.35	65.08				46.98	90.00
Dar Es Salaam	62.76					61.92	63.60
Delhi	61.31	75.35	98.59	70.98	0.00		61.60
Ho Chi Minh	44.30	68.79	88.30	0.00	0.00	64.41	
Hong Kong	37.29	34.08	79.39	60.87	0.00	16.01	33.40
Jakarta	62.39	66.12	96.43	100.00	15.83	35.94	60.00
Lagos	25.61	79.18	41.07	0.00	0.00	0.00	33.40
Lima	78.21	77.04				72.60	85.00
London	45.29	78.58	38.95	0.00	12.30	45.91	96.00
Madrid	75.42	82.01	67.36	100.00	48.98	77.22	76.92
Mexico City	73.81	81.21				46.26	93.94
Moscow	62.88	70.34	71.34	100.00	26.10	42.35	67.12
Nairobi	74.62	64.19				68.68	91.00
New York (Greater)	61.38	86.92	63.50	100.00	8.50	46.62	62.74
Osaka	70.11					70.11	
Paris	70.45	70.56	63.64	100.00	22.74	67.62	98.16
Riyadh	71.97	97.94	91.80	100.00	0.00		70.10
Santiago	50.04	74.00	78.25	57.96	0.00		40.00

City	EQUITY AND SOCIAL INCLUSION	Property Affordability (Price to income ratio)	Affordability of Mass Public Transport (number of trips afforded)	Affordability of Non-Massive Public Transport (number of trips afforded)	Beer Price (US$)	Gini Coefficient (coefficient)	Women in Local Government (%)
Sao Paulo	40.86	75.38				0.00	47.20
Seoul	63.44	58.68	83.66	100.00	23.08		51.80
Shanghai	56.55	47.88	95.27	100.00	0.00	76.16	20.00
Singapore	72.33	72.96	89.52	100.00	96.23	25.27	50.00
Sydney (Greater)	61.55	87.98	53.68	100.00	0.00	67.62	60.00
Tokyo	57.80	78.95	39.20	100.00	0.00	70.82	
Toronto	79.60	83.52				78.29	77.00
Wuhan	68.39	68.39					

Source: Centro EURE, 2022.

Table 8: Comparative Analysis of Cities. Environmental Sustainability Dimension. Standardized Values

City	ENVIRONMENTAL SUSTAINABILITY	PM2.5 Concentration (µg/m3)	Wastewater Treatment (%)	Waste Generation per Capita (tonnes/year/person) (municipal solid waste)	City Diversion Rate (recycling, %)	Natural Protected Areas (%)
Bangkok	55.25	74.07	33.20	13.72	100.00	
Beijing	37.01	31.35	86.10	0.00	4.00	63.61
Bogotá	47.13	74.28	70.00	8.13	34.00	49.23
Buenos Aires	66.66	94.10	86.00	49.56	100.00	3.65
Dar Es Salaam	36.82	81.10	10.00	30.18	26.00	
Delhi	43.31	0.00	72.00	75.65	46.00	22.88
Ho Chi Minh	43.76	78.12	10.00	38.92	48.00	
Hong Kong	58.95	70.56	85.66	0.00	58.00	80.54
Jakarta	49.25	78.01	3.00	100.00	16.00	
Lagos	47.84	67.25	5.00	71.28		
Lima	43.16	67.47	62.00	0.00		
London	60.03	92.93	98.80	0.00	84.00	24.42
Madrid	62.75	95.70	100.00	0.00	50.00	68.08
Mexico City	52.64	81.10	94.00	17.76	24.00	46.35
Moscow	50.09	91.33	99.95	0.00	8.00	51.15
Nairobi	59.32	90.26	80.00	57.00	10.00	
New York (Greater)	51.60	98.04	100.00	0.00	34.00	25.96
Osaka	64.53	91.01	43.00	91.43		32.69
Paris	60.38	91.75	49.60	80.93	40.00	39.62
Riyadh	31.82	35.29	62.00	0.00	30.00	
Santiago	42.62	76.20	100.00	0.00	20.00	16.92

City	ENVIRONMENTAL SUSTAINABILITY	PM2.5 Concentration (μg/m3)	Wastewater Treatment (%)	Waste Generation per Capita (tonnes/year/person) (municipal solid waste)	City Diversion Rate (recycling, %)	Natural Protected Areas (%)
Sao Paulo	35.60	89.84	20.00	26.55	6.00	-
Seoul	80.48	76.63	100.00	56.15	100.00	69.62
Shanghai	58.93	56.81	78.90	0.00	100.00	-
Singapore	58.69	84.62	100.00	0.00	100.00	8.85
Sydney (Greater)	69.59	98.36	99.00	0.00	56.00	94.62
Tokyo	83.10	90.37	100.00	86.67	100.00	38.46
Toronto	72.16	98.15	95.30	63.50	100.00	3.85
Wuhan	23.26	40.51	6.00	-	-	-

Source: Centro EURE, 2022.

Table 9: Comparative Analysis of Cities. Urban Governance and Legislation Dimension. Standardized Values

City	URBAN GOVERNANCE AND LEGISLATION	Voter Turnout (%)	Days to Start a Business (days)	Ratio of Land Consumption Rate to Population Growth Rate (ratio, 2000-2015)	Local Online Service Index (LOSI, index value)
Bangkok	85.34	100.00	97.60	100.00	43.75
Beijing	89.32	71.23	96.73	100.00	
Bogotá	76.56	53.82	95.86		80.00
Buenos Aires	85.95	79.78	95.21	88.80	80.00
Dar Es Salaam	54.31		87.36		21.25
Delhi	71.02	56.70	92.37	99.00	36.00
Ho Chi Minh	74.62		93.25	90.60	40.00
Hong Kong	69.70	71.23	99.56	38.30	
Jakarta	70.54	77.02	95.86		38.75
Lagos	68.19	35.60	97.17	100.00	40.00
Lima	70.92	82.61	88.89		41.25
London	85.08	65.80	98.26	100.00	76.25
Madrid	64.81	68.23	94.77	0.00	96.25
Mexico City	57.67	70.41	96.51	0.00	63.75
Moscow	76.92	31.00	95.42	100.00	81.25
Nairobi	77.19	72.32	90.20	100.00	46.25
New York (Greater)	75.91	17.20	98.47	96.70	91.25
Osaka	49.45	52.70	95.64	0.00	
Paris	65.96	80.35	98.47	0.00	85.00
Riyadh	58.59	29.80	95.42	60.40	48.75
Santiago	65.17	45.31	98.47	76.90	40.00

City	URBAN GOVERNANCE AND LEGISLATION	Voter Turnout (%)	Days to Start a Business (days)	Ratio of Land Consumption Rate to Population Growth Rate (ratio, 2000-2015)	Local Online Service Index (LOSI, index value)
Sao Paulo	86.25	76.90	94.34	100.00	73.75
Seoul	58.11	58.20	96.73	0.00	77.50
Shanghai	91.27		96.30	100.00	77.50
Singapore	98.50	95.81	99.56	100.00	98.61
Sydney (Greater)	86.96	91.00	99.35	100.00	57.50
Tokyo	51.93	55.00	95.21	0.00	57.50
Toronto	71.02	41.00	99.56		72.50
Wuhan	0.00			0.00	

Source: Centro EURE, 2022.

ANNEX 2: COMPARATIVE CPI INDEX INDICATORS METADATA

The CPI is constituted by six dimensions: Productivity, Infrastructure, Quality of Life, Equity and Inclusion, Environmental Sustainability, and Urban Governance and Legislation. The overall CPI value results from the aggregation of these six dimensions.

This exercise consider three levels of the CPI: basic, extended, and contextual, in addition to new indicators that allowed to expand the scope of the analysis, for a total of 46 indicators. Some of them were integrated in new seven CPI's sub-dimensions within the structure of the six spokes of the wheel of prosperity.

Dimension 1. Productivity Index

Productivity is an economic measure of output per unit of input, that can be measured at different scales. Productivity inputs include labour and capital, while the output is typically measured in GDP components. The City Prosperity Initiative conceptualizes a prosperous city as one that fosters economic development and creates conditions necessary to provide decent jobs and equal opportunities for everyone, by implementing effective economic policies.

Urban areas contribute substantially to national productivity because they concentrate economic activities, incubate talents and nurture creativity and innovation. The concentration of economic activities leads to substantial benefits and efficiency due to economies of agglomeration and scale. Agglomeration economies give cities a competitive advantage as it makes economic productivity cheaper in the densely populated areas within cities. Therefore, productivity gains are vital to any city as it would allow the city to produce more with less. A prosperous city contributes to economic growth and development, generating income, employment and equal opportunities that further provide adequate living standards for the entire population.

TABLE 1. Productivity Dimension: Indicators for Comparative Analysis of Cities

01 PRODUCTIVITY (P)	1. Economic Strength (ES)	1.1 City Product per Capita
	2. Economic Agglomeration (EA)	2.1 Economic Density
	3. Employment (Em)	3.1 Unemployment Rate
	4. Innovative Development (ID)*	4.1 Tech Adoption Rate

*Note: * Sub-dimensions added to CPI original structure.*

1. Economic Strength (ES)

1.1 City product Per Capita

Indicator:	City Product Per Capita
Scope:	Basic CPI / SDG 8.1.1. Annual growth rate of real GDP per capita
Rationale:	Cities have traditionally served as economic centers and have become the primary providers of services and engines of economic growth and development. Additionally, cities currently generate over half of national economic activity worldwide (UN-Habitat, 2003). Urban production, as measured through the City Product, is an important indicator for the economic development of a city, vis-à-vis national development, and it provides information about income levels and the capacity to generate employment (United Nations, 2001). A prosperous city must increase its City Product Per Capita in-order to achieve higher levels of economic well-being.
Definition:	The City Product Per Capita is the sum of the gross value added (wages plus business surplus plus taxes less imports), or the total final demand (consumption plus investment plus exports), relative to the city's total population.
Unit:	US$ PPP per capita.
Methodology:	The City Product Per Capita is calculated as the sum of the products of the national Gross Domestic Product (GDP) of urban economic sectors (industrial and service) and the city's share of that sector's total employment, divided by total city population as shown below: $$City\ Product\ per\ capita = \frac{\sum_{j=1}^{J} National\ Product_j * \left(\frac{city\ employment_j}{national\ employment_j}\right)}{Total\ City\ Population}$$ Where j represents the industry sector. When city employment information by sector is not available, it is possible to use census information about the employment structure. The total City Product is the sum of all City Sector Products converted to international dollars using the annual Purchasing Power Parity (PPP) exchange rate. This ensures comparable figures across countries.
Source:	Census data, Rosstat and Mosstat / 2019.
Benchmark:	Min = US$714.64 Per Capita, PPP Max = US$108,818.96 Per Capita, PPP Calculated from World Bank data (2014).
Standardization:	$$City\ Product\ per\ capita^{(S)} = 100\left[\frac{\ln(City\ Product\ per\ capita) - In(Min)}{In(Max) - In(Min)}\right]$$ $$City\ Product\ per\ capita^{(S)} = 100\left[\frac{\ln(City\ Product\ per\ capita) - 6.57}{11.60 - 6.57}\right]$$ Decision: $$City\ Product\ per\ capita^{(S)} = \begin{cases} 100, & If\ In(City\ Product\ per\ capita) \geq 11.60 \\ City\ Product\ per\ capita^{(S)}, & If\ 6.57 < ln(City\ Product\ per\ capita) < 11.60 \\ 0, & If\ ln(City\ Product\ per\ capita) \leq 6.57 \end{cases}$$
Limitations:	The method to calculate the City Product Per Capita assumes that mean sector labor productivity is the same for workers across regions of the country. Hence, this indicator does not consider the differences in labor productivity by sector across cities in the same country. Moreover, when census data are utilized, the indicator assumes that the sector structure has not changed between the census date and calculation date. Because the City Product Per Capita is based on GDP Per Capita, informal sector production is not considered. Therefore, the CPI will include a variable for median household income.
References:	Bibliographic references: UN-Habitat (2003). The habitat agenda goals and principles, commitments, and the global plan of action. United Nations (2001). The State of the World's Cities Report 2001. United Nations (2008). International Standard Industrial Classification of All Economic Activities. Statistical papers. Revision No 4. The World Bank (2014). World Development Indicators 1960 – 2013. URL references: [1]: http://data.worldbank.org/indicator/PA.NUS.PPPC.RF, Accessed August 10, 2014.

Indicator:	City Product Per Capita
	[2]: http://data.worldbank.org/indicator/NY.GNP.PCAP.PP.KD?display=default, Accessed August 10, 2014.

2. Economic Agglomeration (EA)

2.1 Economic Density

Indicator:	Economic Density
Scope:	Basic CPI
Rationale:	This is an aspect of productivity that looks at the concentrations and distributions of economic activity. Economic Density means, the intensity of labor, human, and physical capital relative to physical space (Ciccone & Hall, 1996). Density is high when there is a large amount of labor, capital, and other economic factors per square kilometer. Economic density in the CPI, therefore, looks at the intensity of production that a city generates in monetary terms per specified area i.e., GDP per Square kilometer of the urban agglomeration. A high economic density is desirable mainly because of the following reasons: - If there are externalities associated with the physical proximity of production then density will contribute to productivity for this reason as well (Ciccone & Hall, 1996). For example, transportation costs of some goods and services will reduce because of closer geographical proximity that arises from higher density. - At the same time, economic density enables the specialization of the production of input, final goods, and the labor force, which decreases production costs (Ciccone & Hall, 1996; Jenks, Burton and Williams, 2005). A prosperous city will therefore seek to take advantage of these agglomeration effects to increase the well-being of its population.
Definition:	Economic Density is the City Product divided by built-up area of the urban agglomeration (square kilometers).
Unit:	Million US$ PPP per km2
Methodology:	$Economic\ Density = \left[\frac{City\ Product\ (\$PPP)}{City's\ built-up\ area\ (square\ kilometres)}\right]$
Source:	Organization for Co-operation and Economic Development / 2019.
Benchmark:	$X*$ = ln ($857.37 million (PPP)/ Km2) The reference for the benchmark is the 2010 world GDP per square kilometer estimation from 275 OECD cities. It is the maximum value from the calculations that were done as explained below: • Data was obtained from the OECD database. 275 cities and smaller regions (TL3 regions [1]) were used in the calculation. • Components (found in OECD website [2]) used in the calculation were: - City GDP, 2010 - Estimates of GDP of metropolitan areas, expressed in millions of US$, PPPs, OECD base year (2005). The estimates are derived from the values of TL3 regions. - City area, 2006 - The urbanized area is defined as the land area covered by buildings or infrastructure for urban use. It includes, for example, residential and non-residential buildings, major roads, railways, and sport facilities.
Standardization:	$Economic\ Density^{(S)} = 100\left(1 - \left\lvert\frac{In(Economic\ Density) - In(X^*)}{In(X^*)}\right\rvert\right)$ $Economic\ Density^{(S)} = 100\left(1 - \left\lvert\frac{In(Economic\ Density) - In(857.37\ mil)}{In(857.37\ mil)}\right\rvert\right)$ $Economic\ Density^{(S)} = 100\left(1 - \left\lvert\frac{In(Economic\ Density) - 20.57}{20.57}\right\rvert\right)$

Indicator:	Economic Density
	$Economic\ Density^{(S)} = \begin{cases} Economic\ Density^{(S)}, & If\ 0 \leq (Economic\ Density) < In\ (857.37\ mil) \\ 100, & If\ (Economic\ Density) \geq In\ (857.37\ mil) \end{cases}$
Limitations:	The economic density indicator assumes that the economic activity of a city is homogenously spatially distributed, i.e. regional differences within the city area are not taken into account. Moreover, it is possible that a high concentration of the economic activity generates negative externalities (e.g. rising prices, a population's quality of life).
References:	Bibliographic references: Ciccone, A, & Hall, R. E. (1996). Productivity and the density of economic activity. The American Economic Review. Vol 86, N 1. Jenks, Mike, Burton, Elizabeth and Katie, Williams, Eds. (2005). The compact City. A sustainable Urban Form? Taylor & Francis e-Library. United Kingdom. URL references: [1] http://www.oecd-ilibrary.org/urban-rural-and-regional-development/data/small-regions-tl3_region-tl3-data-en, accessed 14th August 2015 [2] http://stats.oecd.org/Index.aspx?Datasetcode=CITIES, The estimates are derived from the values of TL3 regions, accessed 13th August 2015

3. Employment (Em)

3.1 Unemployment Rate

Indicator:	Unemployment Rate
Scope:	Basic CPI / SDG 8.5.2. Unemployment rate, by sex, age and persons with disabilities / ESG (Environmental, Social and Corporate Governance).
Rationale:	Work can be defined as a founding value of the human society. This interpretation was not motivated by mere economic reasons, but rather stemmed from the recognition that work is the most appropriate tool for the expression of the human personality in society and that it is an asset and a right that will increase the dignity of every person. Also, it corresponds to a fundamental human desire to fulfill oneself in relationship with other persons and the entire world. Unemployment rate, therefore, is one of the most comprehensive indicators of economic activity and general human well-being. High levels of unemployment are detrimental to the city's economy and reflect structural problems in the labor market. Moreover, people who are willing to work but are unable to do so suffer not only income losses but also a decline in their mental health and social relationships and personal vulnerability effects (Darity and Goldsmith, 1996). In addition, rising levels of unemployment reflect macroeconomic uncertainty that leads to lower consumption, investment, and production. A prosperous city will seek to reduce unemployment to lead the economy into a growth path with better opportunities for all its inhabitants.
Definition:	The number of unemployed people as a proportion of the total labor force. • Unemployed Person – according to the International Labor Organization (2013), an unemployed person is one that, during the reference period, is without work but available to work and is actively seeking employment. • Labor force – The labor force comprises all those persons in the working age population (as specified by the country) who either had jobs (the Employed), or those who did not have jobs but were willing, able, and looking for work (the Unemployed). The labor force excluded some groups of people who have voluntarily or involuntarily left the labor market. These include: - People on disability allowance (unable to work) - People on sickness benefits (unable to work) - Women having children on maternity leave - Fathers on paternity leave. - People demotivated by years of unemployment and so no longer seek work. - People who have taken early retirement - Adults in full time education
Unit:	%
Methodology:	$Unemployment\ Rate = 100 \left[\frac{Unemployment}{Labour\ Force}\right]$

Indicator:	Unemployment Rate
Source:	Open Data Moscow City Government / 2020.
Benchmark:	Min = 1% Max = 28.2% Calculated from The World Bank (2014).
Standardization:	$Unemployment\ Rate^{(S)} = 100\left[1 - \frac{\sqrt[4]{Unemployment\ Rate} - Min}{Max - Min}\right]$ $Unemployment\ Rate^{(S)} = 100\left[1 - \frac{\sqrt[4]{Unemployment\ Rate} - 1}{2.3 - 1}\right]$ Decision: $Unemployment\ Rate^{(S)} = \begin{cases} 0, & If\ \sqrt[4]{Unemployment\ Rate} \geq 2.3 \\ Unemployment\ Rate^{(S)}, & If\ 1 < \sqrt[4]{Unemployment\ Rate} < 2.3 \\ 100, & If\ \sqrt[4]{Unemployment\ Rate} \leq 1 \end{cases}$
Limitations:	The age coverage used to calculate the unemployment rate is 15 years and over. However, some countries have a lower age limit or have imposed an upper age-limit. This means that country comparisons have to be made with caution. Additionally, unemployment rate says nothing about the type of unemployment - whether it is cyclical and short term or structural and long term. Finally, this measure masks information on the composition of the jobless population and therefore misses out on the particularities of the education level, ethnic origin, socioeconomic background, work experience, etc. (ILO, 2013).
References:	Bibliographic references: Darity, William Jr. and Goldsmith, Arthur H. (1996). Social Psychology, Unemployment and Macroeconomics. The Journal of Economic Perspectives. Vol 10 (1). International Labour Organization (ILO). (2013). Key Indicators of the Labour Markets. 8th edition. The World Bank (2014). World Development Indicators 1960 – 2013. [4] URL references: [1] http://www.ncbi.nlm.nih.gov/pubmed/21298870 - Work as a basic human need and health promoting factor, accessed August 13, 2015. [2]: http://www.sib.org.bz/documentation/labour-force, accessed August 20, 2015. [3]:http://www.economicshelp.org/blog/569/economics/size-of-labour-force-and-working-population/, accessed August 20, 2015[4]: http://data.worldbank.org/indicator/SL.UEM.TOTL.ZS, accessed August 9, 2014.

4. Innovative Development (ID) *

4.1 Tech Adoption Rate

Indicator	Tech Adoption Rate
Scope:	Global Comparative Index
Rationale:	Technology and its adoption by the public can be a way to reshape the traditional forms of participation by reducing barriers and increasing efficiency and strengthen the mechanisms for urban governance [1] by allowing citizens and governments to develop new ways of relating to each other and working together [2]. A prosperous city aims at taking advantage of technology to improve its governance and civic engagement mechanisms.
Definition:	Technology adoption rate. Rate of tech adoption of new electronic technologies within a city based on demographic data. This considers the propensity to download a new app or service on a smart device [3].
Unit:	(%)
Methodology:	$Tech\ adoption\ rate = \left[\frac{Total\ population\ using\ technology}{Total\ city\ population}\right]$
Source:	City government statistics, as well as censuses and surveys
Benchmark:	Min: 1 Max: 20 Calculated from 2thinknow City Benchmarking Data using data for selected cities [4].

Standardization:	$$Tech\ adoption\ rate^{(S)} = 100\left[\frac{Tech\ adoption\ rate - Min}{Max - Min}\right]$$ $$Tech\ adoption\ rate^{(S)} = 100\left[\frac{Tech\ adoption\ rate - 1}{20 - 1}\right]$$ Decision: $$= \begin{cases} 100, if\ Tech\ adoption\ rate \geq 20 \\ Tech\ adoption\ rate^{(S)}, if\ 1 \leq Tech\ adoption\ rate < 20 \\ 0, if\ Tech\ adoption\ rate < 1 \end{cases}$$
Limitations:	This indicator is intended to show overall use of basic technological devices and services, but does not show if the technology is used for participation or civic engagement. This data point varies considerably pre-Covid and post-Covid. The percentage has generally risen significantly in cities that were locked down for extended periods during 2020-2021. [3]
References	URL References: [1] https://unhabitat.org/sites/default/files/2021/08/innovation_and_digital_technology_to_re-imagine_participatory_budgeting.august.2021_mp57813rh_1.pdf, Accessed, December 15, 2021 [2] http://urbanresiliencehub.org/wp-content/uploads/2018/11/Social-Resilience-Guide-SMALL-Pages.pdf, Accessed, December 15, 2021 [3] Based on 2thinknow metadata 2022. [4] http://go.2thinknow.com/, Accessed January 5, 2022

Dimension 2. Infrastructure Development

Infrastructure is defined as the set of basic physical systems, organizational structures, facilities, and installations needed for the functioning of a society, or economy. The prosperity of a city largely depends on the development of infrastructure, including transportation, communication, or provision of basice services, among others. Social infrastructure, like water supply, sanitation, and education and health facilities, have a direct impact on the quality of life and overall prosperity of the citizens.

