



Technology and Innovation for Developing Land Transport in Arab countries



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Economic and Social Commission for Western Asia

Technology and Innovation for Developing Land Transport in Arab countries



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Contents

1	Background	04
	A. Relationship between technology and the transport sector	05
	B. Digital technology for developing land transport	07
	C. Examples from the Arab region	09
	D. Challenges of applying technology solutions	10
2	Status of Technology and Innovation in Land Transport in the Arab Region	12

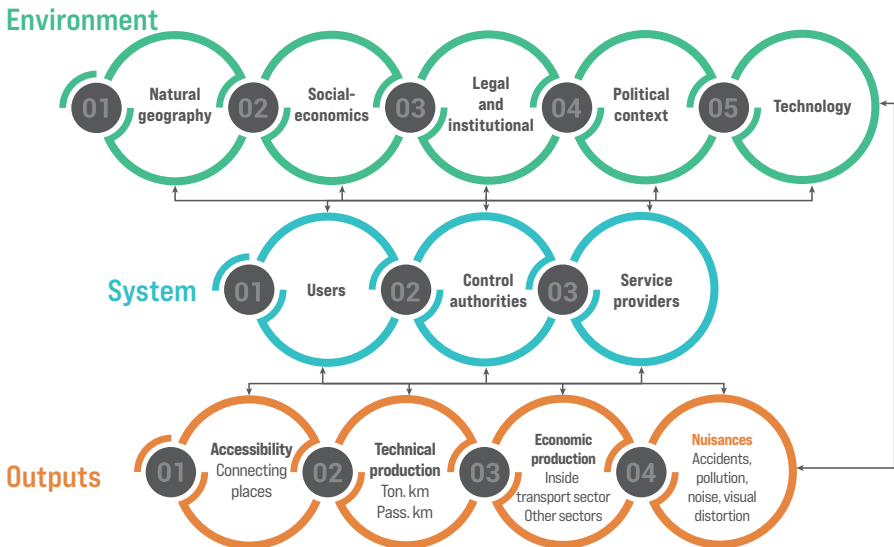
1. Background



Through the ages, innovations and technological inventions have triggered structural transformations in the performance of the transport system and the wider framework of its surrounding environment. The current exponential progress in technology, the variety of new technologies, and the emerging innovative solutions are expected to change land transport in terms of its structure and labour force, mobility of people, and movement of goods.

Transport services and activities are the results of complicated interactions between many exogenous and endogenous factors. Figure 1 highlights the relationships between the various elements that constitute the transport system's environment, the mutual effects between the system and its environment, and the role of these relationships and effects in determining the development features of the system. Therefore, the planning and management of transport issues requires the application of an appropriate 'systems approach' that takes into accounts the complex interactions of these factors.

Figure 1. Conceptual framework of the transport system



Source: Shalom Reichman, *Les Transports: Servitudes ou Liberté* (Paris, Presses Universitaires de France, 1983).

