Technology and Innovation for Developing Land Transport in the Arab Countries

Ms. Salam YAMOUT – Mr. Rami SEMAAN
ESCWA’s Consultants
Part 2: Overview
Relevance of the Report

The Arab countries have the second highest annual population growth rate in the world at 1.9%. In fact, by 2050 roughly 70% of the region’s population will be living in cities.

ESCWA, Arab Sustainable Development Report 2020

Most of Arab cities have high population density, which is a real opportunity for PT system and technological integration.
1- Improved traveller experience  
SDG 8 (8.1)

2- Improved energy efficiency  
SDG 9 (9.4),  
SDG 13 (13.2)

3- Better operational performance  
SDG 7 (7.a, 7.b)  
SDG 9 (9.1)

4- Increased safety  
SDG 3 (3.6),  
SDG 11 (11.2)
- Currently, the modal share is based globally on private motorized modes.

- This is why, reducing GHG emission and fuel consumption where cars and traffic are the main source, has become a common policy goal.

- Most approaches focus on curtailing automobile use in cities to reduce greenhouse gases, improve air quality, and support sustainable development.
Main Benefits – Socio Economic

- Public transport contribute to access to jobs
- Public & private spaces dedicated for transport facilities are needed for economic development
- Technology in transport creates jobs and digital skills and contribute to economic development (i.e. smart cities)
- Effective policies will demonstrate link between transport infrastructure and economic growth
Part 2: Digital technological solutions in land Transport
Advancements in Transport Technology

- IOT
- Hyperloop
- On demand rides
- AVS
- Light weight material
Technology Trends Affecting Transport

Big Data

Internet of Things (IoT)
- Road Sensors
- Traffic Lights
- Vehicle Tracking Devices
- Cameras
- ...

Artificial Intelligence (AI)
- AVS
- Pods
- ITS
- Route Planning
- Route Analysis
- ...

Cloud Computing

IaaS, PaaS, SaaS, MaaS, CaaS & XaaS
Uses of AI in Transportation

Vehicle Control
People would have extra free time with autonomous vehicles

Traffic Control
People would save time because of prediction in congestion conditions

Road Safety
People would be exposed to fewer crashes with systems that autonomously anticipate them
Harnessing Technologies in Transport Sector – Dubai Case Study

Dubai has a **strategy for autonomous transportation** (2030). It is expected to save **bn 22 Dirham annually** in different sectors.

By 2020, 75% of the new metro systems will be driverless. The strategy itself will convert **25%** of mobility journeys in Emirates to autonomous transportation.

RTA has been testing the world first **autonomous pods**.

Source: https://www.dubaifuture.gov.ae/ar/our-initiatives/dubais-autonomous-transportation-strategy
Harnessing Technologies in Transport Sector – Dubai Case Study

“Mahboob” is an institutional chatting system harnessing AI to present 89 services to public.

8 cameras established in 4 service centers to measure customers’ happiness based on AI.

“Suhail” is a comprehensive platform facilitating accessibility to all transport means by one window. 849,000 planned journey by this platform.

### Enabling technologies for land transport

1. **Connectivity Infrastructure**
2. **IOT**
3. **Big Data**
4. **Cloud Computing**
5. **Global Positioning System (GPS)**
6. **Geographic Information System (GIS)**
7. **Open Data**
8. **Inter-operability and cross borders cooperation**
Levels for connectivity

Wireless or wireline for IOT
Technology applications in land transport

- Management of Freight
  Transportation Management Systems (TMS)
  Fleet Management Systems (FMS)

- Management of Traffic and Infrastructure
  GeoFencing
  Electronic Toll Systems
  Intelligent Transport Systems (ITS)
Technology applications in land transport

Management of Passengers
Mobility as a Service (MAAS)
Mobility on Demand (MOD)
Dynamic Ride Sharing
Other
Difference between MOD and MAAS

**Mobility on Demand**
- Passenger and goods movement
- Transportation systems management (i.e., managing supply and demand through feedback control)

**Mobility as a Service**
- Mobility aggregation
- Subscription services

Reference: Susan Shaheen, University of Berkeley, 2020
Part 3: Status of technology and innovation in land transport in the Arab region
Main Target

The aim of technology integration is to facilitate data exchanges and to enhance the fluidity of land transport routes by avoiding dissimilarities, inconsistencies and gaps.

Some challenges which are impacting the technology incorporation in land transport have to be identified and addressed.
1. Rural Roads:

More developed and economically flourishing countries have high level of integration of technology with quite high standard conditions.