Physical infrastructures like transportation, power and communication facilities contribute to economic development and industrialization, and encourage trade and mobility of labour. Both types of infrastructure connect people, markets, workers, and families; a connectivity process that is essential to induce economic growth and reduce poverty.

Prioritizing infrastructure development, in the long term, fosters economic and social development. A prosperous city deploys the infrastructure, physical assets and amenities –adequate water, sanitation, power supply, road network, information and communications technology, etc.– required to sustain both the population and the economy, and provide better quality of life.

TABLE 2. Infrastructure Development Dimension: Indicators for Comparative Analysis of Cities

Dimension	Sub-dimension	Indicator
02 INFRASTRUCTURE DEVELOPMENT (ID)	1. Housing Infrastructure (HI)	1.1 Access to Improved Water
		1.2 Access to Improved Sanitation
		1.3 Access to Electricity
	2. Social Infrastructure (SI)	2.1 Physicians Density
	3. Information and Communication Technology (ICT)	3.1 Internet Access
	4. Urban Mobility (UM)	4.1 Access to Public Transport
		4.2 Length of Mass Transport Network
		4.3 Traffic Fatalities
		4.4 Change in Transport Mode (ratio)
		4.5 Congestion Level
	5. Global Connectivity (GC)*	5.1 Flight Destinations
	6. Urban Form (UF)	6.1 Built-Up Area per Capita 2015
		6.2 Change in Total Built-Up Area 2000 - 2015

Note: * Sub-dimensions added to CPI original structure.

1. Housing Infrastructure (HI)

1.1 Access to Improved Water

Indicator:	Access to Improved Water
Scope:	Basic CPI / SDG 6.1.1. Proportion of population using safely managed drinking water services
Rationale:	Clean water is necessary for life and health, but nearly 2 billion people lack access to an adequate water supply or can only obtain it at high prices. Households in informal settlements are rarely connected to the network and only rely on water purchased from vendors at up to 200 times the tap price. Improving access to safe water reduces the burden, especially on women, to collect water from the available sources, and reduces water-related diseases. This will improve the quality of life (UN-Habitat, 2009). A prosperous city must provide access to improved water to its entire population so that individuals can spend their time on productive activities rather than fetch household drinking water.
Definition:	The percentage of urban households with access to an improved source of drinking water. According to WHO/UNICEF Joint Monitoring Program for Water Supply and Sanitation (year), improved sources of drinking water are: • Piped water into dwelling • Piped water to yard/plot • Public tap or standpipe • Tube wells or borehole • Protected dug well • Protected spring • Rainwater And the following are considered unimproved sources of drinking water: • Unprotected spring • Unprotected dug well • Cart with small tank/drum • Tanker-truck • Surface water • Bottled water
Unit:	%
Methodology:	$Acess\ to\ Improved\ Water = 100\left[\frac{number\ of\ households\ with\ sustainable\ access\ to\ piped\ water\ source}{total\ number\ of\ households}\right]$
Source:	Open Data Moscow City Government and World Bank / 2020.
Benchmark:	Min= 50% Max = 100% Calculated from The World Bank (2014).
Standardization:	$Access\ to\ Improved\ Water^{(S)} = 100\left[\frac{Access\ to\ Improved\ Water - Min}{Max - Min}\right]$ $Access\ to\ Improved\ Water^{(S)} = 100\left[\frac{Access\ to\ Improved\ Water - 50}{100 - 50}\right]$ Decision: $Access\ to\ Improved\ Water^{(S)} = \begin{cases} Access\ to\ Improved\ Water^{(S)}, & If\ 50 < Access\ to\ Improved\ Water \leq 100 \\ 0, & If\ Access\ to\ Improved\ Water \leq 50 \end{cases}$
Limitations:	According to United Nations (2007), although the existence of a water outlet near the household is often used as a proxy for availability of safe water, there is no guarantee that water will always be available or safe, or that people will always use such sources.
References:	Bibliographic references: United Nations (2007). Indicators of Sustainable Development: Guidelines and Methodologies. Third Edition, United Nations, New York. UN-Habitat (2009). Urban Indicators Guidelines; Better Information, Better Cities. Monitoring the Habitat Agenda and the Millennium Development Goals-Slum Target.

Indicator:	Access to Improved Water
	The World Bank (2014). World Development Indicators 1960 – 2013. [2] URL references: [1]: http://www.wssinfo.org/definitions-methods/watsan-categories/ , Accessed July 2, 2014. [2]: http://data.worldbank.org/indicator/SH.H2O.SAFE.UR.ZS , Accessed July 2, 2014.

1.2 Access to Improved Sanitation

Indicator:	Access to Improved Sanitation
Scope:	Extended CPI / SDG 6.2.1. Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water
Rationale:	The lack of sanitation is a major public health problem that causes disease, sickness and even death. Highly infectious, excreta-related diseases such as cholera still affect whole communities in developing countries. Diarrhea, which is spread easily in an environment of poor hygiene and inadequate sanitation, kills approximately 2.2 million people each year, most of who are children under five years old. Inadequate sanitation, through its impact on health and environment, has considerable implications on economic development, when individuals miss work due to excreta-related sickness and diseases. Moreover, lack of excreta management poses a fundamental threat to global water resources. Adequate sanitation is important for both urban and rural populations, but the risks are greater in slum areas where it is more difficult to avoid contact with waste (UN-Habitat, 2009). A prosperous city seeks to guarantee full coverage of sewer system facilities to improve quality of life and reduce productivity losses due to excreta-related sickness and diseases.
Definition:	Percentage of the population with access to facilities that hygienically separate human excreta from human, animal, and insect contact (UN-Habitat, 2009). According to WHO/UNICEF Joint Monitoring Program for Water Supply and Sanitation, improved sanitation includes the following facilities: • Flush toilet • Piped sewer system • Septic tank • Flush/pour flush to pit latrine • Ventilated improved pit latrine • Pit latrine with slab • Composting toilet And “unimproved” sanitation includes: • Flush/pour flush to elsewhere • Pit latrine without slab • Bucket • Hanging toilet or hanging latrine • No facilities or bush or field
Unit:	%
Methodology:	$Access\ to\ Improved\ Sanititation = 100\left[\frac{number\ of\ households\ with\ improved\ sanititation}{total\ number\ of\ households}\right]$
Source:	Open Data Moscow City Government and World Bank / 2020.
Benchmark:	Min= 15% Max = 100% Calculated from The World Bank (2014).
Standardization:	$Access\ to\ Improved\ Sanitation^{(S)} = 100\left[\frac{Access\ to\ Improved\ Sanitation\ - Min}{Max - Min}\right]$ $Access\ to\ Improved\ Sanitation^{(S)} = 100\left[\frac{Access\ to\ Improved\ Sanitation\ - 15}{100 - 15}\right]$ Decision:

Indicator:	Access to Improved Sanitation
	$Access\ to\ Improved\ Sanitation^{(S)} = \begin{cases} Access\ to\ Improved\ Sanitation^{(S)}, & If\ \ 15 < Access\ to\ Improved\ Sanitation \leq 100 \\ 0, & If\ Access\ to\ Improved\ Sanitation \leq 15 \end{cases}$
Limitations:	According to United Nations (2007), this indicator uses a proxy for adequate sanitation facilities, as it is not currently possible to define entirely the proportion of population with sanitary facilities according to the conceptual definitions above.
References:	Bibliographic references: United Nations (2007). Indicators of Sustainable Development: Guidelines and Methodologies. Third Edition, United Nations, New York. UN-Habitat (2009). Urban Indicators Guidelines; Better Information, Better Cities. Monitoring the Habitat Agenda and the Millennium Development Goals-Slum Target. The World Bank (2014). World Development Indicators 1960 – 2013. [2] URL references: [1]: http://www.wssinfo.org/definitions-methods/watsan-categories/ , Accessed July 2, 2014. [2]: http://data.worldbank.org/indicator/SH.STA.ACSN.UR , Accessed July 2, 2014.

1.3 Access to Electricity

Indicator:	Access to Electricity
Scope:	Extended CPI / SDG 7.1.1. Proportion of population with access to electricity
Rationale:	Access to electricity is important to fulfill basic needs, work, and education. Energy services are important for providing adequate food, shelter, water, sanitation, medical care, education, and access to communication. Reliable, adequate, and affordable energy services are necessary to guarantee sustainable development (United Nations, 2007). A prosperous city must provide access to electricity to its entire population to improve standards of living, foster economic development and productivity.
Definition:	The percentage of households that are connected to the national grid and receive a continuous supply of electricity.
Unit:	%
Methodology:	$Access\ to\ Electricity = 100\left[\frac{number\ of\ households\ with\ connection\ to\ the\ city\ electricity\ grid}{total\ number\ of\ households}\right]$
Source:	Open Data Moscow City Government and World Bank / 2020.
Benchmark:	Min= 7% Max = 100% Calculated from The World Bank (2014).
Standardization:	$Access\ to\ Electricity^{(S)} = 100\left[\frac{Access\ to\ Electricity - Min}{Max - Min}\right]$ $Access\ to\ Electricity^{(S)} = 100\left[\frac{Access\ to\ Electricity - 7}{100 - 7}\right]$ Decision: $Access\ to\ Electricity^{(S)} = \begin{cases} Access\ to\ Electricity^{(S)}, & If\ \ 7 < Access\ to\ Electricity \leq 100 \\ 0, & If\ Access\ to\ Electricity \leq 7 \end{cases}$
Limitations:	This indicator does not cover off-grid access to electricity, i.e., solar, wind or other alternatives access to electricity at the household level.
References:	Bibliographic references: United Nations (2007). Indicators of Sustainable Development: Guidelines and Methodologies. Third Edition, United Nations, New York. The World Bank (2014). World Development Indicators 1960 – 2013. [1] URL references: [1]: http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS, Accessed July 2, 2014

2. Social Infrastructure (SI)

2.1 Physicians Density

Indicator:	Physicians Density
Scope:	Basic CPI / SDG 3.c.1 Health worker density and distribution
Rationale:	A health system comprises all activities with the primary goal of improving health. The number of physicians (medical doctors) available in the city relative to the total urban population gives a good idea of the strength of a city's health care system. The number of physicians is positively associated with immunization coverage, outreach of primary care, and infant, child, and maternal survival (WHO, World Health Statistics 2006). A prosperous city seeks to provide adequate health care services to most of its population to reduce health related productivity losses and improve the quality of life for all.
Definition:	Number of physicians per 1,000 people, relative to the total city population. Physicians are doctors that study, diagnose, treat, and prevent illness, disease, injury, and other physical and mental impairments in humans through the application of modern medicine. Physicians (medical doctors) include generalist and specialist medical practitioners that work in the city.
Unit:	# per 1,000 people.
Methodology:	$Physicians\ Density = \ 1{,}000\left[\frac{number\ of\ physicians\ available\ within\ the\ city}{City\ population}\right]$
Source:	Integrated Data Warehouse Moscow and World Bank / 2019.
Benchmark:	Min = 0.01 Max = 7.74 Calculated from The World Bank (2014).
Standardization:	$Physicians\ Density^{(S)} = \ 1{,}000\left[\frac{\sqrt[2]{Physicians\ Density} - Min}{Max - Min}\right]$ $Physicians\ Density^{(S)} = \ 1{,}000\left[\frac{\sqrt[2]{Physicians\ Density} - 0.1}{2.78 - 0.1}\right]$ Decision: $Physicians\ Density^{(S)} = \begin{cases} 100, & If\ \sqrt[2]{Physicians\ Density} \geq 2.78 \\ Physicians\ Density^{(S)}, & If\ \ 0.1 < \sqrt[2]{Physicians\ Density} < 2.78 \\ 0, & If\ \sqrt[2]{Physicians\ Density} \leq 0.1 \end{cases}$
Limitations:	Data to measure this indicator at the city level may be difficult to obtain in some countries (e.g., Colombia). Moreover, traditional healers that are important for the primary care health system in some countries are not considered in this indicator. This Indicator is strictly defined to only include highly skilled medical professional. The reality is that there are several family members looking after the sick and other unpaid caregivers and volunteers who contribute to the improvement of health and are part of the health workforce.
References:	Bibliographic references: The World Bank (2014). World Development Indicators 1960 – 2013. [3] URL references: [1]: http://www.cityindicators.org/IndicatorsDescriptions/49851779Hlth-%20physicians.pdf , Accessed June 11, 2014. [2]: https://www.cia.gov/library/publications/the-world-factbook/geos/co.html , Accessed June 27, 2014. [3]: http://data.worldbank.org/indicator/SH.MED.PHYS.ZS/countries/1W?order=wbapi_data_value_2010%20wbapi_data_value&sort=asc&display=default , Accessed July 2, 2014.

3. Information and Communications Technology (ICT)

3.1 Internet Access

Indicator:	Internet Access
Scope:	Basic CPI / SDG 17.8.1 or 9.c.1 Proportion of individuals using the Internet/ Proportion of population covered by a mobile network, by technology.
Rationale:	The Internet is an information distribution system, and its usage brings education and information within the reach of all who have access to it. It can reduce time lags and open new information resources, new economic opportunities, and possibilities for more environmentally - friendly options for the marketplace (United Nations, 2007). The Internet can allow businesses from developing nations to leapfrog into the development mainstream and offer considerable promise in facilitating the delivery of basic services, such as health and education, which are unevenly distributed at present (United Nations, 2007). Access to the Internet is very important to foster creativity and economic productivity. A prosperous city seeks to give access to the Internet to many within its population to ensure connectivity and equal opportunities for all.
Definition:	The Internet is a world-wide public computer network that provides access to several communication services including the World Wide Web and carries email, news, entertainment, and data files. Internet access may be via a computer, Internet-enabled mobile phones, digital TV, games machines etc. (United Nations, 2007). Internet users are people with access to the worldwide network, relative to the total population. It is the ratio of the total number of Internet users in a city to the total city population, expressed per 100 persons.
Unit:	%
Methodology:	$$Internet\ access = 100\left[\frac{Number\ of\ internet\ users}{total\ population}\right]$$
Source:	Integrated Data Warehouse Moscow / 2020.
Benchmark:	Min = 0% Max = 100%
Standardization:	Not required
Limitations:	This indicator does not account for the quality of the Internet access. Poor quality access may not be enough to foster creativity, economic productivity, and growth.
References:	Bibliographic references: United Nations (2007). Indicators of Sustainable Development: Guidelines and Methodologies. Third Edition, United Nations, New York. URL references: [1]: http://data.worldbank.org/indicator/IT.NET.USER.P2 , Accessed August 14, 2014.

4. Urban Mobility (UM)

4.1 Access to Public Transport

Indicator:	Access to Public Transport
Scope:	Basic CPI
Rationale:	Over dependence on car use can generate several environmental, economic, and social problems in urban areas such as congestion, pollution and traffic fatalities and continuous reduction of open public spaces. To achieve safer, more affordable, accessible, and sustainable mobility in urban areas, a dual approach based on the improvement of public transit systems and the encouragement of non-motorized modes like walking and cycling and public transit system should be encouraged. Particularly paying spatial attention the most vulnerable road users. A prosperous city seeks to reduce car use by improving the quality of other transportation systems based on public and non-motorized transport.
Definition:	Percentage of trips made in a Public Transport (PT) mode from the total number of motorized trips.
Unit:	%
Methodology:	Method A: $$Use\ of\ PT\ Ratio\ = 100\left[\frac{number\ of\ trips\ \ in\ PT\ modes}{number\ of\ total\ motorized\ trips}\right]$$
Source:	Moscow Transport / 2020.

Indicator:	Access to Public Transport
Benchmark:	Min = 5.95% Max = 62.16% Calculated from CERTU world regions (CERTU, 2008)
Standardization:	$Use\ of\ PT\ Ratio^{(S)} = 100\left[\frac{Use\ of\ PT\ Ratio - Min}{Max - Min}\right]$ $Use\ of\ PT\ Ratio^{(S)} = 100\left[\frac{Use\ of\ PT\ Ratio - 5.95}{62.16 - 5.95}\right]$ Decision: $Use\ of\ PT\ Ratio^{(S)} = \begin{cases} 100, & If\ Use\ of\ PT\ Ratio \geq 62.16 \\ Use\ of\ PT\ Ratio^{(S)}, & If\ 5.95 < Use\ of\ PT\ Ratio < 62.16 \\ 0, & If\ Use\ of\ PT\ Ratio \leq 5.95 \end{cases}$
Limitations:	Although this indicator does not capture non-motorized trips, it is highly recommended that it is included and measured in modal share surveys. Non-formal transport or paratransit is very frequent in some cities, but surveys do not always capture this information.
References:	Bibliographic references: CERTU (2008). Guide pédagogique: Stratégie de Mobilité durable. Lyon (Francia). p.73 Winston, H. Motor vehicles and the environment. Resources for the future RFF Report. Washington. 2003. URL references: [1] http://www.rff.org/rff/Documents/RFF-RPT-carsenviron.pdf , Accessed August 14, 2014.

4.2 Length of Mass Transport Network

Indicator:	Length of Mass Transport Network
Scope:	Extended CPI
Rationale:	Transit connects and integrates distant parts of the city. Although various forms of transit support urban transport needs including low and high-capacity vehicles, taxis and motorized rickshaws, bi-articulated buses and trains (ITDP, 2013); high-capacity public transit allows for highly efficient and equitable urban mobility and supports dense and compact development patterns. A prosperous city seeks to cover most parts of its territory through an adequate public transport network system based on optimal technologies, quality, and performance to ensure a more comfortable and efficient system.
Definition:	The total length of all superior modes of public transport, i.e. BRT, trolleybus, tram, light rail and subway, cable cars and ferry relative to the size of the city (number of inhabitants). This indicator applies to cities above 500,000 inhabitants. Intermediate cities with less than 500,000 inhabitants may achieve efficient mobility through lower capacity public transport modes.
Unit:	Km/1,000,000 people
Methodology:	$Length\ of\ mass\ transport\ network = 1{,}000{,}000\ \frac{Total\ length\ of\ mass\ transport\ lanes}{total\ number\ of\ city\ inhabitants}$
Source:	Moscow Transport / 2020.
Benchmark:	$X*$= 80 km per 1,000,000 people. Obtained from CERTU (2008) p.131.
Standardization:	$Length\ of\ mass\ transport\ network^{(S)} = 100\left(1 - \left\|\frac{Length\ of\ mass\ transport\ network - X^*}{X^*}\right\|\right)$ $Length\ of\ mass\ transport\ network^{(S)} = 100\left(1 - \left\|\frac{Length\ of\ mass\ transport\ network - 80}{80}\right\|\right)$ Decision:

Indicator:	Length of Mass Transport Network
	$Length\ of\ mass\ transport\ network^{(S)} = \begin{cases} 0, If\ Length\ of\ mass\ transport\ network < 0 \\ Length\ of\ mass\ transport\ network^{(S)}, \quad If\ 0 \leq Length\ of\ mass\ transport\ network < 80 \\ 100, \quad If\ Length\ of\ mass\ transport\ network \geq 80 \end{cases}$
Limitations:	This data must be treated carefully because it doesn't include the conventional bus transport which is the principal form of public transport in the city especially in many cities of the developing countries.
References:	Bibliographic references: Institute for Transportation and Development Policy (2013) TOD Standard v. 2.0. New York. [1] CERTU. (2008). Guide pédagogique: Stratégie de Mobilité durable. Lyon (France). URL references: [1]: http://mexico.itdp.org/wp-content/uploads/TOD_v2_FINAL.pdf , Accessed August 14, 2014.

4.3 Traffic Fatalities

Indicator:	Traffic Fatalities
Scope:	Extended CPI
Rationale:	Traffic fatalities is the eighth leading cause of death globally, and the leading cause of death for young people aged 15–29 years. The World Health Organization predicted that by 2020, traffic fatalities will be the third cause of mortality in the world. This is not only a matter of health care, as many cities have found that by reducing traffic fatalities, they reduce related health and productivity losses (World Health Organization, 2004). Over one-third of road traffic fatalities in low and middle- income countries involve pedestrians and cyclists. Less than 35% of low and middle-income countries have policies to protect these road users (World Health Organization, 2013). A prosperous city seeks to reduce traffic fatalities through improvement of physical infrastructure and policy implementation.
Definition:	A traffic fatality is defined as any person killed immediately or dies within 30 days because of a road traffic accident. This is calculated as the ratio of the total number of fatalities from traffic accidents per year to the total city population, expressed per 100,000 people.
Unit:	# per / 100,000 people
Methodology:	$Traffic\ fatalities = 100{,}000\ \frac{Total\ traffic\ fatalities\ per\ year}{City\ population}$
Source:	Integrated Data Warehouse Moscow and World Bank / 2020.
Benchmark:	Min = 1 fatalities per 100,000 people per year Max = 31 fatalities per 100,000 people per year Calculated from World Health Organization data [1].
Standardization: 2.1	$Traffic\ fatalities^{(S)} = 100\left[1 - \frac{Traffic\ fatalities\ - Min}{Max - Min}\right]$ $Traffic\ fatalities\ ^{(S)} = 100\left[1 - \frac{Traffic\ fatalities\ - 1}{31 - 1}\right]$ Decision: $Traffic\ fatalities^{(S)} = \begin{cases} 0, \quad If\ Traffic\ fatalities \geq 31 \\ Traffic\ fatalities\ ^{(S)}, \quad If\ 1 < Traffic\ fatalities < 31 \\ 100, \quad If\ Traffic\ fatalities\ \leq 1 \end{cases}$

Indicator:	Traffic Fatalities
Limitations:	Traffic fatalities are not frequently reported or are partially reported by the authorities. It is necessary that this information is recorded by each city in order to allow for global comparability in a bid to improve road safety.
References:	Bibliographic references: World Health Organization (2004). World report on road traffic injury prevention. Geneva. [2] World Health Organization (2013). Global report on road safety. Luxembourg. [3] URL references: [1]: http://apps.who.int/gho/data/node.main.A997 , Accessed June 11, 2014. [2]: http://www.who.int/violence_injury_prevention/publications/road_traffic/world_report/en/ , Accessed June 11, 2014. [3]: http://www.who.int/violence_injury_prevention/road_safety_status/2013/en/ , Accessed June 11, 2014.

