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Smart mobility in GCC cities

Fast track to the future

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EXECUTIVE SUMMARY

Cities in the Gulf Cooperation Council (GCC)[1] currently face challenges of urban congestion, traffic safety, and accessibility for underserved populations. Fortunately, radical disruption in the global transportation industry is providing them with an opportunity to catch up and even leapfrog other urban areas. The emergence of smart mobility — the use of technology to create urban transportation networks that are far more efficient, sustainable, and data-enabled — can improve residents' quality of life and promote economic growth. Governments can use smart mobility to reduce traffic congestion, increase road safety, improve the environment, and make transportation more accessible and affordable.

Several GCC governments have already incorporated smart mobility into their urban planning for cities in development, as have cities in other countries. Most other city authorities in the GCC are further behind in assessing the options. However, all cities in the region need to understand the scope of the technology available and use a structured, holistic, and realistic agenda to assess and implement it.

Rather than just investing in roads and public transit systems, governments need to consider all aspects of smart mobility, including the user experience, transportation modes currently in use, more advanced solutions still in development, data and technology, infrastructure, and governance and regulation.

Once they have such a comprehensive approach as a foundation, governments need a three-part implementation framework:

- Establish a policy and strategy for smart mobility
- Develop an institutional and regulatory framework
- Collaborate through partnerships and platforms

Although still in the early stages of development, smart mobility has already changed the way people, goods, and services move. Used correctly, it can reshape cities and transform society.

A NEED FOR SMARTER URBAN TRANSPORT

City authorities in the GCC have made considerable investments in the mobility sector. However, they have more to do to meet residents' needs and to lower the currently high congestion, accident rates, and air pollution.

In general, the transport sector is estimated to be responsible for up to 50 percent of particulate emissions in developing countries — compared to about 30 percent in developed countries — mostly due to diesel traffic.[2] The lower usage of public transport is the main contributing factor to poor transportation outcomes. For example, people use public transport for 17.5 percent of daily trips in Dubai, an estimated half that in Riyadh, 4.9 percent in Abu Dhabi, and an even smaller proportion in other major GCC cities, as compared to 59 percent in New York, 33 percent in Tokyo, or 37 percent in London.[3]

