CAREC Smart Mobility Working Group guiding document

(working draft for discussion)

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1. Introduction

This report has been prepared with the aim of contributing to the work of the CAREC Smart Mobility Working Group by providing a structured set of analyses, tools and recommendations to support the development of more efficient, sustainable and digitally integrated mobility systems along the CAREC corridors and within national transport systems.

The Central Asia Regional Economic Cooperation (CAREC) region occupies a strategic position within the Euro-Asian transport system, acting as a bridge between East Asia, Central Asia, the Middle East and Europe. Over the past two decades, CAREC countries have made significant investments in the development of transport infrastructure, particularly along the regional corridors that form the main network connecting the markets of the area. These interventions have helped to strengthen territorial connectivity and consolidate the region's role in international trade flows.

At the same time, the transport sector is undergoing a phase of profound transformation at global level. The adoption of digital technologies, the spread of Intelligent Transport Systems (ITS), the development of digital logistics platforms and the growing electrification of vehicles are reshaping the way mobility systems operate. In this context, smart mobility represents a new transport development paradigm, centered on the integration of infrastructure, digital technologies, data management and sustainable mobility solutions.

For CAREC countries, this transformation represents an important opportunity to improve the operational efficiency of transport systems, reduce environmental impacts and strengthen the competitiveness of regional corridors. However, the level of development of smart mobility policies and solutions remains uneven across the region. In several cases, national strategies continue to focus primarily on infrastructure development, while the integration of digital technologies, intelligent traffic management systems and advanced planning tools remains limited or fragmented. In this context, there is therefore a clear need for a shared strategic framework capable of supporting CAREC countries in identifying common priorities and developing smart mobility initiatives in a coordinated manner.

In light of this need, this study adopts an operational definition of smart mobility developed through a review of scientific and institutional literature, integrated with the analysis of the strategic directions set out in CAREC documents, particularly the CAREC Transport Strategy 2030 and its Midterm Review.

Smart mobility is therefore defined as **an *integrated set of technological developments, innovations, business models and public policies aimed at improving the safety, efficiency, flexibility, integration and environmental sustainability of transport systems*.**

Its main applications include Intelligent Transport Systems and transport digitalization, low-emission vehicles, public transport, shared mobility, cycling and walking, transport

demand management, integrated urban planning, and freight transport and logistics optimization.

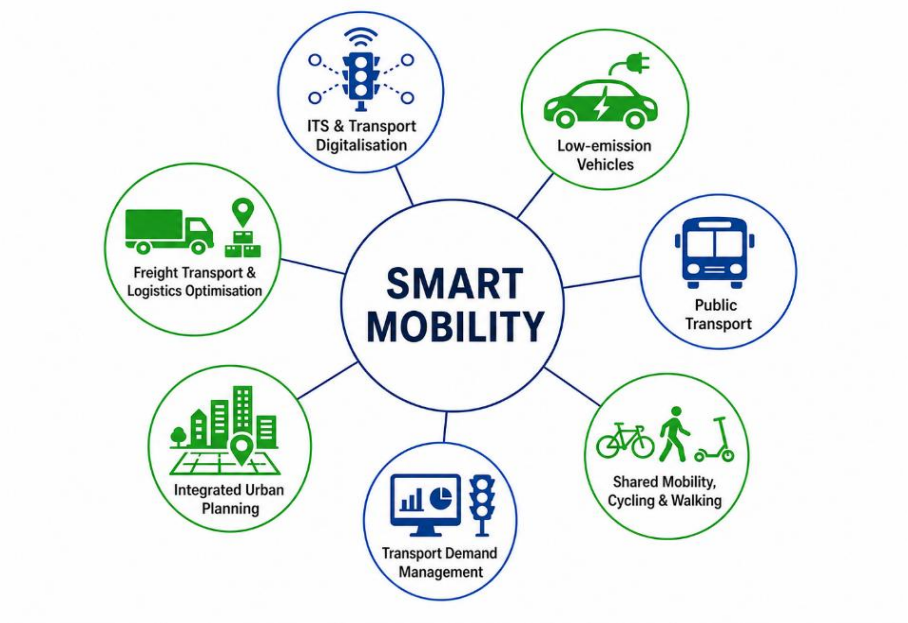


Figure 1-Smart mobility domains

This document has been developed through the following phases: i) review of the main regional and national strategic documents in the transport sector (***view Annex 1***); ii) consultations and questionnaires to identify priorities, barriers and existing smart mobility initiatives (***view Annex 2***) iii) gap analysis aimed at comparing current policies with international smart mobility standards; iii) identification of the main work topics and definition of the Working Group's work program.

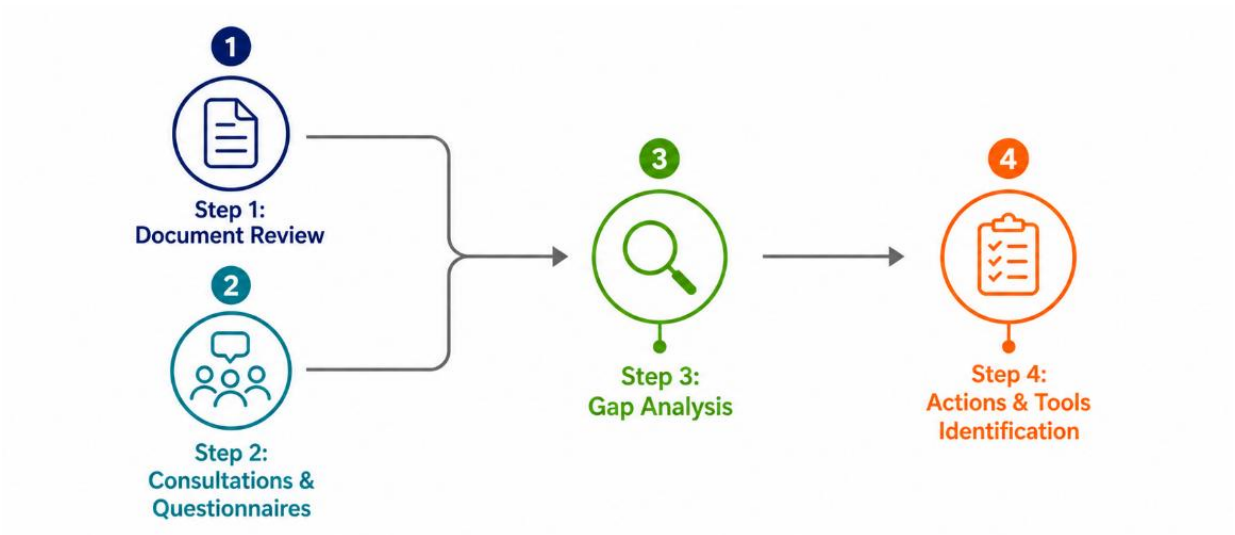


Figure 2-Work phases

2. Review of CAREC and national transport policies

This chapter analyses the smart mobility initiatives in the CAREC region, with the aim of providing a comparative reading of the state of progress of smart mobility, highlighting both the common directions of transformation and the specific features of individual national and urban contexts.

While the 'CAREC Transport Strategy 2030' is analyzed on the one hand, on the other initiatives in the various smart mobility domains are analyzed on the national and urban scale.

1.1 CAREC Transport Strategy 2030

The CAREC Transport Strategy 2030, adopted in 2019, represents the main strategic framework for transport development in the region up to 2030. The strategy is embedded within the broader CAREC 2030 framework, *Connecting the Region for Shared and Sustainable Development*, and pursues two main objectives: improving regional connectivity and ensuring the long-term sustainability of the transport system.

At the center of the strategy are the six CAREC corridors, multimodal road and rail networks connecting East Asia, Central Asia, the Middle East, Europe, the Black Sea and the Arabian Sea. Compared with the previous Transport and Trade Facilitation Strategy 2020, the approach evolves from a predominantly infrastructure-based logic, focused on the construction and rehabilitation of roads and railways, towards a more mature phase centered on operational efficiency, maintenance, multimodal interoperability and the reduction of non-physical barriers.

Indeed, while the Strategy 2020 achieved and exceeded its quantitative infrastructure development targets, improvements in the overall performance of the corridors were more limited. Border-crossing times, logistics costs and procedural inefficiencies continued to negatively affect commercial speed and the competitiveness of regional transport. This is the basis for the paradigm shift introduced by the Strategy 2030: building corridors is not sufficient; they must function as integrated, efficient and sustainable systems.

The strategy is structured around five pillars: cross-border transport and logistics facilitation; roads and road asset management; road safety; railways; and aviation. These pillars combine connectivity and sustainability, promoting digitalization, asset management systems, performance-based maintenance, safety, institutional reforms, railway strengthening and improved regional integration.

A further relevant reference is provided by the ITF studies on *Transport Decarbonisation in Central Asia*, which analyze the evolution of transport-sector emissions in the region and identify possible transition pathways towards low-emission mobility systems. These analyses highlight the growing weight of road transport, both passenger and freight, driven by increasing private motorization, dependence on road freight and the presence of often obsolete fleets. The ITF therefore stresses the need to integrate regional connectivity objectives with decarbonization policies, through the strengthening of rail

transport, logistics modernization, the development of intermodal hubs, the digitalization of transport chains, the adoption of ITS and the improvement of urban public transport.

Within this framework, freight transport plays a strategic role for the entire CAREC area. The CAREC Corridor Performance Measurement and Monitoring Annual Report 2023 shows that the main challenge is no longer only network expansion, but the improvement of the actual performance of the corridors. Delays at border-crossing points, high costs, congestion at multimodal nodes and procedural inefficiencies persist. The case of the Middle Corridor / Trans-Caspian International Transport Route, which grew significantly in 2023, demonstrates how increasing flows can generate new bottlenecks unless accompanied by targeted investments, procedural harmonization and greater capacity at ports, terminals and border-crossing points.

1.2 CAREC countries

This chapter reports on the initiatives in the smart mobility domains by CAREC countries based on both the analysis of strategic and programming documents and the findings of the consultations.

For each country, a synthesis table is provided which provides an overview of the uptake of smart mobility across various domains of application, through the following initiative classification:

- **Present (🟢):** Indicates that, based on the information analyzed, initiatives, policies or projects clearly related to the specific smart mobility category have been identified. Their presence may refer to initiatives that are already operational, under implementation or formally planned within national or urban strategies and programs.
- **Partially present (🟡)**: Indicates that the category is present only in a partial or limited form. This may occur when initiatives cover only some aspects of the category without constituting a systematic approach.
- **Not identified (🔴)**: Indicates that, based on the available sources, no specific or sufficiently clear initiatives attributable to the category considered were identified. This classification does not necessarily imply the complete absence of measures in the country but indicates that such elements do not emerge explicitly from the documentation, questionnaires or consultations analyzed.

1.2.1 Kazakhstan

Kazakhstan has developed a structured framework of policies and initiatives related to smart mobility, linking the green transition, economic modernization, transport digitalization and the strengthening of logistics. At national level, documents such as the Concept for Transition to a Green Economy, the Energy Efficiency–2020 program, the National Development Plan and the Nurly Zhol State Infrastructure Development Programme 2020–2025 promote energy efficiency, the use of alternative fuels, the

development of infrastructure for electric and gas-powered vehicles, fleet renewal and the improvement of transport infrastructure quality. Although Nurly Zhol is not directly dedicated to smart mobility, it includes several elements consistent with this field, particularly in relation to the modernization of the road network, the digitalization of transport nodes and services, the strengthening of electronic tolling systems and the integration of the country into Euro-Asian corridors.