4.4 Change in Transport Mode

Indicator:	Change in Transport Mode
Scope:	Global Comparative Index / SDG 11 target 11.2.
Rationale:	A change in the urban mobility paradigm necessarily requires good, high-capacity public transport systems that are well integrated with other infrastructures and mobility alternatives in a multi-modal arrangement. Such arrangement also requires that public transport access is within adequate comfortable walking or cycling distances from homes and places of work. Achieving a structural change in the mobility paradigm will also help achieving SDG 11 target 11.2. [1]
Definition:	Ratio of the share of users who have increased the use of public transport and personal mobility devices (including walking on foot) and the share of those who have increased the use of motor vehicles.
Unit:	Dimensionless
Methodology: 2.1	Using survey data, two variables are measured: 1) The share of respondents who have, over the last several years, increased the use of public transport, on foot, or personal mobility devices (PMDs). 2) The share of those who have increased the use of motor vehicles. $$Change\ in\ transport\ mode = \left[\frac{Share\ of\ users\ of\ PTFPMDs}{Share\ of\ users\ of\ MV}\right]$$
Source:	McKinsey & Company (2021). Urban transportation systems of 25 global cities. Elements of success (e-book). P. 34.
Benchmark:	Min: 1 Max: 7 Based on McKinsey & Company (2021) using data for 25 global cities.
Standardization:	$$Change\ in\ transport\ mode^{(S)} = 100\left[\frac{ln(Change\ in\ transport\ mode) - \ln(Min)}{\ln(Max) - \ln(Min)}\right]$$ $$Change\ in\ transport\ mode^{(S)} = 100\left[\frac{Change\ in\ transport\ mode - 0}{1.95 - 0}\right]$$ Decision: $$= \begin{cases} 100, if\ Change\ in\ transport\ mode \geq 1.95 \\ Change\ in\ transport\ mode^{(S)}, if\ 0 < Change\ in\ transport\ mode < 1.95 \\ 0, if\ Change\ in\ transport\ mode \leq 0 \end{cases}$$
Limitations:	Data available only for 17 cities.
References:	Bibliographic reference: McKinsey & Company (2021). Urban transportation systems of 25 global cities. Elements of success (e-book). P. 34. URL reference: [1] https://unhabitat.org/sites/default/files/2020/06/indicator_11.2.1_training_module_public_transport_system.pdf Accessed December 10, 2021.

4.5 Congestion Level

Indicator:	Congestion Level
Scope:	Global Comparative Index
Rationale:	Urban road congestion is a serious phenomenon worldwide but particularly in high-density cities. This congestion is associated not only with wasted time, but also with a substantial increase in fuel consumption and many damaging environmental effects. The continuation of high levels of congestion thus frustrates many of the aims of transportation policy.
Definition:	This indicator shows the current extra travel time drivers experience in average.
Unit	%
Methodology:	TomTom International BV calculates the baseline per city by analyzing the current extra travel time drivers are experiencing on average using real-time traffic data. Congestion levels are weighted averages derived from hourly data. $Congestion\ level = Percentage\ of\ congestion\ in\ the\ city$
Source:	TOMTOM, 2019: Congestion level (TomTom International BV)
Benchmark:	Min: 0 Max: 100 Based on TOM TOM, Congestion level.
Standardization: 2.2	$Congestion\ level^{(S)} = 100\left[1 - \left(\frac{Congestion\ level - Min}{Max - Min}\right)\right]$ $Congestion\ level^{(S)} = 100\left[1 - \left(\frac{Congestion\ level - 0}{100 - 0}\right)\right]$ Decision: $= \begin{cases} 100, if\ Congestion\ level \leq 0 \\ Congestion\ level^{(S)}, if\ 0 < Congestion\ level \leq 100 \\ 0, if\ Congestion\ leveel > 100 \end{cases}$
Limitations:	Data available for 25 cities only. 2019 data was used in order to avoid potential bias due to the Covid-19 pandemic-related circulation restrictions.
References:	URL reference: [1] https://www.tomtom.com/en_gb/traffic-index/about/ Accessed: December 14, 2021.

5. Global Connectivity (GC)*

5.1 Flight Destinations

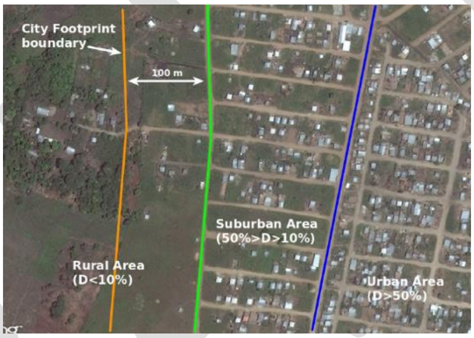
Indicator:	Flight Destinations
Scope:	Global Comparative Index
Rationale:	Improved air connectivity benefits users of air transport networks (passengers). Perhaps the most important economic benefit of air transport is the value that passengers derive from the ability to access destinations and markets around the world. Over the course of the past decades, air travel has offered consumers and producers more choice in routings and faster linkages to the rest of the world, at an ever-decreasing cost in real terms. In 2019, the air transport industry connected a record number of cities worldwide, reaching and exceeding 23,000 unique city-pair connections for the first time. Moreover, the cost of air travel transportation has been decreasing in real terms as savings from new technology adoption and greater efficiencies are being passed on to the consumer in the form of a lower price in real terms (IATA, 2021). As many as flight destinations -national and international- a world city has it reflects the economic, social, and cultural magnitude of relationships with other countries and cities.
Definition:	Number of non-stop passengers, national and international, flights scheduled for the upcoming 12 months (December 2021 to December 2022) from the main airport of each city.
Unit:	#
Methodology:	$Destinations = Total\ number\ of\ destinations\ in\ the\ city's\ main\ airport$

Indicator:	Flight Destinations
Source:	Flightconnections.com
Benchmark:	Min: 30 Max: 118 Based on the data available for selected cities.
Standardization: 1.2	$Destinations^{(S)} = 100\left[\frac{Destinations - Min}{Max - Min}\right]$ $Destinations^{(S)} = 100\left[\frac{Destinations - 30}{250 - 30}\right]$ Decision: $= \begin{cases} 100, if\ Destinations \geq 250 \\ Destinations^{(S)}, if\ 30 < Destinations < 250 \\ 0, if\ Destinations \leq 30 \end{cases}$
Limitations:	Only the main or largest airport of each city was considered.
References:	Bibliographic reference: IATA, 2021. Air Connectivity. Measuring the connections that drive economic growth (e-book). P. 8. URL reference: [1] https://www.flightconnections.com/ Accessed: December 9, 2021.

6. Urban Form (UF)

6.1 Built-up area per capita 2015

Indicator:	Built-Up Area per Capita 2015
Scope:	Contextual CPI / SDG 11.3.1. Ratio of land consumption rate to population growth rate
Rationale:	Cities require an orderly urban expansion that makes the land use more efficient. They need to prepare for future population growth of their own population and the one resulting from migrations. They also need to accommodate for new and thriving urban functions as they grow. However, frequently the physical growth of urban areas is disproportionate in relation to population growth, and this result in land use that is wasteful in different forms. This type of growth turns out to violate every premise of sustainability that an urban area could be judged by. It has been accused of encroaching on environmentally sensitive areas and is blamed for consuming land and resources. It has also been attributed negative social and economic consequences, increasing spatial inequalities, and affecting the functionality of the urban form with the decline of central areas and the reduction of economies of agglomeration.
Definition:	Built-up area (m^2) per capita, 2015
Unit:	m^2 per capita

Indicator:	Built-Up Area per Capita 2015
Methodology:	Built-up area per capita is estimated based on classification of Landsat imagery for 2015. Based on the classification of satellite images and based on the UN HABITAT methodology, urban land use is disaggregated as follows: 1. Acquire a built-up layer for the area of interest either from validated global BUP datasets or satellite image classification (Landsat/ Sentinel, or similar). 2. Define the city boundaries (using DEGURBA approach: https://ghsl.jrc.ec.europa.eu/degurba.php) 3. Compute the built-up area within the city boundaries/extents, and express it as a proportion of the total population of the city: a) Built up area (Grid classification): 1. Urban center: ≥ 50% of built-up area. 2. Urban cluster: ≥30% and ≤ 50% built-up area. 3. Rural: < 30% of built-up area. 4. City Footprint boundary: 100 meters from suburban area. b) Supervised classification in geographic information systems (Local unit classification): 1. Cities: units that have ≥ 50% urban centers grid cells. 2. Towns & semi-dense: units that have ≤ 50% urban centers as well as rural grid. 3. Units that have ≥30% rural grid cells. c) Delimitation of Urban, Suburban and Rural Areas Tools: GIS applications such as QGis or ArcMap.  Population data used to compute the population growth rate is Global Human Settlement - POP. $Built - up\ area\ per\ capita = \left[\frac{Total\ built - up\ area}{Total\ city\ population}\right]$
Source:	UN Habitat. World Cities Report 2020 [1] Original data: United Nations Human Settlement Programme (UN-Habitat), Global Urban Indicators Database 2020.
Benchmark:	Target (X*): 180 Min: 60 Max: 300 Based on assuming 60m² for housing per capita, plus 60m² for public space per capita, plus 60m² for infrastructure per capita.
Standardization: 5	$Built - up\ area\ per\ capita^{(S)} = 100\left[1 - \left\lvert\frac{Built - up\ area\ per\ capita - X^*}{X^* - Min}\right\rvert\right]$ $Built - up\ area\ per\ capita^{(S)} = 100\left[1 - \left\lvert\frac{Built - up\ area\ per\ capita - 60}{180 - 60}\right\rvert\right]$ Decision: $= \begin{cases} 100, if\ Built - up\ area\ per\ capita = 180 \\ Built - up\ area\ per\ capita^{(S)}, if\ 60 < Built - up\ area\ per\ capita < 300 \\ 0, if\ 60 \leq Built - up\ area\ per\ capita \geq 300 \end{cases}$
Limitations:	Data available only for 24 cities.
References:	Bibliographic References: UN-Habitat. World Cities Report 2020 The Value of Sustainable Urbanization. 1st ed. [ebook] Nairobi, Kenya: United Nations Human Settlements Programme (2020), pp.322 - 334. Measurement of the city prosperity index. Methodology and metadata, 2019.

Indicator:	Built-Up Area per Capita 2015
	URL reference: [1] https://unhabitat.org/World%20Cities%20Report%202020 Accessed: December 20, 2021.

6.2 Change in total built-up area 2000-2015

Indicator:	Change in Total Built-Up Area per Capita 2000-2015
Scope:	Global Comparative Index / SDG 11.3.1. Ratio of land consumption rate to population growth rate
Rationale:	Cities require an orderly urban expansion that makes the land use more efficient. They need to prepare for future population growth of their own population and the one resulting from migrations. They also need to accommodate for new and thriving urban functions as they grow. However, frequently the physical growth of urban areas is disproportionate in relation to population growth, and this result in land use that is wasteful in different forms. This type of growth turns out to violate every premise of sustainability that an urban area could be judged by. It has been accused of encroaching on environmentally sensitive areas and is blamed for consuming land and resources. It has also been attributed negative social and economic consequences, increasing spatial inequalities, and affecting the functionality of the urban form with the decline of central areas and the reduction of economies of agglomeration.
Definition:	Change in total built-up area per capita between 2000 – 2015.
Unit:	%
Methodology:	Built-up area per capita is estimated based on classification of Landsat imagery for 2000 and 2015. Based on the classification of satellite images and based on the UN HABITAT methodology, urban land use is disaggregated as follows: 1. Acquire a built-up layer for the area of interest for time periods *t* and *t+n,* either from validated global BUP datasets or satellite image classification (Landsat/ Sentinel, or similar). 2. Define the city boundaries (using DEGURBA approach: https://ghsl.jrc.ec.europa.eu/degurba.php). City boundaries should be the same for both time periods. 3. Compute the built-up area within the city boundaries/extents, and express it as a proportion of the total population of the city for time periods *t* and *t+n*: a) Built up area (Grid classification): 1. Urban center: ≥ 50% of built-up area. 2. Urban cluster: ≥30% and ≤ 50% built-up area. 3. Rural: < 30% of built-up area. 4. City Footprint boundary: 100 meters from suburban area. b) Supervised classification in geographic information systems (Local unit classification): 1. Cities: units that have ≥ 50% urban centers grid cells. 2. Towns & semi-dense: units that have ≤ 50% urban centers as well as rural grid. 3. Units that have ≥30% rural grid cells. c) Delimitation of Urban, Suburban and Rural Areas Tools: GIS applications such as QGis or ArcMap.  Population data used to compute the population growth rate is Global Human Settlement - POP. $$Change\ in\ built-up\ area\ per\ capita = 100\left[\left(\frac{Built-up\ area\ per\ capita_{t+n}}{Built-up\ area\ per\ capita_{t}}\right)-1\right]$$
Source:	2020. World Cities Report 2020 The Value of Sustainable Urbanization. 1st ed. [ebook] Nairobi, Kenya: United

Indicator:	Change in Total Built-Up Area per Capita 2000-2015
	Nations Human Settlements Programme (UN-Habitat), pp.322 - 334. Original data: United Nations Human Settlement Programme (UN-Habitat), Global Urban Indicators Database 2020.
Benchmark:	Target (X*): 0% Max: 10%
Standardization:	$$Change\ in\ built-up\ area\ pc^{(S)} = 100\left[1-\left\lvert\frac{Change\ in\ built-up\ area\ pc - X^{*}}{Max - X^{*}}\right\rvert\right]$$ $$Change\ in\ built-up\ area\ pc^{(S)} = 100\left[1-\left\lvert\frac{Change\ in\ built-up\ area\ pc - 0}{10-0}\right\rvert\right]$$ Decision: $$= \begin{cases} 100, if\ Change\ in\ built-up\ area\ pc = 0 \\ Change\ in\ built-up\ area\ pc^{(S)}, if\ 0 < Change\ in\ built-up\ area\ pc \leq 10 \\ 0, if\ Change\ in\ built-up\ area\ pc > 10 \end{cases}$$
Limitations:	Data available only for 24 cities.
References:	Bibliographic references: 2020. World Cities Report 2020 The Value of Sustainable Urbanization. 1st ed. [ebook] Nairobi, Kenya: United Nations Human Settlements Programme (UN-Habitat), pp.322 - 334. Measurement of the city prosperity index. Methodology and metadata, 2019. URL reference: [1] https://unhabitat.org/World%20Cities%20Report%202020 Accessed: December 20, 2021.

Dimension 3. Quality of Life Index

In the past, prosperity was only defined in terms of economic strength i.e. a person was considered more prosperous as their income or wealth increased. However, attention has shifted to other definitions of prosperity that include more components apart from just economic ability. And quality of life is one of such components, that has proven to be among the most significant aspects of prosperity.

Quality of life can be understood in terms of how an individual's life or society's condition is in comparison to another person or society, i.e. how good (or bad) someone's life is compared to other individuals' lives. Therefore, this is the measurement of a city's average achievements for ensuring general well-being and satisfaction of its citizens.

Ferrell, who has carried out a large research programme on pain and quality of life, defined quality of life as well-being in terms of the physical, mental, social, and spiritual dimensions (Ferrell, 1995). Lindströ and Henriksson, (1996) present a model where quality of life is divided into four life spheres: global, external, interpersonal, and personal, where the latter is represented by the physical, mental, and spiritual dimensions. An individual is satisfied when their external (physical, apart from monetary needs) and internal (mental, social, spiritual, and emotional) needs are met. The Quality of Life dimension measures how well these needs are being addressed by the city.

Prosperous cities provide amenities such as social services, education, health, recreation, safety and security required for improved living standards, enabling the population to maximize individual potential and to lead fulfilling lives.

TABLE 3. Quality of Life Dimension: Indicators for Comparative Analysis of Cities

Dimension	Sub-dimension	Indicator
03 QUALITY OF LIFE (QOL)	1. Health (H)	1.1 Life Expectancy at Birth
		1.2 Vaccination Coverage
	2. Education (Ed)	2.1 Mean Years of Schooling
		2.2 Share of Students in Higher Education
	3. Science and Technology (ST)*	3.1 Scientists
		3.2 Science Impact Index
	4. Culture and Recreation (CR)*	4.1 Museums
		4.2 Accommodation Affordability
	5. Safety and Security (SS)	5.1 Homicide Rate
		5.2 Crime Index Rank
	6. Public Space (PS)	6.1 Green Area per Capita
		6.2 Land Allocated to Open Public Space
		6.3 Land Allocated to Streets
		6.4 Accessibility to Open Public Space

*Note: * Sub-dimensions added to CPI original structure.*

1. Health (H)

1.1 Life Expectancy at Birth

Indicator:	Life Expectancy at Birth
Scope:	Basic CPI
Rationale:	A health system's main objective is to preserve individuals' lives. Life expectancy is the most used measure to describe population health as it reflects the overall mortality levels of a population. It measures on average how long a person is expected to live, based on current age and sex-specific death rates. The life expectancy for a particular person or population group depends on variables such as their lifestyle, access to healthcare, diet, economic status and the relevant mortality and morbidity data. It is, therefore, related to the health conditions of the population, which are key factors in fostering economic growth, sustainable development and increase people's well-being. Life expectancy at birth is expressed as the number of years of life newborn is expected to live if current mortality rates continue to apply. It summarizes the mortality pattern that prevails across all age groups - children and adolescents, adults, and the elderly (WHO, 2006). A prosperous city will thus seek to increase the life expectancy of its citizens to increase their quality of life.
Unit:	Years
Methodology:	The most generalized and widely accepted procedure to estimate this indicator in case it is not available at city level is to construct a life table. The World Health Organization (2014) mentions, "life tables have been developed for all Member States for years 1990-2012 starting with a systematic review of all available evidence from surveys, censuses, sample registration systems, population laboratories and vital registration on levels and trends in under-five and adult mortality rates." According to Fitzpatrick (2001), the information needed to estimate a life table is: a) Population expressed in year age bands (usually in 5 years age bands) and b) Deaths in year age bands (usually in 5 years age bands). Based on that information all other columns of data and the expectation of life can be calculated. The final estimation of life expectancy is made through the following formula: $Life\ expectancy\ at\ birth\colon e_0 = \dfrac{T_0}{l_0}$ This equation has been adapted from the following generalized life expectancy estimation formula used to estimate the life table: $e_x = \frac{T_x}{l_x}$ where: ex: Life expectancy at age "x", which means the number of years a person aged "x" can be expected to live. Tx: Total number of years lived at age "x" after the interval. lx: Number of people alive at the start of the interval. Both "Tx" and "lx" include previous calculations of the probability of surviving, the average proportion of the year lived by those who die and intervals' corrections and adjustments (For more estimation details, see Fitzpatrick, 2001). It is important to note that as mentioned by World Health Organization (2014) there are alternative ways of estimating life tables and life expectancy; some of them may include adjustments for health and country conditions (e.g., high levels of HIV). Then, the procedure selected depends on the country.
Definition:	Average number of years that a newborn could expect to live if he or she were subject to the age-specific mortality rates of a given period (United Nations, 2007).
Source:	Rosstat and World Bank / 2020.
Benchmark:	Min =54 years Max = 83.48 years Calculated from World Bank: World Development Indicators [4].
Standardization:	$$Life\ expectancy\ at\ birth^{(S)} = 100\left[\frac{Life\ expectancy\ at\ birth - Min}{Max - Min}\right]$$ $$Life\ expectancy\ at\ birth^{(S)} = 100\left[\frac{Life\ expectancy\ at\ birth - 54}{83.48 - 54}\right]$$ Decision:

Indicator:	Life Expectancy at Birth
	$Life\ expectancy\ at\ birth^{(S)} = \begin{cases} 100, & If\ Life\ expectancy\ at\ birth \geq 83.48 \\ Life\ expectancy\ at\ birth^{(S)}, & If\ 54 < Life\ expectancy\ at\ birth < 83.48 \\ 0, & If\ Life\ expectancy\ at\ birth \leq 54 \end{cases}$
Limitations:	Usually, this indicator is estimated every five years. As a result of this, yearly changes may not be available. When high quality data on deaths (from vital registrations) or appropriate age adjustments cannot be found, population censuses can provide adequate information. If high quality data is not available, a method that encompasses indicators of mortality from indirect information on the risks of death obtained from special questions included in censuses or demographic surveys can be used (United Nations, 2007).
References:	Bibliographic references: World Health Organization (WHO). (2006). Metadata: Life Expectancy at Birth. [3] Fitzpatrick, Justine. (2001) Calculating life expectancy and infant mortality rates Technical Supplement. [5] United Nations (2007). Indicators of Sustainable Development: Guidelines and Methodologies. Third Edition, United Nations, New York. [6] World Health Organization (2014). WHO methods for life expectancy and healthy life expectancy – Department of Health Statistics and Information. Systems (page 5). Geneva, Switzerland [7] URL references: [1]: http://www.aihw.gov.au/deaths/life-expectancy, accessed August 21, 2015 [2]: http://www.news-medical.net/health/What-is-Life-Expectancy.aspx, accessed August 21, 2015 [3] http://www.who.int/whosis/whostat2006DefinitionsAndMetadata.pdf, accessed June 11, 2014. [4]: http://data.worldbank.org/indicator/SP.DYN.LE00.IN, accessed June 11, 2014. [5]: http://www.lho.org.uk/Download/Public/7656/1/tech_supp_3.pdf, accessed June 11, 2014. [6]:http://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/health/life_expectancy.pdf, accessed June 11, 2014.[7]: http://www.who.int/healthinfo/statistics/LT_method.pdf, accessed June 11, 2014.

1.2 Vaccination Coverage

Indicator:	Vaccination Coverage
Scope:	Extended CPI / SDG 3.b.1 Proportion of the target population covered by all vaccines included in their national program.
Rationale:	The goal of immunization is to reduce morbidity and mortality due to communicable diseases. Moreover, lower vaccination coverage may carry long run consequences in terms of absences, lower productivity, and higher medical costs (Andre et al., 2008). This indicator, also known as immunization rate, monitors the quality of healthcare system in the city. It shows whether immunization against infectious childhood diseases has been properly complied with at the city level (WHO, 2014). A prosperous city seeks to cover all its population with basic vaccination schemes.
Definition:	The percent of the eligible population that have been immunized according to national immunization policies. Eligible Population: As United Nations (2007) mentions, eligible population usually includes: For infants: The numerator is the number of infants fully immunized with the specified vaccines during a specified period (year), while the denominator is the number of one-year old infants (target age group) in the same period. For women: The numerator is the number of women immunized with two or more doses of tetanus toxoid during pregnancy, while the denominator is the number of live births. Proper immunization for these eligible persons is when: children immunized against diphtheria, tetanus, pertussis, measles, poliomyelitis, tuberculosis, and hepatitis B before their first birthday, and against yellow fever in affected countries of Africa. The proportion of women of child-bearing age immunized against tetanus (United Nations, 2007).
Unit:	%
Methodology:	It is important to note that due to the indicator estimation procedure, some percentages might surpass 100%. Nevertheless, the rank of the indicator will be kept between 0 and 100. If any value surpasses 100% it will be assumed as 100%. $Vaccination\ Coverage = 100\frac{population\ that\ have\ been\ immunized\ according\ to\ national\ immunization\ policies}{Eligible\ population\ according\ to\ national\ immunization\ policies}$

Indicator:	Vaccination Coverage
Source:	Rosstat and World Bank / 2020.
Benchmark:	Min = 0% Max = 100%
Standardization:	Not required
Limitations:	Given the composite nature of the indicator it may not be easy to collect the sufficient data for all the different vaccination diseases (United Nations, 2007). While the indicator is appropriate to measure the extent to which vaccination coverage reaches a city, it does not reflect health preventive factors such as education or diet.
References:	Bibliographic references: United Nations (2007). Indicators of Sustainable Development: Guidelines and Methodologies. Third Edition, United Nations, New York [1] World Health Organization (WHO). (2014). Immunization coverage. Factsheet N° 378 [2] Andre, F.; Booy, R.; Bock, H.; Clemens, J.; Datta, S.; John, T.; Lee, B.; Lolekha, S.; Peltola, H.; Ruff, T.; Santosham, M. & Schmitt, H. (2008). Vaccination greatly reduces disease, disability, death and inequity worldwide. Bulletin of the World Health Organization, 86 (2), 81-160. [3] URL references: [1]:http://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/health/immunization.pdf, accessed June 11, 2014. [2]: http://www.who.int/mediacentre/factsheets/fs378/en/, accessed August 7, 2014. [3]: http://www.who.int/bulletin/volumes/86/2/07-040089/en/, accessed August 7, 2014.