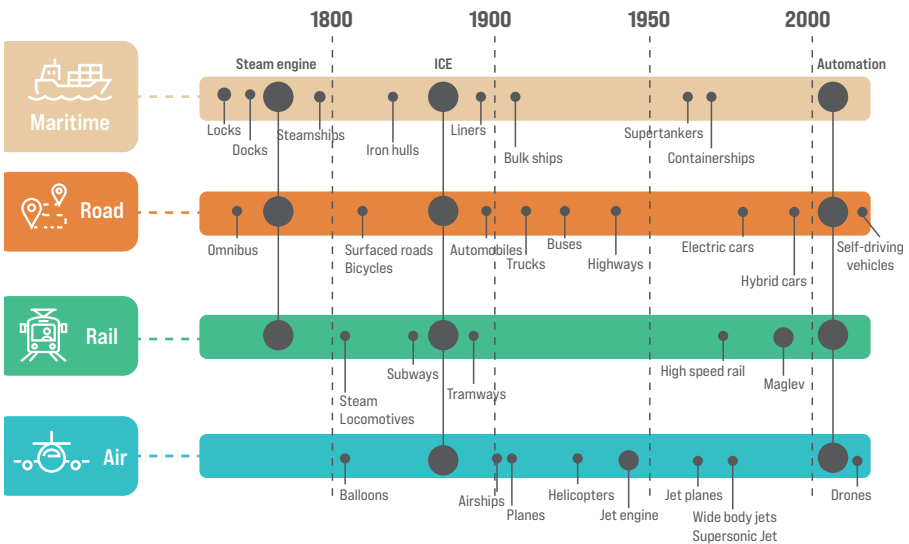


A. Relationship between technology and the transport sector

A historical perspective on the evolution of transport systems underlines the impact of technological innovations in introducing deep and structural transformations to transport systems worldwide. Current transport systems are therefore the outcome of a long evolution, marked by periods of rapid changes where new technologies emerged. The invention of the wheel is an example of a key invention/innovation, along with the structural transformations it introduced to the transport system and subsequent impact on the societies and economies. After thousands of years, land transport globally is still largely dominated by the wheel, which is considered the most famous invention that revolutionized transport.

Many innovations followed the wheel in transforming transport, including the sail, steam engine, combustion engine, aviation, and containerization. Figure 2 shows the main evolution of transport technology since the eighteenth century.

Figure 2. Evolution of transport technology since the eighteenth century



Source: J. Rodrigue, *The Geography of Transport Systems* (New York, Routledge, 2020).



Benefits of integrating technology in land transport:



Improved traveller experience, mainly through accurate, live information on timings and road conditions;



Improved monitoring of the status of infrastructure to arrange for maintenance of roads, railroads and public transportation vehicles;



Increased safety by tracking speeds and heavy braking, and reporting on accidents and emergencies;



Reduced supply chain inefficiencies, improvement in demand-supply matching, and increased connectivity and visibility across systems;



Improved energy efficiency through reduced congestion and energy, resulting in reduced greenhouse gas emissions.

Technology for developing land transport and links to SDGs

Improved traveller experience	SDG 8 (8.1)
Improved energy efficiency	SDG 9 (9.4), SDG 13 (13.2)
Better operational performance	SDG 7 (7.a, 7.b), SDG 9 (9.1)
Increased safety	SDG 3 (3.6), SDG 11 (11.2)



B. Digital technology for developing land transport

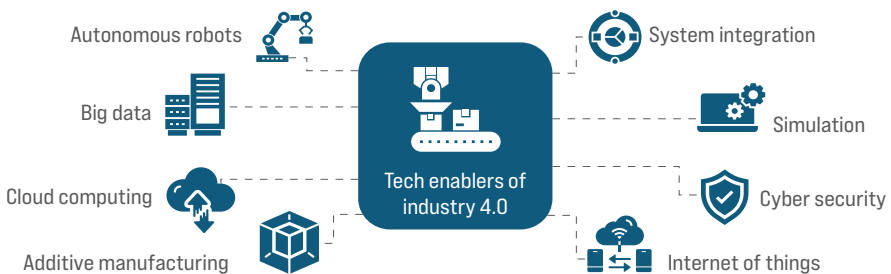
In the last two decades, information and communication technology (ICT) has introduced new solutions for increasing energy efficiency, reducing greenhouse gas emissions, and reorganizing traditional processes in different sectors, including the transport and logistics sectors.

ICT systems have fostered the efficient use of devices in infrastructure to regulate and manage vehicular traffic, have adopted emerging and novel technologies for collecting and processing data, and disseminated them in the form of useful information for passengers and travellers. The application of ICT to transportation systems has enhanced services and required the adoption of new models and resources.

Today, the most important technologies for land transport are:

- Internet and connectivity infrastructure;
- Internet of Things (IoT) and its applications;
- Open data;
- Big data;
- Cloud computing;
- Global positioning systems;
- Mobile applications.

Figure 3. Enablers of the Fourth Industrial Revolution






Source: Klaus Schwab, The Fourth Industrial Revolution (London, Penguin Books, 2016).



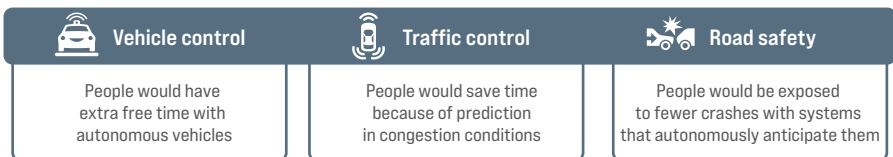
It has been demonstrated that well-developed digital infrastructure is crucial to facilitating the use of technologies for land transport, including Internet of Things, big data, open data, cloud computing and artificial intelligence (AI), since these technologies facilitate the provision of practical services.