Current initiatives confirm this direction. In urban areas, relevant measures include the introduction of electronic payment systems in public transport, the use of cameras and traffic control systems, bus fleet renewal, the development of e-mobility through electric vehicles and charging stations, as well as the still partial development of cycling infrastructure in the main cities. Astana and Almaty represent the most significant cases: the former develops smart mobility within the Smart Astana program, based on the integration of mobility, digital governance, environment and quality of life; the latter presents a more advanced framework, based on ITS, Digital Twin, modal integration, electronic ticketing, real-time information, smart parking, fleet renewal, low-emission vehicles and possible Low Emission Zones.

Alongside urban measures, digitalization and monitoring of the extra-urban road network also play an important role. The consultation highlighted the preparation of a project for a speed control information system, designed to integrate weather monitoring, vehicle weight control, cameras and traffic monitoring, with an initial application planned on the regional and republican road network. Reference was also made to the "Autodromo" digitalization system, aimed at creating a digital copy of roads, including information on pavement condition, road category and ownership, completed and planned works, as well as geodata on services and supporting infrastructure.

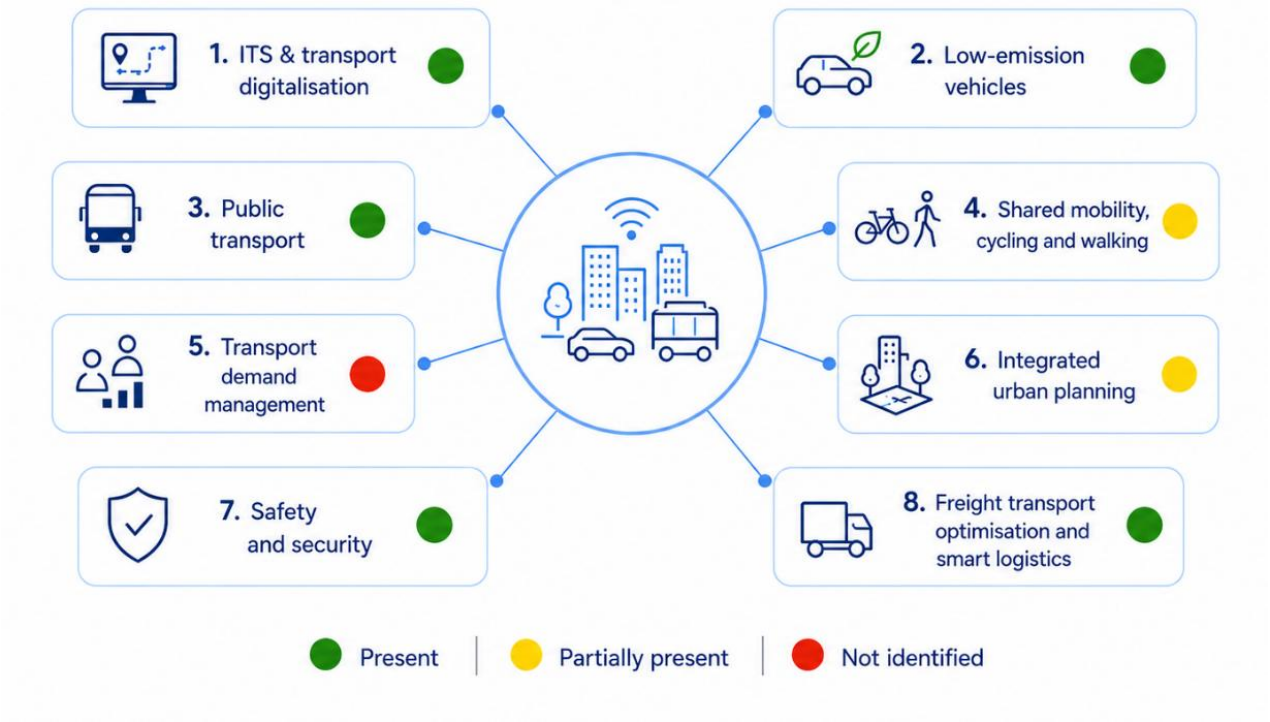


Figure 3- Level of development of smart mobility key aspects in Kazakhstan

1.2.2 Azerbaijan

The Republic of Azerbaijan is progressively steering its mobility system towards a model based on decarbonization, digitalization, infrastructure modernization and the strengthening of the country's role as a regional logistics hub. This direction is reflected in national climate commitments, particularly the 2023 Updated Nationally Determined Contribution, which assigns the transport sector an important role in reducing emissions, and in the Socio-economic Development Strategy 2022–2026, which links transport modernization to economic competitiveness, sustainability and regional integration.

Among the main initiatives currently under way, the Mobility Transformation Programme stands out. It aims to improve public transport management, optimize bus and taxi services and strengthen the institutional and regulatory framework. This is complemented by the development of the Mobility as a Service (MaaS) concept through the AYNA platform, which integrates route planning, bus arrival information and digital payment services linked to the BakıKART ecosystem. Baku plays a central role in this process: the city faces strong pressure on its road network, high dependence on private cars and growth in taxi and ride-hailing services, but it also has a significant metro network and advanced traffic management tools, including the Intelligent Transport Management Centre, operational since 2011, and the Digital Twin of Baku, used to simulate traffic scenarios and support more efficient urban planning.

A further strategic axis concerns the transition towards low-emission vehicles. From 1 January 2025, only electric or compressed natural gas buses are expected to be used within Baku's administrative area. This measure forms part of a broader framework that includes incentives for electric mobility, digital platforms for locating charging stations,

alignment with Euro 4, Euro 5 and Euro 6 emission standards, and the partnership with BYD for the local assembly of electric buses and the development of the related charging network.

Digitalization also concerns rail transport, freight and international logistics. The ADY Smart platform introduces real-time tracking, electronic documentation, online tariff calculation and paperless cargo operations. At the same time, the development of a national Single Window logistics platform, together with e-transit systems, digital customs integration and GPS tracking of goods, aims to facilitate flows along the main international corridors. Finally, in the urban context, Baku is expanding infrastructure for micromobility and active mobility, with protected lanes for bicycles and scooters, dedicated parking areas and the progressive pedestrianization of some central areas.

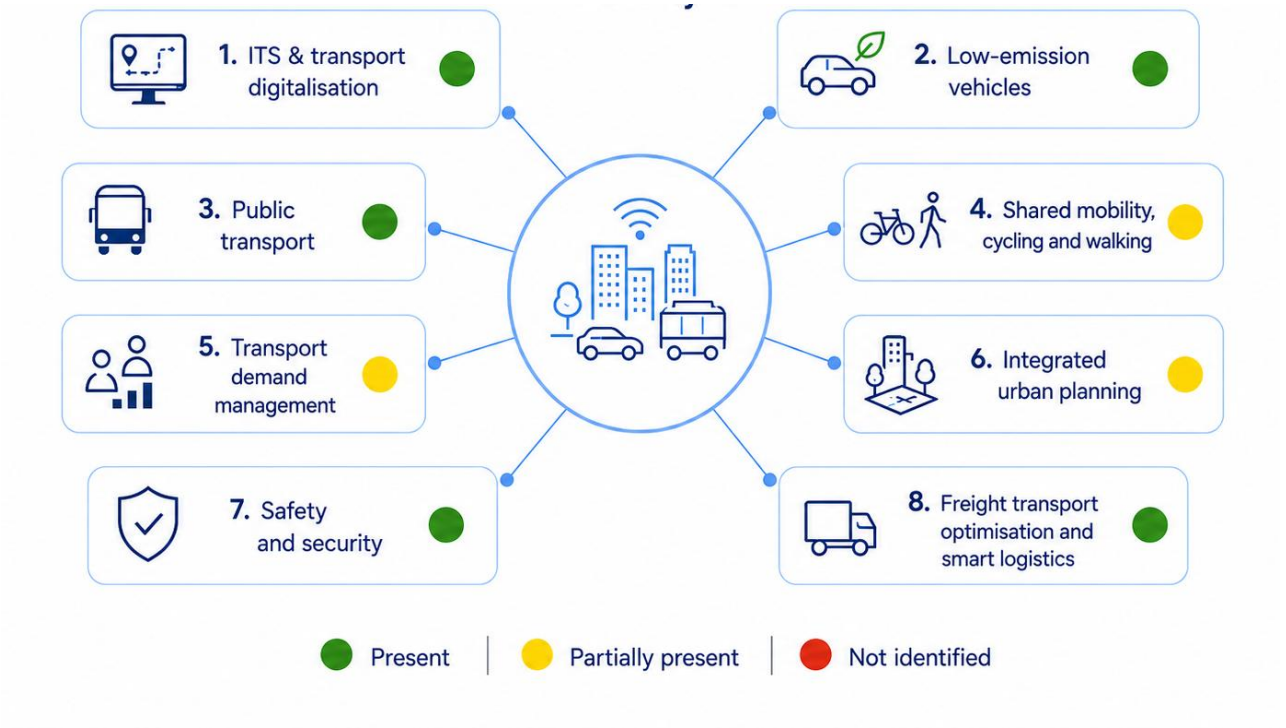


Figure 4- Level of development of smart mobility key aspects in Azerbaijan

1.2.3 Kyrgyz Republic

The Kyrgyz Republic presents favorable conditions for the development of sustainable mobility, thanks to electricity production that is strongly based on renewable sources, particularly hydropower. This creates a positive context for the progressive electrification of transport and for reducing environmental impacts. At national level, the strategies analyzed steer transport policy towards decarbonization, technological modernization and service improvement. The Updated NDC 2021 includes measures to reduce emissions, such as replacing diesel and petrol buses with gas-powered vehicles, promoting greener transport and gradually introducing electric vehicles. In parallel, the VNR 2020 refers to public transport interventions, with a focus on fleet renewal, service quality and accessibility.

A particularly relevant area concerns the digitalization of road and freight transport, the intelligent management of corridors and the improvement of information available to users and administrations. The National Development Strategy 2018–2040 aims to strengthen the country's transit potential by reducing the time and costs associated with import-export procedures, while Digital Kyrgyzstan 2019–2023 creates favorable conditions for the development of digital systems and smart mobility solutions. Within this framework, the e-permit system for international transport has already been used with some partner countries, including Uzbekistan, China and Türkiye, replacing paper-based procedures and lengthy diplomatic exchanges with a faster digital process. In the railway sector, measures are also planned for electrification, infrastructure modernization and the digitalization of management systems, including centralized databases, digital archives and electronic transport documents.

Bishkek represents the main urban laboratory for this transition. The city faces challenges related to high levels of private motorization, congestion, road safety and air quality, but is starting a modernization pathway based on fleet renewal, electrification and ITS. CNG buses have been introduced, electric bus projects have been launched with ADB support, depots and charging infrastructure have been modernized, and electric eco-taxis have been tested. On the digital side, initiatives are under way relating to smart traffic lights, traffic management systems, electronic parking, smart street lighting, cameras and control centers.

Further initiatives strengthen the role of smart mobility in the management of the national road network. The Safe Country project, based on the installation of CCTV cameras on republican roads, at main intersections and in cities, performs functions related to traffic control, violation detection and accident recording. Intelligent QR-code payment systems have also been reported in an important mountain tunnel, together with the planned introduction of automated road tolls, automatic weigh-in-motion systems and the creation of a single information portal of the Ministry of Transport, intended to collect data on roads, bridges, service stations, bus stops, parking areas and other components of the network.