2. Education (Ed)

2.1 Mean Years of Schooling

Indicator:	Mean Years of Schooling
Scope:	Basic CPI
Rationale:	A high-quality workforce, or human capital, is considered a critical factor in economic development. The concept of human capital recognizes that not all labor is equal, and that the quality of employees can be improved by investing in them. The education, experience and abilities of an employee have an economic value for employers and for the economy. Cities with higher levels of human capital tend to have higher economic growth levels as well as higher productivity. This productivity is generally reflected in higher wages for the entire population. (Psacharopolous and Arriagada, 1986). Based on raw estimates of returns to education for 98 countries, Psacharopoulos and Patrinos (2004) show empirical evidence that the average rate of return to an additional year of schooling leads to an increase of 10 percent of the wages. This shows that the higher the city's education, the higher the economic returns the citizens perceive. A prosperous city seeks to provide optimal conditions for its inhabitants to invest in additional years of schooling.
Definition:	Mean years of schooling (MYS) provides the average number of years of education completed by a country's adult population (25 years and older), excluding years spent repeating grades.
Unit:	Years
Methodology:	Following UNESCO (2013) the methodology can be defined by two equations: The following formula shows the calculation of $\mathbf{\mathit{Mean\ years\ of\ schooling}}$ adjusted by the duration of individual levels: $$Mean\ years\ of\ schooling\ = \sum_a \sum_l HS_{al} * YS_{al}$$ Where: • $HSal$: Proportion of the population in age group a, for which the level of education l is the highest level attained. • $YSal$: Official duration of the level of education l for age group a at the time when this age group was in school. • $Mean\ years\ of\ schooling$ for the population aged 25 years and older is thus the population-weighted average $years\ of\ schooling$ for each age group a. If the duration of each level of education remains constant over time, the formula can be simplified as follows: $$Mean\ years\ of\ schooling\ = \sum_l HS_l * YS_l$$ Where: • HSl : Proportion of the population for which the level of education l is the highest level attained. • YSl : Official duration of the level of education l.

Indicator:	Mean Years of Schooling
Source:	UNDP / 2018.
Benchmark:	Max = 14 years Min = 0 years The objective is to provide tertiary education to the whole population, which usually includes: 6 years of primary, 3 years of secondary, 3 years upper secondary and minimum 2 years of technical program (Obtained from UNESCO, 2013).
Standardization:	$Mean\ years\ of\ schooling^{(S)} = 100\left(\left\lvert\frac{Mean\ years\ of\ schooling - X^{*}}{X^{*}}\right\rvert\right)$ $Mean\ years\ of\ schooling^{(S)} = 100\left(1 - \left\lvert\frac{Mean\ years\ of\ schooling - 0}{14 - 0}\right\rvert\right)$ Decision: $Mean\ years\ of\ schooling^{(S)} = \begin{cases} 0, & If\ Mean\ years\ of\ schooling < 0 \\ Mean\ years\ of\ schooling^{(S)}, & If\ 0 \leq Mean\ years\ of\ schooling < 14 \\ 100, & If\ Mean\ years\ of\ schooling \geq 14 \end{cases}$
Limitations:	While the optimal value is based on a system with 6 years of primary, 3 years of secondary, 3 years upper secondary and minimum 2 years of technical program, as UNESCO, 2013 propose, systems may vary across countries causing adjustments in some countries. Therefore, caution is required when looking at cross country comparisons. Even though this is an indicator of the stock of human capital, it does not measure the quality of education (or quality of human capital).
References:	Bibliographic references: Psacharopoulous, G. and Patrinos, H. (2004) Returns to Investment in Education: A Further Update. Economics of Education. Vol. 12 No. 2 [2] Psacharopoulos, G., & Arriagada, A. M. (1986). The Educational Attainment of the Labor Force: An International Comparison. Education and training series discussion paper No. EDT 38. Washington, DC: World Bank. [6] UNESCO Institute for Statistics. (2013). UIS Methodology for Estimation of Mean Years of Schooling [4] UNDP (2014). Open Data – Mean Years of Schooling (of adults) years 2005 – 2012. [5] URL references: [1] http://www.investopedia.com/terms/h/humancapital.asp, accessed August 24, 2015 [2]: http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-2881, accessed August 7, 2014. [3]: http://www.uis.unesco.org/Education/Pages/mean-years-of-schooling.aspx, accessed August 24, 2015 [4]:http://www.uis.unesco.org/Library/Documents/mean-years-schooling-indicator-methodology-2013-en.pdf, accessed August 7, 2014. [5]: https://data.undp.org/dataset/Mean-years-of-schooling-of-adults-years-/m67k-vi5c, accessed August 7, 2014. [6]:http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2005/09/01/000112742_20050901145133/Rendered/PDF/edt38.pdf, accessed August 7, 2014.

2.2 Share of Students in Higher Education

Indicator:	Share of Students in Higher Education
Scope:	Global Comparative Index
Rationale:	Nowadays higher education rationale includes the achievement of national and international academic standards for research, for teaching and for economic productivity. It is paramount for a global city to offer as many as higher education programmes possible to increase its place within the global city rankings. As Qiang (2003) states “Academic and professional requirements for graduates increasingly reflects the reflect the demands of the globalization of societies, economy and labor markets and thus higher education must provide an adequate preparation for that. These requirements include not only academic and professional knowledge, but also multilingualism, and social and intercultural skills and attitudes. The level of specialization in research and the size of the investments that are indispensable to certain fields of research and development require collaborative efforts and intensive international cooperation”. [1]

Indicator:	Share of Students in Higher Education
	“Higher education has now become a real part of the globalization process: the cross-border matching of supply and demand. Consequently, higher education can no longer be viewed in a strictly national context. This calls for a broader definition of internationalization, which embraces the entire functioning of higher education and not merely a dimension or aspect of it, or the actions of some individuals which are part of it” [2]. This indicator provides a measurement of a city’s ability to attract local students from its influence area, but also at the national and international level.
Definition:	Total number of tertiary (university &/or college) students enrolled as studying a recognized qualification, at a tertiary university or college. Will often depend on local definitions of what is a tertiary institution, but does not generally include trade and technical non-tertiary schools. [3]
Unit	%
Methodology:	$$Share\ of\ students\ in\ higher\ education = 100\left[\frac{Total\ students\ in\ higher\ education}{Total\ population\ in\ the\ city}\right]$$
Source:	Censuses, surveys and universities, educational authorities and municipal statistics.
Benchmark:	Min: 1% Max: 5% Based on 2thinknow City Benchmarking Data using the overall relative position of cities [4].
Standardization: 2.1	$$SSHE^{(S)} = 100\left[\frac{SSHE - Min}{Max - Min}\right]$$ $$SSHE^{(S)} = 100\left[\frac{SSHE - 1}{5 - 1}\right]$$ Decision: $$= \begin{cases} 100, if\ SSHE \geq 5 \\ SSHE^{(S)}, if\ 1 < SSHE < 5 \\ 0, if\ SSHE \leq 1 \end{cases}$$
Limitations:	This indicator presents a snapshot about the current higher education enrollment status; however, it does not address other relevant issues, such as the diversity or quality of the programs, or the capacity of the labor market to absorb the graduates.
References:	Bibliographic references: [1] Qiang, Zha 2003. Internalization of Higher Education: towards a conceptual framework, Policy Futures in Education, Volume 1, Number 2, 2003. [2] Astin, A. W. (1999). Student involvement: A developmental theory for higher education. *Journal of College Student Development, 40*(5), 518–529. [3] Based on 2thinknow metadata 2022. URL references: [4] https://go.2thinknow.com/, Accessed January 5, 2021

3. Science and Technology (ST)*

3.1 Scientists

Indicator:	Scientists
Scope:	Global Comparative Index
Rationale:	Cities face unprecedented challenges mainly driven by climate change, but also from other factors, such as mobility, crime and violence, generation of waste and consumption of resources, among others. The role of the scientific community in shaping more adequate policies that address these issues is ever important. [1] A prosperous city aims at producing high quality, relevant science, by generating adequate conditions for science and scientific development.
Definition:	Number of scientists per 10,000 inhabitants. The indicator considers an estimation of the number of resident scientists that work in a scientific field or are currently potentially actively seeking work, from best available commercial sources. Defined as those who narrowly identify as a scientist (e.g. chemists, physicists), not those in related fields which may use science skills, or have science degrees but are not scientists. [2]
Unit:	Scientists per 10,000 (#)
Methodology:	$$Scientists = 10{,}000\left[\frac{Total\ number\ of\ scientists}{Total\ city\ population}\right]$$
Source:	Censuses, surveys and municipal statistics
Benchmark:	Min: 1 Max: 30 Calculated from 2thinknow City Benchmarking Data using the overall relative position of cities [3].

Standardization: 2.1	$Scientists^{(S)} = 100\left[\frac{Scientists - Min}{Max - Min}\right]$ $Scientists^{(S)} = 100\left[\frac{Scientists - 1}{30 - 1}\right]$ Decision: $= \begin{cases} 100, if\ Scientists \geq 30 \\ Scientists^{(S)}, if\ 1 < Scientists < 30 \\ 0, if\ Scientists \leq 1 \end{cases}$
Limitations:	This indicator does not consider scientific production or its relevance, but rather only shows the ability for a city to attract scientists.
References	URL references: [1] https://www.scientificamerican.com/article/scientists-are-key-to-making-cities-sustainable/, Accessed January 2, 2022 [2] Based on 2thinknow metadata 2022. [3] https://go.2thinknow.com/, Accessed January 5, 2021

3.2 Science Impact Index (Index score)

Indicator	Science Impact Index
Scope:	Global Comparative Index
Rationale:	Cities face unprecedented challenges mainly driven by climate change, but also from other factors, such as mobility, crime and violence, generation of waste and consumption of resources, among others. The role of the scientific community in shaping more adequate policies that address these issues is ever important. [1] A prosperous city aims at producing high quality, relevant science, by generating adequate conditions for science and scientific development.
Definition:	Relative impact within the Science impact index. This is a numerical data point that scores cities out of an absolute highest possible score to zero. The ranking includes 500 cities for measuring relative performance. The indicator scores based on data points related to science and technology universities rankings, and infrastructure. [2]
Unit:	Dimensionless
Methodology:	$Science\ impact = Relative\ position\ in\ the\ Science\ impact\ index$
Source:	Science impact data is usually produced by specialized outlets that compare impact using a variety of measures, such as publications, citations and reach, between other factors.
Benchmark:	Min: 1 Max: 7,000 Calculated from 2thinknow City Benchmarking Data using the overall relative position of cities [3].
Standardization: 3	$Science\ impact^{(S)} = 100\left[\frac{\sqrt[2]{Science\ Impact} - \sqrt[2]{Min}}{\sqrt[2]{Max} - \sqrt[2]{Min}}\right]$ $Science\ impact^{(S)} = 100\left[\frac{\sqrt[2]{Science\ Impact} - \sqrt[2]{1}}{\sqrt[2]{7000} - \sqrt[2]{1}}\right]$ $Science\ impact^{(S)} = 100\left[\frac{\sqrt[2]{Science\ Impact} - 1}{83.66 - 1}\right]$ Decision: $= Science\ impact^{S}$
Limitations:	This indicator considers specific measures in order to develop the science impact index, which could be shaped from different angles. Thus, this index shows only one way of approaching science impacts among many potential approaches.
References:	URL references: [1] https://www.scientificamerican.com/article/scientists-are-key-to-making-cities-sustainable/, Accessed January 2, 2022 [2] Based on 2thinknow metadata 2022. [3] https://go.2thinknow.com/, Accessed December 15, 2021

4. Culture and Recreation (CR)*

4.1 Museums

Indicator	Museums
Scope:	Global Comparative Index
Rationale:	Culture is a key resource for urban sustainable development. Cities naturally attract cultural capital, including museums, which fosters creativity, innovation, inclusiveness and offer economic opportunities. [1] A prosperous city is concerned with the conservation of its cultural, historical, social, and natural heritage, and uses culture as a means to strengthen social cohesion and tackle inequalities.
Definition:	Number of museums per million inhabitants. This includes national, government and general museums (e.g. museums of natural history, nautical museums, museums of industry, etc.). Each museum is counted once (some museums have multiple sites), and excludes art museums. [2]
Unit:	# / 1,000,000 people
Methodology:	$$Number\ of\ museums = 1{,}000{,}000 \left[\frac{Number\ of\ museums\ within\ the\ city}{City\ population}\right]$$
Source:	Museum's information and data is usually produced by censuses and surveys. Local authorities or city governments also produce such data.
Benchmark:	Min: 1 Max: 33 Calculated from 2thinknow City Benchmarking Data using the overall number of museums for selected cities [3].
Standardization: 2.1	$$Number\ of\ museums^{(S)} = 100 \left[\frac{number\ of\ museums - Min}{Max - Min}\right]$$ $$Number\ of\ museums^{(S)} = 100 \left[\frac{number\ of\ museums - 1}{33 - 1}\right]$$ Decision: $$= \begin{cases} 100, if\ Number\ of\ museums \geq 33 \\ Number\ of\ museums^{(S)}, if\ 1 < Number\ of\ museums < 33 \\ 0, if\ Number\ of\ museums \leq 1 \end{cases}$$
Limitations:	This indicator does not consider how relevant the museums are in terms of its local, regional or international influence; and it does not consider the amount of funding they receive, therefore limiting its comparison capabilities.
References:	URL references: [1] https://unesdoc.unesco.org/ark:/48223/pf0000245999, Accessed December 15, 2021 [2] Based on 2thinknow metadata 2022. [3] https://2thinknow.com/, Accessed December 15, 2021

4.2 Accommodation Affordability

Indicator:	Accommodation Affordability
Scope:	Global Comparative Index
Rationale:	Accommodation establishments belong to the basic facilities of tourism infrastructure because they allow visitors to stay in the visited area. As many as tourism attractions a city has, accommodation facilities and affordability should be promoted for different income visitors to enjoy city´s tourist sites and services.
Definition:	Cost of an average night, excluding 5-star accommodations, as a share of income per capita.
Unit:	%
Methodology:	Average accommodation price (USD) of: Hostel ($ per Night) 1-Star Hotel ($ per Night) 2-Stars Hotel ($ per Night) 3-Stars Hotel ($ per Night) 4-Stars Hotel ($ per Night) $$Accommodation\ affordability = 100 \left[\frac{Average\ cost\ per\ night}{City\ product\ per\ capita}\right]$$
Source:	Obtained from: KNOEMA Original data: GoEURO

Indicator:	Accommodation Affordability
Benchmark:	Min: 0.1% Max: 1% Based on estimations using KNOEMA data base for selected cities. [2]
Standardization:	$$Accommodation\ affordability^{(S)} = 100\left[\frac{Accommodation\ affordability - Min}{Max - Min}\right]$$ $$Accommodation\ affordability^{(S)} = 100\left[\frac{Accommodation\ affordability - 0.1}{1 - 0.1}\right]$$ Decision: $$= \begin{cases} 100, if\ Accommodation\ affordability \leq 0.1 \\ Acommodation\ affordability^{(S)}, if\ 0.1 < Accommodation\ affordability < 1 \\ 0, if\ Acommodation\ affordability \geq 1 \end{cases}$$
Limitations:	Data available only for 22 cities.
References:	URL reference: [1] Original data: https://de.camping-and-co.com/blog/accommodation-price-index-en-d/ Download URL: http://public.knoema.com/sbzvys/accommodation-price-index-2017 Accessed: January 5, 2022

5. Safety and Security (SS)

5.1 Homicide Rate

Indicator:	Homicide Rate
Scope:	Basic CPI / SDG 16.1.1. Number of victims of intentional homicide per 100,000 population, by sex and age.
Rationale:	Crime affects a city negatively, mainly by affecting personal security, the attractiveness of an area for recreation and general amenities. Homicide rate provides an approximation to the degree of criminality in a city. Local governments must work to reduce the levels of crime. Their job is to guarantee the rights of their citizens to be protected from crime, violence, and aggression. In a safe city, individuals can prosper, and society develop (United Nations, 2005). A prosperous city seeks to increase its inhabitants' quality of life through a better management of security that leads to a reduction on the number of homicides.
Definition:	Number of intentional and unlawful deaths (Homicide) purposefully inflicted on a person by another person.
Unit:	# Per 100,000 population
Methodology:	$$Homicide\ rate = 100{,}000\ \frac{homicides}{city\ population}$$
Source:	Integrated Data Warehouse Moscow and UNODC / 2019.
Benchmark:	Min = 1 homicides per 100,000 inhabitants Max = 1,654 homicides per 100,000 inhabitants Obtained from United Nations Office on Drugs and Crime (UNODC) [2]
Standardization:	$$Homicide\ rate^{(S)} = 100\left[1 - \frac{\ln(Homicide\ rate\ ) - Min}{Max - Min}\right]$$ $$Homicide\ rate^{(S)} = 100\left[1 - \frac{\ln(Homicide\ rate)}{7.41}\right]$$ Decision: $$Homicide\ rate^{(S)} = \begin{cases} 0, & If\ \ln(Homicide\ rate) \geq 7.41 \\ Homicide\ rate^{(S)}, & If\ 0 < \ln(Homicide\ rate) < 7.41 \\ 100, & If\ \ln(Homicide\ rate) \leq 0 \end{cases}$$

Indicator:	Homicide Rate
Limitations:	The indicator may differ based on the efficiency of police systems across countries. If city governments are not independent of the central government, they may not be able to affect their corresponding homicide rates. However, the indicator does not aim to identify police efficiency. Deaths caused by injuries; suicides may not be included in this indicator as well as non-reported homicides that are common in conflict countries.
References:	Bibliography references: United Nations (2007). Indicators of Sustainable Development: Guidelines and Methodologies. Third Edition, United Nations, New York. [3] United Nations (2005). In larger freedom: towards development, security, and human rights for all: Report of the Secretary-General. [4] URL references: [1] https://www.unodc.org/documents/data-and-analysis/IHS%20methodology.pdf, accessed August 25, 2015 [2]: https://www.unodc.org/gsh/en/data.html , accessed June 11, 2014. [3]:http://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/governance/homicides.pdf , accessed June 11, 2014. [4]: http://www.un.org/en/ga/search/view_doc.asp?symbol=A/59/2005, accessed June 11, 2014.

5.2 Crime Index Rank

Indicator:	Crime Index Rank
Scope:	Global Comparative Index
Rationale:	Urbanization, particularly in the developing world, has been accompanied by increased levels of crime, violence, and lawlessness. To tackle violence and perceptions of insecurity, which disproportionally affect children, women, and vulnerable groups; are some of the most pressing challenges that cities face. [1] A prosperous city is concerned with public safety and aims at reducing the negative effects that crime and violence have over its inhabitants, particularly those of vulnerable groups.
Definition:	Relative position within the crime index rank. This is a ranking that measures the total and relative (per 100K population) propensity to non-violent crime. Includes data related to petty crimes (general theft, property crime and car thefts) [2].
Unit:	Dimensionless
Methodology:	$Crime\ index\ rank = Relative\ position\ in\ the\ Crime\ index\ rank$
Source:	Crime-related data is usually produced by censuses and surveys.
Benchmark:	Min: 1 Max: 500 Calculated from 2thinknow City Benchmarking Data using the overall relative position of cities [2].
Standardization: 2.1	$Crime\ index\ rank^{(S)} = 100\left[\frac{Crime\ index\ rank - Min}{Max - Min}\right]$ $Crime\ index\ rank^{(S)} = 100\left[\frac{Crime\ index\ rank - Min}{Max - Min}\right]$ Decision: $= \begin{cases} 100, if\ Crime\ index\ rank = 0 \\ Crime\ index\ rank^{(S)}, if\ 0 < Crime\ index\ rank < 6.21 \\ 0, if\ Crime\ index\ rank \geq 6.21 \end{cases}$
Limitations:	This indicator addresses the relative position of a city in terms of its crime index, however it does not consider changes in past levels of crime, which would show the path the city is following. The rank includes 500 cities.
References	URL references: [1] https://unhabitat.org/es/node/142308, Accessed December 15, 2021 [2] Based on 2thinknow metadata 2022. [3] https://go.2thinknow.com/, Accessed December 15, 2021

6. Public Space (PS)

6.1 Green Area per Capita

Indicator:	Green Area per Capita
Scope:	Extended CPI
Rationale:	Green areas are defined as public and private areas that have flora such as plants, trees, and grass (e.g., forests, parks, gardens). These areas are also a way to compensate for CO_2 emissions as green spaces generally generate environmental sustainability. This indicator provides information about the amount of geographical space that the city dedicates to green space. A prosperous city seeks to increase the green areas per capita to have a better air quality and improve the quality of life of its population.
Definition:	Total green area within the boundary of the urban agglomeration (forests, parks, gardens, etc.) per inhabitant.
Unit:	m^2 per capita
Methodology:	$Green\ area\ per\ capita = \frac{Total\ green\ area\ within\ the\ city}{city\ population}$
Sources:	Integrated Data Warehouse Moscow / 2020.
Benchmark:	$\boldsymbol{Max}$ = 15 m^2/hab $\boldsymbol{Min}$ = 0 m^2/hab Obtained from POT Medellin (2013) based on World Health Organization's suggestion.
Standardization:	$Green\ area\ per\ capita^{(S)} = 100\left(\left\lvert\frac{Green\ area\ per\ capita - Min}{Max - Min}\right\rvert\right)$ $Green\ area\ per\ capita^{(S)} = 100\left(\left\lvert\frac{Green\ area\ per\ capita}{15}\right\rvert\right)$ Decision: $Green\ area\ per\ capita^{(S)} = \begin{cases} 0, & If\ Green\ area\ per\ capita < 0 \\ Green\ area\ per\ capita^{(S)}, & If\ 0 < Green\ area\ per\ capita < 15 \\ 100, & If\ Green\ area\ per\ capita \geq 15 \end{cases}$
Limitations:	Cities located in deserted areas have a natural disadvantage; however, it is a duty of the city to guarantee a minimum amount of green space to its population. Cities with very high population density will have difficulty preserving green area within the city boundaries.
References:	Bibliographic references: Fuller, R. & Gaston, K. (2009). The scaling of green space coverage in European cities. Biology letters, On-line publication: doi:10.1098/rsbl.2009.0010. [1] Laghai, H. & Bahmanpour, H. (2012). GIS Application in Urban Green space Per Capita Evaluation. Annals of Biological Research, 2012, 3 (5):2439-2446. POT Medellín (2013). Plan de Ordenamiento Territorial – Medellín. Revisión y ajuste del Plan de Ordenamiento Territorial de Medellín: Evaluación y Seguimiento – Tomo IIIC. Versión 2: Concertación con área metropolitana del Valle de Aburrá. Pag: 156. URL references: [1]: http://rsbl.royalsocietypublishing.org/content/early/2009/02/22/rsbl.2009.0010.full, accessed June 11, 2014.