Other less income countries still need to focus more on the infrastructure of their roads, their pavement and connection, implementing new technologies appears to be with less priority.
### Rural Roads - Status by Technology

<table>
<thead>
<tr>
<th>Technology</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic Information System</td>
<td>1</td>
</tr>
<tr>
<td>Intelligent Transport System</td>
<td>2</td>
</tr>
<tr>
<td>Electronic pavement management system for road network</td>
<td>3</td>
</tr>
<tr>
<td>E-payment of Toll Motorway (toll plaza)</td>
<td>4</td>
</tr>
<tr>
<td>Toll motorway free flow sensor</td>
<td>5</td>
</tr>
<tr>
<td>Automated detection for incidents and accidents</td>
<td>6</td>
</tr>
<tr>
<td>Variable Message Signs (VMS)</td>
<td>7</td>
</tr>
<tr>
<td>Variable Message Signs connected to a real-time system</td>
<td>8</td>
</tr>
<tr>
<td>Real-time follow up of traffic and services information for traffic flows</td>
<td>9</td>
</tr>
<tr>
<td>Centralized Traffic management center</td>
<td>10</td>
</tr>
<tr>
<td>Automatic Radars for detection of Speed Violations</td>
<td>11</td>
</tr>
</tbody>
</table>

**Legend:**
- A - Implemented
- B - In process
- C - Under Design
- D - Planned
- E - N.A

**Automatic radars, traffic management centers and GIS systems are the most technologies implemented on rural roads.**
More advanced countries like Qatar and UAE have the greatest number of implemented technologies, countries like Palestine, Syria and Lebanon barely / don't yet have any of the implemented technologies for their rural roads.
2. **Railways:**

The questionnaire results show that railways infrastructures and facilities are globally not advanced in the Arab countries and need to be developed at both coverage and performance levels.

More investment and modernization programs should be engaged together with the technological integration.
Few railway technologies have been implemented, while most have not yet been planned (especially automated management, Wi-Fi availability and online information system technologies)
Qatar is the leading country in terms of railway technology implementation, while countries like Jordan, Libya, Oman and Lebanon have yet to have plans for railway technologies.
3. **Urban streets:**  
There is generally more focus in Arab countries towards building streets more relying on private vehicles, with limited (to no focus) on pedestrian and cyclist routes, public transport lanes, open green spaces.  
This problem is making Arab urban cities rely more on private motorized modes rather than shared or collective modes, which in return is causing congestion, accidents, and negative effects on the environment and the public spaces.
Urban streets - Status by technology

<table>
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<tr>
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<tbody>
<tr>
<td>Geographic Information System</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Intelligent Transport System</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Centralized Traffic Management Systems</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Actuated Traffic Control Systems</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Variable Message Signs (VMS)</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Variable Message Signs (VMS) connected to a real-time system</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Web Application for information on traffic conditions</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Online Information on traffic conditions on Board navigators</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>E-payment available for urban street toll</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>E-payment available for urban parking</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Urban street technologies are mostly either implemented or planned. Few are still mostly not planned, such as Online Information on urban traffic conditions in on Board navigators in vehicles.
Qatar is the leading country in terms of railway technology implementation, while countries like Jordan, Libya, Oman and Lebanon have yet to have plans for railway technologies.
4. Public transportation:
With some exceptions, the majority of the Arab cities have not developed or organized heavy public transport systems and have suffered from a lack of anticipatory strategy when transport demand is constantly increasing.

Globally there is a need for more investments and modernization programs in the PT technology systems, taking into account significant differences between the countries.
Public transportation - Status by technology

Public transport technologies are mostly either implemented, planned or not planned
Public transport technologies are implemented in countries like UAE, Qatar, Jordan and Egypt, while countries like Libya have not yet planned for such technologies.
5. **Land Transport Management, Operation and Border Crossings:**

The transport conditions and transport regulations and standards differ markedly around the Arab region.