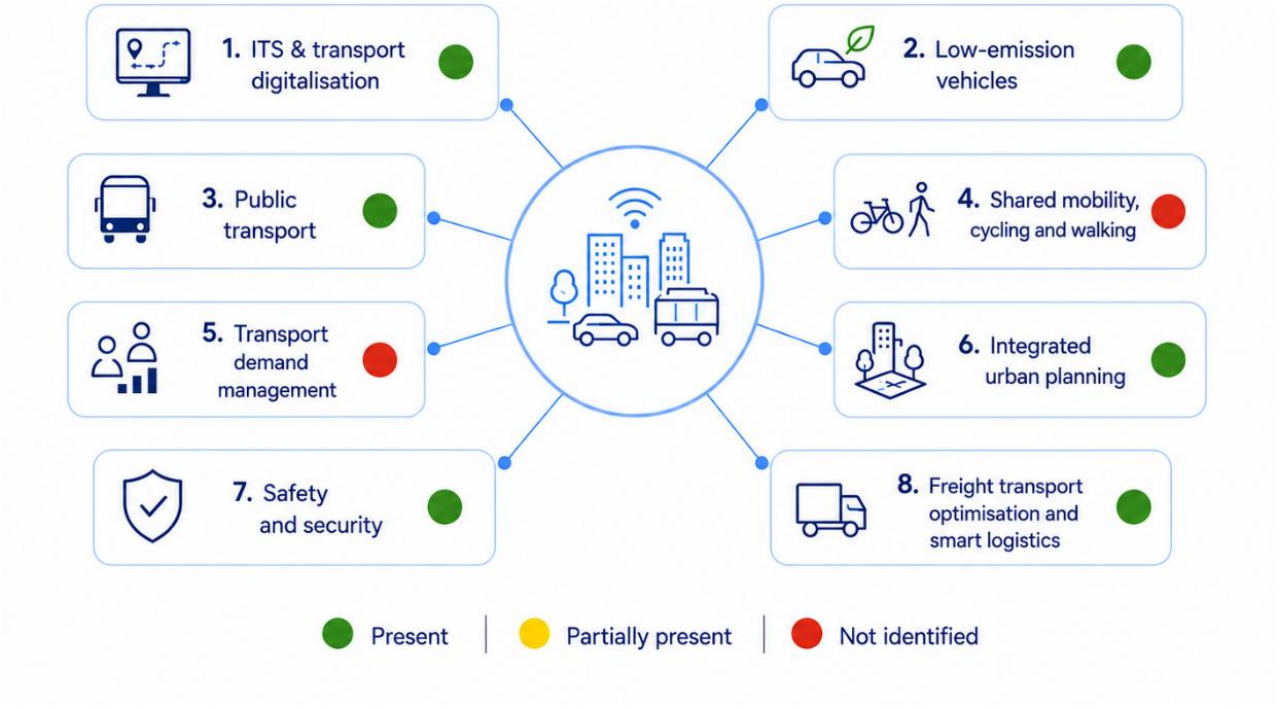


Figure 5- Level of development of smart mobility key aspects in Kyrgyz Republic

1.2.4 Tajikistan

In recent years, Tajikistan has begun a process of modernizing its transport sector, integrating decarbonization, digitalization and infrastructure development objectives into its main national strategies, including the Updated NDC, the National Development Strategy 2030, the National Transport Development Program and medium-term development programs. A central area is the electrification of the vehicle fleet, supported by the Electric Transport Development Program 2023–2028, which aims to increase the share of electric vehicles, develop a national charging network, introduce digital technologies for the management of electric transport, and also promote battery recycling and domestic production of electric vehicles.

At urban level, Dushanbe represents the main case of smart mobility application in the country. The capital faces challenges related to population growth, increasing private motorization, congestion, parking shortages and air pollution, but in recent years it has started a process of digitalization and modernization of urban transport. Initiatives include the purchase of new buses, the partial renewal of rolling stock, the reorganization of some routes, the introduction of electronic information boards, automated ticketing, GPS systems for buses and trolleybuses, as well as digital systems for taxis and urban services. These are complemented by projects for electric buses and charging infrastructure, including public transport modernization measures in other cities, such as Bokhtar.

A second line of action concerns the introduction of Intelligent Transport Systems and advanced tools for road network management. The Safe City project, based on cameras, traffic signal control and centralized traffic management, represents one of the most relevant examples in Dushanbe. At national level, the country is also developing a Road

Asset Management System, installing Weigh-in-Motion systems to protect infrastructure, and establishing a Road Safety Observatory as part of broader reforms related to road safety.

A further area of development concerns the digitalization of customs and logistics procedures, through the national implementation of ASYCUDA World, the introduction of electronic services for passenger declarations and the connection of advance cargo information with the TIR EPD system. These measures strengthen the digital management of transit and border operations and form part of the broader process of modernizing railway, road and logistics infrastructure.

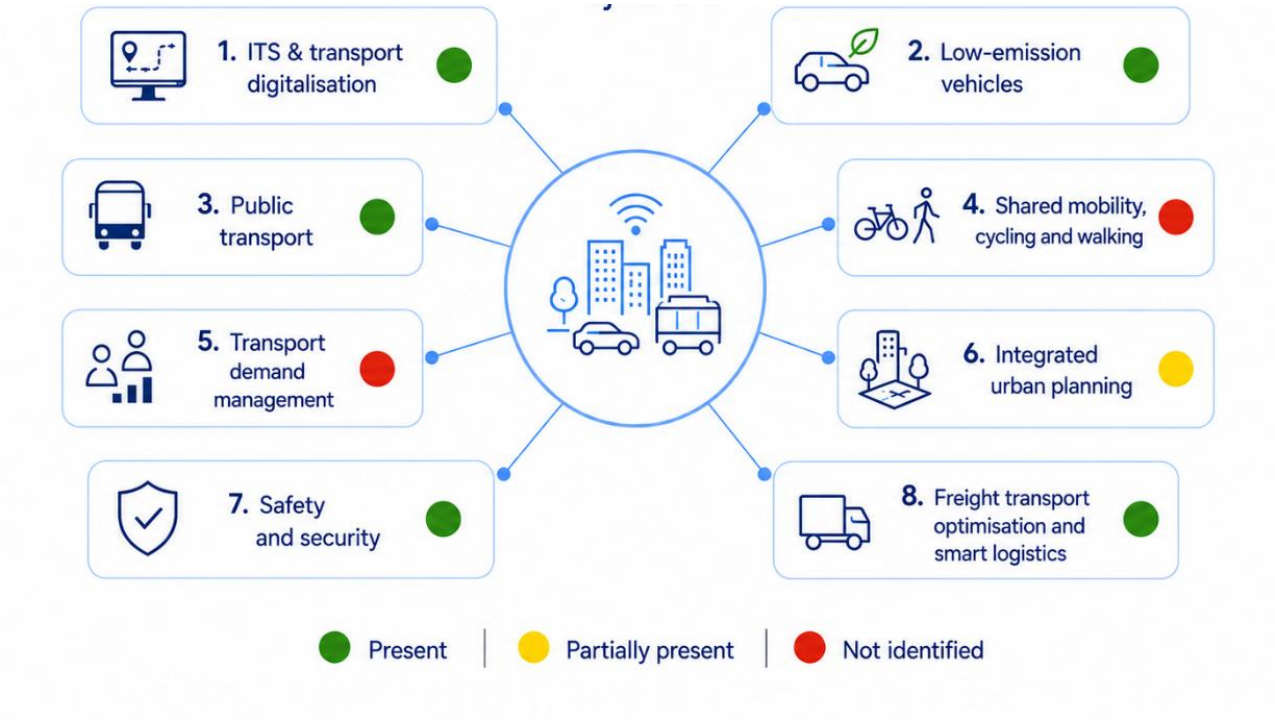


Figure 6- Level of development of smart mobility key aspects in Tajikistan

1.2.5 Pakistan

In Pakistan, smart mobility is developing through a broad set of climate policies, electrification measures, transport digitalization, road safety initiatives and investments in public transport. At national level, the main reference is the Pakistan Updated NDC 2021, which identifies the decarbonization of the transport sector as a priority, promoting the electrification of the vehicle fleet, the use of cleaner fuels and the modernization of public transport. This approach is reinforced by the National Electric Vehicle Policy, the Alternative and Renewable Energy Policy 2019 and the 2022 regulatory framework for charging infrastructure, which support the development of electric mobility and its integration with smart energy systems.

Current initiatives confirm this direction, particularly through electric and "green" public transport programs in the provinces of Punjab and Sindh, where electric bus services have been launched in several cities, accompanied by GPS tracking systems, smart ticketing and charging infrastructure. In Punjab, the Super Autonomous Rapid Transit

system is also being introduced in Lahore, designed as an electric road-based system similar to a metro or trackless tram, while a pilot e-taxi program with electric vehicles has also been launched. These initiatives are complemented by Bus Rapid Transit systems in major cities, including Karachi Breeze, Peshawar and Lahore, which are helping to strengthen urban public transport through dedicated lanes, smart ticketing and digital service management.

The digital dimension represents a further strategic pillar. The Digital Pakistan Policy 2018 supports the development of digital infrastructure and public-private cooperation, while the National Freight and Logistics Policy 2020 promotes digitalization, data interoperability, ICT technologies and tracking systems in the freight and logistics sector. In parallel, electronic tolling systems, such as M-Tag, are being developed to improve operational efficiency along motorways and major corridors, with growing interest in extending cashless tolling to other parts of the network.

At urban level, Karachi, Lahore and Peshawar show converging trajectories based on BRT, ITS, electronic ticketing, digital public transport management and public-private partnership models. Lahore has developed mass transit infrastructure such as the Metrobus and the Orange Line, alongside smart roads and electric vehicle charging infrastructure, while Peshawar has introduced a high-capacity BRT system and intelligent traffic management solutions. Projects involving adaptive traffic signals and smart intersections are also reported in cities such as Sahiwal and Quetta, together with smart city initiatives focused on sensors, ICT, smart parking and congestion analysis.

Road safety is another pillar of smart mobility in Pakistan, through the National Road Safety Strategy 2018–2030, the growing use of ITS on highways and motorways for control, enforcement and traffic management, and ongoing work on new road safety legislation.

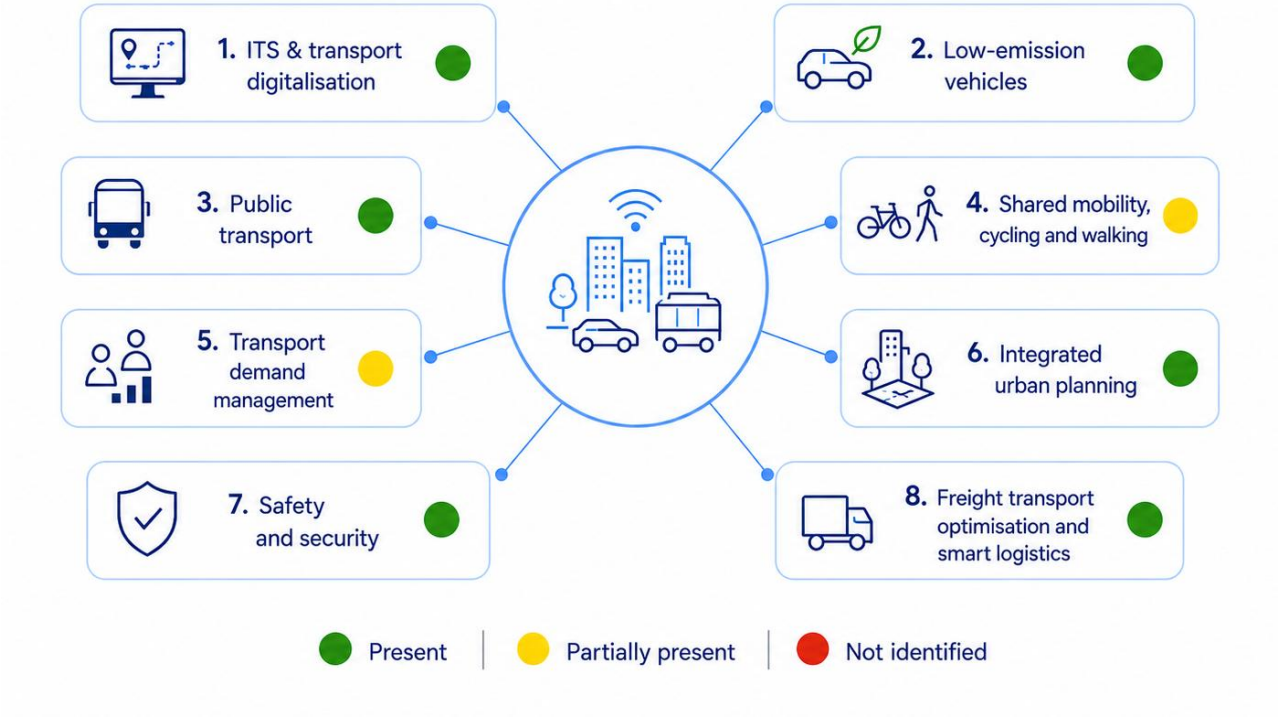


Figure 7- Level of development of smart mobility key aspects in Pakistan

1.2.6 Uzbekistan

In Uzbekistan, smart mobility forms part of a broader process of modernizing the transport system, oriented towards environmental sustainability, energy transition, digitalization and regional integration. The main national strategic documents define long-term objectives related to reducing the use of fossil fuels, increasing the use of alternative fuels, expanding hybrid and electric vehicles, and converting public transport to natural gas and electricity. This transition is accompanied by the development of charging infrastructure, the gradual introduction of Euro 4 and Euro 5 standards, and the strengthening of renewables in the electricity mix.

