

Building sustainable urban mobility ecosystems

The Sustainable Mobility Readiness Index

November 2024



Contents

01

Context

Sustainable mobility is essential for resilient, liveable cities

02

Cities are different

How do we classify them and how do they perform?

2.1

Mature cities: Well established infrastructure, efficient public transport networks

2.2

Emerging cities: Navigating growth despite mobility challenges

2.3

Developing cities: Limited resources and infrastructure, advancing mobility capabilities

03

The way forward

Harnessing stakeholder collaboration for sustainable urban mobility



1. Context

Sustainable mobility is essential for resilient, liveable cities

Urbanisation is accelerating globally. This is placing significant strain on transportation systems, which are major contributors to environmental challenges, including air pollution and climate change. Developing sustainable urban mobility systems is crucial for addressing these challenges and preparing for a more sustainable future.

Sustainable mobility solutions, such as expanded bike lanes, electric vehicle charging networks, or “Mobility as a Service” platforms that integrate public transportation, car-sharing and bike-sharing options, have the potential to significantly reduce greenhouse gas emissions, improve air quality, and help cities meet their climate targets. Also, they promote social equity by offering affordable, reliable and accessible transport options for all citizens, including those in low-income communities, thereby reducing dependency on personal vehicles and fostering inclusivity. Sustainable mobility also enhances economic efficiency by easing traffic congestion, saving time and boosting productivity, while also driving the creation of green jobs and technological innovation.

Moreover, they improve the overall quality of life by reducing car traffic, minimising noise pollution and encouraging healthier lifestyles through walking and cycling in more livable urban spaces. It is no overstatement to say that the world’s ability to meet its ambitious net zero goals largely depends on our collective capacity to reengineer the systems that move people, goods and services through dynamic metropolitan areas.

Around the world, national governments and the private sector are making transformative investments to develop policy frameworks and incentives to encourage sustainable mobility. And while these efforts are laudable, there is a need to measure their impact through a data-driven tool that can help assess capabilities, measure progress and serve as a benchmark.

The identification of this need to measure for success has been the inspiration behind the development of the **Sustainable Mobility Readiness Index (SMRI)** – a comprehensive analytical tool designed to evaluate the preparedness of cities to adopt and sustain mobility solutions that are environmentally friendly, efficient, and resilient. It assesses 68 indicators across six dimensions of urban mobility: transport supply, transport demand, innovation, policies, finance and environment and energy.

This index will measure and compare the readiness of cities from five continents, offering a comprehensive assessment of how well cities are transitioning to sustainable mobility. By highlighting gaps and areas of improvement, the index will guide policymakers, businesses and communities in making data-driven decisions. SMRI stands out as an index that is not limited to city centers, but measures passenger and logistics sustainability for the whole metropolitan area of a city.



1. Context

Sustainable mobility is essential for resilient, liveable cities

Index development methodology

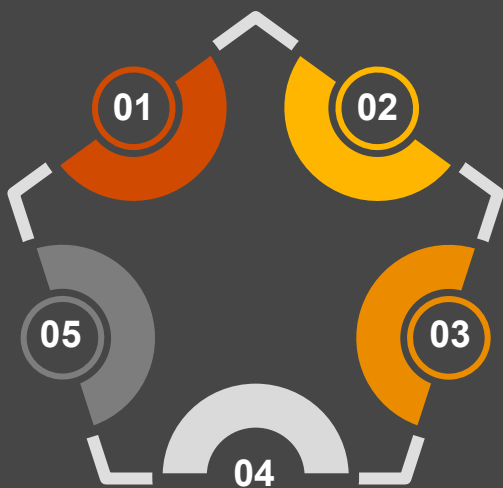
The development of the SMRI follows a systematic, rigorous process to accurately reflect the readiness of 26 global cities for sustainable mobility. A theoretical framework outlines the key dimensions of the concept and how they interconnect, serving as a blueprint for the index. Relevant indicators are selected for each dimension based on their ability to provide measurable data. The data is standardised into uniform units for cross-city comparison, with values for each indicator ranging from 0 to 10, simplifying analysis and comparison.