6.2 Land Allocated to Open Public Space

Indicator:	Land Allocated to Open Public Space
Scope:	Global Comparative Index / SDG 11.7.1. Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities.
Rationale:	Open public space is determinant for improving quality of life and for the proper functioning of the mobility system, and of the city. Well-designed and properly maintained open public spaces have the potential to reduce crime and violence, foster formal and informal economic activities, and provide a

Indicator:	Land Allocated to Open Public Space
	variety of services and opportunities for users. This is specially the case for marginalized groups, where open public space provides recreation, social, cultural, and economic development. Open public space as a common good is the key enabler for the fulfillment of human rights, empowering women and providing opportunities for youth. [1] A prosperous city aims at having better and more accessible open public space, providing services and opportunities for all its inhabitants.
Definition:	Total area of urban surface allocated to open public space.
Unit:	%
Methodology:	$$Land\ allocated\ to\ public\ space = 100\left[\frac{Total\ surface\ of\ urban\ open\ public\ space}{Total\ built-up\ area}\right]$$
Source:	Local or city urban planning authorities, Open Street Map and Satellite imagery
Benchmark:	Min: 0% Max: 20% Based on UN Habitat, training module for Public Space using the overall recommendation for open public space [2].
Standardization: 2.1	$$Land\ allocated\ to\ public\ space^{(S)} = 100\left[\frac{Land\ allocated\ to\ public\ space - Min}{Max - Min}\right]$$ $$Land\ allocated\ to\ public\ space^{(S)} = 100\left[\frac{Land\ allocated\ to\ public\ space - 0}{20 - 0}\right]$$ Decision: $$= \begin{cases} 100, if\ Land\ allocated\ to\ public\ space \geq 20 \\ Land\ allocated\ to\ public\ space^{(S)}, if\ 0 < Land\ allocated\ to\ public\ space < 20 \\ 0, if\ Land\ allocated\ to\ public\ space \leq 0 \end{cases}$$
Limitations:	It's challenging to obtain complete information about city's open public space. It is sometimes necessary to make assumptions about open space size or if they serve as open public space, and remote sensing data could be useful in these cases.
References:	URL references: [1] https://unhabitat.org/sites/default/files/2020/07/indicator_11.7.1_training_module_public_space.pdf Accessed, December 15, 2021 [2] *Ibid*.

6.3 Land Allocated to Streets

Indicator:	Land Allocated to Streets
Scope:	Global Comparative Index / SDG 11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities
Rationale:	The matrix that connects and integrates the city is mostly formed by its streets and public space. An adequate network of streets, boulevards and roads improves mobility and quality of life of city dwellers. If the network is well-designed, it can the help reduce crime and create opportunities for all kinds of economic activities and for a diversity of users. [1] A prosperous city aims at having adequate and sufficient streets, in order to foster an adequate communication and mobility for all its inhabitants.
Definition:	Total area of urban surface allocated to streets.
Unit:	%
Methodology:	$$Land\ allocated\ to\ streets = 100\left[\frac{Total\ surface\ of\ streets}{Total\ built-up\ area}\right]$$
Source:	Local or city urban planning authorities, Open Street Map and Satellite imagery
Benchmark:	Min: 0% Max: 30% Based on UN Habitat, training module for Public Space using the overall recommendation for streets [2].
Standardization: 2.1	$$Land\ allocated\ to\ streets^{(S)} = 100\left[\frac{Land\ allocated\ to\ streets - Min}{Max - Min}\right]$$ $$Land\ allocated\ to\ streets^{(S)} = 100\left[\frac{Land\ allocated\ to\ streets - 0}{30 - 0}\right]$$ Decision: $$= \begin{cases} 100, if\ Land\ allocated\ to\ streets \geq 30 \\ Land\ allocated\ to\ streets^{(S)}, if\ 0 < Land\ allocated\ to\ streets < 30 \\ 0, if\ Land\ allocated\ to\ streets \leq 0 \end{cases}$$

Limitations:	It's challenging to obtain complete information about city's streets, and remote sensing data could be useful in these cases.
References:	URL references: [1] https://unhabitat.org/sites/default/files/2020/07/indicator_11.7.1_training_module_public_space.pdf Accessed, December 15, 2021 [2] *Ibid*.

6.4 Accessibility to Open Public Space

Indicator:	Accessibility to Open Public Space
Scope:	Basic CPI / SDG 11.7.1. Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities.
Rationale:	Open Public Space (OPS) alludes to Public Space with "Open" features. This is the non-built up public areas within the city's urban footprint. Also "Open area" concept is related to free access. In most of the countries around the world, the concept of "open public area" is related to "green area" (green areas are defined as public and private areas that have flora such as plants, trees, and grass). However, OPS include but is not limited to green area. Nevertheless, the two principal roles an open public area must provide are to provide a healthy social interaction space and to contribute to air quality and a healthy environment (WHO, 2012). People living in towns and cities should have an accessible natural green space or an open public space less than 400 meters from home (Natural England; see also The Wildlife Trust & Natural England, 2009; Harrison et al., 1995; Barker, 1997; Handley et al., 2003; Wray et al., 2005;). This indicator looks at how accessible these open public spaces are to the population. It also takes into the way in which total public area is distributed across the city. A prosperous city has enough open public area for its population, if it is properly distributed and people have easy access to it.
Definition:	According to POT Medellin (2013), Sandalack & Alaniz (2010) and Project for Public Spaces, the elements which can be considered as open public space are: Park: open space inside a municipal territory. Its objective is to provide free air recreation and contact with nature. The principal characteristic is the significant proportion of green area in the zone. Civic parks: open space created as the result of building agglomeration around an open area, which later was transformed to a representative and civic area. It has a considerable proportion of nature, specifically gardens. It is a good place for cultural events and passive recreation. Square: open space created because of building agglomeration around an open area. Its main characteristics are the significant proportion of architectonic elements and the interaction between those buildings and the open area. Squares are usually public spaces that are relevant for the city due to their location, territorial development and/or cultural importance. Recreational green area: public green areas that contribute to environmental preservation. All recreational green areas must guarantee accessibility and must be linked to urban areas. Their main functions are ornament and passive recreation. Facility public area: open space meeting and recreational facilities that are part of the land for city's facilities (a facility is defined such as places which are elementary in all cities. Places that all cities must have, e.g.: public libraries, stadium, public sports centers, etc.). This land complies with the following characteristics: public property, free transit and access, and active and passive recreation. (e.g.: public area outside a stadium) Metropolitan open public space: public spaces that are larger than 50 ha (500,000 m2).
Unit:	%
Methodology:	$Accessibility\ to\ open\ public\ area = 100\,\frac{population\ less\ than\ 400m\ away\ open\ public\ area\ or\ 1000m\ from\ a\ metropolitan\ open\ public\ space}{city\ population}$ Population" is referring to every person that lives less than 400m away from an open public area, nevertheless it is complicated to get data of every person that complies with that characteristic, and almost no city has that information available If the information is available, the best is to estimate the indicator with that information; otherwise, Methodology "B" must be followed. METHODOLOGY A. Percentage of urban area that is located less than 400 meters away from an open public space. $Accessibility\ to\ open\ public\ area = 100\,\frac{urban\ area\ less\ than\ 400m\ away\ open\ public\ area\ or\ 1000m\ away\ from\ a\ metropolitan\ open\ public\ area}{total\ built-up\ area\ of\ the\ urban\ extent}$

Indicator:	Accessibility to Open Public Space
	To calculate the indicator, it is necessary to use a map of urban open public areas and to follow these steps: - Identify and draw the polygons of open public spaces within the built-up area of the city. - Classify as metropolitan open public areas, those public spaces larger than 50 ha. - Delineate a buffer of 1000 meters from metropolitan public areas and 400 meters from the rest of open public spaces polygons. - Merge and clip with urban perimeter. - Calculate areas inside the accessibility meters buffer. - Calculate the proportion of urban area located inside the buffer. Open-source data, such as Open Street Maps, assisted with satellite imagery and on-the-ground verification can be used to identify intra-urban open public areas when no other information is available.
Source:	UN Habitat / 2020.
Benchmark:	Min = 0% Max = 100%
Standardization:	Not required
Limitations:	Types of Open Public Space vary across cities; however, the types listed in this indicator are usually the most accepted ones. Contemporary constraints on mobility and behavior need to be examined before physical distance to measure effectively the accessibility to open public space. There are social and cultural constraints on access, anxiety and fears for personal safety are some of them (Harrison et al., 1995).
References:	Bibliographic references: Natural England. Natural England website http://www.naturalengland.org.uk/ The Wildlife Trust & Natural England. (2009). Analysis of Accessible Natural Greenspace provision for Essex, including Southend-on-Sea and Thurrock Unitary Authorities. Harrison, C., Burgess, J., Millward, A., Dawe, G., 1995. Accessible natural green space in towns and cities: a review of appropriate size and distance criteria. English Nature research report number 153. English Nature, Peterborough. Barker, G., 1997. A framework for the future: green networks with multiple uses in and around towns and cities. English Nature research report number 256. English Nature, Peterborough. Handley, J., Pauleit, S., Slinn, P., Barber, A., Baker, M., Jones, C., Lindley, S., 2003. Accessible natural green space standards in towns and cities: a review and toolkit. English Nature research report number 526. English Nature, Peterborough. Sandalack, B. & Alaniz, F. (2010). Open space typology as a framework for design of the public realm. In The faces of Urbanized Space, R. Barelkowski (editor). World Health Organization (WHO). (2012). Health Indicator of sustainable cities: in the context of the Rio+20 UN Conference on sustainable development. [3] Wray, S., Hay, J., Walker, H., Staff, R., 2005. Audit of the Towns, Cities and Development Work stream of the England Biodiversity Strategy. English Nature research report number 652. English Nature, Peterborough. POT Medellín (2013). Plan de Ordenamiento Territorial – Medellín. Revisión y ajuste del Plan de Ordenamiento Territorial de Medellín: Evaluación y Seguimiento – Tomo IIIC. Versión 2: Concertación con área metropolitana del Valle de Aburrá. Pag: 153. UN-Habitat (2014) Guidelines and Metadata on the City Prosperity Initiative, use of selected indicators, Nairobi. UN-Habitat (2013) Streets as Public Spaces and Drivers of Urban Sustainability, Nairobi. UN-Habitat (2013) The relevance of street patterns and public space in urban areas, Nairobi. Institute for Transportation and Development Policy (2013) TOD Standard, v. 2.0, New York. URL references: [1]: http://ec.europa.eu/environment/europeangreencapital/index_en.htm, accessed June 11, 2014. [2]: http://www.pps.org/, accessed June 11, 2014. [3]: http://www.who.int/hia/green_economy/indicators_cities.pdf, accessed August 18, 2014. http://epa.gov/smartgrowth/pdf/ptfd_primer.pdf

Dimension 4. Equity and Social Inclusion (ESI)

An inclusive society is one that treats people equally regardless of their race, ethnicity, age, gender, identity, sexual orientation, class, and place of origin, and ensures inclusion and equality of opportunities for all of its members. This can be achieved partly by enhancing gender equality, protecting the rights of minorities and vulnerable groups, as well as by ensuring participation on the social, political, and cultural spheres. A prosperous city seeks to acknowledge and integrate the traditionally excluded groups into the city's decision-making processes.

When inclusion and equity are embedded in decision-making, there are direct and indirect positive effects that favor the overall development of the city. For example, equity has a significant impact on economic performance by fostering each person's ability to self-develop, including skills and creative talent.

A city is only prosperous to the extent that poverty and inequalities are minimal. No city can claim to be prosperous when large segments of the population live in abject poverty and deprivation. This involves reducing the incidence of slums and new forms of poverty and marginalization.

TABLE 4. Equity and Social Inclusion Dimension: Indicators for Comparative Analysis of Cities

Dimension	Sub-dimension	Indicator
04 EQUITY AND SOCIAL INCLUSION (ESI)	1. Economic & Social Equity (ESE)*	1.1 Property Affordability
		1.2 Urban Transit Price Index
		1.3 Affordability of Mass Public Transport
		1.4 Affordability of Non-Massive Public Transport
		1.5 Gini Coefficient
	2. Gender Inclusion (GI)*	2.1 Women in Local Government

*Note: * Sub-dimensions added to CPI original structure.*

1. Economic & Social Equity (ESE)*

1.1 Property Affordability

Indicator	Property Affordability
Scope:	Global Comparative Index
Rationale:	The pace of urbanization has exceeded many cities' capacity to absorb the needs of a growing population. This rapid urban growth generates high proportions of informal dwellings on one side, and an ever-increasing property prices on the other, on both cases reducing the possibilities of cities' inhabitants to have access to adequate housing. [1] A prosperous city implements policies to guarantee accessibility to adequate housing for all.
Definition:	Ratio of the median apartment price to the median annual net disposable family income.
Unit:	Dimensionless
Methodology:	$$Property\ Affordability = \left[\frac{Median\ apartment\ price}{Median\ net\ disposable\ family\ income}\right]$$ In order to estimate family income, the median net salary is multiplied by 1.5, assuming that a second family member provides half of main provider's income. $$Property\ Affordability = \left[\frac{Median\ apartment\ price}{1.5(Median\ net\ salary)}\right]$$
Source:	City government statistics, censuses and surveys.
Benchmark:	Min: 1.43 Max: 67.81 Based on Numbeo property prices index by city 2021 [2].
Standardization: 2.2	$$Property\ affordability^{(S)} = 100\left[1-\left(\frac{Property\ affordability - Min}{Max - Min}\right)\right]$$ $$Property\ affordability^{(S)} = 100\left[1-\left(\frac{Property\ affordability - 1.43}{67.81 - 1.43}\right)\right]$$ Decision: $$= \begin{cases} 100, if\ Property\ affordability \leq 1.43 \\ Property\ affordability^{(S)}, if\ 1.43 < Property\ affordability \leq 67.81 \\ 0, if\ Property\ affordability > 67.81 \end{cases}$$
Limitations:	This indicator takes the median apartment price, as well as median family disposable income, which does not reflect the degree of variation on the housing market.
References	URL references: [1] https://unhabitat.org/sites/default/files/download-manager-files/Housing%20for%20All%20The%20Challenges%20of%20Affordability%2CAccessibility%20and%20Sustainability.pdf, Accessed December 15, 2021 [2] https://www.numbeo.com/property-investment/rankings.jsp?title=2021, Accessed January 3, 2022

1.2 Urban Transit Price Index

Indicator:	Urban Transit Price Index
Scope:	Global Comparative Index
Rationale:	The SDGs' imperative to make cities more inclusive means that cities will have to move away from car-based travel to public transport and active modes of transport such as walking and cycling with good inter-modal connectivity. It is empirically proven that public transport makes cities more inclusive, safe and sustainable. Effective and low-cost transportation is critical for reducing urban poverty and inequalities and enhancing economic development because it provides access to jobs, health care, education services and other public goods. [1] Around the world, millions of people use public transportation to commute between their workplaces, schools and homes each day. Some do so for convenience, because they would have no other feasible way of reaching their destinations, while others do so for environmental reasons. Whatever the need, public transportation often forms the central network that laces a city together. But at what cost? [2] A prosperous city will aim at having an efficient transport system that facilitates mobility for all of its citizens and visitors.
Definition:	Index that includes the cost of transport using uber, taxi and public transport.

Indicator:	Urban Transit Price Index
Unit	Dimensionless
Methodology:	$$\text{Urban transit price index} = \text{Overall average cost of public transport}$$
Source:	Urban Transit Price Index, 2016 consulted in: KNOEMA, 2014: Global City Index [3]
Benchmark:	Min: 2 Max: 46 Based on estimations using KNOEMA data base for selected cities. [3]
Standardization: 2.1	$$\text{Urban transit price index}^{(S)} = 100\left[1-\left(\frac{\text{UTPI}-\text{Min}}{\text{Max}-\text{Min}}\right)\right]$$ $$\text{Urban transit price index}^{(S)} = 100\left[1-\left(\frac{\text{UTPI}-2}{46-2}\right)\right]$$ Decision: $$=\begin{cases} 100, \text{if Urban transit price index} \leq 2 \\ \text{Urban transit price index}^{(S)}, \text{if } 2 < \text{UTPI} \leq 46 \\ 0, \text{if Urban transit price index} > 46 \end{cases}$$
Limitations:	Data available only for 21 cities. This indicator does not consider non-motorized transport alternatives.
References:	URL references: [1] UN-Habitat (2018). SDG Indicator 11.2.1 Training Module: Public Transport System. United Nations Human Settlement Programme (UN-Habitat), Nairobi. [2] https://thepointsguy.com/guide/monthly-public-transport-costs-worldwide/, Accessed January 10, 2022 [3] https://public.knoema.com/ygudsc/urban-transit-price-index-2016, Accessed, January 10, 2022

1.3 Affordability of Mass Public Transport

Indicator:	Affordability of Mass Public Transport
Scope:	Global Comparative Index
Rationale:	Because most trips involve a combination of several modes of transport, cities need to provide multi-modal transport systems and address modal integration as a major component of any urban mobility strategy. For example, high-capacity public transport systems – metro, light rail, or bus rapid transit (BRT) – need to be integrated with other forms of public transport that serve as feeder services to ensure full utilization of their conveyance capacity. Emphasis is therefore to be placed on "last mile access," to allow residents easy access to the public transport system (UN-Habitat, 2021). [1] A secondary indicator for the SDG, Goal 11" Make cities and human settlements inclusive, safe, resilient and sustainable" considers that the poorest quintile should not spend more than 5% of their net household income on transport. (UN-Habitat, 2021) [2] A prosperous city will aim at having a massive public transport system that is accessible and affordable for all people, but particularly for lower income groups.
Definition:	Number of trips that can be afforded in the massive public transport system
Unit	#
Methodology:	$$\text{Affordability of Massive Public Transport} = \left[\frac{(0.05)(\text{City product per capita})}{\text{Cost of a trip}}\right]$$ All values are in US dollars adjusted by the purchase power parity conversion factor.
Source:	Urban Transit Price Index, 2016 consulted in: KNOEMA, 2014: Global City Index [3]
Benchmark: 2.1	Min: 510 Max: 1,020 Based on the average number of working days per year (255), assuming two to four trips per working day.
Standardization: 2.1	$$\text{AMPT}^{(S)} = 100\left[\frac{\text{AMPT}-\text{Min}}{\text{Max}-\text{Min}}\right]$$ $$\text{AMPT}^{(S)} = 100\left[\frac{\text{AMPT}-510}{1{,}020-510}\right]$$

Indicator:	Affordability of Mass Public Transport
	Decision: $$= \begin{cases} 100, \text{if AMPT} \geq 1{,}020 \\ \text{AMPT}^{(S)}, \text{if } 510 \leq \text{AMPT} < 1{,}020 \\ 0, \text{if AMPT} < 510 \end{cases}$$
Limitations:	Data available only for 21 cities. This indicator considers the city product per capita as a proxy for the family net disposable income.
References:	URL references: [1] UN-Habitat, 2021: *https://unhabitat.org/topic/mobility-and-transport* Accessed: December 14, 2021. [2] UN-Habitat, 2021: *https://unstats.un.org/sdgs/metadata/files/Metadata-11-02-01.pdf* Accessed: December 15, 2021. [3] *https://public.knoema.com/crcqwve/prices-of-important-traveling-items-in-cities-around-the-world* Accessed: December 14, 2021.

1.4 Affordability of Non-Massive Public Transport

Indicator:	Affordability of Non-Massive Public Transport
Scope:	Global Comparative Index
Rationale:	Because most trips involve a combination of several modes of transport, cities need to provide multi-modal transport systems and address modal integration as a major component of any urban mobility strategy. For example, high-capacity public transport systems – metro, light rail, or bus rapid transit (BRT) – need to be integrated with other forms of public transport that serve as feeder services to ensure full utilization of their conveyance capacity. Emphasis is therefore to be placed on "last mile access," to allow residents easy access to the public transport system (UN-Habitat, 2021). A secondary indicator for the SDG, Goal 11" Make cities and human settlements inclusive, safe, resilient and sustainable" considers that the poorest quintile should not spend more than 5% of their net household income on transport. (UN-Habitat, 2021) [2] A prosperous city will aim at having a massive public transport system that is accessible and affordable for all people, but particularly for lower income groups.
Definition:	Number of trips that can be afforded in the non-massive public transport system
Unit	#
Methodology:	$$\text{Affordability of Non} - \text{Massive Public Transport} = \left[\frac{(0.05)(\text{City product per capita})}{\text{Cost of a trip}}\right]$$ All values are in US dollars adjusted by the purchase power parity conversion factor.
Source:	Urban Transit Price Index, 2016 consulted in: KNOEMA, 2014: Global City Index [3]
Benchmark:	Min: 96 Max: 240 Based on the average number of working weeks per year (48), assuming two to five trips per week (one per day). Uses the average Uber service price.
Standardization: 2.1	$$\text{ANMPT}^{(S)} = 100\left[\frac{\text{ANMPT} - \text{Min}}{\text{Max} - \text{Min}}\right]$$ $$\text{ANMPT}^{(S)} = 100\left[\frac{\text{ANMPT} - 96}{240 - 96}\right]$$ Decision: $$= \begin{cases} 100, \text{if ANMPT} \geq 240 \\ \text{ANMPT}^{(S)}, \text{if } 96 \leq \text{ANMPT} < 240 \\ 0, \text{if ANMPT} < 96 \end{cases}$$
Limitations:	Data available only for 21 cities. This indicator considers the city product per capita as a proxy for the family net disposable income and relies on the average Uber service price.
References:	URL references: [1] UN-Habitat, 2021: *https://unhabitat.org/topic/mobility-and-transport* Accessed: December 14, 2021.

Indicator:	Affordability of Non-Massive Public Transport
	[2] UN-Habitat, 2021: *https://unstats.un.org/sdgs/metadata/files/Metadata-11-02-01.pdf* Accessed: December 15, 2021. [3] *https://public.knoema.com/crcqwve/prices-of-important-traveling-items-in-cities-around-the-world* Accessed: December 14, 2021.