A second central area concerns transport digitalization and the introduction of ITS. National policies envisage intelligent traffic management systems, GPS monitoring of vehicles, automatic dispatching, digital platforms for logistics and freight transport, as well as international cooperation on artificial intelligence, video surveillance and autonomous vehicles. In parallel, cities such as Tashkent and Samarkand are developing smart city initiatives to improve the management of urban infrastructure and mobility services.

Particular attention is also given to public and rail transport, through fleet renewal with CNG and electric buses, improved accessibility and the gradual electrification of the railway network. The freight sector is also included in the strategy, with measures for multimodal hubs, dry ports, customs digitalization, real-time weight control and logistics information systems.

Tashkent represents the main urban laboratory for this transformation. The city is focusing on integrated planning, expansion of the metro network, electronic ticketing

systems, multimodal apps, AVL, ITS for dynamic traffic management and the renewal of the bus fleet with electric vehicles.

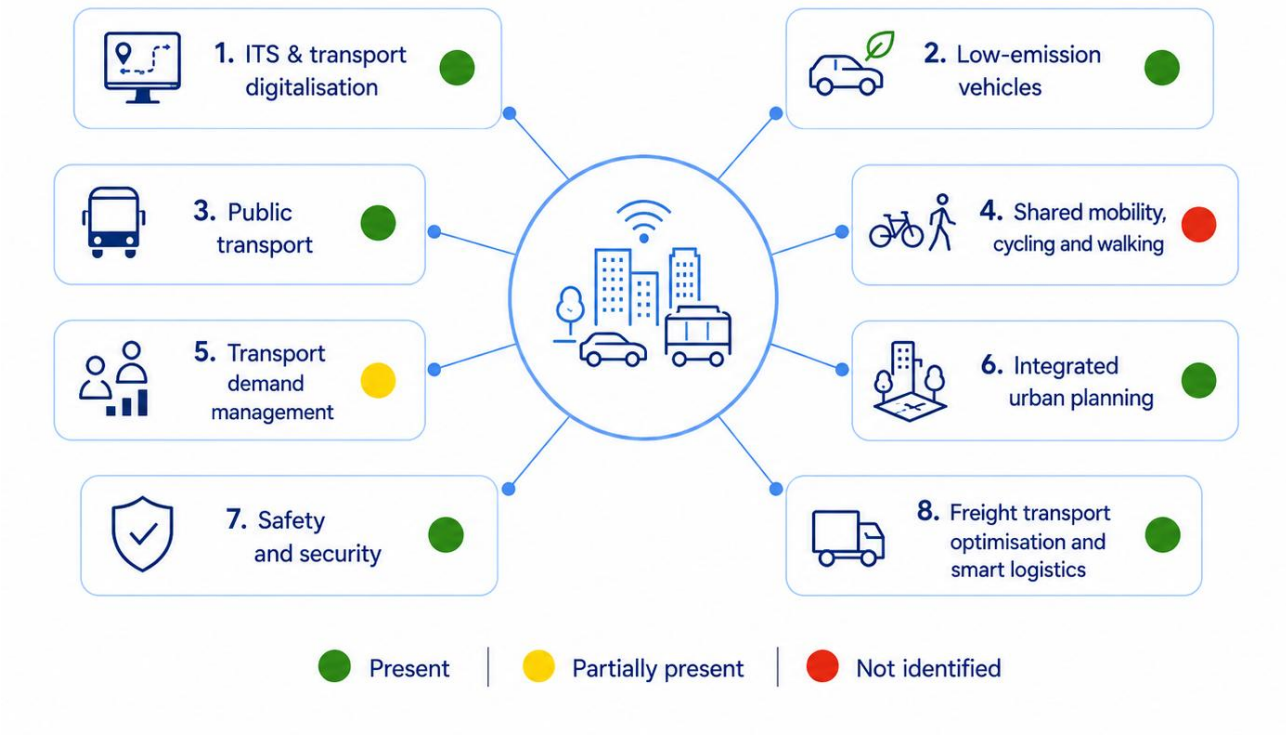


Figure 8- Level of development of smart mobility key aspects in Uzbekistan

1.2.7 Mongolia

In Mongolia, smart mobility is developing through a broad set of national strategies that integrate road safety, digitalization, decarbonization, railway modernization and logistics development. Documents such as Vision 2050, the Mongolia Green Development Policy, the National Program on Road Safety, the NDC and the Government Action Plan 2020–2024 outline a pathway oriented towards the introduction of ITS, the uptake of low-emission vehicles, transport electrification and the strengthening of logistics corridors.

A first area concerns Intelligent Transport Systems and transport digitalization, with the development of intelligent traffic management systems, digital platforms, cameras for flow monitoring, and tools for the control of accidents and violations. This is particularly evident in Ulaanbaatar, where systems such as the Bus Management System, Automatic Fare Collection and integrated traffic management platforms help to improve traffic control and the quality of public transport services.

A second area concerns low-emission mobility and public transport renewal. The country is promoting the uptake of electric, gas-powered and hybrid vehicles, together with the gradual introduction of electric buses in urban public transport. In parallel, the government is exploring broader public transport modernization projects, including BRT, MRT and other mass transit solutions, with the aim of reducing emissions, improving air quality and providing more efficient alternatives to private mobility, particularly in the capital.

Smart mobility also includes railway modernization and freight transport optimization, through measures to improve railway infrastructure, promote modal shift from road to rail, and develop multimodal logistics hubs and dry ports along the main Euro-Asian transit corridors. These developments are also accompanied by a growing role for the private sector, which is introducing bike-sharing and scooter-sharing services.

In the urban context of Ulaanbaatar, these strategies are particularly relevant due to rapid urbanization, high levels of motorization, congestion and environmental challenges. However, current initiatives still face significant shortcomings in terms of road safety, accessibility, parking and the quality of road infrastructure, especially with regard to the effective integration of new forms of mobility into the overall urban system.

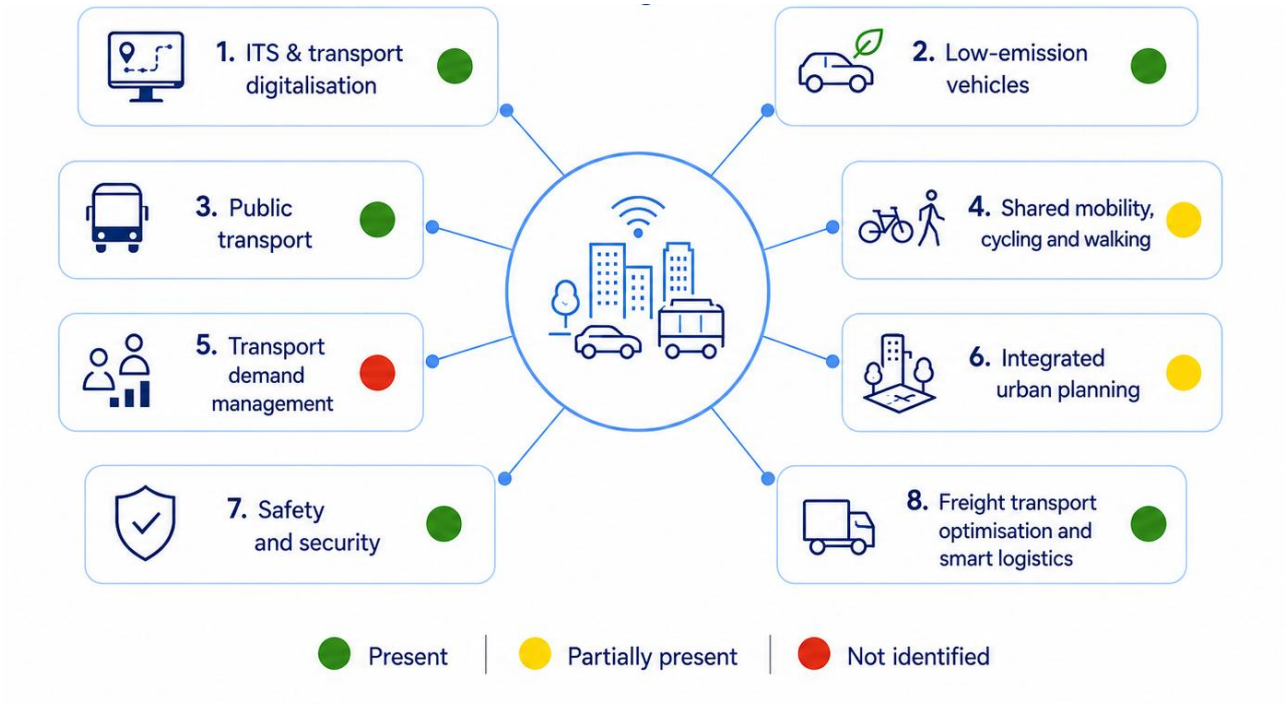


Figure 9- Level of development of smart mobility key aspects in Mongolia

1.2.8 People's Republic of China

In recent years, the People's Republic of China has developed a highly structured strategy for transforming its transport system, integrating decarbonization, technological innovation and industrial development. Electric mobility is one of the main pillars, supported by the New Energy Vehicle Industry Development Plan (2021–2035), the regulatory credit system for new energy vehicles, and substantial investments in charging infrastructure. China is currently the world's largest market for electric vehicles and is also promoting the integration of vehicles with the electricity grid through Vehicle-to-Grid technologies.

A second central area concerns transport digitalization and the development of intelligent and connected vehicles. Strategies such as Made in China 2025, the national artificial intelligence plan and the guidelines for Intelligent Connected Vehicles promote

ITS, V2X communication, autonomous driving and digital infrastructure. The transformation of the transport system is also supported by economic instruments, such as the national emissions trading system, which helps steer the market towards low-emission solutions.

In the case of Ürümqi, the capital of Xinjiang, smart mobility is developing along three main lines: the modernization of urban transport, the strengthening of its regional logistics role, and fleet electrification. The Urumqi Urban Transport Improvement Project, supported by the World Bank, has promoted the development of BRT corridors, interchange hubs and intelligent systems for the management of buses, taxis, parking and user information. In parallel, the city is strengthening its role as a logistics hub through integrated infrastructure linking rail, road, airport and customs zones. Finally, Ürümqi is accelerating the uptake of electric vehicles in public transport and urban services, with the aim of reducing emissions and air pollution.

