FUTURE-HORIZON D2.1

Factsheet collection on RTR in established markets

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Deliverable author(s): Jakob, MICHELMANN, VDIVDE
Carolin, ZACHÄUS, VDIVDE
Gereon, MEYER, VDIVDE
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<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AD</td>
<td>Automated Driving</td>
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<tr>
<td>ADS</td>
<td>Autonomous Driving Systems</td>
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<td>AI</td>
<td>Artificial Intelligence</td>
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<tr>
<td>APRA-C</td>
<td>Advanced Research Projects Agency-Climate</td>
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<td>ARPA-E</td>
<td>Advanced Research Projects Agency-Energy</td>
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<tr>
<td>AV</td>
<td>Autonomous Vehicles</td>
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<tr>
<td>BAIC</td>
<td>Beijing Automotive Group Co</td>
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<tr>
<td>BYD</td>
<td>Beyond Your Dreams</td>
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<tr>
<td>CALT</td>
<td>China Academy of Launch Vehicle Technology</td>
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<td>CINEA</td>
<td>Climate, Infrastructure and Environment Agency</td>
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<td>C-ITS</td>
<td>Cooperative Intelligent Transport Systems</td>
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<tr>
<td>CCVT</td>
<td>Coupling Capacitor Voltage Transformers</td>
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<td>COVID-19</td>
<td>Coronavirus Disease 2019</td>
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<tr>
<td>CSIT</td>
<td>Computational Science and Information Technology</td>
</tr>
<tr>
<td>CRAES</td>
<td>Chinese Research Academy of Environmental Sciences</td>
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<tr>
<td>DIVP</td>
<td>Driving Intelligence Validation Platform</td>
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<tr>
<td>DOE</td>
<td>Department of Energy</td>
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<tr>
<td>DOT</td>
<td>Department of Transportation</td>
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<tr>
<td>EEERE</td>
<td>Office of Energy and Renewable Energy (DOE)</td>
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<tr>
<td>E-GMP</td>
<td>Electric Global Modular Platform</td>
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<td>ERTRAC</td>
<td>European Road Transport Research Advisory Council</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<td>EV</td>
<td>Electric Vehicles</td>
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<td>FHWA</td>
<td>Federal Highway Administration</td>
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<td>FOT</td>
<td>Field Operations Tests</td>
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<tr>
<td>FCV</td>
<td>Fuel cell vehicle</td>
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<td>5G</td>
<td>Fifth-generation wireless</td>
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<tr>
<td>4G</td>
<td>Fourth-generation wireless</td>
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<tr>
<td>GAC</td>
<td>Guangzhou Automobile Group</td>
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<td>GHG</td>
<td>Greenhouse Gas</td>
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<td>GGS</td>
<td>Green Growth Strategy (Japan)</td>
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<td>GPS</td>
<td>Global Positioning System</td>
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<td>HD</td>
<td>High Definition</td>
</tr>
<tr>
<td>ICEs</td>
<td>Internal Combustion Engines</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
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<tr>
<td>IGE</td>
<td>Institute for Global Economics (Korea)</td>
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<tr>
<td>ITS</td>
<td>Intelligent Transport Systems</td>