There are many technological applications in land transport for the following:

-  Management of freight, including transportation management systems, telematics, and fleet management systems;
-  Management of traffic and infrastructure, including geofencing, electronic toll services, and intelligent transport systems;
-  Management of passengers, including mobility as a service, mobility on demand, and dynamic ride sharing.

“
A variety of technological applications are widely used today for the management of freight, traffic, infrastructure and passengers. These applications improve efficiency, safety and mobility of people, and reduce costs. Arab countries should consider these technologies given their benefits for improving land transport.
 ”

Figure 4. Artificial intelligence uses in transport



Source: Compiled by ESCWA.

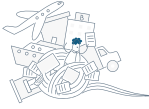


C. Examples from the Arab region

Kuwait: Public buses

Citybus is the largest public transport operator in Kuwait. In early 2020, it reported measurable improvements in bus utilization, with passenger journeys up by 12 per cent in one year following the deployment of a smart IoT-based system. Around 85 per cent of the fleet's busses have been fitted with IoT technology, which generates data that is analysed in a smart mobility software platform. The system supports control, decision-making and planning. It also provides passengers with real-time information, thus improving customer satisfaction.





Smart Traffic System Project in Dubai

In 2018, the Road and Traffic Authority of Dubai launched a \$160 million project for expanding the smart traffic system in the city. The project intends to increase system coverage from 11 per cent of Dubai's roads to 60 per cent. Its objective is to reduce congestion, optimize accident detection and response, improve safety, and enhance personal mobility. The system is based on a number of technologies, including IoT and entails implementing the following five bundles of technologies: cameras, devices and sensors; dynamic road information signs; infrastructural installations; traffic support software system for decision-making and automated response; and a traffic control centre. By August 2019, the project had reached a 65 per cent implementation rate.



D. Challenges of applying technology solutions

There are many challenges facing the application of technology in land transport and other sectors, including the following:

- **Security and privacy concerns:** Technology solutions may cause security and privacy concerns. Areas of privacy concerns arising from IoT deployment, for instance, include unauthorized surveillance, uncontrolled data generation and use, and information security risks. Solid cybersecurity frameworks are needed to tackle this challenge;
- **Regulatory environment:** Emerging technologies such as AI, big data, cloud computing and IoT are creating new ways for consumers to interact; however, they are also disrupting traditional business models. Governments must be willing and able to create, modify, and enforce regulations in line with the new technologies;



- **Allocation of budgets:** Automation require the allocation of major budgets for the deployment of city-wide wireless networks and/or 3G/4G cellular networks, and to equip transport vehicles adequately with GPS receivers, mobile connectivity, and IoT sensors, among other things;
- **Digital skills:** The application of emerging technologies requires high-level digital skills and an entire ecosystem for innovation and entrepreneurship;
- **Availability of data:** Governments have a special role in making data related to transport available for general use and analysis.



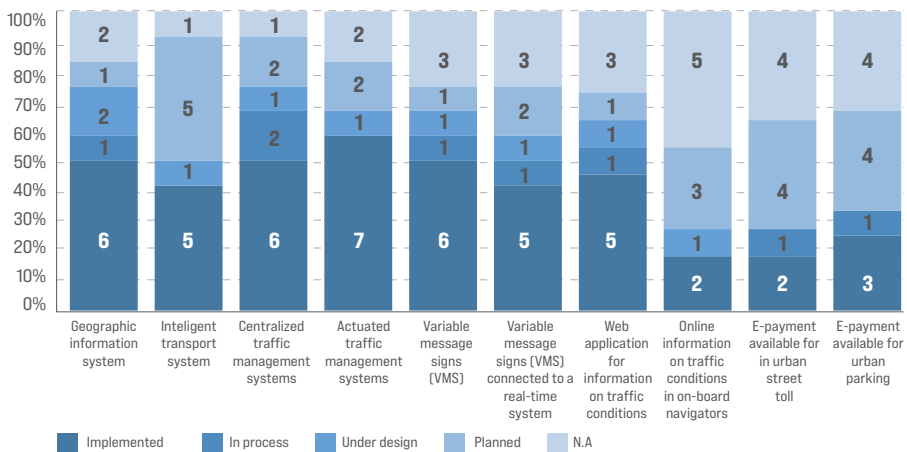
2. Status of Technology and Innovation in Land Transport in the Arab Region



Traditional IT systems are relatively well established in 50 per cent of Arab countries. This includes GPS, transport management systems, e-government services, e-payment and fleet management systems. However, more advanced systems, such as the intelligent transport systems, IoT, and AI are still limited or non-existent in land transport in the Arab region.