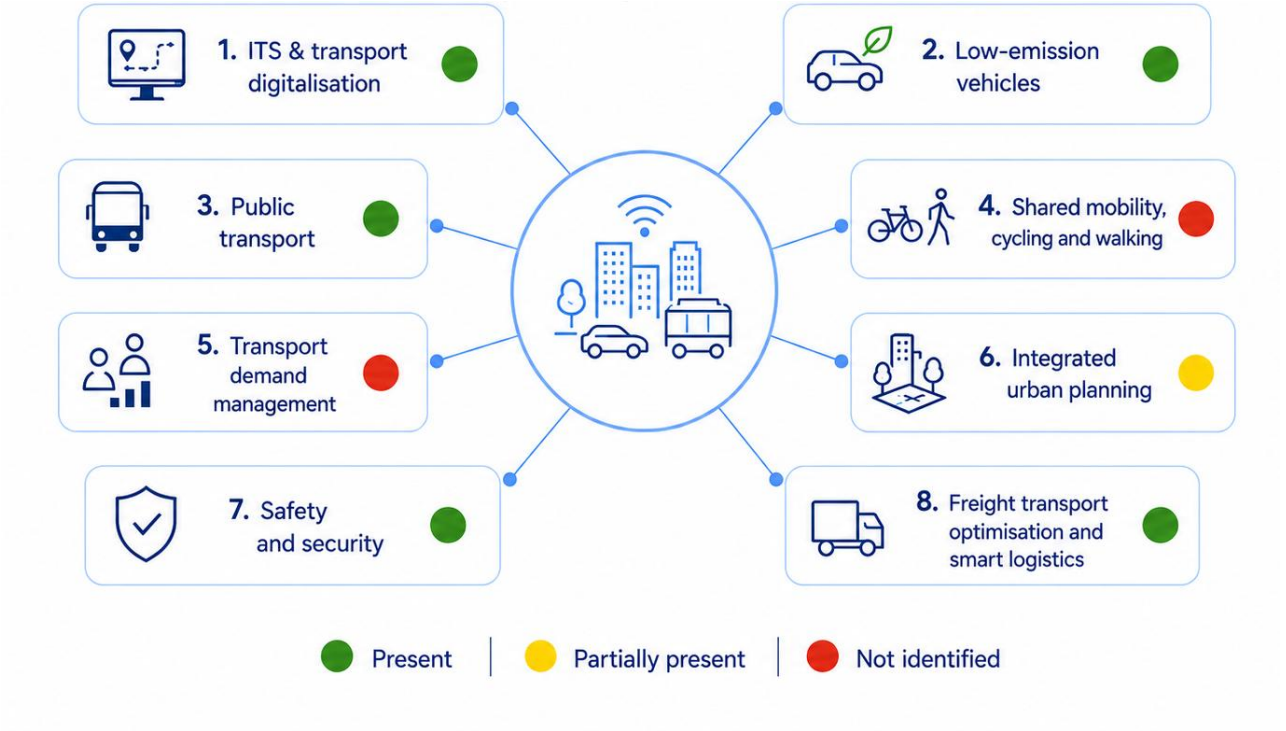


Figure 10- Level of development of smart mobility key aspects in People's Republic of China

1.2.9 Georgia

In recent years, Georgia has begun a gradual process of modernizing its transport system, integrating decarbonization, energy transition, digitalization and logistics development objectives. The main strategic references are the National Energy and Climate Plan 2025–2030, the National Renewable Energy Action Plan and the Climate Change Strategy and Action Plan 2030. Within this framework, transport is progressively being linked to energy and climate policies, with particular attention to reducing emissions, improving system efficiency and supporting the future electrification of mobility.

At urban level, Tbilisi represents the most advanced case. The city has started a process of public transport modernization, also supported by international partners such as the EBRD, through bus fleet renewal, the introduction of real-time information systems, electronic displays at stops and digital tools for service monitoring. The urban strategy is also based on the development of a Sustainable Urban Mobility Plan, which integrates public transport, active mobility, traffic management and ITS technologies. In this context, Tbilisi is working on the development of an integrated ITS system aimed at managing traffic flows and prioritizing public transport and active mobility. Studies are also under way on the introduction of Low Emission Zones and congestion charging zones, to be integrated into future intelligent traffic management systems, alongside the initial implementation of the action plan for on-street parking reform.

On the transport supply side, measures are under way to upgrade the metro network, purchase electric buses and assess the feasibility of a possible commuter rail system. These measures form part of a broader transition towards low-emission vehicles, including electric and CNG buses, although at national level the uptake of electric vehicles and charging infrastructure remains limited.

A second line of action concerns the national and international scale, with a strong focus on the digitalization of cross-border and logistics transport. Georgia is capitalizing on its geographical position along the Middle Corridor by promoting freight traceability, interoperability of information systems and more efficient management of transport flows. In this area, the Maritime Single Window was introduced in national ports in 2024, enabling electronic management of ship customs and clearance procedures, together with the transmission of data on goods, passengers, crews and transport documents. This is complemented by the development of the Port Community System, still at the planning stage, and participation in cross-border digitalization initiatives such as the CAREC Advanced Transit System, the TRACECA pilot project for e-CIM/SMGS consignment notes, and accession to the New Computerized Transit System.

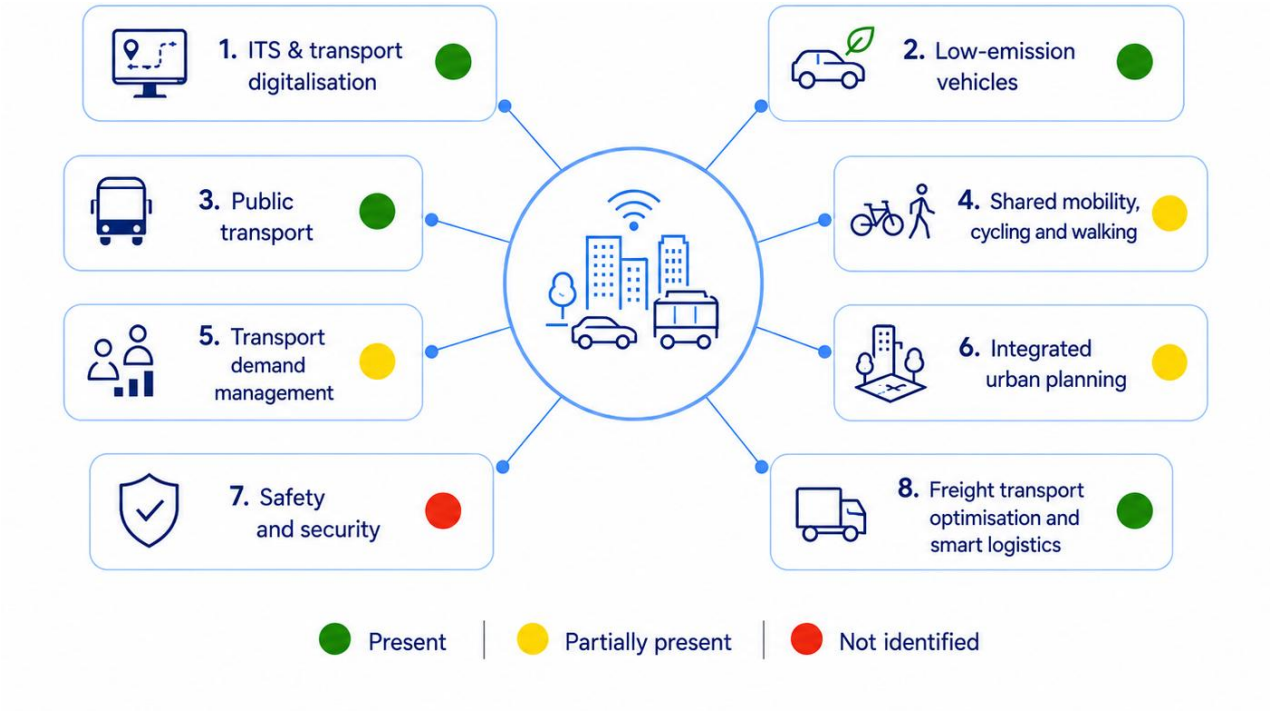


Figure 11- Level of development of smart mobility key aspects in Georgia

2.2.10 Turkmenistan

Turkmenistan has begun a gradual process of modernizing its energy and transport infrastructure, integrating energy efficiency, environmental sustainability, technological innovation and logistics strengthening objectives into its national strategies. Although the country remains heavily dependent on fossil fuels, it is showing growing attention to reducing energy intensity and introducing more efficient technologies, including in the transport sector. Documents such as the national renewable energy strategy, the state program for energy saving and the Updated NDC identify transport as a relevant area for reducing emissions and improving energy performance.

A central axis of smart mobility in Turkmenistan concerns the digitalization of transport and logistics processes, corridor modernization and multimodal integration between road, rail and maritime transport. The questionnaires show a framework in which the country is promoting electronic data exchange systems to simplify procedures, reduce administrative burdens and improve coordination among the different actors in the logistics system. These measures are complemented by interventions for the development of multimodal logistics hubs, aimed at strengthening integration between different transport modes, together with the modernization of corridor infrastructure to improve connectivity, safety and operational performance. Digital transport corridors and railway modernization also form part of this perspective, with particular reference to the Ashgabat–Turkmen Bashi axis, confirming the central role of rail in the national strategy.

At urban level, Ashgabat is undergoing a process of infrastructure modernization and the gradual introduction of technological solutions, although it does not yet have a specific smart mobility plan comparable to European SUMPs. Projects such as

Sustainable Cities in Turkmenistan aim to strengthen sustainable urban planning and the integrated management of urban infrastructure, including transport. The consultation also highlighted the purchase of around 700 new modern buses, which have enabled a significant renewal of the passenger vehicle fleet and are equipped with integrated GPS navigation, supported by a mobile app through which users can monitor services and arrival times at stops.

The case of Arkadag is also particularly relevant. This new city has been designed as a smart city, with digital infrastructure, intelligent urban management systems, electric buses and taxis, charging stations, smart parking and traffic monitoring. This case demonstrates a more advanced component of urban innovation, although it remains concentrated in a specific context.