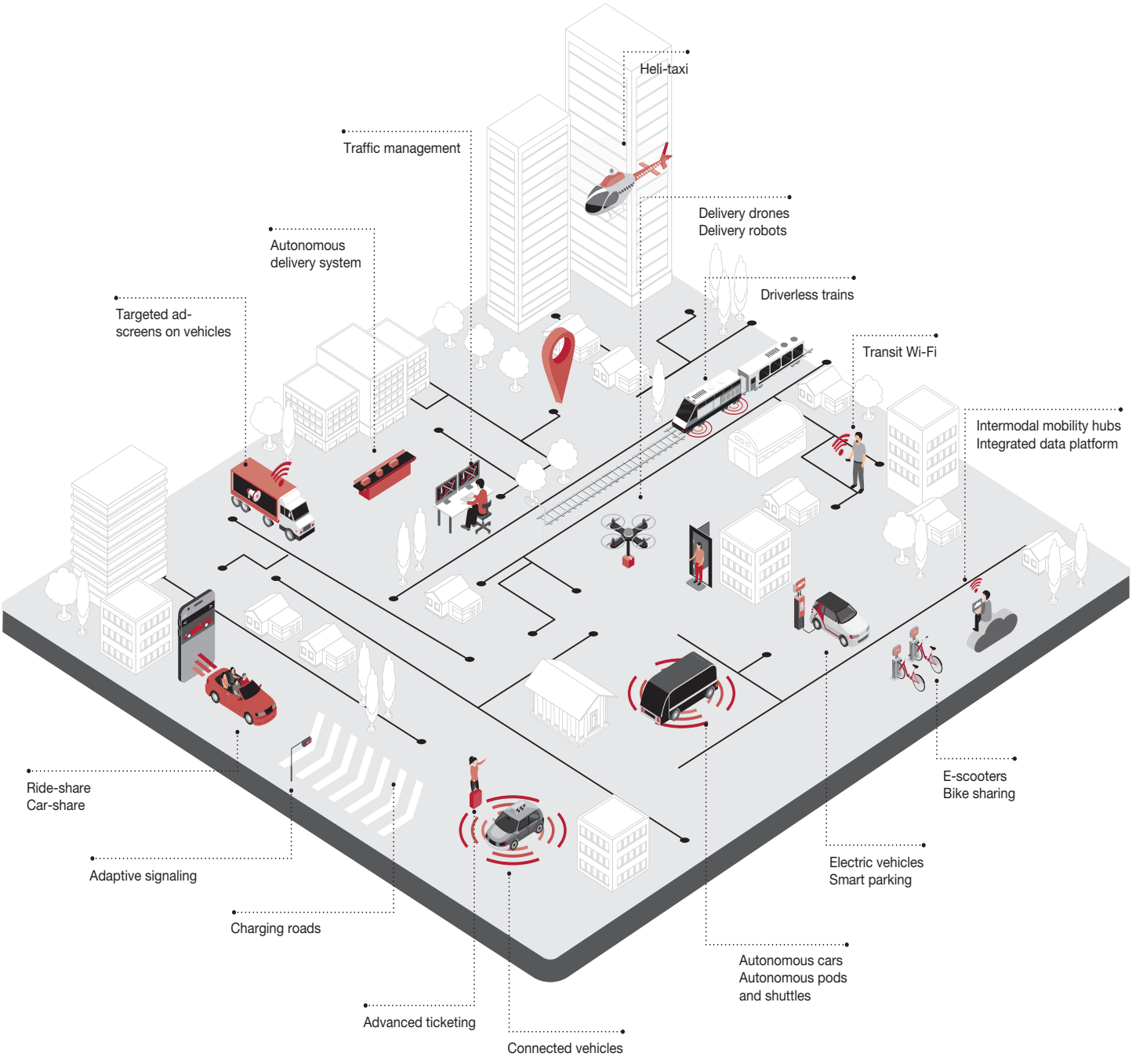
Population growth and increased urbanization in the region will only exacerbate these problems, with growing economic, environmental, and health impacts. Given the scope of the challenges, simply investing in more roads, bridges, and other traditional infrastructure will not be enough. Instead, governments need to rethink their approach to transportation and focus on smart mobility.

Smart mobility uses innovative digital technologies and solutions to create open and connected transportation networks that can move people and freight more efficiently and sustainably than in the past. By making vehicles and transportation infrastructure technology-enabled and data-informed, smart mobility has the potential to transform society.

In the future, city transportation will be a linked network of autonomous vehicles (some electric-powered), shared-mobility solutions, adaptive traffic signals that can sense current conditions and adjust to improve traffic flows, micromobility options (e.g. e-scooters and bikes), and even airborne taxis (heli-taxis). These will work together to create a faster, more sustainable, and more efficient system. Vehicles will communicate with each other and with infrastructure. People will have a much wider range of options for getting around (*see Exhibit 1*).

EXHIBIT 1

Smart mobility technologies



Source: Strategy&

PROJECTS UNDER WAY IN THE GCC

Some cities in the GCC are already incorporating smart mobility into their urban planning. Saudi Arabia and the United Arab Emirates will invest nearly US$50 billion in smart city projects through 2025 according to Frost & Sullivan, and most of the smart city projects in the GCC have a distinct focus on mobility for residents.[4]

In Saudi Arabia, the NEOM megacity project recently announced plans to develop the world's most user-centric, environmentally friendly, and technologically advanced land mobility ecosystem. NEOM will prioritize active, autonomous, electric, shared, and smart mobility options. Similarly, Dubai's strategy for smart vehicles aims to convert 25 percent of total journeys to various types of driverless options by 2030. Qatar, in line with its Vision 2030 and its preparations to host the FIFA World Cup in 2022, is investing in capabilities to improve sustainable and smart public transportation options.