Questions, such as, “How prevalent is private car usage?” or “What are the hours of operation of a train system?” or “What is the car ownership rate?” and “Do bus riders have access to e-ticketing?” are just a few examples of the many indicators evaluated.

Quantifying these and several dozen other indicators has enabled us to construct a robust framework for evaluation. Additionally, the methodology used for constructing the SMRI, includes an input-output-outcome chain analysis, offering deeper insights into how specific factors influence the mobility ecosystem in cities.

The SMRI assesses cities across three archetypes – mature, emerging and developing – offering a comprehensive evaluation of their sustainable mobility readiness amongst their equivalent peers.

The SMRI tool can:



Comprehensive assessment

Offer a holistic evaluation of a city's sustainable mobility readiness, covering infrastructure innovation, policies and environmental impact



Data-driven

Deliver objective, data-driven analysis that helps cities understand their current standing and areas for improvement



Benchmarking Capability

Allow cities to compare their performance with others, identifying best practices and setting goals for improvement



Tailored recommendations

Deliver actionable insights and customised recommendations to guide cities toward achieving sustainable mobility



Strategic guidance

Empower policymakers and stakeholders to make informed decisions that support the adoption of sustainable urban mobility practices

2. Cities are different

How do we classify them and how do they perform?

Our index uses city archetypes — mature, emerging and developing — as a framework to enable meaningful comparisons across global cities. This approach highlights the diverse, yet interconnected pathways cities can follow toward sustainable mobility, offering contextually relevant benchmarks and solutions. The three archetypes represent distinct patterns of urban development, transportation infrastructure and mobility challenges. Each faces unique issues shaped by socio-economic factors and spatial characteristics, which influence their approach to sustainable mobility. These differences guide how cities prioritise and implement strategies for more efficient, eco-friendly transport systems.

It is essential to note that while archetypes provide a useful framework for categorising cities, they do not limit the potential for sustainable mobility advancements. This index shows that some emerging cities achieve scores on par with or even exceeding those of mature cities, indicating that a city's sustainable mobility success is driven by innovation and commitment as much as by prosperity.

On the following pages, we examine key cities from each archetype to illustrate the main drivers behind their scores and pinpoint areas where they can enhance their sustainable mobility outcomes.

	Cities	Transport Supply	Transport Demand	Innovation	Policies	Finance	Environment and Energy	Total Scores
Mature	London	9.8	8.3	9.3	9.7	8.0	9.3	8.3
	Amsterdam	9.5	9.5	8.5	6.9	8.8	7.9	7.8
	Singapore	9.2	9.5	9.5	6.5	6.4	7.8	7.6
	Munich	9.0	8.5	9.2	5.7	8.8	7.4	7.5
	Madrid	9.0	9.2	8.2	7.1	7.1	7.3	7.4
	San Francisco	7.6	5.8	9.6	8.9	9.0	7.5	7.4
	Melbourne	6.7	7.2	8.6	8.7	5.6	8.7	7.0
	Milan	6.8	9.7	6.5	9.3	6.2	5.1	6.8
	New York	5.7	7.4	7.7	9.0	7.4	6.6	6.7
	Tokyo	6.4	6.7	7.3	7.1	7.6	4.6	6.1
	Boston	4.9	5.5	7.5	7.2	7.5	6.8	6.0
Emerging	Helsinki	8.9	10.0	9.4	8.8	7.0	9.0	8.2
	Hong Kong	9.6	9.7	9.3	6.7	5.2	5.9	7.3
	Seoul	7.6	8.1	8.6	6.7	6.2	5.9	6.7
	Shanghai	7.1	7.9	7.3	9.3	6.1	5.9	6.7
	Dubai	6.6	6.4	8.9	9.6	6.0	4.8	6.5
	Toronto	5.5	5.2	6.8	9.2	5.0	8.1	6.0
	Los Angeles	5.6	2.9	7.5	8.6	7.4	6.1	5.8
Developing	Buenos Aires	4.0	7.8	6.6	5.8	3.9	6.0	5.3
	Istanbul	5.9	6.1	5.3	8.2	4.8	3.3	5.2
	New Delhi	5.1	6.7	5.4	6.3	6.3	3.1	5.0
	São Paulo	4.8	5.5	4.7	3.8	7.1	6.3	4.9
	Riyadh	4.2	5.5	4.9	7.1	3.8	3.5	4.5
	Bogota	4.2	6.2	3.7	3.6	6.4	5.5	4.5
	Cape Town	5.2	3.9	4.9	5.7	2.4	5.5	4.3
	Lagos	1.9	5.1	2.4	6.0	2.2	2.8	3.1