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<tr>
<td>ITS-JPO</td>
<td>Intelligent Transportations Systems Joint Program Office (US)</td>
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<tr>
<td>IoT</td>
<td>Internet of Things</td>
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| JAC          | Jianghuai Automobile Co.
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<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>JMCG</td>
<td>Jiangling Motors Corporation Group</td>
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<tr>
<td>JSPS</td>
<td>Japan Society for the Promotion of Science</td>
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<td>JST</td>
<td>Japan Science and Technology</td>
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<tr>
<td>L4</td>
<td>Level four automated driving</td>
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<tr>
<td>L5</td>
<td>Level five automated driving</td>
</tr>
<tr>
<td>METI</td>
<td>Ministry of Economy, Trade and Industry (Japan)</td>
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<tr>
<td>MEXT</td>
<td>Ministry of Education, Culture, Sports, Science and Technology (Japan)</td>
</tr>
<tr>
<td>MIT</td>
<td>Massachusetts Institute of Technology</td>
</tr>
<tr>
<td>MLIT</td>
<td>Ministry of Land, Infrastructure, Transport and Tourism (Japan)</td>
</tr>
<tr>
<td>MOE</td>
<td>Ministry of Environment (Korea)</td>
</tr>
<tr>
<td>MOLIT</td>
<td>Ministry of Land, Infrastructure and Transport (Korea)</td>
</tr>
<tr>
<td>MOTIE</td>
<td>Ministry of Trade, Industry and Energy (Korea)</td>
</tr>
<tr>
<td>MSIT</td>
<td>Ministry of Science and ICT (Korea)</td>
</tr>
<tr>
<td>NEDO</td>
<td>New Energy and Industrial Technology Development Organization (Japan)</td>
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<td>NEDP</td>
<td>New Energy Vehicle Industrial Development Plan (China)</td>
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<tr>
<td>NTCAS</td>
<td>National Technical Committee of Auto Standardization (China)</td>
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<td>NEV</td>
<td>New Energy Vehicles</td>
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<td>NYC</td>
<td>New York City</td>
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<td>ODOT</td>
<td>Ohio Department of Transportation</td>
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<td>OEMs</td>
<td>Original Equipment Manufacturers</td>
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<td>PHEVs</td>
<td>Plug-in Hybrid Electric Vehicle</td>
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<tr>
<td>SAKURA</td>
<td>Safety Assurance Kudos for Reliable Autonomous vehicles</td>
</tr>
<tr>
<td>SDI</td>
<td>Samsung Digital Interface</td>
</tr>
<tr>
<td>SIP-adus</td>
<td>Strategic Innovation Promotion Program-Automated Driving for Universal Services</td>
</tr>
<tr>
<td>SMEs</td>
<td>Small and Medium Enterprises</td>
</tr>
<tr>
<td>SOC</td>
<td>Social Overhead Capital</td>
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<tr>
<td>REFUEL Projects</td>
<td>Renewable Energy to Fuels Through Utilization of Energy-Dense Liquids</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Design</td>
</tr>
<tr>
<td>R&amp;I</td>
<td>Research and innovation</td>
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<tr>
<td>RTR</td>
<td>Road Transport Research</td>
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<tr>
<td>TaaS</td>
<td>Testing-as-a-Service</td>
</tr>
<tr>
<td>UC Davis ITS</td>
<td>Institute of Transportation Studies at UC Davis at the University of California, Davis</td>
</tr>
<tr>
<td>U.S</td>
<td>United States of America</td>
</tr>
<tr>
<td>USDOT</td>
<td>U.S. Department of Transportation</td>
</tr>
<tr>
<td>V2I</td>
<td>Vehicle-to-infrastructure</td>
</tr>
<tr>
<td>V2V</td>
<td>Vehicle-to-Vehicle</td>
</tr>
<tr>
<td>V2X</td>
<td>Vehicle-to-everything</td>
</tr>
<tr>
<td>VECC</td>
<td>Vehicle Emission Control Center</td>
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1. Introduction