Other cities are taking smaller steps and generating notable progress. Besides investing in a multibillion-dollar public transit project with driverless trains, Riyadh has already invested in a multimillion-dollar, artificial intelligence-based adaptive signaling project, which has had a significant impact on day-to-day traffic management. Muscat has implemented smart road technology to manage traffic. Abu Dhabi's environmentally friendly Masdar City now has a self-driving shuttle service and partnerships with several e-scooter providers, and Kuwait is applying an intelligent traffic control system for overcrowded intersections.

Some city authorities in other countries are further along in the use of smart mobility technology. London exploits vast amounts of data about how people move across its transportation network to better manage traffic throughout the city. A central system pulls data from 9,200 buses, 6,000 traffic signals, and 1,400 cameras, and adjusts signals to improve vehicle flows.[5] New York City is piloting connected vehicle-to-vehicle and vehicle-to-infrastructure technology to improve the safety of travelers and pedestrians through deployments in Manhattan and Brooklyn.[6] Cities like Tokyo, Phoenix, and Singapore have all successfully tested autonomous taxis.[7]

Applying smart mobility on a wider scale across the GCC will lead to broader benefits in several areas:

- **Safer roads.** Vehicle automation (either full or partial) and better safety technology can reduce the number of traffic accidents, leading to fewer roadway fatalities and injuries.

- **Less traffic.** Smart mobility can move vehicles and people more efficiently over existing roadway networks with less congestion. It can also provide people with alternative options such as shared rides, scooters, bicycles, or mass transit, leading to reduced travel times.

- **Cleaner environment.** Smart mobility can lead to a reduction in negative environmental effects of the transportation sector by providing travelers and transportation system operators with more environmentally friendly options.

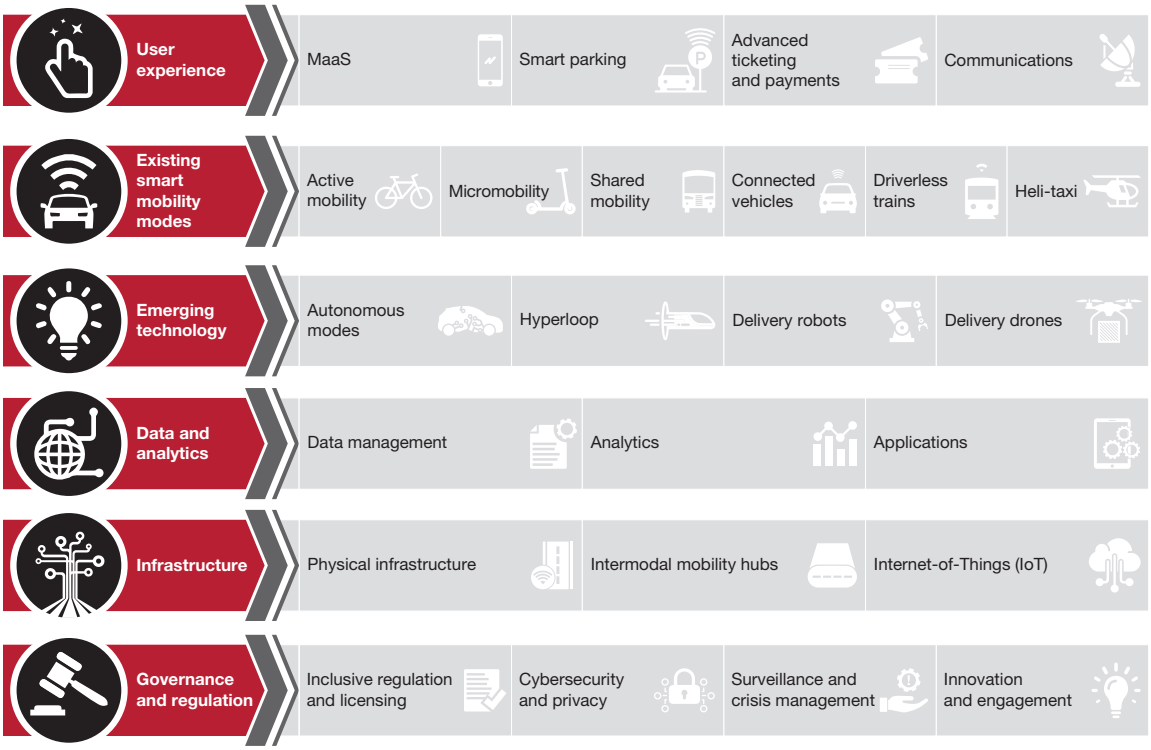
- **More effective workforce.** Reinventing mobility will have an important effect on the workforce. Some households will be able to move closer to urban areas (and dispose of private vehicles), increasing their employment prospects and options. Others that choose to move farther away from urban centers can do so as travel times decrease and as autonomous vehicles and other transit options allow commuters to be productive while traveling.