“Most of the technology used for land transport in the Arab countries is centred in the urban context. Rural areas and railway infrastructures and facilities need more investment and modernization programmes for technological integration.”

Figure 5. Use of technology in urban streets in selected Arab countries

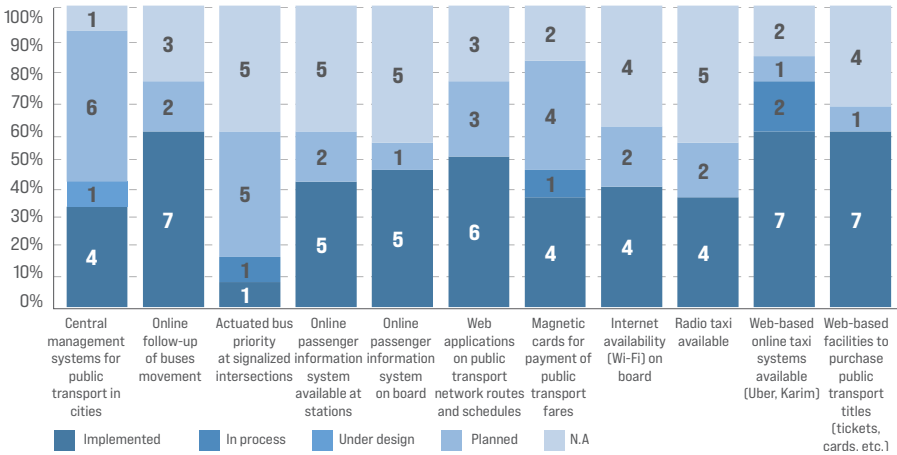


Source: Compiled by ESCWA.



“
 With few exceptions (mostly Morocco and some Gulf countries), the majority of Arab cities have not developed or organized any heavy public transport systems, and they suffer from a lack of urban transport policy while transport demand is constantly rising.
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Figure 6. Use of technology in public transport in selected Arab countries

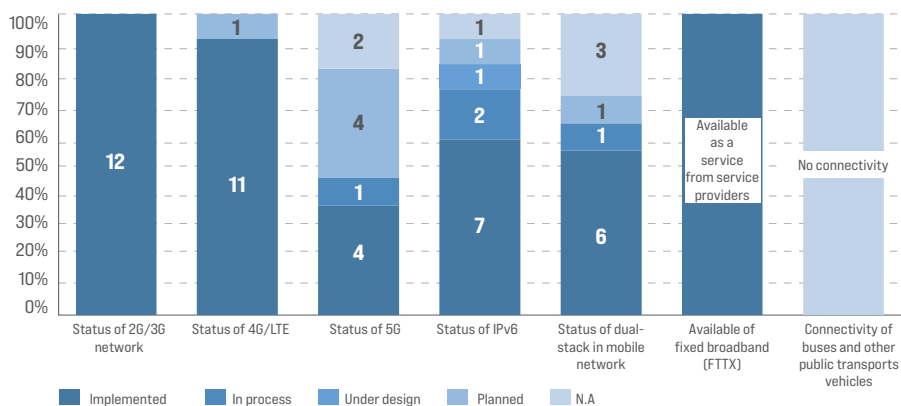


Source: Compiled by ESCWA.

“
 Basic mobile services are well spread in urban areas; however, coverage should be extended to rural areas. Furthermore, telecom infrastructure should be modernized to respond to the requirements of emerging technologies, such as IoT and big data.
 ”



Figure 7. Status of connectivity in the Arab region



Source: Compiled by ESCWA.



ESCWA is publishing a report entitled “Technology and innovation for developing land transport in the Arab region”. The report establishes a base study on the use of technology and innovation for developing land transport in Arab countries. It also aims to improve knowledge on the role of technology and innovation in modernizing land transport in Arab countries. The report covers the following:

- The importance of the transport sector for social development and economic growth, and the positive impact of technology and innovation on safety, efficiency, mobility and planning in land transport;
- The role of digital and emerging technologies in improving the land transport sector globally and in Arab countries;
- The status of technology use in land transport in selected Arab countries;
- The policy framework needed to ensure that countries benefit from ICT and emerging technologies in land transport.





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