2. Cities are different

How do we classify them and how do they perform?

2.1 Mature Cities

Mature cities, with well-established infrastructure and comprehensive public transit systems covering buses, subways and rail, face relatively low levels of mobility challenges. Their high GDP per capita, compact size and high population density contribute to a mature public transport network, with a significant reliance on public and non-motorised modes of transport. While they are well-positioned to adopt innovative mobility solutions, such as electrification and smart traffic management, they still have to face congestion and aging infrastructure challenges.

A key focus for these cities is integrating renewable energy into transport systems. This includes providing subsidies for public transport, shared mobility services, and electric vehicles (EVs), as well as investing in EV-charging infrastructure. These efforts are already showing positive results, with increased usage of renewable energy in transportation.

However, moderate investment in EV infrastructure indicates there is still significant potential to further electrify transport systems and reduce reliance on private vehicles. To drive more significant long-term reductions in both emissions and congestion, mature cities must ramp up their investments in EV subsidies, charging infrastructure, and sustainable mobility technologies.



London: Progress in renewable energy, gaps in EV investment

Mature cities like London (scoring 8.3 on the SMRI index) are actively working to integrate renewable energy into their transport systems and have shown progress (scoring a 10 in this domain). Inputs, such as the subsidisation of public transport and promotion of shared mobility are also yielding results. However, the relatively moderate investment in EVs and charging infrastructure (scoring 4-5) indicate that there is still untapped potential in advancing electrification. While CO₂ emissions from transport in London remain high (scoring 9), the city's traffic congestion has reduced (seen by a relatively low score of 4), suggesting opportunities for further emissions reduction.



Singapore: Strong connectivity, but room for expanded coverage

Singapore's public transport system is robust, offering excellent bus and subway services (both scoring 9 on the SMRI index). However, rail coverage is somewhat limited, and other modes like trams and ferries are only moderately available. Additionally, operating hours are somewhat restrictive (scoring 4), potentially limiting flexibility for commuters, particularly during off-peak hours.

Despite these constraints, Singapore excels in providing a connected experience with full Wi-Fi availability and advanced smart ticketing systems (each of these scoring a 10), enhancing the convenience and usability of the system.

Although punctuality remains high, the persistent traffic congestion indicates the need for further efforts to encourage greater public transport use and reduce dependence on private vehicles. Expanding rail services and extending operating hours could help alleviate congestion and improve the overall system appeal.

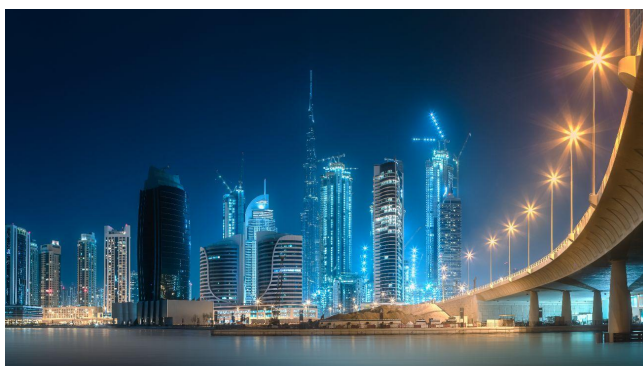
2. Cities are different

How do we classify them and how do they perform?