THE SMART MOBILITY ECOSYSTEM

As mobility technologies are developing rapidly, technology investments will be only a stepping stone. Most important, GCC governments need a comprehensive approach that factors in the entire transportation ecosystem, which consists of six elements (*see Exhibit 2*).

EXHIBIT 2

The smart mobility ecosystem has six elements



Note: MaaS = Mobility-as-a-Service
Source: Strategy&

User experience

There is a significant opportunity to improve the transportation experience. Too often it can be unpleasant, whether sitting in traffic, waiting for a bus, or trying to find a parking space. Governments can prioritize the user experience as a means of generating early momentum because it is the "people-facing" aspect of a transportation system. The ubiquity of smart phones and mobility apps, along with the availability and processing of real-time information and widespread data connectivity and communications, enable new mobility solutions that can reduce, or eliminate, some of the difficulties that citizens encounter from transportation.

Mobility options should become more flexible and convenient. This can include ride-sourcing, demand-responsive bus services, and smart parking garages that sense available spaces and provide directions to them. Similarly, integrated "mobility-as-a-service" (MaaS) solutions are revolutionizing the way people get around and could shift an increasing amount of existing travel demand in cities from personally owned vehicles to demand-responsive services. MaaS combines public transit and other shared mobility services through a single user-centric interface, allowing users to plan and pay for a journey across a city using multiple modes of transportation.

Existing smart mobility modes

Already, urban residents have far more efficient transportation options than they did a few years ago, including shared bikes and scooters, car-sharing and ride-sharing services, connected vehicles, electric vehicles, and autonomous mass transit. Technology and digitization are increasingly allowing cities to fully integrate such modes through a single interface.

Emerging technology

As technologies advance, new mobility solutions are emerging. For example, automated vehicles that can reduce driver errors and accidents are nearly market-ready. Similarly, some cities are testing urban freight delivery options such as robots and drones. All of these have the potential to significantly disrupt transportation networks and communities. More futuristic examples for inter-city travel are the hyperloop tunnels being developed by several companies, with the goal of moving people at speeds exceeding 1,000 kilometers/hour.

Data and analytics

The smart mobility ecosystem generates large amounts of data from increasingly connected vehicles, transit fleets, traffic management centers, mobile devices, users, agencies, and smart infrastructure. In the age of artificial intelligence and predictive analytics, national governments and city authorities require innovative ways to collect, transmit, sort, store, share, analyze, and visualize data so they can more effectively manage transportation systems. Data streams could feed into citywide integrated command and control centers. The right approach to data and analytics can spur economic growth, via governments sharing data and application processing interfaces (APIs) for developers to create new solutions and tools.