1.5 Gini Coefficient

Indicator:	Gini Coefficient
Scope	Basic CPI
Rationale:	The Gini coefficient is an indicator widely known to measure income inequality across the income (or consumption expenditure) distribution. In this context, it is intended to estimate the income distribution of a city. Cities are the cores of economic development, and a prosperous city cannot develop under conditions of large income inequalities. Moreover, income inequality should be considered as the core of policies that aim to build a more equitable and inclusive city. There is compelling evidence on the relationship between urban development and income inequality. Glaeser et al., (2008) demonstrates that income inequality is related to high crime rates, unhappiness, and lower growth rates (of both income and population). A prosperous, equitable and inclusive city seeks to reduce income disparities among its inhabitants.
Definition:	The Gini Index (Gini Ratio or Gini Coefficient) measures the extent to which the distribution of income (or consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Gini coefficient of zero expresses perfect equality, where all values are the same i.e., where everyone has the same income. A Gini coefficient of one (or 100%) expresses maximal inequality among values i.e., a city in which one person has all the income (Mandal, 2014).
Unit:	0 to 1
Methodology:	$$Gini = \frac{1}{2m}\frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n}\lvert y_i - y_j\rvert$$ Where: yi= Minimum level of income yj = Maximum level of income n= Total population m= Average income If available, consumption expenditure is preferable to income. However, most household surveys do not have this information. The measure of welfare used is household per capita income which includes labour (both monetary and in kind), and non-labour income (both monetary and in kind).
Source:	Integrated Data Warehouse Moscow / 2019.
Benchmark:	Min = 0.24 Max = 0.63 Calculated from The World Bank (2014).
Standardization: 2.1	$$Gini^{(S)} = 100\left[1 - \frac{Gini - Min}{Max - Min}\right]$$ $$Gini^{(S)} = 100\left[1 - \frac{Gini - 0.24}{0.63 - 0.24}\right]$$ Decisión: $$Gini^{(S)} = \begin{cases} 0, & Si\ Gini \geq 0.63 \\ Gini^{(S)}, & Si\ \ 0.24 < Gini < 0.63 \\ 100, & Si\ Gini \leq 0.24 \end{cases}$$
Limitations:	Due to data characteristics, some cities may switch to households rather than individuals. When population households are measured with inconsistent definitions, results are not fully comparable. Given the construction of the Gini coefficient, cities with similar incomes and Gini coefficients may have different income distributions [3]. Given that the Gini coefficient measures relative wealth, it should be noted that

Indicator:	Gini Coefficient
	an increase of the Gini coefficient does not imply absolute poverty reduction; therefore, a complementary measure of poverty is needed.
References:	Bibliographic references: Glaeser, Edward L., Resseger, Matt and Tobio, Kristina, (2009), Inequality in cities, Journal of Regional Science, 49, issue 4, p. 617-646. Mandal, R.M. (2014). Economic Inequality among the Rural Tribal People in Arunachal Pradesh: An Empirical Study. Journal of Global Economy 10.1: 24-36. The World Bank (2014). World Development Indicators 1960 – 2013. [2] URL references: [1]: http://data.worldbank.org/indicator/SI.POV.GINI?page=5, Accessed June 11, 2014. [2]: http://datos.bancomundial.org/indicador/SI.POV.GINI?page=2, Accessed June 11, 2014. [3]: http://www3.nccu.edu.tw/~jthuang/Gini.pdf, Accessed June 11, 2014.

2. Gender Inclusion (GI)*

2.1 Women in Local Government

Indicator:	Women in Local Government
Scope	Extended CPI / SDG 5.5.1. Proportion of seats held by women in (a) national parliaments and (b) local governments. / ESG (Environmental, Social and Corporate Governance).
Rationale:	In most cities of the world, female participation in decision-making positions is disproportionately limited. This fact accentuates the problems of gender inequality and exclusion. Promoting gender equality and the empowerment of women to eliminate all forms of gender-based discrimination in decision making positions is essential to defeat poverty and foster sustainable development. Policies aimed at eradicating the gender gap are crucial to allow women to develop the skills and competencies they need to better participate in decision making positions and increase their contribution to the local and global economies. Female participation is limited, and from this perspective, women are excluded from the opportunity to make decisions and fight for laws that benefit them. When this occurs, the skills and opportunities for training and development of women is violated and slimed, and social and economic growth of the cities is hampered. A prosperous city must seek to be inclusive in political representation.
Definition:	Female representation rate in decision making positions i.e., within the city mayor and council offices is a measure of gender equality and equity established by the UN to observe the inclusion of women in the socio-political life of a nation and its cities. Moreover, it aims to capture the influence of female population on local policies. The index does not differentiate among nations with minimum quota for female participation in government and representation reached freely.
Unit:	%
Methodology:	$Women\ in\ the\ local\ government\ = 100\,\frac{number\ of\ women\ in\ government\ jobs}{Total\ of\ government\ jobs}$
Source:	UN Habitat / 2020.
Benchmark:	$X*$= 50% Obtained from Mossuz-Lavau (2005) [4].
Standardization:	$Women\ in\ the\ local\ government^{(S)} = 100\left(1 - abs\left\|\frac{Women\ in\ the\ local\ government - X^*}{X^*}\right\|\right)$ $Women\ in\ the\ local\ government^{(S)} = 100\left(1 - abs\left\|\frac{Women\ in\ the\ local\ government - 50}{50}\right\|\right)$ Decision: $Women\ in\ the\ local\ government^{(S)} = \begin{cases} 0, & If\ Women\ in\ the\ local\ government = 0\ or\ \text{Women in the}\ local\ government = 2 * 50 \\ Women\ in\ the\ local\ governmentl^{(S)}, & If\ \ 0 < Women\ in\ the\ local\ government < 2 * 50 \\ 100, & If\ Women\ in\ the\ local\ government = 50 \end{cases}$
Limitations:	Some countries may have female participation quotas established by law. In these cases, it would not be possible to identify whether the participation of women in government is by imposition or free will. In addition, some cities may not elect their mayors or councilors. However, given that the indicator aims to

Indicator:	Women in Local Government
	capture women influence on policies, these limitations could be justified.
References:	Bibliographic references: Circle of Rights, (2004). Economic, social, and cultural rights of women. Module 4. Universidad de Minnesota en Estados Unidos. [2] Mossuz-Lavau, J. (2005). La paridad hombres/mujeres en política. Embajada de Francia en Bogotá. [4] URL references: [1] http://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/econ_development/women_wage_employment.pdf , Accessed June 11, 2014. [2] http://www1.umn.edu/humanrts/edumat/IHRIP/circle/modules/module4.htm , Accessed July 12, 2014. [3] http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=557, Accessed June 11, 2014. [4] http://www.ambafrance-co.org/La-paridad-hombres-mujeres-en, Accessed June 11, 2014.

Dimension 5. Environmental Sustainability (ES)

Within the CPI context, environmental sustainability is considered to be the ability for maintaining and strengthening environmental quality, as well as maintaining the factors and practices that contribute to it in the long-term.

Degradation of the environment in an urban context can relate to a variety of causes, such as pollution (including generation of solid and water waste, and burning of fossil fuels), urban sprawl, loss of forest masses, and, in general, the expansion of the urban environmental footprint.

A large proportion of the negative impacts over the environment can be traced to cities. Sprawling cities consume productive land and vital green spaces, where growing numbers of city dwellers put pressure on energy generation, as well as on all kinds of environmental resources. It is estimated that city dwellers are responsible for up to 70% of the world’s greenhouse gas emissions.

Therefore, to tackle climate change, avoid lasting damage to ecosystems and improve the health and well-being of billions of people, solutions to these problems must be sought at the city level. It is imperative that economic growth and urbanization are matched with appropriate policies and governance mechanisms, in order to reduce or eliminate environmental impacts. Cities must build the financial and other institutions required to achieve environmental sustainability (without which economic growth will fall short of ensuring shared prosperity). Environmentally sustainable cities are more compact, energy-efficient, clean, and accessible; but mostly, they reduce their ecological footprint by taking advantage of all the means that are at their disposal.

A prosperous city guarantees that its growth and its economic development does not destroy or degrade the environment; instead, the city’s natural assets are preserved for the sake of sustainable urbanization.

TABLE 5. Environmental Sustainability Dimension: Indicators for Comparative Analysis of Cities

Dimension	Sub-dimension	Indicator
05 ENVIRONMENTAL SUSTAINABILITY (ES)	1. Air Quality (AQ)	1.1 $PM_{2.5}$ Concentration
	2. Waste Management (WM)	2.1 Wastewater Treatment
		2.2 Waste Generation per Capita
		2.3 City Diversion Rate (recycling)
	3. Natural Protected Areas*	3.1 Natural Protected Areas

*Note: * Sub-dimensions added to CPI original structure.*

1. Air Quality (AQ)

1.1 $PM_{2.5}$ Concentration

Indicator:	$PM_{2.5}$ Concentration
Scope	Basic CPI / SDG 11.6.2. Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted) / ESG (Environmental, Social and Corporate Governance).
Rationale:	Particulate Matter (PM) is the sum of all solid and liquid particles suspended in air, many of which are hazardous. PM are particles of size~ 10 micrometers as well as size~2.5 micrometers. This complex mixture includes both organic and inorganic particles, such as dust, pollen, soot, smoke, and liquid droplets. These particles vary greatly in size, composition, and origin. Particles in air are either directly emitted, for instance when fuel is burnt and when dust is carried by wind, or indirectly formed, when gaseous pollutants previously emitted to air turn into particulate matter. At present, most routine air quality monitoring systems generate data based on the measurement of PM10 and include both the coarse (particle size between 2.5 and 10 µg) and fine particles. They are emitted from households, industry power stations, transportation, among others, can penetrate the lungs and cause health problems (World Health Organization, 2011). A prosperous city seeks to improve air quality and urban sustainability by reducing the emissions that contribute to the concentration level of these particulates in the air.
Definition:	Annual mean concentration of particulate matter of less than 2.5 microns (PM2.5) in cities. PM2.5 is used because of its greater health impacts. The estimates represent the average annual exposure level of the average urban resident to outdoor particulate matter. High-quality measurements of PM2.5 concentration from all the monitors in the urban area can be averaged to develop a single estimate.
Unit:	µg/m3
Methodology:	The concentration of PM2.5 is regularly measured from fixed-site, population-oriented monitors located within the urban areas. PM2.5 concentration can be estimated from PM10 using national conversion factors (PM2.5/PM10 ratios) estimated as population-weighted averages of city specific conversion factors for the country. This is applicable to cities where PM10 is the only reported PM parameter. In the absence of national conversion factors, an average of the surrounding country-specific conversion factors working as the regional conversion factors can be used. Care should be taken that the monitors used are not unduly influenced by a single source of pollution (i.e. a power plant, factory or highway). Instead, the monitors should reflect exposures over a wide area (World Health Organization, 2011).
Source:	Department of Nature Management and Environmental Protection of Moscow and World Bank / 2020.
Benchmark:	Min= 10 µg/m3 Max = 20 µg/m3 Obtained from WHO Ambient Air Pollution Database, May 2014
Standardization:	$PM\ 2.5\ concentration^{(S)} = 100\left(1-\left\|\frac{PM\ 2.5\ concentration - Min}{Max - Min}\right\|\right)$ $PM\ 2.5\ concentration^{(S)} = 100\left(1-\left\|\frac{PM\ 2.5\ concentration - 10}{20 - 10}\right\|\right)$ Decision:

Indicator:	$PM_{2.5}$ Concentration
	$PM\ 2.5\ concentration^{(S)} = \begin{cases} 0, & If\ PM\ 2.5\ concentration \geq 20 \\ PM\ 2.5\ concentration^{(S)}, & If\ 10 < PM\ 2.5\ concentration < 20 \\ 100, & If\ PM\ 2.5\ concentration \leq 10 \end{cases}$
Limitations:	To have an accurate measure of the PM concentration in the city it is important to measure this variable in different sites within the city. For this measurement the appropriate number of Fixed Automatic Monitoring Stations is determined using the same table as used under the Number of monitoring station indicator described above. As it is warned by the World Bank (2014), there are non-anthropogenic sources of outdoor particulate matter pollution (e.g. dust storms). These sources deteriorate the air quality but are linked to causes that are beyond the control of local authorities.
References:	Bibliographic references: Ambient Air Pollution Database, WHO, May 2014 World Health Organization (2011). Indicator and Measurement Registry version 1.7.0. [2] The World Bank (2014). World Development Indicators 1960 – 2013. [3] European Commission (2013). The Clean Air Policy Package. [4] URL references: [1]:http://www.greenfacts.org/en/particulate-matter-pm/level-3/01-presentation.htm#0p0 accessed August 31, 2015 [2]: http://apps.who.int/gho/indicatorregistry/App_Main/view_indicator.aspx?iid=1349, accessed June 11, 2014. [3]: http://data.worldbank.org/indicator/EN.ATM.PM10.MC.M3, accessed June 11, 2014. [4]: http://ec.europa.eu/environment/air/quality/standards.htm, accessed June 11, 2014.

2. Waste Management (WM)

2.1 Wastewater Treatment

Indicator:	Wastewater Treatment
Scope	Basic CPI / SDG 6.3.1. Proportion of domestic and industrial wastewater flows safely treated / ESG (Environmental, Social and Corporate Governance).
Rationale:	Water is fundamental to support life and human activities. According to the United Nations, 783 million people do not have access to clean water and around 2.5 billion do not have access to adequate sanitation21. Adequate sanitation helps to keep sewage and other contaminants from entering the water supply. If water is not properly cleaned after use, wastewater can have a huge negative impact on the environment and can become lead to vector-borne diseases (US Environmental Protection Agency, 2008; USGS, 2014). Urban wastewater treatment is a key action to mitigate the impact of urban life in the environment by reducing water pollution. This treatment is a process to convert wastewater - which is water no longer needed or suitable for its most recent use - into an effluent that can be either returned to the water cycle with minimal environmental issues or reused. A prosperous city seeks to increase as much as possible the percentage of treated wastewater to ensure environmental sustainability and a less polluted environment.
Definition:	Percentage of sewage treated from sewage produced within the urban agglomeration. Sewage is waste material that is carried away from homes and other buildings in a system of pipes. It consists mostly of greywater (from sinks, tubs, showers, dishwashers, and clothes washers), blackwater (the water used to flush toilets, combined with the human waste that it flushes away); soaps and detergents; and toilet paper (less so in regions where bidets are widely used instead of paper). Whether it also contains surface runoff depends on the design of sewer system.
Unit:	%
Methodology:	$\text{Wastewater Treatment} = 100\left[\dfrac{sewage\ treated\ in\ \frac{m^3}{year}}{sewage\ produced\ in\ \frac{m^3}{year}}\right]$
Source:	Federal State Statistics Service / 2020.
Benchmark:	Min= 0% Max = 100%

Indicator:	Wastewater Treatment
Standardization:	Not required.
Limitations:	The accuracy of the measurement of sewage effluent produced may vary across countries because the direct measurement of this variable has many technical challenges. For this reason, several countries estimate the sewage effluent as a function of the water consumption, which includes both the water supply system and alternative water sources. In this case, the regulatory agencies establish a conversion factor between consumption and discharge of the form: sewage= water consumption x factor were, Factor≤ 1. As a result, this factor will be different for different cities.
References:	Bibliographic references: USGS (2014). The USGS Water Science School: Wastewater Treatment. [2] US Environmental Protection Agency (2008). Tribal Compliance Assistance Center: Wastewater Topics. [3] URL references: [1]: http://www.merriam-webster.com/dictionary/sewage, accessed August 31, 2015 [2]: http://water.usgs.gov/edu/wuww.html, accessed June 11, 2014. [3]: http://www.epa.gov/tribalcompliance/wwater/wwwastedrill.html, accessed June 11, 2014

2.2 Waste Generation per Capita

Indicator:	Waste Generation per Capita
Scope	ESG (Environmental, Social and Corporate Governance).
Rationale:	Waste generation was defined by the WARR Strategy as "the total amount of material that enters the solid waste management system" (EPA, 2017-2018). Worldwide, waste generated per person per day averages 0.74 kilogram but ranges widely, from 0.11 to 4.54 kilograms. Though they only account for 16 percent of the world's population, high-income countries generate about 34 percent, or 683 million tons, of the world's waste. Most solid waste is generated in cities and the quality of collection and diversion facilities, and services are one of more sensitive social, economic and political urban issues for local governments. [1]
Definition:	Waste generation per capita is defined as the average of total amount of waste produced by the city's population.
Unit:	MSW generation per capita is estimated by dividing MSW generation of a certain area by that area's population with collection service. Tonnes / year / person
Methodology:	$$Waste\ generation\ per\ capita = \left(\frac{Total\ annual\ generation\ of\ tonnes\ of\ waste}{Total\ city\ population}\right)$$
Source:	Local government authority. Municipal Waste Management Agency.
Benchmark:	Min: 0.04 Max: 0.27 Based on World Bank, Trends in Solid Waste Management data worldwide. [1]
Standardization: 2.2	$$Waste\ generation\ per\ capita^{(S)} = 100\left[1 - \left(\frac{Waste\ generation\ per\ capita - \mathrm{Min}}{Max - \mathrm{Min}}\right)\right]$$ $$Waste\ generation\ per\ capita^{(S)} = 100\left[1 - \left(\frac{Waste\ generation\ per\ capita - 0.04}{0.27 - 0.04}\right)\right]$$ Decision: $$= \begin{cases} 100, if\ \text{Waste generation per capita} \leq 0.04 \\ Waste\ generation\ per\ capita^{(S)}, if\ 0.04 < \text{Waste generation per capita} \leq 0.27 \\ 0, if\ \text{Waste generation per capita} > 0.27 \end{cases}$$
Limitations:	In many cities, solid waste generation, collection and management data are currently incomplete or not available.
References:	Bibliographic references: EPA, 2017-18. Calculation method for waste generation, recycling and diversion. Supporting document for the NSW Waste Avoidance and Resource Recovery Strategy Progress Report 2017-18 URL references: [1] https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html Accessed December 5, 2021

2.3 City Diversion Rate (recycling)

Indicator:	City Diversion Rate (recycling)
Scope:	Global Comparative Index / SDG 11.6.1 Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities / ESG (Environmental, Social and Corporate Governance).
Rationale:	Diversion is a sustainable practice that ensures materials are used efficiently while reducing the amount of space and money that society must devote to landfills. The diversion rate includes all methods of diversion, including reducing, recycling, reusing, or composting. [1]
Definition:	Waste diversion (from landfill and incineration) includes the waste being recycled, composted, or treated through anaerobic digestion.
Unit:	%
Methodology:	$$City\ diversion\ rate = 100\left[\frac{Total\ diverted\ waste}{Total\ waste}\right]$$
Source:	World Bank Data Catalog: What A Waste Global Database, accessed by C40 Knowledge.
Benchmark:	Min: 0% Max: 50% Based on C40 Knowledge, Waste Data Explorer.
Standardization:	$$City\ diversion\ rate^{(S)} = 100\left[\frac{City\ diversion\ rate - Min}{Max - Min}\right]$$ $$City\ diversion\ rate^{(S)} = 100\left[\frac{City\ diversion\ rate - 0}{50 - 0}\right]$$ Decision: $$= \begin{cases} 100, if\ City\ diversion\ rate \geq 50 \\ City\ diversion\ rate^{(S)}, if\ 0 < City\ diversion\ rate < 50 \\ 0, if\ City\ diversion\ rate \leq 0 \end{cases}$$
Limitations:	Data available only for 26 cities.
References:	URL references: [1] World Bank Datacatalog: What A Waste Global Database. Accessed on: https://datacatalog.worldbank.org/dataset/what-waste-global-database on April 2019 C40 Knowledge, Accesed on https://www.c40knowledgehub.org/s/article/Waste-Data-Explorer?language=en_US December 6th, 2021. CDP-ICLEI Unified Reporting System: https://data.cdp.net/

3. Natural Protected Areas *

3.1 Natural Protected Areas

Indicator:	Natural Protected Areas
Scope:	Global Comparative Index
Rationale:	A protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values (IUCN Definition 2008). Protected areas – national parks, wilderness areas, community conserved areas, nature reserves and so on – are a mainstay of biodiversity conservation, while also contributing to people's livelihoods, particularly at the local level. Protected areas are at the core of efforts towards conserving nature and the services it provides us – food, clean water supply, medicines, and protection from the impacts of natural disasters. Their role in helping mitigate and adapt to climate change is also increasingly recognized; it has been estimated that the global network of protected areas stores at least 15% of terrestrial carbon (IUCN, 2022).
Definition:	Percentage of surface of the urban area that is considered a natural protected area.
Unit:	%
Methodology:	The main data source used to compute indicators on protected areas is the World Database on Protected Areas. The World Database on Protected Areas (UNEP-WCMC, 2017) is a worldwide record of marine and terrestrial protected areas. Launched by the International Union for Conservation of Nature (IUCN) and UN

Indicator:	Natural Protected Areas
	Environment, the geospatial database has been compiled and is updated monthly by the UN Environment World Conservation Monitoring Centre (UNEP-WCMC). The database is made up of about 242,000 records of protected areas, split into two shape files. Each protected area is recorded either as a polygon, delimiting the boundaries of the area or as a point with a reported area providing information on the extent of the protected area. One shape file contains all the protected areas recorded as polygons and the other one is for protected areas recorded as points. IUCN management categories (IUCN_CAT): the different categories of protected areas made by the International Union for Conservation of Nature (IUCN) correspond to the management objectives within the areas. Seven different categories can be distinguished, going from the most restrictive natural zone management to a zone with sustainable use of natural resources (Ia: Strict Nature Reserve, Ib: Wilderness Area, II: National Park, III: Natural Monument or Feature, IV: Habitat/Species Management Area, V: Protected Landscape/Seascape, VI: Protected area with sustainable use of natural resources). This variable can also take the following values: not applicable, not assigned or not reported. Protected area • The metropolitan land area (RA) is calculated from the metropolitan areas' shape file. • The protected area extent (PA) is calculated from the protected areas raster, the protected areas recorded as points shape file and the metropolitan boundaries' shape file. The first part of the protected area extent (PA1) is calculated as the sum of the reported areas of all the points located within the metropolitan area. The second part (PA2) is calculated as the protected zones extent within the metropolitan boundaries measured from the raster. The total protected area extent (PA) is thus calculated as PA1 + PA2. $$Natural\ protected\ areas = 100\left[\frac{Total\ protected\ land\ area}{City\ land\ area}\right]$$
Source:	OECD.stat OECDilibrarie (Moscow data) Beijing government (Beijing data) Buenos Aires Ciudad (2021). Buenos Aires City Voluntary Local Review (Buenos Aires data) The World Bank data (Hong Kong data).
Benchmark:	Min: 0% Max: 52% Based on OECD.Stat using one standard deviation to the right of the average value for all metropolitan areas considered.
Standardization: 2.1	$$Natural\ protected\ areas^{(S)} = 100\left[\frac{Natural\ protected\ areas - Min}{Max - Min}\right]$$ $$Natural\ protected\ areas^{(S)} = 100\left[\frac{Natural\ protected\ areas - 0}{52 - 0}\right]$$ Decision: $$= \begin{cases} 100, if\ Natural\ protected\ areas \geq 52 \\ Natural\ protected\ areas^{(S)}, if\ 0 < Natural\ protected\ areas < 52 \\ 0, if\ Natural\ protected\ areas \leq 0 \end{cases}$$
Limitations:	Data available only for 26 cities. The indicator does not reflect the effectiveness of these areas, nor whether or not they are suitably located. Studies of the biodiversity outcomes of protected areas show mixed results. Protected areas are occasionally recorded as points which increases the risk that protected areas will be double-counted or attributed to the wrong domain. Results may differ from summaries published elsewhere because of differences in the definitions of terrestrial and marine areas, the country baselines used, the definition of a country (e.g. which overseas territories are included), areal calculation technique used, how protected areas recorded as points are treated, time lag between national or regional data and updates to the WDPA, different treatment of a particular type of protected area designation and whether that meets the definition of a protected area. The WDPA also includes data from non-governmental data providers which may not be included in national databases.
References:	URL references: IUCD, 2022 Accessed on https://www.iucn.org/theme/protected-areas/about on January 7th, 2022. OECD.stat Accesed on https://stats.oecd.org/index.aspx?queryid=86794# December 7th, 2021. Moscow data: OECD (2021), "A territorial approach to the Sustainable Development Goals in Moscow, Russian Federation", OECD Regional Development Papers, No. 23, OECD Publishing, Paris, https://doi.org/10.1787/733c4178-en. Beijing data: http://nj.tjj.beijing.gov.cn/nj/main/2021-tjnj/zk/html/E07-24.jpg Buenos Aires City: Buenos Aires City Voluntary Local Review 2021 Accessed on: https://www.tablebuilder.singstat.gov.sg/publicfacing/createDataTable.action?refId=15665

Indicator:	Natural Protected Areas
	Hong Kong data: The World Bank data (HongKong data). Accessed on https://data.worldbank.org/indicator/ER.LND.PTLD.ZS

Dimension 6. Urban Governance and Legislation (UGL)

Governance is the exercise of managing the political, economic, and administrative affairs at all levels, whilst legislation refers to a body of laws, rules, rulings, regulations, acts, bills, statutes, enactments, and ordinances that would facilitate governance. Governance and legislation comprise the complex mechanisms, processes, and institutions through which citizens and groups articulate their interests, mediate their differences, and exercise their legal rights and obligations, ensuring that administrative authorities are accountable in the use and distribution of public resources.