2.2 Emerging Cities

Emerging cities, often experiencing rapid expansion and rising car ownership, face medium-level mobility challenges. These cities typically have moderate GDP per capita, cover large geographical areas, and have low population density, which contributes to the dominance of private vehicles and raises concerns over emissions and sustainability. Despite the challenges, there are significant opportunities to embed sustainable mobility practices, enhance public transit networks, and promote greener modes of transport.

In many of these cities, government initiatives around public transport, shared mobility, and electric vehicle (EV) technologies are in their early stages. This slows the shift towards renewable energy in transport and exacerbates congestion and emissions issues.



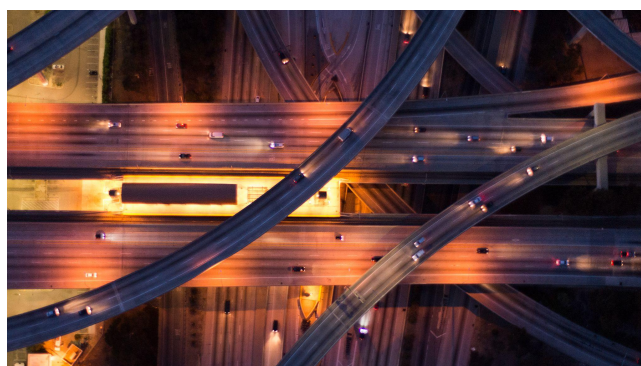
Dubai: Opportunities to boost EV infrastructure and incentives for shared mobility

In Dubai (scoring 6.5 on the SMRI index), there is moderate subsidisation of public transport and significant government investment in electric vehicle (EV) technologies (scoring 7). The city has also experimented with futuristic mobility options such as Air Taxi and autonomous vehicles. However, the development of EV charging infrastructure at scale remains limited, creating a gap in the EV ecosystem, which could hinder the adoption of cleaner technologies.

Additionally, the absence of financial incentives for shared mobility further discourages the adoption of sustainable travel behaviors. By introducing such incentives, the government could promote shared transportation options, easing traffic congestion and supporting eco-friendly, cost-effective mobility solutions. Also, expanding infrastructure for cycling, walking and other shared modes of transport would further enhance eco-friendly travel options and help reduce congestion.

Public transport systems in emerging cities usually vary widely in terms of coverage, ownership and efficiency. Some areas have moderate bus and rail services, while subways or trams are often lacking or underdeveloped. Additionally, promoting alternatives like cycling and walking faces significant hurdles, as infrastructure and policy support for these modes are often limited.

There is also an opportunity to expand shared and on-demand mobility services in emerging cities. Limited car-sharing options restrict the ability to reduce reliance on private vehicles. In many cases, moderate car ownership rates persist, reflecting both the convenience of private vehicles and the need for better shared mobility infrastructure.



Los Angeles: Limited cycling and pedestrian infrastructure

In Los Angeles (scoring 5.8 on the SMRI Index), efforts to promote sustainable travel through shared and on-demand mobility services are constrained by limited availability of subway stations (scoring 1), on-demand services (scoring 2), car-sharing services (scoring 2), alongside moderate bus stop density (scoring 5) and bus coverage (scoring 6). Although the cycling network density is slightly better (scoring 4), it still lacks the comprehensive coverage needed to serve as a viable commuting option. Pedestrian street coverage is relatively better (5), promoting walkability, but this alone is not enough to overcome the city's heavy reliance on cars.