Infrastructure

An important element of the value chain for smart mobility is a city's investment in intelligent infrastructure, including pavement markings, signage, signals, and other aspects that can gather information and communicate both with vehicles and with centralized management hubs. Accordingly, transport infrastructure should be designed to accommodate and adapt to new developments like sensing, taking advantage of the latest fiber optics, and 5G technology. Moreover, some smart mobility solutions do not require fully replacing existing infrastructure but merely upgrading it. For example, reimagining roadway configurations allows a city to accommodate more travelers on its current network of roads, without requiring costly additions or expansions.

Governance and regulation

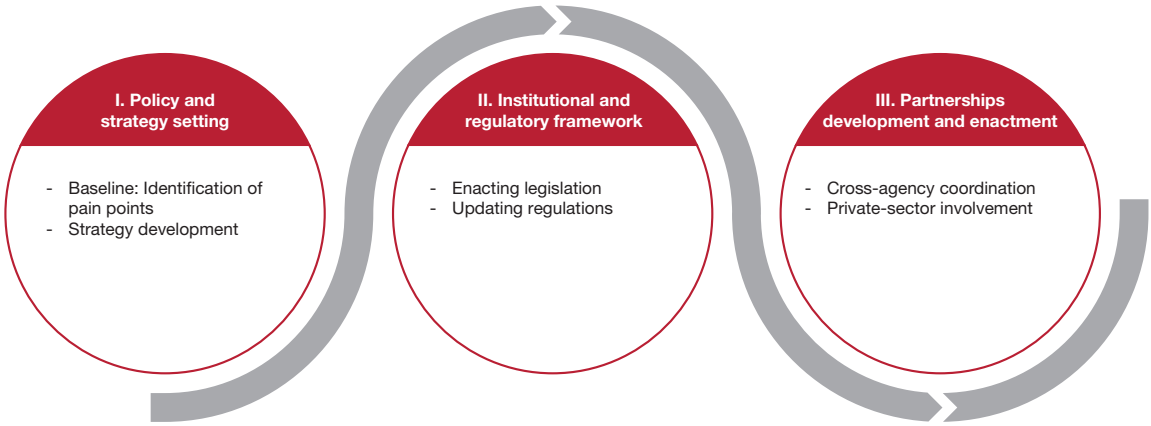
Smart mobility requires an appropriate governance framework and regulations, both of which demand legislative action and involvement from multiple jurisdictions. The rapid pace of technological development means that ministries and city authorities have to coordinate governance across disciplines and institutions to ensure that new solutions and business models are fair, accessible, equitable, and sustainable. Broadly, national entities should spearhead the development of nationwide policies, while city-level entities should develop realistic smart mobility agendas that address the unique transportation problems of their city. Similarly, national governments should establish standards, such as intelligent transport system architectures, so that systems from different providers can operate and communicate with each other.

On the regulatory front, governments need to craft a flexible, inclusive, and responsive set of regulations to support smart mobility. For example, many governments will need to revamp the way they license and regulate vehicles to accommodate smart technologies. Cybersecurity, data privacy, and physical security issues are other focal areas, in addition to the legal and liability concerns of current mobility services and how these might develop or change with increasing integration of new mobility concepts. Only this kind of comprehensive approach will provide confidence among the private sector (original equipment manufacturers, service providers, and other entities) and encourage them to engage in the smart mobility revolution.

AN IMPLEMENTATION FRAMEWORK FOR GCC CITIES — THE WAY FORWARD

To reap the benefits of smart mobility, and avoid or mitigate the problems, GCC authorities need to learn to manage a fast-moving set of technologies, solutions, and providers. They can master the smart mobility ecosystem through a three-step approach (*see Exhibit 3*).

EXHIBIT 3
Three steps to promote a smart mobility agenda



Source: Strategy&

1. Establish a holistic policy and strategy for smart mobility

City authorities should conduct a thorough assessment of their current mobility challenges to identify the most urgent problems and pain points. Problems can be categorized in different ways, but most fall into one of several main categories: safety, mobility, accessibility, and environmental sustainability. For example, some cities may have frequent car accidents on certain roads, while others may see unacceptable traffic congestion during specific times of day, or they may lack first- and last-mile connections to transit stations from underserved neighborhoods.