Good governance and legislation are participatory, transparent, accountable, effective, and equitable, and promotes the rule of law. Good governance and legislation assure that political, social, and economic priorities are based on broad consensus in society and that the voices of the poorest and the most vulnerable are heard when decisions are being made.

Governance and legislation includes the State but transcends it by taking in the private sector and civil society. The State creates conducive political and legal environments, while the private sector generates jobs and income, and the civil society facilitates political and social interactions by mobilizing groups to participate in economic, social, and political activities.

The increasing realization that urban governance and legislation require more prominent and measurable conditions within urban prosperity, was the driving force behind the development of this dimension. The Urban Governance and Legislation dimension has the purpose of portraying the role of adequate governance mechanisms for local action towards prosperity, including the capacity to regulate and manage responsibly the urbanization process. This dimension intends to provide assistance to local governments in making informed decisions based on evidence in order to improve their overall performance.

Cities are best able to combine sustainability and shared prosperity through effective urban governance and transformational leadership, deploying appropriate and effective policies, laws and regulations, and creating adequate institutional frameworks with strong local institutions and sound institutional arrangements.

TABLE 6. Urban Governance and Legislation Dimension: Indicators for Comparative Analysis of Cities

Dimension	Sub-dimension	Indicator
06 URBAN GOVERNANCE AND LEGISLATION (UGL)	1. Participation and Institutional Capacity (PIC)	1.1 Voter Turnout
		1.2 Days to Start a Business
	2. Governance of Urbanization (GU)	2.1 Ratio of Land Consumption Rate to Population Growth Rate
	3. Development of e-Government (DEG)*	3.1 Local Online Service Index (LOSI)

*Note: * Sub-dimensions added to CPI original structure.*

1. Participation and Institutional Capacity (PIC)

1.1 Voter Turnout

Indicator:	Voter Turnout
Scope	Basic CPI
Rationale:	Voter turnout indicates the degree of civic engagement within a society and a measure of individual participation in elections. Political participation is the foundation of democratic institutions; it ensures accountability of governments and public institutions and increases the likelihood that decisions and policy makers reflect the will of many individuals. People vote to affect the actions of government in ways that are meaningful to them (OECD, 2011). Although voter turnout is the best means of measuring civic and political engagement, this measure is far from ideal because of institutional differences in electoral systems, the population's education level since more educated people are more likely to vote, and voter's age because older people are more likely to vote than younger people. A prosperous city seeks to motivate the eligible voters to participate in all elections and hence promote democratic practices and increase the chance that the political systems reflect the will of the majority and for the city government to have a high degree of legitimacy.
Definition:	Voter turnout is the number of eligible voters who cast a ballot in an election. The voter's turnout varies between countries based on factors such as type of electoral system, place of residence, level of education, type of election (national or local), among others.
Unit:	%
Methodology:	$\text{Voter Turnout} = 100\,\dfrac{\textit{Voters who cast a ballot in a local election}}{\textit{Number of elegible voters}}$ The number of eligible voters changes between countries and it is not necessarily the total adult population. Since local elections do not occur every year, the city should use the voter turnout of the most recent elections.
Source:	Central Election Commission of the Russian Federation / 2018.
Benchmark:	Min = 0% Max = 100%
Standardization:	Not required.
Limitations:	Cities within non-democratic countries cannot assess this indicator.
References:	Bibliographic references: OECD (2011) "Civic engagement and governance", in How's life? Measuring well-being. OECD Publishing. [1] URL references: [1]: http://dx.doi.org/10.1787/9789264121164-11-en, Accessed August 6, 2014. [2]: http://www.oecdbetterlifeindex.org/topics/civic-engagement/, Accessed August 6, 2014.

1.2 Days to start a Business

Indicator:	Days to Start a Business
Scope:	Basic CPI
Rationale:	A government should provide competitive environment in the market it regulates. Competition improves quality of goods and services, lowers costs for both producers and consumers, and creates facilities for those who want to enter to any market. Excessive business regulation affects economics performance and development because it increases the costs of engaging in the formal economy (Doing Business, 2014). A prosperous city should develop regulatory environment that permits the entry of any firm in the market.
Definition:	One way to identify the easy of starting a business is the number of days it takes a firm to register. Registration must include obtaining all necessary licenses, and permits and completing any required notifications, verifications or inscriptions for the company and employees with the relevant authorities [1] Number of days required to start a business
Unit:	# of days
Methodology:	Days to start a business recorded in calendar days. The measure captures the median duration that incorporation lawyers indicate is necessary in practice to complete a procedure. $Days\ to\ start\ a\ business = Number\ of\ days\ required\ to\ start\ a\ business$
Source:	World Bank.
Benchmark:	Min: 2 Max: 208 Based on World Bank, Doing Business Ranking. [2]
Standardization: 2.2	$Days\ to\ start\ a\ business^{(S)} = 100\left[1-\left(\frac{ln(Days\ to\ start\ a\ business)-\ln(Min)}{ln(Max)-\ln(Min)}\right)\right]$ $Days\ to\ start\ a\ business^{(S)} = 100\left[1-\left(\frac{ln(Days\ to\ start\ a\ business)-0.69}{5.34-0.69}\right)\right]$ Decision: $= \begin{cases} 100, if\ \ln(Days\ to\ start\ a\ business) \leq 0.69 \\ Days\ to\ start\ a\ business^{(S)}, if\ 0.69 < \ln(Days\ to\ start\ a\ business) \leq 5.34 \\ 0, if\ \ln(Days\ to\ start\ a\ business) > 5.34 \end{cases}$
Limitations:	The data may not be available since the requirements for starting a business may depend on different levels and branches of government.
References:	Bibliographic References: Doing Business (2014). Understanding Regulations for Small and Medium-Size Enterprises. 11th Edition URL References: [1] http://www.doingbusiness.org/Methodology/starting-a-business#time,accessed Accessed December 15, 2021 [2] http://www.doingbusiness.org/data/exploretopics/starting-a-buseness, Accessed December 15, 2021

2. Governance of Urbanization (GU)

2.1 Ratio of Land Consumption Rate to Population Growth Rate

Indicator:	Ratio of Land Consumption Rate to Population Growth Rate 2000-2015
Scope:	Contextual CPI / SDG 11.3.1. Ratio of land consumption rate to population growth rate / ESG (Environmental, Social and Corporate Governance).
Rationale:	A global study on 120 cities shows that urban land cover has, on average, grown more than three times as much as the urban population (UN-Habitat, 2018); in some cases, similar studies at national level showed a difference that was three to five times fold. To effectively monitor land consumption growth, it is not only necessary to have the information on existing land use cover but also the capability to monitor the dynamics of land use resulting from both changing demands of increasing population and forces of nature acting to shape the landscape. Cities require an orderly urban expansion that makes the land use more efficient. They need plan for future internal population growth and city growth resulting from migrations. They also need to accommodate new and thriving urban functions such as transportation routes, etc., as they expand. However, frequently the physical growth of urban areas is disproportionate in relation to population growth, resulting in land use that is less efficient in many forms. This type of growth turns out to violate every premise of sustainability that an urban area could be judged by including impacting on the

Indicator:	Ratio of Land Consumption Rate to Population Growth Rate 2000-2015
	environment and causing other negative social and economic consequences such as increasing spatial inequalities and lessening of economies of agglomeration. The indicator measures how compact cities are at any given time, to assess whether they are becoming compact over time. With this indicator in mind, meeting Target 11.3 by 2030 requires, at the minimum, slowing down the decline in compactness and, if possible, ensuring that the compactness of cities is maintained or increased over time. Ideally, an accepted ratio of land consumption to population growth rate should equal one. In the cities where this ratio is higher, progress on this indicator should be measured by reduction of the baselines moving towards one. However, numerous exceptions can be identified in the measurement of this indicator (i.e. overcrowding/ saturation/high-plot coverage or on the contrary low growth rates and densities/large urban areas), specific policies towards more efficient land consumption patterns should be designed and implemented (UN-Habitat, 2018).
Definition:	Ratio of land consumption rate to population growth rate is a good indicator for measuring land use efficiency and is intended to answer the question of whether the remaining undeveloped urban land is being developed at a rate that is less than, or greater than, the prevailing rate of population growth. With a primary aim of achieving optimal urban land use, a rate of land consumption lower than the rate of population growth would be desirable. This indicator requires defining the two components of population growth and land consumption rate. Computing the population growth rate is more straightforward and more readily available, while land consumption rate is slightly challenging, and requires the use of new techniques. In estimating the land consumption rate, one needs to define what constitutes “consumption” of land since this may cover aspects of “consumed” or “preserved” or available for “development” for cases such as land occupied by wetlands. Secondly, there is not one unequivocal measure of whether land that is being developed is truly “newly-developed” (or vacant) land, or if it is at least partially “redeveloped”. As a result, the percentage of current total urban land that was newly developed (consumed) will be used as a measure of the land consumption rate. Tracking and understanding land consumption is critical in maintaining a sufficient supply of developable land. • *Population growth rate (PGR)* is the rate at which population size changes in a country during a period, usually one year, expressed as a percentage of the population at the start of that period. It reflects the number of births and deaths during a period and the number of people migrating to and from a country. • *Land consumption* is defined as the uptake of land by urban developments including the urbanized open spaces • *City proper:* The Built-Up Area is the total area of the impervious surfaces in the city proper—roofs, streets, and parking lots—but excluding urbanized open space, both public and private, as well as vacant lands, measured in hectares. • *Urban extent (Urban area)* is the total built-up area of the city proper and the Urbanized Open Space in and around it. *The Population of the city* is the total population in the set of administrative districts encompassing the urban area of the city [1].
Unit:	Dimensionless
Methodology:	The formula to estimate the land will be provided with two stages. *Stage 1: Estimate the population growth rate.* Population Growth rate i.e. $$PGR = \frac{LN\left(\frac{Pop_{(t+n)}}{Pop\ (t)}\right)}{(y)}$$ *Where:* *Popt* = Total population within the urban extent in the past/initial year *Pop(t+n)*= Total population within the urban extent in the current/final year *y* = the number of years between the two measurement periods *Stage 2: Estimating the land consumption rate* This rate gives us a measure of compactness, which indicates a progressive spatial expansion of a city. Land consumption rate i.e. (LCR) $$LCR = \frac{LN\left(\frac{Urb_{t+n}}{Urb_t}\right)}{y}$$ *Where,* $Urb_t t$= Total area of the urban extent of the in km2 for past/initial year *Urb(t+n)* = Total area of the urban extent of the in km2 for current year *y* = The number of years between the two measurement periods

Indicator:	Ratio of Land Consumption Rate to Population Growth Rate 2000-2015
	The formula to estimate the ratio of land consumption rate to population growth rate (LCRPGR) is provided as follows: And the overall formula can be summarized as: $LCRPGR = \frac{Annual\ Land\ Consumption\ rate}{Annual\ Population\ growth\ rate}$ The periods for both urban expansion and population growth rates should be at comparable scale. $LCRPGR = \frac{LN\left(\frac{Urb_{t+n}}{Urb_t}\right)}{y} / \frac{LN\left(\frac{Urb_{t+n}}{Urb_t}\right)}{y}$
Source:	2020. World Cities Report 2020 The Value of Sustainable Urbanization. 1st ed. [ebook] Nairobi, Kenya: United Nations Human Settlements Programme (UN-Habitat), pp.322 - 334. Original data: United Nations Human Settlement Programme (UN-Habitat), Global Urban Indicators Database 2020.
Benchmark:	Min: 1 Max: 2 Based on UN Habitat, Global Urban Indicators Database 2020.
Standardization: 2.2	$LCRPGR^{(S)} = 100\left[1 - \left(\frac{LCRPGR - Min}{Max - Min}\right)\right]$ $LCRPGR^{(S)} = 100\left[1 - \left(\frac{LCR\ to\ PGR - 1}{2 - 1}\right)\right]$ Decision: $= \begin{cases} 100, if\ LCRPGR \leq 1 \\ LCRPGR^{(S)}, if\ 1 < LCRPGR < 2 \\ 0, if\ LCRPGR \geq 2 \end{cases}$
Limitations:	Data available only for 24 cities. The value of the indicator is interpreted based on the value. If the value is below one it implies efficient land use, a value above one implies inefficient land use. However, this interpretation has various issues. • Land use as currently formulated is only a measure of change and not absolute • The negatives values that could arise from the computation could be from population loss or shrinking built-up footprint whereas the positive values could come from population loss and shrinking built-up footprint together (ratio of two negative values). • Aggregating the measure for more than one city makes the interpretation ambiguous. For example, an average land use efficiency for a country with two cities might be between 0 and 1 ("efficient") if both cities are "efficient", or if one is inefficient (above 1) and another is shrinking (below 0). • Increasing density is not necessarily more efficient, e.g. in cities with overcrowding and no services. To overcome these challenges, it is proposed to consider the possibility of using high and low dense type of disaggregates at city level. It may be difficult for the indicator to capture appropriately the cases of cities with negative or zero population growth; or cities that due to severe disaster have lost part of their territories. To face this challenge, the baseline/benchmark of population density and its change over time must be taken into consideration. Reducing densities below sustainable levels have impacts on the cities' sustainability. The indicator presents the opportunity for data and methodology convergence and can be calculated for available datasets with a guideline for interpretation.
References:	Bibliographic reference: UN-Habitat (2018). Metadata on SDGs Indicator 11.3.1 Indicator category: Tier II. UN-Habitat. URL reference: [1] https://unhabitat.org/World%20Cities%20Report%202020 Accessed: December 20, 2021.

3. Development of e-Government (DEG)*

3.1 Local Online Service Index (LOSI)

Indicator:	Local Online Service Index (LOSI)
Scope:	Contextual CPI / Global Comparative Index
Rationale:	This indicator presents the results of a study (by The Department of Economic and Social Affairs of the United Nations Secretariat) assessing the e-government portals of selected cities using the Local Online Service Index (LOSI). This process was initiated in 2018 as a pilot study assessing portals in 40 cities and seeks to continue to provide evidence-based data to contribute to the assessment of progress made in local e-government development. The LOSI measures both technical and content aspects of the portals, as well as the electronic services and e-participation initiatives available through them. In the 2020 study, the assessment was scaled up to include 100 cities in different regions of the world. The need to enhance the range and quality of services and to optimize the integration of evolving technologies to achieve this goal drives governments to improve their online presence. National and local governments are engaged in a growing effort to capitalize on the benefits ICT offers in public services provision, including greater social inclusion, enhanced efficiency and effectiveness, more personalized service delivery, and 24/7 service availability.
Definition:	The 2020 Online Services Questionnaire (OSQ) consists of a list of 148 questions. Each question calls for a binary response. Every positive answer generates a "more in-depth question" inside and across the patterns. The outcome is an enhanced quantitative survey with a wider range of point distributions reflecting the differences in the levels of e-government development among Member States. The total number of points scored by each country is normalized to a range of 0 to 1. The online index value for a given country is equal to the actual total score less the lowest total score divided by the range of total score values for all countries. For example, if country "x" has a score of 114, and the lowest score of any country is 0 and the highest equal to 153, then the online services value for country "x" would be: $$Online\ Service\ Index\ (Country\ \mathrm{x}) = \frac{114-0}{153-0} = 0.7451$$ To arrive at a set of Online Service Index values for 2020, along with 14 UN staff members and 18 interns who has worked for the Survey, a total of 212 online United Nations Volunteer (UNV) researchers from 98 countries covering 69 languages, assessed each country's national website in the native language, including the national portal, e-services portal and e-participation portal, as well as the websites of the related ministries of education, labor, social services, health, finance and environment, as applicable. The UNVs included qualified graduate students and volunteers from universities in the field of public administration. The data collection and Survey research ran from June 2019 until the end of September 2019. Each country was assessed by at least two researchers who conducted the assessment in the country's national language.
Unit:	Dimensionless
Methodology:	The LOSI comprises 80 indicators relating to four criteria: technology, content provision, services provision, and participation and engagement. 1. Technology: The dimension focuses on technical features of the portals to specify how the site and content are made available for users; relevant indicators relate to factors such as accessibility, quality, functionality, reliability, ease of navigation, visual appeal, and alignment with technology standards. 2. Content provision: the aim is to identify the extent to which essential public information and resources are available online. 3. Services provision: focusing on the availability and delivery of targeted government services. 4. Participation and engagement: assess the availability of mechanisms and initiatives for interaction and opportunities for public participation in local governance structures. The data collection and survey research took place during the second half of 2019. Each city's portal was assessed by at least two researchers, who conducted the assessment in one of the national languages of the country in which the city was located. After the initial assessment, the evaluations by the two researchers for each city were compared, and any discrepancies were reviewed together and resolved by the researchers. A final review and verification of all the answers was carried out by a senior reviewer. Once the LOSI value was approved by the senior reviewer, the statistics team assigned the LOSI ranking.
Source:	United Nations (2020). Department of Economic and Social Affairs of the United Nations Secretariat.
Benchmark:	Min: 0 Max: 1
Standardization:	Not required.
Limitations:	Data available only for 24 cities.

Indicator:	Local Online Service Index (LOSI)
References:	Bibliographic reference: United Nations (2020). United Nations E-Government Survey 2020. Digital government in the decade of action for sustainable development. UN. URL reference: https://publicadministration.un.org/egovkb/en-us/Data/City Accessed: December 13, 2021.

ANNEX 3. BIBLIOGRAPHIC AND URL SOURCES

From a global review of sources of urban development information, the following provided sensible data for most of the 29 cities subject to the comparative analysis and ranking:

Source	URL Reference
2THINKNOW (2020)	https://2thinknow.com/
2THINKNOW (2018)	https://2thinknow.com/
aci.aero (2020)	https://aci.aero/2021/04/22/aci-world-data-reveals-covid-19s-impact-on-worlds-busiest-airports/
Aeropuertosdelmundo (2020a)	https://www.aeropuertosdelmundo.net/mx/aeropuerto-BOG/
Aeropuertosdelmundo (2020b)	https://www.aeropuertosdelmundo.net/mx/aeropuerto-YYZ/
Affinitaslegal (2021)	https://affinitaslegal.com/proyecto/wastewater-treatment-plant-ptar-canoas/
airport-technology (2018)	https://www.airport-technology.com/projects/wuhan_tianhe/
airportthai.co.th (2020)	https://www.airportthai.co.th/wp-content/uploads/2021/07/Report-2020.pdf
Airwaysmag (2020)	https://airwaysmag.com/airports/2020-pax-traffic-spanish-airports/
Asahi (2020)	https://www.asahi.com/ajw/articles/14155964
Asian Development Bank (2016)	https://www.adb.org/sites/default/files/publication/209511/sanitation-sustainable-dev-japan.pdf
Asian Development Bank (2013)	https://www.adb.org/documents/people-s-republic-china-wuhan-wastewater-management-project
Asian Green City Index (2011)	https://www.taipeiecon.taipei/article_cont.aspx?MmmID=1204&MSid=654253602755354677
Asian Green City Index (2009)	https://w1.siemens.com.cn/userfiles/AGCI%20Report_EN.pdf
Assessment of public open spaces (POS) and landscape quality based on per capita POS index in Delhi, India	https://link.springer.com/article/10.1007/s42452-019-0372-0
Australia State of the Environment (2016)	https://soe.environment.gov.au/theme/built-environment/topic/2016/livability-urban-amenity
Australian Government (2016)	https://data.gov.au/dataset/ds-dga-d79245f3-fc52-4b11-afca-343eb1034c7a/details
baike.baidu.com (2020)	https://baike.baidu.com/item/%E5%8C%97%E4%BA%AC%E5%9C%B0%E9%93%81/408485
Bangkok Metropolitan Council (2021)	https://bmc.go.th/en/members/
Beijing Stat (2020a)	http://nj.tjj.beijing.gov.cn/nj/main/2021-tjnj/zk/indexeh.htm
Beijing Stat (2020b)	http://nj.tjj.beijing.gov.cn/nj/main/2021-tjnj/zk/html/tu12.jpg
Beijing Stat (2020c)	http://nj.tjj.beijing.gov.cn/nj/main/2021-tjnj/zk/html/E07-24.jpg
bitre.gov.au (2020)	https://www.bitre.gov.au/sites/default/files/documents/domestic-aviation-activity-annual-2020.pdf
Buenos Aires City (2020)	https://www.buenosaires.gob.ar/sites/gcaba/files/vlr_2021_-_english.pdf
Buenos Aires Ciudad (2020)	https://www.buenosaires.gob.ar/sites/gcaba/files/vlr_2021_-_english.pdf
Bureau of Construction (2020)	https://www.kensetsu.metro.tokyo.lg.jp/english/jigyo/park/01.html
Businessdailyafrica (2020)	https://www.businessdailyafrica.com/bd/corporate/shipping-logistics/jkia-passenger-72pc-as-covid-rocks-aviation-3333266
Business Insider India	https://www.businessinsider.in/politics/elections/news/final-voter-turnout-in-delhi-election-2020/articleshow/74023521.cms
C40 Knowledge (2019)	https://www.c40knowledgehub.org/s/article/Waste-Data-Explorer?language=en_US
Camara Municipal de Sao Paulo (2021)	https://www.saopaulo.sp.leg.br/vereadores/