The project FUTURE-HORIZON is funded by the European Union under the framework programme for research and innovation, Horizon Europe. It aims at supporting the European Commission, the European Road Transport Research Advisory Council (ERTRAC) and European partnerships of authorities, research institutes and industry to align strategies, policies and funding programmes in road transport research in accordance to international benchmarks.

1.1. Reference to description of the action

To explore opportunities for complementing the strategic planning of the well-established road transport research (RTR) ecosystem in Europe by analysis, benchmark and collaborations with other world regions, a list of main players of the RTR ecosystem, divided into research institutes, suppliers, OEMS, mobility services providers and innovation policy has been elaborated. This has been completed with information about public funding programs and political framework conditions, and relevant technical innovations and socio-economic developments in road transport resulting in comprehensive factsheets for the United States of America, China, Japan and South Korea. The factsheets focus on relevant knowhow and recovery actions due to the Covid-19 pandemic as well as on mitigation measures related to other crises, such as global warming. Present information on legal frameworks and deployment of road transport technologies, as well as best practices, e.g. examples of concepts, ecosystems, demonstrations have been pointed out. Future trends have been derived from government plans, company announcements and assessments of stakeholders, and have been reviewed by relevant reference points (ambassadors) in the different markets and countries. The relevant findings have been allocated to the corresponding topics of the ERTRAC Working Groups (Energy & Environment, Connectivity and Automated Driving, Urban Mobility, Freight & Logistics, Road Transport Safety & Security)\(^1\). The topic of electrification was separately viewed from energy and environment to display the in-vehicle technology developments related to electric mobility in the four countries specifically. The format of factsheets was chosen because they give a brief but in-depth overview necessary for the workshops of T2.2 in the further process of WP 2, where the country specifics will be compared to current developments in road transport research in Europe. If new findings for the four countries result from the activities in T2.2 and T2.3, the factsheets will be updated by T2.1.

1.2. Objectives and scope of the report

The report entails the results for the described action (T2.1) under section 1.1 in form of the condensed fact sheets “International Road Transport Research” for the four countries China, Japan, South Korea and the U.S. in a condensed visual format. The factsheets cover highlights representing the countries up to date approach to road transport research and displays goals and strategies. Transport-related socio-economic developments are displayed. The impacts of COVID-19, if applicable, are listed as well. Based on the findings, a conclusion of possible future developments is drawn per country. The results provide the base for the comparison of international developments in road transport research. This is the final deliverable. The report summarizes most important findings and conclusions. Nevertheless, during the course of T2.2 and T2.3, the discussions and analysis may bring up new findings. In this case, the factsheets will be updated and seen as a living document, which can be found under the following link: [https://vdivide-it.de/de/publication/future-horizon-country-factsheets-road-transport-research](https://vdivide-it.de/de/publication/future-horizon-country-factsheets-road-transport-research).

\(^1\) [https://www.ertrac.org/index.php?page=ertrac-working-groups](https://www.ertrac.org/index.php?page=ertrac-working-groups)
1.3. Methodology

To analyse the international developments in legislation and policy and R&I, documents as well R&I projects were screened, documented and evaluated through desk research and dialogues with experts from the respective countries. For this report only information from 2019 onwards was accounted relevant, to give an up-to-date overview. In certain cases, ongoing projects and programmes and policy goals of high relevance beginning before 2019 were considered as well. In order to better understand the road transport research frameworks around the world, the project has involved a number of experts as international “ambassadors”. These ambassadors have taken a key role in the exchange of information and joint learning between the road transport research communities in China, Japan, South Korea, the United States of America. The dialogues were held in the form of web conferences with VDI/VDE-IT. The process covered one, sometimes two input sessions with the ambassadors per country. The dialogues were aligned with the thematic areas of ERTRAC, i.e. energy and environment, road safety, urban mobility, freight and logistics, competitiveness, connected and automated mobility and electrification. The sessions were guided, but not limited by the following catalogue of questions:

- What are important strategic goals for road transport research (RTR) in your country?
- What are the relevant players in the RTR domain?
- What are the main projects in the RTR sector in the country? (research and innovation, pilots)
- What funding for RTR has the government provided in recent years?
- What innovation-relevant investments has the government made on the RTR sector in last years? (e.g. new charging spots, testing areas, etc.)
- What were the main learnings taken from the COVID-19 pandemic in the road sector?
- Are there any funding budget to recover from the COVID-19 pandemic?