City authorities need to quantify all problems through documented data, statistics, and performance measures. They should also identify and better understand problems by engaging stakeholders such as transport-related entities (public transit operators, police departments) or residents (commuters in specific problem areas). These stakeholders will ultimately be the "customers" for any solution, so they should be involved from the earliest stages.

Next, city authorities need to establish broad policies for the deployment of smart mobility technologies. These policies can be part of a broader national transportation vision or, in the absence of a national plan, they can become a building block for GCC governments to begin developing such a vision.

In either case, national and city authorities need to start making important decisions about the development and deployment of constantly evolving smart mobility technologies. These decisions include a commitment to funding and deploying smart technologies and making related improvements to infrastructure. Smart mobility policies also need to address issues such as privacy, data security, and standardized communications.

With key problems identified and overarching policies in place, city authorities can begin to develop a city-specific strategy to implement smart mobility solutions to solve their most urgent problems. Take, for example, the following problem areas and potential solutions:

- **Unsafe roads:** Governments can deploy connected vehicle applications that provide alerts and warnings to drivers, to reduce the frequency and severity of accidents.

- **Inaccessible transit options for residents in underserved areas:** City authorities can partner with a ride-sourcing company to provide low-cost, on-demand mobility solutions for communities that have no public transportation service.

- **Traffic congestion and high emissions during peak travel times:** Schemes can incentivize drivers to share rides, for example through higher road tolls for single-occupancy vehicles. They can also encourage people to take public transportation through lower fares during peak hours, which will reduce traffic congestion and lower auto emissions.

- **Inefficient parking:** Smart parking solutions can improve the utilization of existing parking facilities, reducing the need for additional parking structures. They help reduce congestion by eliminating the often-frustrating search for parking spots. They can also discourage private vehicle travel through schemes that offer free curbside spaces for other mobility solutions like vehicle- or ride-sharing.

- **Reduced mobility and productivity:** Deploying signals that adapt to real-time traffic conditions by using traffic analytics decreases wait times at busy signalized intersections, reduces congestion on roads in city centers, and thus increases overall productivity.

Once the relevant smart mobility strategy is in place, authorities should develop a realistic implementation plan with clear time lines, anticipated costs and benefits, responsible entities, and target beneficiaries. Proactive performance management, or gauging the impact of new technologies, is a critical aspect of implementation. The plan should include a list of metrics to be computed and tracked before, during, and after the deployment of any mobility solution.

Above all, the strategic planning process should be agile and repetitive in nature, to ensure that authorities can continue to adapt to new challenges and new technologies as they emerge.

2. Develop an institutional and regulatory framework

Authorities need to develop an institutional and regulatory framework that corresponds to their mobility policy and strategy. At a high level, the institutional and regulatory framework ensures that public agencies are prepared to deploy smart mobility systems for an array of possible scenarios. More specifically, it identifies the various players that are responsible for and perform specific actions to implement smart mobility solutions, along with any institutional changes needed. It covers the full spectrum of transportation modes, their assets, and their owners and operators within a city.

In addition, the framework encompasses any legislation or regulations required to support the adoption of smart mobility solutions. Such rules include setting parameters for common standards, creating open platforms, allowing for modular systems that can expand, and openness to new technologies.

Governments will need legislative changes for large-scale solutions, such as allowing autonomous vehicles on the road or enabling MaaS apps. However, given the rapidly developing mobility landscape, regulatory updates can allow governments to more frequently address operational, equity, and infrastructure considerations of new market entrants and technological changes.

3. Collaborate through partnerships and platforms

Planning, developing, and implementing smart mobility solutions calls for cooperation by a wide range of entities in the public sector (other authorities and ministries), the private sector (technology firms, service providers, and professional organizations), and academic institutions.