On the positive side, Los Angeles provides significant subsidies for shared modes of transport (8), encouraging the use of alternatives like ride-sharing and public transit. However, with high traffic congestion and low adoption of sustainable travel behaviors (both rated 1), the city struggles to move away from its car-centric culture, even with these subsidies. To foster sustainable mobility, Los Angeles should focus on expanding its cycling and pedestrian infrastructure while increasing financial incentives for shared mobility and public transit. This could help reduce car dependency and ease congestion while promoting more eco-friendly transportation options.

2. Cities are different

How do we classify them and how do they perform?

2.3 Developing cities

Developing cities, constrained by limited resources and underdeveloped public transport infrastructure, face significant mobility challenges. These densely populated cities, often with low GDP per capita, heavily rely on public and non-motorised modes of transport. The focus in such cities is on creating accessible, affordable and sustainable transit systems to avoid the negative consequences of rapid urbanisation. By implementing advanced, sustainable mobility solutions from the outset, these cities have the potential to leapfrog traditional development models.

While there is often considerable investment in public transport to reduce dependence on private vehicles and alleviate congestion, support for electric vehicles (EVs) and charging infrastructure tends to be minimal. This lack of infrastructure limits the adoption of cleaner transport alternatives. Though some cities are exploring shared mobility and autonomous vehicle technologies, insufficient incentives for EV purchases slow the shift toward renewable energy in the transport sector.

Despite slow adoption of renewable energy, many developing cities manage to maintain relatively low CO₂ emissions due to robust public transport systems, which encourage mass transit over private car use. However, to make meaningful progress toward sustainability, greater emphasis on EV subsidies and infrastructure will be crucial for fully embracing cleaner, more efficient transport systems.

Developing cities are increasingly leveraging smart technologies to manage traffic flow and enhance road safety, though several areas still require improvement. While open data for public transport, traffic and parking is only moderately available, enhancing the transparency and accessibility of this data could significantly improve traffic planning and management. Investments in advanced traffic management centres and smart traffic lights are helping optimise signal timing and improve real-time traffic flow. Additionally, some cities are beginning to adopt connected and autonomous vehicles (CAVs) to further modernise transport systems.

Despite these advancements, traffic congestion remains a persistent issue in developing cities, often driven by rapid population growth and increased private vehicle ownership. Greater focus on expanding smart technologies and improving data accessibility will be key to addressing these challenges.



New Delhi: Further investments required in alternative modes and expanding transport coverage

India's capital city, New Delhi (scoring 5), presents a mixed picture in terms of transportation outcomes. The city has strong public transport subsidies (this scores a 10), but support for shared modes and electric vehicle (EV) adoption is much lower. Minimal investment in EVs and charging infrastructure reflects in the very low use of renewable energy in transport (scoring a 1), with the system still largely reliant on conventional energy sources, hindering emissions reduction efforts. Robust public transport investments have helped keep congestion and emissions somewhat in check.

While New Delhi benefits from a punctual subway system, and has rail coverage, there is an opportunity to develop alternative modes, such as trams or ferries for better connectivity. Additionally, short operating hours and minimal Wi-Fi availability reduce the overall appeal of public transport. Also, bus routes have long wait times, driven by high commuter footfall and low frequency. Persistent traffic congestion underscores the need for further investments in expanding transport coverage, improving smart ticketing and adding amenities like Wi-Fi to compete more effectively with private vehicle use and alleviate road congestion.

2. Cities are different

How do we classify them and how do they perform?



São Paulo: Smart city efforts show promise but face challenges in CAV integration

The economic powerhouse of Brazil, São Paulo is making strides in smart city technologies. However, there is still significant room for improvement. The city excels in open public transport data (scoring a 10), which provides valuable insights for effective public transportation planning and management. However, open traffic data and parking data are limited, hindering the ability to address traffic and parking challenges effectively. The traffic management centre and smart traffic lights (4) are also underdeveloped, affecting real-time traffic monitoring and signal optimisation. Additionally, São Paulo's progress in adopting connected and autonomous vehicles (CAVs) has been minimal, reflecting a need for further investment in integrating these technologies into its transportation system. Focusing on improving these areas could greatly enhance São Paulo's mobility infrastructure and overall urban efficiency.