The results from the dialogues and desk research were documented in an internal data base. After the factsheets were completed, the sheets were validated by experts from the respective country except for Japan, where it was not possible for the entire consortium to receive the validation through the existing contacts having no capacity for this. The following ambassadors were so kind to support the task in country-specific dialogues:

U.S.: Kevin Shannahan, Sara Odenwald and Tyler Warga, Bosch (U.S)
China: Jiao Wenwen (Research Institute of Highway, Ministry of Transport China), Nina Guan (China Highway and Transportation Society), Prof. Yacan Wang (Beijing Jiao Tong University)
South Korea: Young-Jun Moon (The Korea Transport Institute)
2. Factsheets
Strategic Innovation Policy Goals and Programmes

2030: 20% reduction by 2050: Carbon neutrality

- Bipartisan Law: Hydrogen hubs for production & delivery (9.5 t, DOE)
- NEXTCAR: Automated driving for energy reduction (18 t, ARPA-E)
- Energy Storage Grand Challenge
- IRA: Large investment in energy & climate initiatives (439.5 t, DOE)
- Half of U.S. sales to be zero emission vehicles; no ICE phase-out
- California phase out ICE vehicles; no ICE phase-out
- Bipartisan Law: Clean buses/trucks (7.5 t) & EV charging (7.5 t)
- Promotion of PHEVs (e.g. through DOE accelerator programme, 20 m)

Research Activities

- 2019: Apply the ARPA-E NEXTCAR AV algorithms to road-side infrastructure to save energy
- Research in alternative fuels for heavy duty trucks (e.g. REFUEL projects funded by DOE, 2016)
- Mitigating impacts on grid of 10 millions EVs to be charged in the future (DOE)
- 45% reduction to $80/kWh manufactured cost for a battery pack by 2030 for a 300-mile range electric vehicle (DOE)
- Connected Vehicle Pilot Programme (USDOT): Advanced Driver Assistance System tests, collaborative driving with road side units for passenger and heavy duty vehicles in Wyoming, NY, NY and Florida, addressing environmental and safety needs (Phase 3 tests finished in 2021)
- RTR for vehicle automation pushes research in advanced manufacturing, and vehicle-based decision making using AI & quantum computing
- Social acceptance studies of PHEVs
- EV-battery recycling and second-use for EV-batteries (60 m, EERE, DOE)
- Connected Vehicle Pilot Programme (Phase 3, DOT)
- V2V and V2I demonstration with 5G (CARMA, FHWA)
- Driverless taxi pilot by Waymo One (Phoenix, AZ)

Socio-Economic Developments

- Car-centric mobility system
- Strong IT-industry and start-ups as drivers for innovation
- Cost-intensive, usually government-backed policies as provision of charging infrastructure are carried out in some cases by the private sector
- Shortage of about 60,000 drivers in the logistic sector

Road Safety

- Truck platooning demonstrator cooperative adaptive cruise control on Interstate 66 (Exploratory Advanced Research Programme, FHWA)
- Automated delivery with light duty vehicles and drones (ODOT)
- UDELY: The start-up delivers groceries and goods for Walmart for mid-last-mile by its automated, modular container pods.
- R&D on data-driven fleet management for shared micro mobility (Santa Monica, CA)
- Apply AI and high performance computing to anticipate and reduce congestions

Connected Vehicle Pilot Programme: In the NYC-pilot, vehicles connected to road side units and wirelessly with each other test safety issues with pedestrians with/without disabilities

Freight & Logistics

- Supertruck 3: 1.6 new energy vehicle development (199 m, DOE)
- Oklahoma Advanced Mobility Pilot: Automated Delivery (ODOT)
- Exploratory Advanced Research Programme (FHWA)
- 2019: Semi-automated postal trucks service on 1000 miles route in Texas by the U.S. Postal Service
- Pedestrian & bicyclist communication through headlights projecting signs
- Research for redundancy in mobility systems and definitions of systems that accommodate mistakes (Save System Approach)