Within the public sector itself, various agencies must collaborate on smart mobility solutions. For example, a system to give priority signals at intersections to certain vehicles, such as connected city buses, would require close coordination between the public transit operator and the infrastructure operator, such as through a traffic management center. Other types of solutions call for a similar collaboration among city authorities, transportation departments, transit operators, toll road authorities, police departments, and other transportation-related entities.

Regarding the private sector, a wide range of players are developing smart mobility technologies and applications, from auto manufacturers and suppliers to technology firms. GCC cities should pursue public–private partnerships with these companies via innovative business models that combine private-sector expertise and public-sector funding, market access, and incentives. Such partnerships can yield significant economic benefits.

For example, cities worldwide have managed to provide more commuting solutions within busy urban centers by encouraging micromobility solutions. These have involved partnerships with private bike-sharing or e-scooter companies. Partnering with innovative mobility providers will allow GCC cities to transform urban mobility with minimal infrastructure disruptions or changes.

Similarly, public–private collaboration will be needed in any area where privately owned vehicles need to integrate with public infrastructure. For example, vehicle-to-infrastructure connectivity allows cars to communicate directly with traffic signals, toll booths, and other fixed elements of a city's transportation network. Governments can also partner with private firms such as logistics and delivery companies and private taxi operators to support pilot tests of the equipment, overcoming initial recruitment barriers and allowing early-stage technologies to be deployed at a faster pace. On the data front, a partnership that provides the private sector with open API platforms can be a major catalyst for innovative business models and job creation.

Last, GCC governments should take active steps to foster innovation. They should create platforms that link private companies, academic institutions, and other experts to cultivate an ecosystem based on knowledge sharing and technology-transfer initiatives. This approach would also support prototyping and testing of new concepts at a smaller scale — a good strategy to minimize risk and consider the widest range of ideas to improve transportation.

To succeed across all of these partnerships and platforms, and to structure meaningful collaboration, governments will need to upgrade their internal technical expertise and capabilities. They cannot simply outsource the entire concept of smart mobility to external entities. Instead, they will need to make a concerted effort to stay abreast of new technologies and understand what is currently in development.

CONCLUSION

Worldwide, the transportation sector is going through the most significant revolution since the development of cars more than a century ago. Even more than other parts of the world, GCC cities are ripe for the benefits of smart mobility. Capitalizing on these technologies requires a structured approach, with the rewards more than justifying the effort.

ENDNOTES

1. The GCC countries are Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates.

2. World Health Organization, Air Pollution (https://www.who.int/sustainable-development/transport/health-risks/air-pollution/en/).

3. Dubai: Khaleej Times, "Revealed: Dubai's most popular public transport; 589 million commuters in 2018" March 2, 2019 (https://www.khaleejtimes.com/news/transport/revealed-dubais-most-popular-public-transport-589-million-commuters-in-2018). Abu Dhabi, Tokyo: 2015 (Union Internationale des Transports Publics, Public Transportation Data). Paris: "AllTransitTM Rankings" (https://alltransit.cnt.org/rankings/). London: Mayor of London, "Travel in London: Report 11," Transport for London 2018 (http://content.tfl.gov.uk/travel-in-london-report-11.pdf).

4. Aarti Nagraj, "Smart cities: Is the GCC seeing the transformation?," *Gulf Business*, October 7, 2017.

5. Ryan Sweeney, "Opening data fully to improve London's transport network," Intelligent Transport, February 26, 2018 (https://www.intelligenttransport.com/transport-articles/65404/opening-data-full-capacity-transport/).

6. U.S. Department of Transportation, ITS Joint Program Office, Connected Vehicle Pilot Deployment Program.

7. Multiple sources from autonomous vehicles companies and operators: ZMP & Hinomaru Kotsu (Tokyo); Waymo (Phoenix); NuTonomy, now part of Delphi (Singapore).

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