Generally, efficiency of sustainable transport regulations can be enhanced if they are linked with economic incentives and adequate technological solutions.
### Land Transport Management, Operation & Border Crossings - Status by technology

<table>
<thead>
<tr>
<th>Technology</th>
<th>A- Implemented</th>
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<th>C- Under Design</th>
<th>D- Planned</th>
<th>E- N.A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centralized electronic information system for vehicle registration</td>
<td>44</td>
<td>1</td>
<td>1</td>
<td>8</td>
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<tr>
<td>Centralized electronic information system for driving license registration</td>
<td>45</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Centralized electronic information system for fatal road crashes</td>
<td>46</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Web application for the payment of vehicle registration/renewal fees</td>
<td>47</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td></td>
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<tr>
<td>Digital recognition of vehicle registration plates through image processing</td>
<td>48</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td></td>
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<tr>
<td>Centralized Digital Management Information System for Governmental vehicles fleet</td>
<td>49</td>
<td>4</td>
<td>1</td>
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<tr>
<td>Automated Customs Management Systems at land border crossings</td>
<td>50</td>
<td>4</td>
<td>1</td>
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<tr>
<td>E-CMR adopted for freight transport</td>
<td>51</td>
<td>4</td>
<td>1</td>
<td>4</td>
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<tr>
<td>E-TIR system for transit transport</td>
<td>52</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
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<tr>
<td>Real time tracking system for transit trucks</td>
<td>53</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Land Transport Management, Operation & Border Crossing technologies are mostly either implemented or planned. Few are not yet planned in some countries.
Land Transport Management, Operation & Border Crossings - Status by country

Land Transport Management, Operation & Border Crossing technologies are implemented in countries like UAE, Oman, Jordan and Iraq, while countries like Kuwait or Libya have mostly not yet planned for such technologies.
Main Issues

1. Limited financial capacity, no real incentives for PPP schemes

2. Governance structures

3. Lack of proactive policies and frameworks

4. Less focus from lower income economies on implementing transport technologies
Part 4: Policies for mainstreaming technological solutions in transport planning
Policy Recommendations / Challenges

I. Flexible Regulatory Framework
II. Financial Incentives
III. Open data
IV. Vibrant Innovation and Entrepreneurship Eco-system
V. Reducing Fuel Consumption
VI. Privacy and Security
VII. Ubiquitous Connectivity
VIII. Standardization and Inter-operability
The regulatory framework determines the way in which transport services are designed, planned and produced.

1. A flexible regulatory framework will help to achieve economic efficiency, quality of service and transparency in operation & organization.

2. Transparent rules should be established between the different agents of the systems (allocation of responsibilities and sharing of risks).

3. The main issue that influences the implementation of sustainable transport services is the insufficient national or regional legislation.
II. Financial Incentives

Budgetary constraints remain a real problem for most countries; Incentives can affect change in consumption and production behaviors

1. Public Private Partnerships to boost risks sharing in investment funds.

2. Implementing corrective taxes on consumers and producers (e.g. a citizen may be given a subsidy to purchase cleaner cars and/or to support PT facilities).

3. Control externalities in order for the market to achieve an efficient equilibrium.
III. - Open Data

Government data is the number one source of open data

1. Citizens become partners in monitoring and planning.

2. Citizens and start-ups can innovate around this data to provide new services to help a city or region.

3. Ease the life of public transport users and systems (provides passengers with basic transit maps, transit signs, screens and apps, information systems that allow for planning efficient trips by PT and for avoiding unnecessary waiting).
IV. - Vibrant Innovation and Entrepreneurship Eco-system

A vibrant innovation and Entrepreneurship Eco-system will ensure

1. Digital skills are developed in-country.

2. Innovative strategies for transport policies are developed at adequate scale locally to solve identified needs.

3. Local solutions (mobile apps and others) are developed to solve local problems.
V. Reducing fuel consumption and global warning

Transport generates a large and growing share of greenhouse gas emissions, this calls for Governmental policies to restrain emissions such as

1. Fuel taxes and fuel economy regulations
2. Road pricing
3. Fuel quality regulations
4. Attempts to modify mode choice
5. Use technology to provide safer, more efficient, cheaper, and greener transportation systems
VI. Privacy and Security

- **Safety & Security**: Improving of related conditions for the whole multimodal chain of services is an appreciated achievement, but it still need efforts and investments.

- **Privacy and personal data protection**: To keep balance between privacy protection conditions and technical needs to enhance technological integration (to facilitate and to smooth the land transport route).
VII. Ubiquitous Connectivity

Provide connectivity to everyone and everything, everywhere, every time

1. Lower the price of International bandwidth and interconnection
2. Adopt IPV6
3. Make fiber available as a service
4. Establish national IXPs to provide local redundancy and lower latency
5. Ease regulations on technology (cloud computing, IOT, etc.)
VIII. Standardization and Inter-Operability

- **Standardization**: Levels and quality of the coordination and administrative reticence could be an obstacle.

- **Interoperability**: Main issues could be related to different level of development and/or performances as well as problems of interfaces.
Q&A

For more information please contact: idlebi@un.org