Source	URL Reference
canada.ca (2017)	https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/municipal-wastewater-treatment.html
Central Government Ministries (2021)	https://www.metro.tokyo.lg.jp/english/directory/ministries.html
Centreforpublicimpact (2017)	https://www.centreforpublicimpact.org/case-study/improving-urban-transport-wuhan
city.osaka.lg.jp (2022)	https://www.city.osaka.lg.jp/contents/wdu020/enjoy/en/content_b.html
CPI Profile Riyadh	CPI Profile Riyadh
Concejo de Bogotá (2021)	https://concejodebogota.gov.co/directorio-telefonico/cbogota/2018-02-22/153105.php
Concejo Metropolitano de Lima (2021)	http://www.legislaturasconectadas.gob.ar/Legislatura/123/Concejo-Metropolitano-de-Lima
Concejo Municipal de Santiago (2021)	https://www.munistgo.cl/concejo/
Congreso de la CDMX (2021)	https://www.congresocdmx.gob.mx/orden-alfabetico-106-2.html
Dar es Salaam City Council (2021)	http://www.dcc.go.tz/list-councilors
Datoselectorales.org (2019)	https://www.datoselectorales.org/datos-y-resultados-electorales/
Delhi Tourism	https://www.delhitourism.gov.in/delhitourism/entertainment/museum_in_delhi.jsp
Dem. WUA (2021)	http://www.demographia.com/db-worldua.pdf
Deptrans (2020)	https://transport.mos.ru/common/upload/public/prezentacii/80/mosdeptransbrochure2019eng.pdf
District Council Election (2019)	https://www.elections.gov.hk/dc2019/eng/turnout_numsum.html
Doing Business (2020)	https://www.doingbusiness.org/en/data/exploreeconomies/
El Pleno de Madrid (2021)	https://www.madrid.es/portales/munimadrid/es/Inicio/El-Ayuntamiento/El-Pleno/Organizacion/Junta-de-Portavoces/La-Junta-de-Portavoces/?vgnextfmt=default&vgnextoid=ef4539b48936c010VgnVCM100000d90ca8c0RCRD&vgnextchannel=9a7e8c291c557310VgnVCM1000000b205a0aRCRD
Elections Department (2020)	https://www.eld.gov.sg/press_2020.html
Elsevier (2011)	https://www.sciencedirect.com/science/article/pii/S2468227621003458
espowiki.com (2021)	https://espowiki.com/jakarta_lrt
eureau.org (2017)	https://www.eureau.org/resources/publications/members-reports/5299-public-water-and-waste-water-services-in-france/file
europa.eu (2020)	https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Air_transport_statistics
e.vnexpress.net (2020)	https://e.vnexpress.net/news/business/companies/tan-son-nhat-named-among-world-s-best-airports-4340476.html
fieldsintrust.com (2020)	https://www.fieldsintrust.org/green-space-index
Flightconnections (2021)	https://www.flightconnections.com/
GBA Stat (2020)	http://www.estadistica.ec.gba.gov.ar/dpe/index.php/datos-basicos
GBM (Global Metro Monitor	https://www.brookings.edu/research/global-metro-monitor/
General Authority for statistics, Kingdom of Saudi Arabia	https://www.stats.gov.sa/en/903
Geotab (2019)	https://www.geotab.com/urban-footprint/
Global CPI (2017)	
Global CPI (2016)	
Global CPI (2015)	
Global CPI (2013)	
Global Mass Transit Report (2021)	https://www.globalmasstransit.net/archive.php?id=41516
Global Opportunity Explorer (2018)	https://goexplorer.org/wuhan-industrial-city-becomes-ecological-town/
Gob Buenos Aires (2019)	https://www.buenosaires.gob.ar/justiciayseguridad/resultados-electorales/ano-2019

Source	URL Reference
Gobierno de España (2019)	http://www.infoelectoral.mir.es/infoelectoral/min/busquedaAvanzadaAction.html
gotokyo.org (2021)	https://www.gotokyo.org/en/plan/getting-around/subways/index.html
govinsider.asia (2016)	https://govinsider.asia/inclusive-gov/96-of-jakarta-has-no-sewage-system/
Gowithguide (2022)	https://gowithguide.com/blog/is-it-easy-to-use-public-transportation-in-tokyo-3015
Green Cities Index (2018)	https://ftnnews.com/tours/34119-world-s-greenest-cities-revealed
Greenpeace (2019)	https://es.greenpeace.org/es/wp-content/uploads/sites/3/2021/05/Greening-the-City_Greenpeace.pdf
GUO (2020)	https://data.unhabitat.org/pages/urban-transport
HAL – ENPC (2017)	https://hal-enpc.archives-ouvertes.fr/hal-01449109/document
Halmstad University (2011)	https://www.diva-portal.org/smash/get/diva2:427129/FULLTEXT01.pdf
Hongkongairport (2020)	https://www.hongkongairport.com/en/media-centre/press-release/2021/pr_1510
IEBC (2017)	https://www.iebc.or.ke/resources/?Publications_/_Reports
IECM (2018)	https://www.iecm.mx/elecciones/proceso-electoral-2017-2018/comparativo-de-las-ultimas-elecciones-2017-2018/
IEPC (2021)	https://www2.iepcjalisco.org.mx/tablero-electoral-2021/?page_id=3075
International Institute of Health and Hygiene,New Delhi	http://www.sulabhenvis.nic.in/database/stst_wastewater_2090.aspx
Kipepeobeach (2022)	http://kipepeobeach.com/travelling-around-dar-public-transport-in-dar-es-salaam/
KNOEMA (2017)	https://public.knoema.com/sbzvys/accommodation-price-index-2017
KNOEMA (2015)	https://public.knoema.com/dufrjdg/beer-price-index-2015-discontinued
KNOEMA (2014a)	https://public.knoema.com/sbzvys/accommodation-price-index-2017
KNOEMA (2014b)	https://public.knoema.com/crcqwve/prices-of-important-traveling-items-in-cities-around-the-world
Lagos State Executive Council (2021)	https://lagosstate.gov.ng/executive-council/
Land Transport Authority (2021)	https://www.lta.gov.sg/content/ltagov/en/getting_around/public_transport/rail_network.html
Le Conseil de Paris (2021)	https://www.paris.fr/pages/le-conseil-de-paris-en-10-questions-7430#qui-le-compose
Legislative Council of the Hong Kong (2021)	https://www.legco.gov.hk/general/english/members/yr16-20/biographies.htm
Legislatura.gov (2021)	https://www.legislatura.gov.ar/seccion/composicion-actual.html
lima-airport (2020)	https://www.lima-airport.com/Documents/Annual%20Traffic%20Stats%20Report.pdf
London.gov (2021)	https://www.london.gov.uk/people/assembly
mapa-metro.com (2021a)	https://mapa-metro.com/es/Mexico/Ciudad%20de%20Mexico/Ciudad%20de%20Mexico-Metro-mapa.htm
mapa-metro.com (2021b)	https://mapa-metro.com/es/China/Hong%20Kong/Hong%20Kong-MTR-mapa.htm
mapa-metro.com (2021c)	https://mapa-metro.com/es/Brasil/Sao%20Paulo/Sao%20Paulo-Metro-mapa.htm
mapa-metro.com (2021d)	https://mapa-metro.com/es/China/Shanghai/Shanghai-Metro-mapa.htm
mapa-metro.com (2021e)	https://mapa-metro.com/es/peru/lima/lima-tren-urbano-mapa.htm
mapa-metro.com (2021f)	https://mapa-metro.com/es/china/wuhan/wuhan-metro-mapa.htm
McKinsey&Company (2021)	https://www.mckinsey.com/~/media/mckinsey/business%20functions/operations/our%20insights/building%20a%20transport%20system%20that%20works%20new%20charts%20five%20insights%20from%20our%2025%20city%20report%20new/elements-of-success-urban-transportation-systems-of-25-global-cities-july-2021.pdf
MDPI (2019)	https://www.iheart.com/live/1065-mix-6533/
Members of Parliament, DKI JAKARTA I, II, III (2021)	https://www.dpr.go.id/en/anggota/index/dapil/9
Metro de Santiago (2021)	https://www.metro.cl/tu-viaje/plano-de-red
Metro, tram (2020)	https://fr.wikipedia.org/wiki/M%C3%A9tro_de_Paris#:~:text=Longueur%20du%20r%C3%A9seau,225%2C1%C2%A0km
metrodebogota.org (2020)	https://www.metrodebogota.gov.co/?q=que-es-metro
Mexiconewsdaily (2021)	https://mexiconewsdaily.com/news/new-treatment-plant-serve-3-million-people-guadalajara/

Source	URL Reference
Ministerio del Interior (2019)	http://www.infoelectoral.mir.es/infoelectoral/min/busquedaAvanzadaAction.html?vuelta=1&private=0
Ministry of Human Resource Development, Government of India All India Survey on Higher Education 2018-2019.	https://www.education.gov.in/sites/upload_files/mhrd/files/statistics-new/AISHE%20Final%20Report%202018-19.pdf
Moovitapp (2022)	https://moovitapp.com/insights/es-419/Moovit_Insights_%C3%8Dndice_de_Transporte_P%C3%BAblico_
Multidimensional Prosperity Iindex: NIUA (2017) "Multi-dimensional Prosperity Index" Delhi, India	https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjLzrn85sv1AhUfJUQIHe4yBM4QFnoECAIQAQ&url=https%3A%2F%2Fniua.org%2Fkhub%2F%3Fsmd_process_download%3D1%26download_id%3D1871&usg=AOvVaw1pOlV_OPgFprbxXTfCMiTG
Nairobi City County (2021)	https://nairobi.go.ke/county-executives/
Nairobi City Water and Sewerage Company (2021)	https://www.nairobiwater.co.ke/waste-water-treatment/
National Capital Region Planning Board	https://tcpharyana.gov.in/ncrpb/FINAL%20SRP%20FOR%20WEB-HOSTING/14_Environment.pdf
nationthailand.com (2020)	https://www.nationthailand.com/noname/30302171
NESDC (2019)	https://www.nesdc.go.th/nesdb_en/ewt_dl_link.php?nid=4317&filename=national_account
New Delhi Municipal Council	https://www.ndmc.gov.in/council_members.aspx
New York City Council (2021)	https://council.nyc.gov/districts/
New York City Transit (2021)	https://new.mta.info/agency/new-york-city-transit
NHK.or.jp (2019)	https://www.nhk.or.jp/senkyo/database/touitsu/2019/27/14984/skh46222.html
Nigeria MICS (2017)	https://www.nigerianstat.gov.ng/nada/index.php/catalog/59/related_materials
NSW Electoral Commission (2017)	https://www.elections.nsw.gov.au/About-us/Reports/Election-reports
Numbeo (2021)	https://www.numbeo.com/property-investment/rankings.jsp?title=2021
NYC Votes (2019)	https://www.nyccfb.info/media/reports/voter-analysis-report-2019-2020/
OECD (2016)	https://www.oecd.org/cfe/regionaldevelopment/cities-and-water-governance.htm
OECD Moscow (2021)	https://www.oecd-ilibrary.org/urban-rural-and-regional-development/a-territorial-approach-to-the-sustainable-development-goals-in-moscow-russian-federation_733c4178-en
OECD Stat (2021a)	https://stats.oecd.org/Index.aspx?DataSetCode=CITIES
OECD Stat (2021b)	https://stats.oecd.org/index.aspx?queryid=86800
OECD Stat (2020a)	https://stats.oecd.org/index.aspx?queryid=86802
OECD Stat (2020b)	https://stats.oecd.org/Index.aspx?DataSetCode=CITIES
OECD Stat (2019a)	https://stats.oecd.org/index.aspx?queryid=86801
OECD Stat (2019b)	https://stats.oecd.org/index.aspx?queryid=86794
OECD Stat (2019c)	https://regions-cities-atlas.oecd.org/metroregional/CT/CHN/8989/PWM_EX/2019/x
OECD Stat (2018a)	https://stats.oecd.org/Index.aspx?DataSetCode=CITIES
OECD Stat (2018b)	https://stats.oecd.org/index.aspx?queryid=86801
OECD Stat (2017a)	https://stats.oecd.org/index.aspx?queryid=86802
OECD Stat (2017b)	https://stats.oecd.org/index.aspx?queryid=97151
OECD Stat (2017c)	https://stats.oecd.org/index.aspx?queryid=86794
OECD Stat (2016)	https://stats.oecd.org/index.aspx?queryid=86801
OECD Stat (2014)	https://stats.oecd.org/index.aspx?queryid=86802
ONPE (2018)	https://resultadoshistorico.onpe.gob.pe/PRERM2018/Participacion/Detalle
OPS-OMS (2016)	https://www.paho.org/chi/dmdocuments/Areas_verdes(1).compressed.pdf
Osaka City Council (2021)	https://www.city.osaka.lg.jp/shikai/page/0000002246.html

Source	URL Reference
Owlapps (2020)	http://www.owlapps.net/owlapps_apps/articles?id=21411901&lang=en
People's Government of Beijing Municipality (2021)	http://english.beijing.gov.cn/government/index.html
Philstar Global	https://www.philstar.com/headlines/2016/04/19/1574840/overseas-voting-riyadh-yields-low-turnout
Railway Technology (2021)	https://www.railway-technology.com/projects/lagosrailmasstransit/
Railway Technology (2020)	https://www.railway-technology.com/projects/vietnammetro/
Rede Social Brasileira (2017)	https://www.redesocialdecidades.org.br/br/SP/sao-paulo/area-verde-por-habitante
Report on Develpment Beijing (2013)	https://books.google.com.mx/books?id=YZL0BwAAQBAJ&pg=PA121&lpg=PA121&dq=green+area+per+person +m2+Beijing&source=bl&ots=ovOxWOBO5a&sig=ACfU3U1y5IAQbA23AmKOUUZqAD1U8HebBA&hl=es-#v=onepage&q=green%20area%20per%20person%20m2%20Beijing&f=false
RIYADH METRO	http://riyadhmetro.sa/en/metro/
Rppnoticias (2016)	https://rpp.pe/data/lima-tiene-un-deficit-de-61-millones-de-metros-cuadrados-en-areas-verdes-noticia-1021931
santiago-airport (2020)	https://www.santiago-airport.com/
Sedema (2017)	https://sedema.cdmx.gob.mx/programas/programa/inventario-de-areas-verdes
SENER (2021)	http://www.revistanoticias.sener/news/conexion-ferroviaria-en-tanzania/54/
Seoul Metropolitan Council (2021)	https://www.smc.seoul.kr/foreign/councilMembers.do?menuId=026001004&lang=english
Seoul Metropolitan Government (2021)	https://www.metropolis.org/sites/default/files/2021-11/Seoul.pdf
Seoul Metropolitan Government (2013)	https://www.metropolis.org/sites/default/files/seoul_metropolitan_rapid_transit_english.pdf
Seoul Urban Solutions Agency (2017)	http://susa.or.kr/en/content/water-management?ckattempt=1
seoul.go.kr (2022)	https://english.seoul.go.kr/service/movement/public-transportation/1-bus/
Shangai Municipal People´s Government (2020)	https://www.shanghai.gov.cn/nw4411/20210115/4432b5c1337245fca21e1aed2a43766b.html
shanghai-airport (2020)	https://www.shanghai-airport.com/
Shanghaihighlights (2022)	https://www.shanghaihighlights.com/shanghai-transportation/city-transport.htm
shangri-la.com (2022)	http://www.shangri-la.com/wuhan/shangrila/about/local-guide/transportation/
Sing. Stat (2021)	https://www.tablebuilder.singstat.gov.sg/publicfacing/selectVariables.action
Sing. Stat (2020a)	https://www.singstat.gov.sg/find-data/search-by-theme/population/geographic-distribution/visualising-data/geographical-distribution-dashboard
Sing. Stat (2020b)	https://tablebuilder.singstat.gov.sg/table/TS/M015231
Sing. Stat (2018)	https://www.tablebuilder.singstat.gov.sg/publicfacing/selectVariables.action
Singapore City Council (2021)	https://www.sgdi.gov.sg/ministries
Statista (2020a)	https://www.statista.com/statistics/1089168/number-of-passengers-by-airport-moscow/#statisticContainer
Statista (2020b)	https://www.statista.com/statistics/1036829/argentina-passengers-airport/
Statista (2020c)	https://es.statista.com/estadisticas/1076873/aeropuertos-mexico-trafico-pasajeros/
Statista (2020d)	https://www.statista.com/statistics/962767/passenger-traffic-new-york-john-f-kennedy-type/
Statista (2020e)	https://www.statista.com/statistics/867835/singapore-number-of-passengers-changi-airport/
Statista (2020f)	https://www.statista.com/statistics/226462/passenger-traffic-at-tokyo-airport/
Statista (2020g)	https://www.statista.com/statistics/702590/south-korea-passengers-at-incheon-international-airport/
Statista (2020h)	https://www.statista.com/statistics/630920/passenger-traffic-australia-regional-airports/
Statista (2020j)	https://es.statista.com/estadisticas/978596/principales-aeropuertos-en-brasil-por-numero-de-pasajeros/
Statista (2018)	https://www.statista.com/statistics/860750/green-areas-per-inhabitant-in-paris-in-france/
Statista	https://www.statista.com/statistics/911333/india-built-up-area-delhi/
Sydney City Council (2021)	https://www.sidneyoh.com/293/City-Council
Sydney Water (2021)	https://www.sydneywater.com.au/water-the-environment/how-we-manage-sydneys-water/wastewater-network/wastewater-treatment-plants.html

Source	URL Reference
Teleport	https://teleport.org/cities/riyadh/safety/
Thai Gov (2020)	https://en.wikipedia.org/wiki/List_of_districts_of_Bangkok
thecitizen.co.tz (2020)	https://www.thecitizen.co.tz/tanzania/news/new-hope-on-the-horizon-for-aviation-3515060
Theculturetrip (2018)	https://theculturetrip.com/africa/nigeria/articles/how-to-navigate-transport-in-lagos/
Theguardian (2020)	https://www.theguardian.com/business/2021/jun/13/uk-airport-passenger-numbers-drop-75-to-74-million-in-2020
thinkdataworks.com (2020)	https://blog.thinkdataworks.com/data-investigation-how-green-is-toronto
TOMTOM (2020)	https://www.tomtom.com/en_gb/traffic-index/ranking/
Toronto City Council (2021)	https://www.toronto.ca/city-government/council/members-of-council/
Toronto City Government (2018)	https://www.toronto.ca/city-government/elections/election-results-reports/election-results/general-election-results/
Travelchinaguide (2021)	https://www.travelchinaguide.com/cityguides/beijing/transportation/
Tripadvisor (2022)	https://www.tripadvisor.com/Travel-g294207-s303/Nairobi:Kenya:Public.Transportation.html
Tripadvisor	https://www.tripadvisor.com/Attractions-g293995-Activities-c49-t30,32,35,161-Riyadh_Riyadh_Province.html
uas Andinas (2017)	https://www.aguasandinasinversionistas.cl/~/media/Files/A/Aguas-IR-v2/aguas-andinas-memoria-anual-2017.pdf
UK Deptrans (2020)	https://www.gov.uk/government/statistical-data-sets/light-rail-and-tram-statistics-lrt#:~:text=LRT0203%3A%20Route%20kilometres%20open%20for%20passenger%20traffic%20on%20light%20rail%20and%20trams%20and%20undergrounds%20by%20system%3A%20Great%20Britain%20(ODS%2C%206.89KB)
UNDP (2018)	https://nonews.co/wp-content/uploads/2018/10/hdr2017.pdf
UNDP (2017)	https://nonews.co/wp-content/uploads/2018/10/hdr2017.pdf
UNDP (2016)	https://nonews.co/wp-content/uploads/2018/10/hdr2017.pdf
UN-Habitat (2020)	https://unhabitat.org/sites/default/files/2020/09/nbo_assesment_overview_and_key_findings_3.pdf
UN-Habitat (2018)	https://publicacionesonuhabitat.org/onuhabitatmexico/cpi/2015/14039_Guadalajara.pdf
unhabitat.org (2015)	https://unhabitat.org/sites/default/files/2020/10/wcr_2020_statistical_annex_2.pdf
unhabitat.org (2012)	https://unhabitat.org/sites/default/files/2020/10/wcr_2020_statistical_annex_2.pdf
unhabitat.org (2011)	https://unhabitat.org/sites/default/files/2020/10/wcr_2020_statistical_annex_2.pdf
unhabitat.org (2010)	https://unhabitat.org/sites/default/files/2020/10/wcr_2020_statistical_annex_2.pdf
unhabitat.org (2005)	https://unhabitat.org/sites/default/files/2020/10/wcr_2020_statistical_annex_2.pdf
United Nations (2020)	https://publicadministration.un.org/egovkb/en-us/Data/City
United Nations (2018)	https://publicadministration.un.org/egovkb/en-us/Data/City
University of Pennsylvania (2014)	https://repository.upenn.edu/cgi/viewcontent.cgi?article=1056&context=mes_capstones
UN-Water (2020)	https://sdg6data.org/indicator/6.3.1
Urbanrail.net	https://www.urbanrail.net/as/in/delhi/delhi.htm#noida
urbanrail.net (2017b)	http://www.urbanrail.net/am/toro/toronto.htm
urbanrail.net (2014)	http://www.urbanrail.net/as/jp/osaka/osaka.htm
Vietnam Investment Review (2018)	https://vir.com.vn/ho-chi-minh-city-seeks-more-green-space-amid-rapid-urbanisation-61677.html
VLR 2021 (2020)	https://www.buenosaires.gob.ar/sites/gcaba/files/vlr_2021_-_english.pdf
Wastewater Management in Urban Area Bangkok (2017)	https://pdf4pro.com/view/wastewater-management-in-urban-area-bangkok-thailand-38d28b.html
WCR 2020 (2020)	https://unhabitat.org/World%20Cities%20Report%202020
WCR 2020 (2015)	https://unhabitat.org/World%20Cities%20Report%202020
Wikipedia (2021a)	https://es.wikipedia.org/wiki/Elecci%C3%B3n_de_gobernador_regional_de_Santiago_de_2021
Wikipedia (2021b)	https://en.wikipedia.org/wiki/2021_South_Korean_by-elections#Results
Wikipedia (2020a)	https://es.wikipedia.org/wiki/Gran_Buenos_Aires

Source	URL Reference
Wikipedia (2020b)	https://en.wikipedia.org/wiki/2020_Tokyo_gubernatorial_election
Wikipedia (2019a)	https://en.wikipedia.org/wiki/Light_rail_in_Sydney
Wikipedia (2019b)	https://en.wikipedia.org/wiki/2019_Lagos_State_gubernatorial_election
Wikipedia (2017)	https://en.wikipedia.org/wiki/2017_Jakarta_gubernatorial_election#cite_note-rc-kpu-1
World Bank (2018)	https://data.worldbank.org/indicator/ER.LND.PTLD.ZS
World Bank (2008)	https://blogs.worldbank.org/nasikiliza/getting-tanzanias-public-spaces-spot-urban-agenda
World Health Organization (2014)	https://www.who.int/water_sanitation_health/resourcesquality/wpccasestudy6.pdf
worldbank.org (2020)	https://data.worldbank.org/indicator/SH.H2O.BASW.UR.ZS?end=2020&start=2000&view=chart
worldbank.org (2019a)	https://data.worldbank.org/indicator/EG.ELC.ACCS.UR.ZS?end=2019&locations=RU&name_desc=true&start=1990
worldbank.org (2019b)	https://data.worldbank.org/indicator/SH.STA.TRAF.P5?end=2019&locations=SG&start=2000&view=chart
worldbank.org (2019c)	https://data.worldbank.org/indicator/SH.IMM.IDPT
worldbank.org (2018)	https://data.worldbank.org/indicator/VC.IHR.PSRC.P5
Worlddometers	https://www.worldometers.info/population/largest-cities-in-the-world/
Zenitlife (2020)	https://zenithoteles.com/zenitlife/las-20-ciudades-con-mas-parques-y-jardines-de-espana/