Urban Mobility

- Explore transfer potentials of AV for duty vehicles and buses for public transit
- Complete Trip Programme: Interstate and national (40 m, ITS JPO)
- Inclusive Design Challenge: Inclusive automated vehicles (5 m, DOT)
- Supertruck 3: 1.6 new energy vehicle development (199 m, DOE)
- Connected Vehicle Pilot Programme (Phase 3, DOT)
- Connected Vehicle Pilot Programme (Programme, FHWA)
- Auto- and robotics delivery for pharmacy businesses (e.g. Nuro gained market share for delivery of pharmaceutics during COVID-19 pandemic)
- 2 b grants for transport providers during COVID-19 pandemic due to low occupancy rate
- Automated delivery start-up like Nuro gained market share for delivery of pharmacies and medical goods

Automotive Industry

- BMW
- Ford
- GM
- Toyota
- Tesla
- Chrysler
- Nissan
- Honda
- Volvo
- Audi
- BMW

Conclusions

Automated driving research funding is a high priority across governmental departments due to its potential for road safety, insurance, availability and health of workforce, energy savings, military and farming. Due to challenges to provide mobile data coverage in some regions in the US, vehicles need to apply most of the decision-making capabilities in vehicle, though some projects aim to strengthen V2I. In most cases, the government does not set specific, timely goals for the industry, since the US aims at fostering market-driven innovation.

The US still focuses both research on ICEs and electric mobility. Regional solutions, pilots and legal ‘patchwork’ for automated or electric mobility hinder nationwide scale-up. Activities of new initiatives and offices, like the Joint Office of Energy and Transport or ARPA-E and the upcoming APA-C could foster research and development to use synergies of automation and electrification.
This series of factsheets highlights main framework conditions as well as goals and significant future trajectories of road transport research (RTR) for China, Korea, Japan, the U.S. and the EU for the next 10 – 15 years. This is an activity of the EU-project FUTURE HORIZON.

**Research Activities**

- Until 2040: Provide half of global green energy capacity (5yrs-Plan)
- 2060: Net-Zero Emissions (5yrs-Plan)

- Electrification
- 2025: Improve hydrogen fuel supply
- 2035: FCV technologies ready
- 2022: Demonstration of 50 solid state battery-driven EVs by Dongfeng
- 2035: Develop novel fast charging technologies

- Energy & Environment
- 2025: 80% of the public fleet to be electric
- 2025: 20% EV fleet; 2035: fleet half electric, half hybrid (NEDP)
- 2035: Scale-up of highly automated & connected driving (NEDP)
- 2025: Reduce energy consumption to 12 kWh/100 km
- 2035: FCV at peak-time

- Digitising transport: AI, Big Data, Cloud Computing (5yrs-Plan)
- 2035: Commercialisation of FVCs (NEDP)
- 2025: AD technology ready (in-vehicle + infrastructure) (NEDP)

- Automation & Connectivity
- 2035: Develop on-demand bus transport to reduce car-ownership
- 2025: Different automatic approaches being under testing to find out, how far automated driving coordination and computing processes can be centralised
- 2025: Bo’ao Dongyu Island V2X project: Smart city trial with intelligent bus stations, robotaxis and trials of linking automated vehicles to the cloud (e.g. city brain).

- Urban Mobility
- 2035: Different urban mobility concepts, e.g. Biomass, electricity, solar power
- 2035: Development of automatic urban-rural areas
- 2035: Smart Transformation Brain currently develops

- Freight & Logistics
- 52 Pilot for integrated passenger and freight transport connecting urban-rural areas

- Road Safety
- Bo’ao Dongyu Island V2X project: Road side units for pedestrian and non-motor-vehicle detection and blind spot alert with decreased time lags for communication

**Socio-Economic Developments**

- Tradable car-permits and payments for car usage at peak-time
- Social scoring and credit-based nudging have been established across different domains such as insurance
- China became the biggest EV market (more than 5 million NEVs) and the world’s biggest producer of batteries

**Impacts from COVID-19**

- Lockdowns lead to decrease or even stops in production, especially in the chip industry and material sourcing as well as processing, e.g. for batteries

**Conclusions**

Start-ups are driving the automation of vehicles and provision of intelligent infrastructure, whereas OEMs focus more on electrification. Synergies between automated driving and electric mobility are not particularly pushed through state goals, but are occasionally considered.