Riyadh: A city poised for mobility transformation despite historical challenges

Saudi Arabia's capital, Riyadh, has shown progress in developing a sustainable mobility ecosystem (scoring 4.5). However, foundational improvements are still needed to integrate different transport services within the city, while addressing environmental and energy issues. The city scored 7.1 in "policies," reflecting the Kingdom's strategic focus on building a smart city platform and enhancing digital infrastructure, such as 4G and 5G networks, signaling potential for a transformative mobility ecosystem.

The Riyadh Metro is set to be a game changer, with over 150 KMs becoming operational in a few months time. The Kingdom has set ambitious goals, including transitioning 30% of all vehicles in Riyadh to electric by 2030, as part of its broader strategy to reduce emissions by 50% and achieve carbon neutrality by 2060. To achieve these goals, several critical factors must be addressed, such as expanding and improving EV and public charging infrastructure, ensuring sustainable energy generation to support EVs, implementing real-time information systems, and developing multimodal journey planners and mobility applications.





3. The way forward

Harnessing stakeholder collaboration for sustainable urban mobility

The success of sustainable mobility in cities relies on a diverse set of stakeholders influencing infrastructure, policy, technology and travel behavior. As a comprehensive mobility index, the SMRI provides tailored recommendations for each stakeholder group to improve urban mobility in a way that is environmentally friendly, socially equitable, and economically efficient.

With ongoing investments from established players and the swift actions of new entrants embracing technology, new value pools are emerging. The way value is created and delivered in this evolving ecosystem is changing rapidly. Small areas of opportunity today may become major industries in the near future, while some legacy sectors could diminish. More importantly, the interplay of technology, climate change, policy, and shifting consumer behavior will significantly impact how value evolves.

Key stakeholders have critical roles in shaping this new landscape. Government and policymakers design and enforce regulations that support sustainable mobility and provide financial incentives. Mobility service providers develop and implement innovative solutions, such as bike-sharing systems, while academics help evaluate policy effectiveness and highlight areas for improvement. Financing these initiatives underscores the vital role of capital in driving progress.

The SMRI offers an invaluable tool for quantifying these variables and addressing complex challenges for governments, businesses and consumers alike. To quote the father of modern management, Peter Drucker, "what gets measured gets managed." As governments, businesses, and consumers grapple with these crucial issues, the SMRI serves as a data-driven, quantitative resource for benchmarking and guiding concrete steps toward improvement. While the scores are a snapshot in time, they contain critical information, providing opportunities for cities to track their progress and take informed action.

Contacts



Hazem Galal

Cities and Local Government Leader
and Global Smart Mobility Co-Leader
PwC Middle East
hazem.galal@pwc.com



Harald Wimmer

Global Automotive Leader and
Global Smart Mobility Co-Leader
PwC Germany
harald.wimmer@pwc.com



Maria Kamargianni

Director, MaaSLab
Professor of Transport Systems
Innovation and Sustainability
m.kamargianni@maaslab.org



Peter Kauschke

Director, Transportation,
Logistics & Mobility
PwC Germany
peter.kauschke@pwc.com

Contributors

Kaushik Deb, PwC India
Prerna Saini, PwC India
Trishul Palekar, PwC India
Woon-Hee Cho, PwC South Korea

Eleni Kalantzi, MaaSLab
Theodora Betsidou, MaaSLab





About PwC

At PwC, our purpose is to build trust in society and solve important problems. We're a network of firms in 151 countries with nearly 364,000 people who are committed to delivering quality in assurance, advisory and tax services. Find out more and tell us what matters to you by visiting us at www.pwc.com.

Established in the Middle East for over 40 years, PwC Middle East has 30 offices across 12 countries in the region with around 11,000 people. (www.pwc.com/me).

PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see www.pwc.com/structure for further details.

© 2024 PwC. All rights reserved