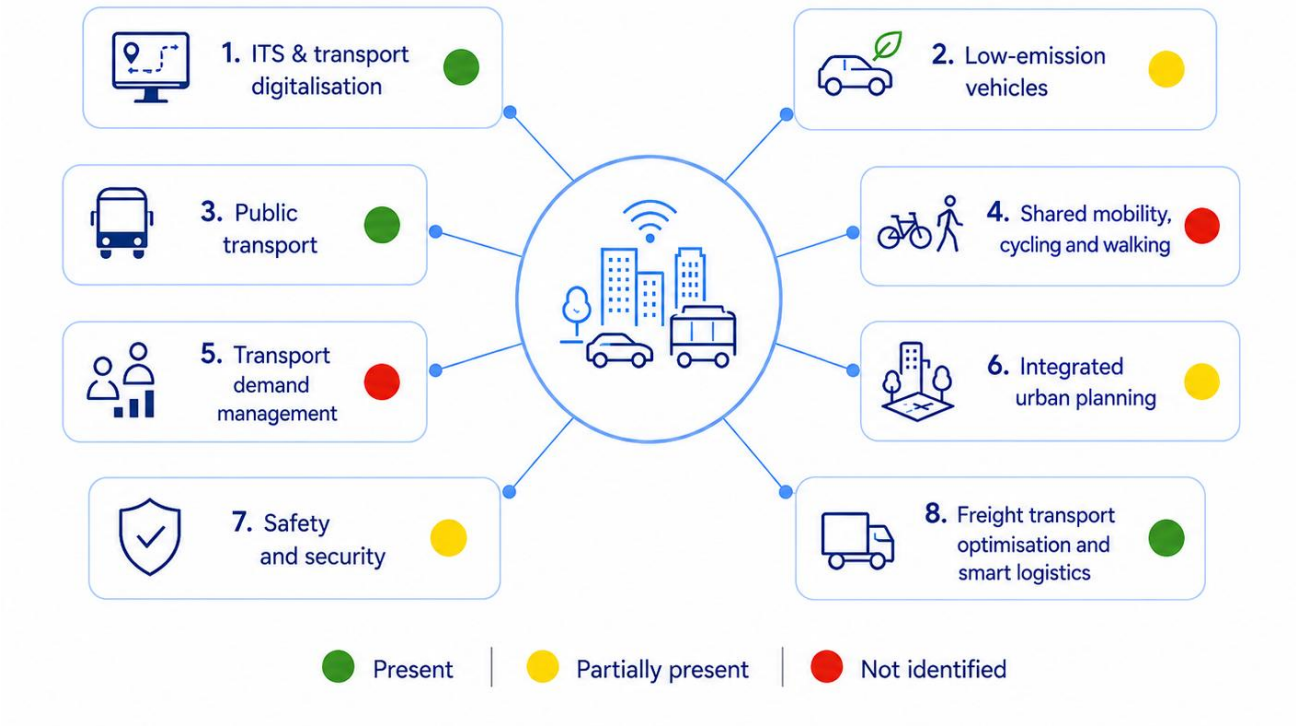


Figure 12- Level of development of smart mobility key aspects in Turkmenistan

1.3 Clustering of CAREC Countries

The outcomes of the previous analyses, combined with part of consultation and questionnaires, are synthesized according to three clusters of countries, distinguished by the smart mobility level of diffusion.

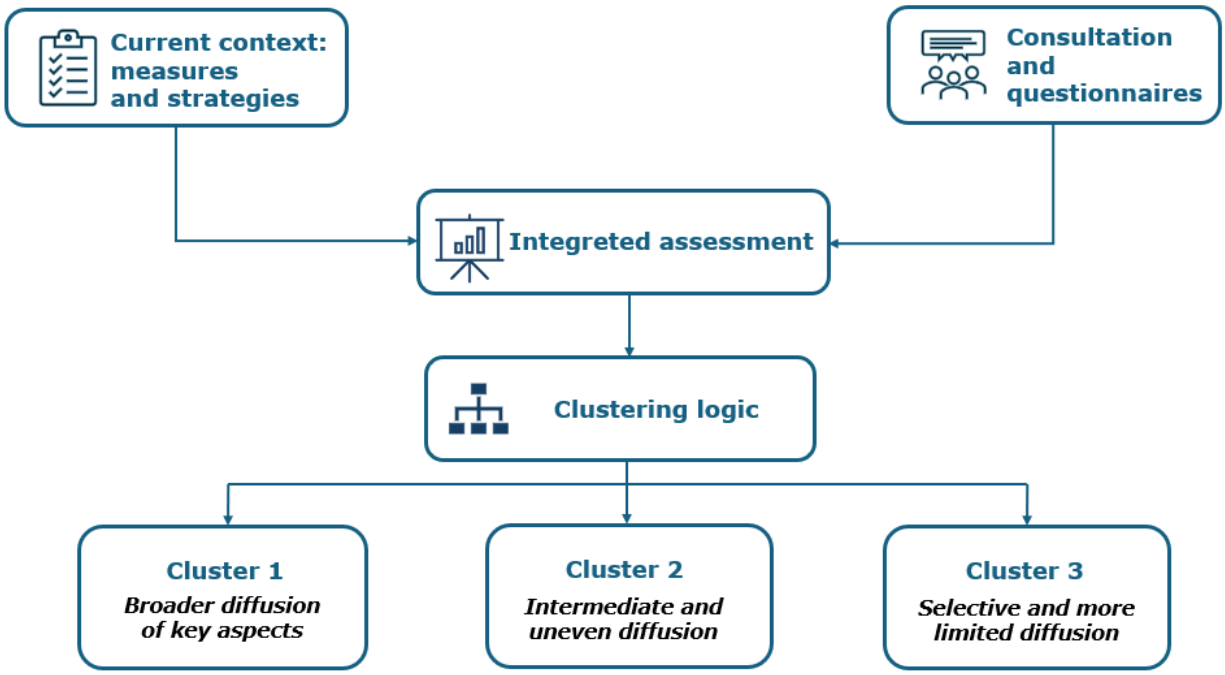


Figure 13- Logical framework for clustering

1.3.1 Cluster 1 – Countries with broad uptake of the key aspects of smart mobility.

The first cluster includes the countries that show the broadest coverage of the key aspects of smart mobility. In these cases, initiatives address several dimensions at the same time: ITS and digitalization, low-emission vehicles, public transport, safety, smart logistics and, at least in part, integrated urban planning or demand management.

This group includes Kazakhstan, Azerbaijan, Pakistan and Uzbekistan. These countries present a relatively advanced framework compared with the rest of the region, as they have policies, programs and projects covering most of the categories analyzed. However, the common gap is not so much the absence of initiatives, but rather their full integration into coordinated, scalable and user-oriented systems.

In Kazakhstan, smart mobility appears to be supported by a broad framework of national strategies, infrastructure programs, urban initiatives and digital tools for road network management. The country has initiatives in ITS, digitalization, low-emission vehicles, public transport, safety and smart logistics. Astana and Almaty represent the most significant urban cases, with electronic payment systems, ITS, digital twin, smart parking, real-time information and fleet renewal. However, some components remain partial or not fully developed, particularly shared and active mobility, transport demand management and integrated urban planning. The prevailing gap is therefore the incomplete transition from a system driven by infrastructure, corridors and major cities towards a fully integrated, multimodal and user-centered ecosystem.

Azerbaijan shows very broad coverage of the key aspects, with initiatives in ITS, digitalization, public transport, low-emission vehicles, demand management, urban planning, safety and smart logistics. Baku plays a central role, thanks to the Intelligent Transport Management Centre, the Digital Twin of Baku, the AYNA platform, the Mobility Transformation Program and measures for electric or CNG buses. Logistics also shows an advanced level of digitalization through ADY Smart, Single Window, e-transit and GPS freight tracking. The main gap concerns the need to extend and consolidate these initiatives beyond the capital and the main logistics axes, avoiding territorial polarization of smart mobility.

Pakistan presents a broad and structured framework, with initiatives in ITS, public transport, low-emission vehicles, motorway digitalization, road safety, smart logistics and demand management. BRT systems, electric buses, the Super Autonomous Rapid Transit system, M-Tag, ITS on highways and motorways, and national policies on electric vehicles and road safety indicate a trajectory clearly oriented towards smart mobility. However, the system remains fragmented across federal, provincial and urban levels, with initiatives distributed across cities, motorway networks, BRT systems and sectoral programs. The prevailing gap is therefore institutional and territorial fragmentation, which limits the possibility of building an interoperable, replicable and consistent model.

Uzbekistan is also among the countries with the broadest diffusion of the key aspects. Initiatives cover ITS and digitalization, low-emission vehicles, public transport, demand management, integrated urban planning, safety and smart logistics. Tashkent represents the main urban laboratory, with expansion of the metro network, electronic ticketing, multimodal apps, AVL systems, ITS for dynamic traffic management and renewal of the bus fleet with electric vehicles. The prevailing gap concerns the need to move from large public and infrastructure programs towards a more fully multimodal, integrated and user-oriented ecosystem, particularly with regard to shared mobility, cycling, walking and MaaS services.

1.3.2 Cluster 2 – Countries with medium-to-high uptake, although still uneven.

The second cluster includes countries that present relevant initiatives across several areas of smart mobility, but with less homogeneous coverage than the first group. This means that initiatives are not evenly distributed across all its components: some areas are already consolidated or clearly present, while others are still only partially developed or not fully integrated into existing policies and projects.

In these cases, ITS, digitalization, public transport, low-emission vehicles and smart logistics are generally present, while components related to demand management, active and shared mobility, integrated urban planning and full-service integration remain weaker.

This group includes Mongolia, the Kyrgyz Republic, Tajikistan, Georgia and the People’s Republic of China, with some important internal differences.

Mongolia shows significant initiatives in ITS, digitalization, public transport, low-emission vehicles, safety and logistics. Ulaanbaatar represents the main area of application, with traffic management systems, a Bus Management System, Automatic Fare Collection, cameras, electric buses and projects for BRT, MRT and other mass transit systems. There is also an initial development of shared mobility, through private bike-sharing and scooter-sharing services. However, the overall framework still appears to be at an early stage, and the integration of new forms of mobility into the urban system remains weak. The main gap therefore concerns the transition from experimentation and planning to full operational implementation, especially in relation to safety, accessibility, parking and the quality of road infrastructure.

The Kyrgyz Republic presents a profile strongly oriented towards the digitalization of road and freight transport, intelligent corridor management and network monitoring. E-permit systems, automatic control projects, cameras, control centers, automated tolling, vehicle weight control and information portals for the road network are present. In Bishkek, initiatives can also be identified in relation to fleet renewal, CNG buses, electric bus projects, smart traffic lights and traffic management. However, shared and active mobility, demand management and integrated urban planning remain underdeveloped. The prevailing gap is therefore the imbalance towards the technical-logistics and infrastructure dimension, compared with a still limited urban and user-centered component.

Tajikistan presents initiatives in ITS, low-emission vehicles, public transport, safety and smart logistics. The country has launched programs for electric transport, urban public transport renewal, GPS systems, automated ticketing, Safe City, a Road Asset Management System, Weigh-in-Motion, a Road Safety Observatory and the digitalization of customs procedures through ASYCUDA World and TIR EPD. However, initiatives remain partly fragmented and are not yet fully embedded within a unified smart mobility strategy. The main gap concerns the capacity for systemic implementation: priorities are clear, but their translation into a coordinated ecosystem is constrained by technical, institutional, financial and interoperability limitations.

Georgia presents a profile characterized by two main lines of action: on the one hand, the urban modernization of Tbilisi, with a SUMP, integrated ITS, public transport, active mobility, parking reform, and studies on Low Emission Zones and congestion charging; on the other, the digitalization of cross-border and logistics transport through the Maritime Single Window, Port Community System, CATS, TRACECA and NCTS. The table shows good coverage of the key aspects, but some components, such as road safety, do not emerge clearly. The prevailing gap is the lack of connection between the urban line of action and the logistics-corridor line: the country has relevant initiatives, but these are still organized along specific axes and are not yet fully integrated into a homogeneous national system.

The People’s Republic of China, within the scope analyzed in this document, presents a technologically advanced profile, especially through the case of Ürümqi. ITS, low-emission vehicles, public transport, safety, smart logistics and integration between rail, road, airport and customs infrastructure are present. However, the table highlights

more limited coverage of some urban components, such as shared mobility, cycling and walking, demand management and integrated urban planning. In the case analyzed, the gap is not technological but concerns the incomplete coverage of the more user-centered and demand management components within the urban framework considered.

1.3.3 Cluster 3 – Countries with selective development of smart mobility.

The third cluster includes countries where smart mobility is present mainly in certain specific dimensions, but not yet as an integrated system. In these cases, initiatives tend to focus on logistics, corridors, process digitalization and selected urban applications, while components related to integrated urban mobility, demand management, active and shared mobility, and user-oriented services remain less developed.