The uptake of automated driving might possibly happen according the goals at similar speed as for electrification due to the economic connection between cities/regions and major enterprises.

Overall, the government strives to reduce the amount of cars, causing congestion, emissions and safety issues, through credit-based nudging, the diffusion of Mobility as a Service and the promotion of resilient public transport as well as public-private partnerships on smart cities. Big-data companies advance AI and their application in smart cities. However, despite the focus on connectivity and smart cities there are no trials of linking automated vehicles to the cloud (e.g. city brain).

**References**

2. New Energy Vehicle Industrial Development Plan for 2021 to 2035

**Impact Areas**

- Energy & Environment
- Automation & Connectivity
- Urban Mobility
- Freight & Logistics
- Road Safety

**Main Players**

- Energy & Environment: Beijing E-Town: Demonstrate integrated smart roads on 60 km², intelligent vehicles, real-time E-Town Agency cloud, reliable network and precise maps (since 2020, Beijing)
- Automation & Connectivity: Different automatic approaches being under testing to find out, how far automated driving coordination and computing processes can be centralised
- Urban Mobility: Bo’ao Dongyu Island V2X project: Smart city trial with intelligent bus stations, robotaxis and trials of linking automated vehicles to the cloud (e.g. city brain)
- Freight & Logistics: Different urban mobility concepts, e.g. Biomass, electricity, solar power
- Road Safety: Bo’ao Dongyu Island V2X project: Road side units for pedestrian and non-motor-vehicle detection and blind spot alert with decreased time lags for communication

**Research Institutes**

1. National Technical Committee of Auto Standardization (NTCAS)
2. Vehicle Emission Control Center (VECCC) of the Chinese Research Academy of Environmental Sciences (CRAES)
3. Electronics and Telecommunications Research Institute
4. Tongji University
5. MIIT
6. MOST
7. BAIC
8. Geely
9. Changan
10. Shaanxi
11. GWM
12. Chery
13. JAC
14. FuJian
15. Liuzhou Wui.
16. JMCG
17. Yutong Gr.
18. VW
19. NIO
20. Xpeng
21. Li Auto
22. WM Motor
23. Byton
24. Singulato
25. Nio

**Suppliers**

- 1. CATL
- 2. Gotion
- 3. Baidu
- 4. T3 Mobile
- 5. DiDi
- 6. Alibaba
- 7. Tencent
- 8. Geely
- 9. Changan
- 10. ShangHai
- 11. GWM
- 12. Chery
- 13. JAC
- 14. FuJian
- 16. JMCG
- 17. Yutong Gr.
- 18. VW

**OEMs**

- 1. SAIC Motor
- 2. Sinodruk
- 3. BYD
- 4. FAW Group
- 5. Dongfeng
- 6. BAIC
- 7. GAC
- 8. Geely
- 9. Changan
- 10. ShangHai
- 11. GWM
- 12. Chery
- 13. JAC
- 14. FuJian
- 16. JMCG
- 17. Yutong Gr.
- 18. VW

**OEMs Startups**

- 1. MIIT
- 2. MOST
- 3. MIT
- 4. MOST

**Digitising transport: AI, Big Data, Cloud Computing (5yrs-Plan)**

- The uptake of automated driving might possibly happen according the goals at similar speed as for electrification due to the economic connection between cities/regions and major enterprises.