This group includes Turkmenistan. The country shows relevant initiatives in the digitalization of transport and logistics processes, the development of digital corridors, multimodal integration between road, rail and maritime transport, multimodal logistics hubs and railway modernization, particularly along the Ashgabat–Turkmen Bashi axis. Elements of innovation are also present in urban public transport, such as the purchase of modern buses equipped with GPS and supported by a mobile app, as well as the case of Arkadag, a new city designed as a smart city, with electric buses and taxis, charging stations, smart parking and traffic monitoring.

However, the diffusion of the key aspects remains more selective than in the other countries. Shared and active mobility, transport demand management and integrated urban planning are still absent or only partially present. The prevailing gap is therefore a still predominantly sectoral vision of smart mobility, focused on corridors, logistics and infrastructure modernization, but not yet fully evolved into an urban, multimodal, user-centered and data-driven system.

3. Gap analysis

Overall, CAREC countries are in an intermediate stage of smart mobility development, with several relevant initiatives already in place, although often focused on specific aspects of the transport system. Furthermore, these initiatives are unevenly distributed across countries, territories and functional areas and, above all, rarely translate into fully integrated systems.

Some components typically associated with more mature smart mobility models remain less developed, such as shared mobility, cycling and walking, transport demand management, integrated urban planning and genuinely user-centered solutions, including MaaS platforms, integrated multimodal systems and digital services built around users' needs.

Moreover, the capacity to transform sectoral interventions into a coordinated and interoperable ecosystem oriented towards common objectives of sustainability, efficiency, safety and service quality appears to be limited.

3.1 Main Gaps

The main gaps limiting the evolution of mobility systems towards more integrated, digitalized, sustainable and user-oriented smart mobility models can be defined in relation to the following aspects:

- **Systemic integration**

  In many countries, initiatives related to smart mobility are already in place, but they tend to develop as separate interventions and are not always designed within a single operational framework. This means that different solutions may improve individual segments of the system, without necessarily generating overall benefits for mobility. This development without systemic integration risks remaining a collection of isolated technological projects, rather than becoming a coordinated model for transport management.

- **Territorial scalability**

  The most advanced initiatives are often concentrated in capital cities, major urban centers or along selected strategic corridors. By contrast, secondary cities, peri-urban areas, rural territories and less central sections of national networks generally remain less covered.

  This gap is significant because it limits the real diffusion of smart mobility at national scale and risks creating two-speed systems, with some areas being highly advanced and others dependent on outdated or absent transport systems. Addressing this aspect is essential to ensure access to the transport system across the entire territory.

- **User-centric solutions**

  Many initiatives are oriented towards infrastructure, traffic management, logistics or administrative digitalization, while services directly perceived by users remain

less developed. In several contexts, tools such as integrated multimodal information, real-time journey planning, interoperable ticketing, MaaS services, accessibility for vulnerable users, and user-oriented solutions aimed at improving the convenience, reliability, accessibility and ease of use of the transport system remain limited.

This reduces the impact of smart mobility on service quality and on the attractiveness of sustainable transport. Without greater attention to users, innovations risk improving system management without significantly changing mobility behaviors.

- **Data interoperability and management**

  In many countries, digital systems, databases and information platforms exist, but these tools are often not fully interoperable. Data relating to traffic, public transport, logistics, road safety, infrastructure and customs may be collected by different entities, using different standards and with limited levels of sharing between institutions, operators and neighboring countries. As a result, there is a risk of having a rich database that is difficult to use in combination.

  Without shared, standardized and interoperable data, integrated planning, performance monitoring, real-time management and cross-border cooperation along CAREC corridors become more difficult.

- **Governance and institutional coordination**

  The development of smart mobility requires the involvement of numerous actors: ministries, municipalities, road agencies, public transport operators, customs authorities, railway operators, ports, the private sector and technology providers. In several countries, however, responsibilities are fragmented and stable coordination mechanisms between the different institutional and operational levels are not always in place.

  This barrier has a significant impact because, even where adequate technologies and investments are available, the absence of coordinated governance can slow down project implementation, generate duplication and prevent the development of integrated systems.

- **Implementation and capacity**

  In several countries, strategies, programs and projects consistent with smart mobility are in place, but their implementation is often discontinuous or limited. The difficulties relate to the availability of specialized technical skills, the capacity to prepare and manage complex projects, access to financial resources, and the ability to transform experiments or pilot projects into large-scale operational solutions.

  If this issue is not addressed, there is a risk of creating an increasing gap between planning and concrete results. Without adequate implementation capacity, even well-designed strategies risk remaining partial, slow or unsustainable over time.

- **Demand management**

  Most of the initiatives identified tend to focus on transport supply, service digitalization or infrastructure modernization. By contrast, measures aimed at directly influencing mobility demand are less evident, such as parking management, access regulation, congestion charging, Low Emission Zones, integrated pricing policies or tools to reduce dependence on private cars.

  By implementing smart mobility initiatives alone, the efficiency of the existing system can be improved, but there is a risk of not addressing some of the structural causes of congestion, emissions and inefficient use of urban space.

- **Active and shared mobility and urban sustainability**

  In several countries, walking, cycling, micromobility, bike-sharing, scooter-sharing, car-sharing and ride-sharing are still marginal, experimental or concentrated in only a few urban areas. Even where these solutions are present, they are not always efficiently integrated with transport systems.

  The limited integration of active and shared mobility reduces the possibility of creating a more sustainable and widespread transport system that is less dependent on private cars.

- **Efficiency and sustainability of freight transport**

  Freight transport is one of the most strategic areas for the CAREC region, but it continues to face challenges related to border crossing times, complex administrative procedures, limited digital interoperability between countries, fragmented logistics platforms and still incomplete integration between road, rail, ports, dry ports and terminals. In addition, the environmental dimension of freight transport, including low-emission freight vehicles, green logistics, energy optimization and emissions reduction along corridors, still appears less developed than procedural digitalization.

  The efficiency of freight corridors is central to the economic competitiveness, regional integration and Euro-Asian role of the countries. If not addressed, this gap may reduce the benefits of infrastructure investments and limit the economic development of the countries themselves.

4. WG work program proposal

The following outlines a proposed work program for the CAREC Smart Mobility Working Group, structured around distinct topics, based on the needs identified in the previous section, the interests expressed during the consultations, and the indications emerging from the analysis of the international context.

Figure 14-Identified topics

TOPIC 1 - Data interoperability and digital standards

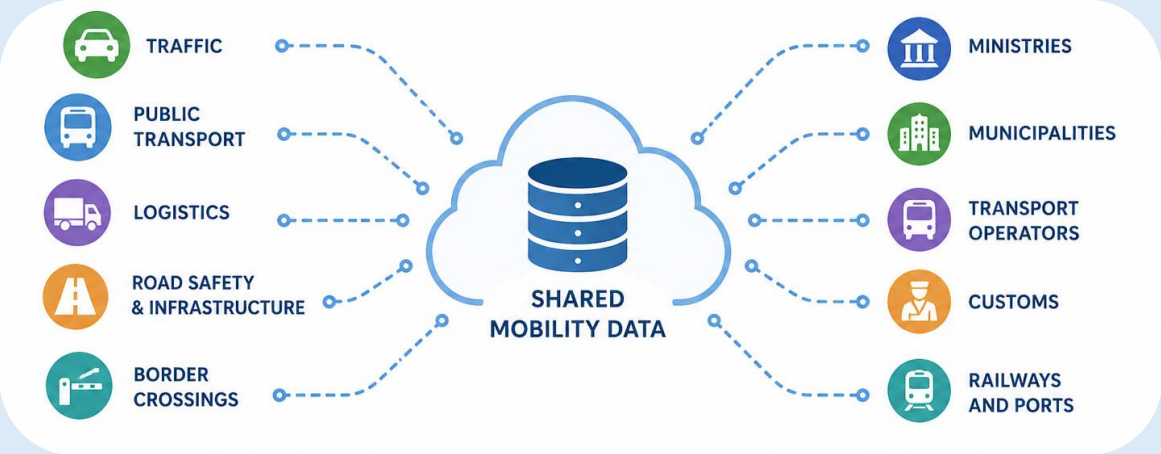
Data management is an enabling condition for any smart mobility system. In many countries, platforms, databases and digital systems already exist, but they are often not interoperable with one another. This limits the possibility of using data for planning, monitoring, real-time management and cross-border cooperation.

Objective

Promote the standardisation, sharing and interoperability of mobility data between institutions, operators and CAREC countries.

Proposed activities

- define a minimum set of regional standards for mobility data, including traffic, public transport, logistics, road safety, infrastructure and border crossings;
- prepare guidelines for data sharing between ministries, municipalities, transport operators, customs authorities, ports, railways and road agencies;
- promote common protocols for the interoperability of digital systems along CAREC corridors;
- launch a pilot project on a selected corridor to test data exchange between countries.



Expected benefits

This topic would make it possible to transform currently fragmented data into a common information base for the planning, monitoring and operational management of mobility, creating a single large database. Data interoperability would improve the capacity of CAREC countries to coordinate systems, reduce duplication and make cooperation between institutions and operators more efficient. In addition, common standards would facilitate the development of more reliable digital services for users and businesses.

TOPIC2 - Active mobility, shared mobility and first/last mile integration

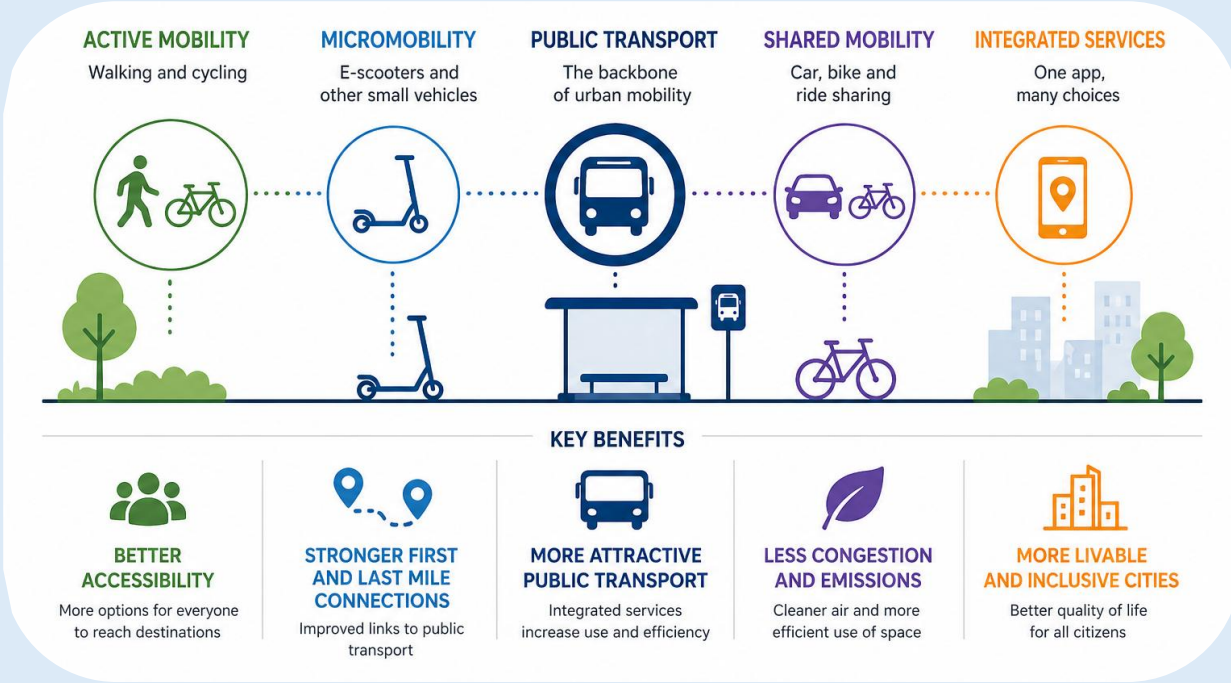
Walking, cycling, micromobility and shared services are still marginal in many CAREC countries. However, these elements are essential to improve urban accessibility, reduce car dependency and make public transport more attractive, especially for first- and last-mile trips.

Objective

Strengthen the role of active and shared mobility as an integrated component of urban smart mobility systems.

Proposed activities

- develop guidelines for safe and integrated cycling, pedestrian and micromobility infrastructure;
- identify pilot cities for the creation of first- and last-mile networks;
- define criteria for integrating bike-sharing, scooter-sharing, car-sharing and ride-sharing with public transport.



Expected benefits

The development of active and shared mobility can improve urban accessibility, strengthen first- and last-mile connections, and make public transport more attractive and competitive compared with private cars. These systems help reduce congestion, emissions and the consumption of urban space, supporting safer, more livable and more sustainable cities. In addition, these solutions can increase social inclusion by offering more accessible mobility alternatives to users who do not have access to a private car or who live in less well-served areas.

TOPIC 3 - Institutional coordination and smart mobility governance

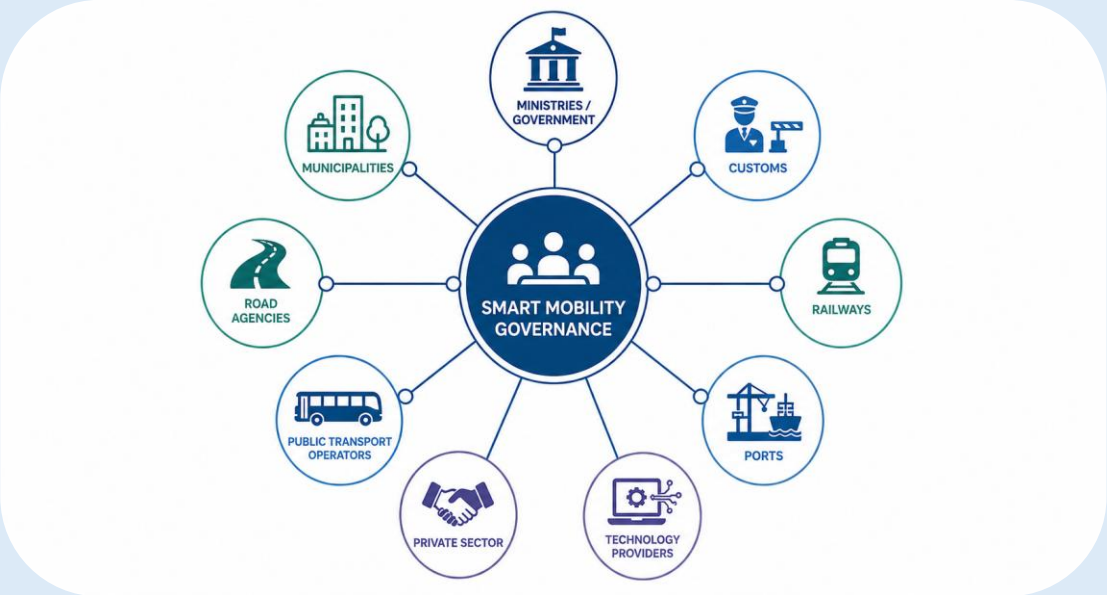
Smart mobility requires the involvement of many actors: ministries, municipalities, road agencies, public transport operators, customs authorities, railways, ports, the private sector and technology providers. Without clear coordination, there is a risk that projects may overlap, remain sector-specific or fail to scale up.

Objective

Strengthen the governance and coordination mechanisms required to design, implement and monitor smart mobility initiatives in an integrated manner.

Proposed activities

- define the roles and responsibilities of the main actors involved in the development of smart mobility;
- prepare guidance for the establishment of national or inter-institutional smart mobility working groups;
- promote cooperation agreements between urban authorities, national agencies and logistics operators;
- develop tools for monitoring implementation, such as dashboards, common indicators and periodic reports.



Expected benefits

Strengthening governance and institutional coordination would improve coherence between policies, projects and investments, reducing duplication and fragmentation. It would also help accelerate the transition from planning to implementation, facilitate the development of integrated projects, strengthen interoperability between systems and improve the monitoring of results through common indicators and shared tools.

TOPIC 4 - Smart and integrated public transport

Public transport is one of the most recurrent areas within smart mobility initiatives in CAREC countries, with interventions relating to fleet renewal, electronic ticketing, GPS, real-time information, BRT, metro, tram and modernized bus services. However, these initiatives do not always translate into fully integrated, accessible, reliable and attractive systems for users.

Objective

Strengthen the role of public transport as a backbone of smart mobility by improving service quality, modal integration, accessibility, operational management and its ability to attract demand away from private mobility.

Proposed activities

- develop guidelines for the modernization of urban and regional public transport;
- promote digital service management systems, smart ticketing and real-time information;
- identify pilot cities, including secondary cities, to test intelligent and scalable public transport models;
- develop common indicators to measure reliability, frequency, punctuality, accessibility, territorial coverage and user satisfaction.

Expected benefits

Strengthening public transport would improve the quality, reliability and accessibility of mobility services, making them more attractive and competitive compared with private cars. It would also support better modal integration, more efficient operational management and more consistent monitoring of service performance through common indicators and shared tools.

TOPIC 5 - Low-emission mobility and clean vehicle transition

The transition towards low-emission vehicles is under way in many CAREC countries, particularly through electric or CNG buses, incentives for electric vehicles, charging stations and fleet renewal programmes. However, these initiatives are often concentrated in a few cities or limited to pilot projects. In several contexts, an integrated approach linking vehicles, charging infrastructure, the electricity grid, financial models, maintenance and operational capacity is still lacking.

Objective

Support the transition towards low-emission mobility fleets and services, promoting solutions that are technically sustainable, financially feasible and scalable across different urban, interurban and logistics contexts in the CAREC region.

Proposed activities

- prepare guidelines for planning the transition towards electric, CNG, hybrid or other low-emission fleets;
- support the definition of charging and refuelling infrastructure plans, taking into account expected demand, location, electricity grid capacity and operational needs;
- define criteria for extending low-emission fleets to secondary cities;
- promote financial and contractual models for fleet renewal, including leasing, PPPs, service contracts and climate finance mechanisms.

Expected benefits

The development of low-emission mobility would contribute to reducing greenhouse gas emissions and local pollution, improving air quality, especially in the most congested urban areas. In addition, integrated planning of vehicles, infrastructure and operational needs would improve fleet efficiency and support more sustainable investment decisions in the medium to long term.

TOPIC 6 - Smart and green freight corridors

Freight transport is central to the CAREC region, but it continues to be affected by border-crossing times, complex procedures, limited digital interoperability and not always complete integration between road, rail, ports, dry ports and terminals.

Objective

Improve the efficiency, interoperability and sustainability of CAREC freight corridors through digital, intermodal and green logistics solutions.

Proposed activities

- promote a CAREC programme for digital freight corridors, based on cross-border data exchange, e-documents, freight tracking and customs interoperability;
- define common indicators to measure border-crossing times, reliability, costs, emissions and corridor performance;
- introduce a green freight component, with measures on low-emission freight vehicles, modal shift, load optimisation, energy efficiency and emissions reduction along the corridors.

Expected benefits

The digitalization of documents, cross-border data exchange and interoperability between customs and logistics systems can reduce border-crossing times, simplify procedures and improve freight traceability. Greater integration between road, rail, ports, dry ports and terminals can also support more efficient intermodal solutions, reducing costs and inefficiencies.

Finally, the introduction of a green freight component would link logistics modernization with sustainability objectives by promoting low-emission vehicles, modal shift, load optimization and energy efficiency.

TOPIC 7 - Smart mobility for secondary cities, rural and non-central areas

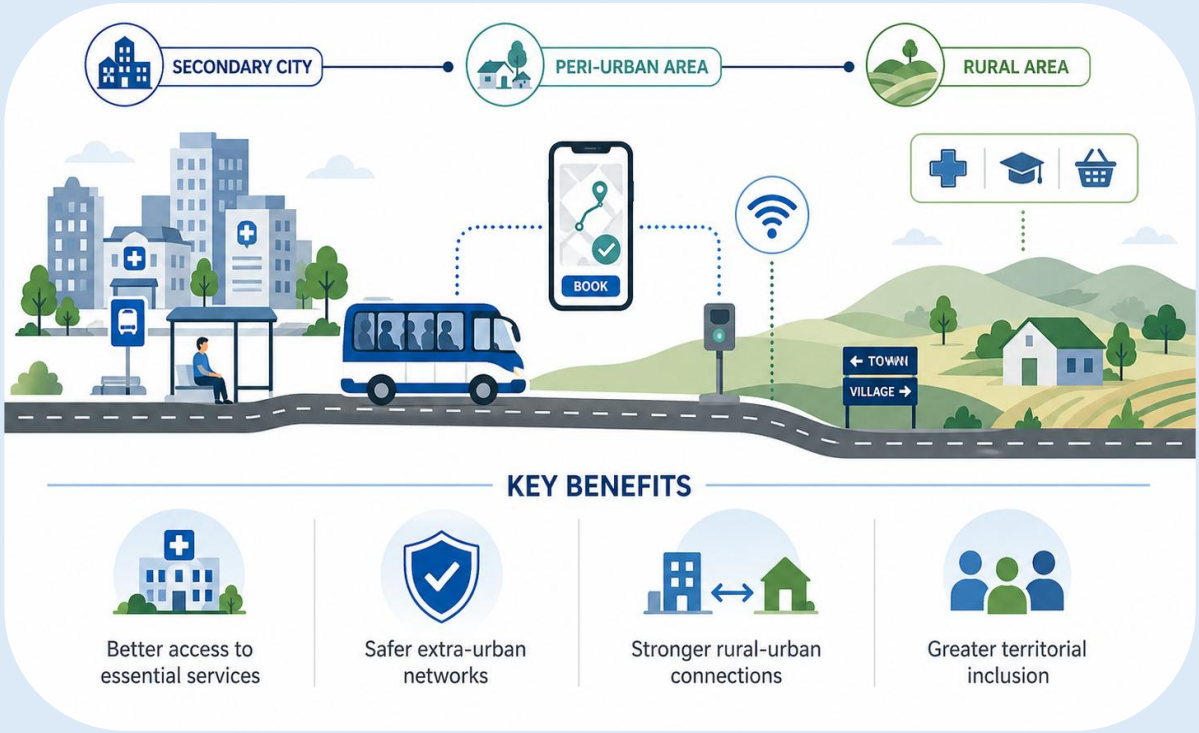
A significant share of smart mobility initiatives in CAREC countries tends to be concentrated in capitals, major urban nodes or along the most important strategic corridors. This approach makes it possible to intervene where mobility demand is highest, but risks leaving secondary cities, peri-urban areas, rural territories and less central sections of national networks less well covered.

Objective

Promote the development of smart mobility solutions that are scalable and appropriate for secondary cities, rural areas, peri-urban territories and interurban corridors, improving access to services, safety, territorial connectivity and social inclusion.

Proposed activities

- develop guidelines for the application of smart mobility in low-density contexts, distinguishing between secondary cities, peri-urban areas, rural areas and interurban corridors;
- support pilot projects.



Expected benefits

Extending smart mobility solutions to less central areas can improve access to essential services, reduce territorial isolation, increase safety on interurban networks, strengthen connections between rural areas and markets, and ensure a more equitable distribution of the benefits arising from the modernization of the transport system.

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