**Smart Transformation Brain**

- Bo’s target is to develop a centralised intelligent traffic light system to control urban traffic in order to reduce peak-time congestion.
- Smart Transformation Brain currently develops

**References**

2. New Energy Vehicle Industrial Development Plan for 2021 to 2035
This series of factsheets highlights main framework conditions as well as goals and significant future trajectories of road transport research (RRP) for China, Korea, Japan, the U.S. and the EU for the next 10 – 15 years. This is an activity of the EU project FUTURE HORIZON.

**Conclusions**

The Japanese government emphasizes industrial competitiveness as well as solving societal issues with their AV policy, following a mixed approach between technology development (e.g. platform technologies) and practical applications & testing of AVs. The development is often initiated from the application side. ITS and connectivity are considered a prerequisite, whereas some innovative technologies lack behind (e.g. AI). Research goals for electrification are mainly related to charging & refuelling infrastructure. Energy-related research has high importance. The road transport research landscape is shaped by a strong cooperation with public authorities and companies with their traditional value chains. Research Institutes

1. Kanazawa Institute of Technology
2. Saitama Institute of Technology
3. Japan Automotive Research Institute
4. Nagoya Institute of Technology
5. Chubu University
6. Ritsumeikan University
7. Waseda University ACROSS

Suppliers

1. Pioneer
2. Denso
3. Hitachi
4. Sony
5. Nikon Unisys
6. Solico
7. Nisshinbo Holdings Inc.
8. ITD Lab

**Refereces**

1. METI (2021) Green Growth Strategy towards 2050 Carbon Neutrality
2. MLIT (2021) Summary of the white paper on land, infrastructure, transport and Tourism in Japan
3. MEXT (2021) Summary of the white paper on energy, environment, and nuclear energy in Japan
5. MEXT (2021) The Future of Road Traffic Systems (FOTs) for 5G Vehicles & Beyond
7. Japan Automobile Research Institute
8. Chubu University
9. Nisshinbo Holdings Inc.
10. Tokyo Metropolitan Government

**Innovation Policy**

1. METI
2. MEXT
3. MLIT
4. NEDO
5. JST
6. JSPS
7. JSPS
8. JSPS
9. JSPS
10. JSPS

**Socio-Economic Developments**

- Society 5.0: Cyber & economic spaces converge to promote economic evolution & solutions to social issues
- Aging society needs secure and comfortable means of transport to move freely & save
- Focus on resilience & prevention (resilient value chain) due to experiences with catastrophes & crises

**Impacts of COVID-19**

- Accelerated development & implementation of next-generation mobility (e.g. smart cities, AVs, use of robots & unmanned platooning)
- Accelerated digital transformation & foundation of a digital agency
- Formation of local public transport planning
This series of fact sheets highlights main framework conditions as well as goals and significant future trajectories of road transport research (RTR) for China, Korea, Japan, the U.S. and the EU for the next 10 – 15 years. This is an activity of the EU-Project FUTURE (Horizon 2020).

**Research Activities**

- R&D on various green technologies in the transport sector
- Eco-friendly mobility of the future (2020-2025, 17 m$)
- Establishment of fuel cell plants & infrastructure for the distribution of H₂
- Carbon Free Island 2030 project: EV trial on Jeju Island
- Adaptable electric vehicle platform “E-GMP” by Hyundai
- Traffic control system first established in Seoul metropolitan area (2024) & nationwide (2030)
- 2024: AD infrastructure on major roads City-wide including all 5,500 km of express toll roads, including V2I on major roads, detailed HD maps, integrated traffic control system, strengthened security
- 5G vehicle to everything (5G+ strategy)
- Temporary permit scheme for AV test-operation on public roads (MOLIT)
- Digitalisation of SOC Project incl. adaptation of C-ITS on major roads
- 2027: Major city-wide autonomous driving infrastructure project in Seoul (125 m$)
- Digital Twin Project (1.5 m$, 2020-2025)
- Smart City Songdo: Planned city with focus on innovative urban management & technology using ICT & utilization of city data
- K-City: Mock city build for testing AVs (10 m$)
- From 2021: Pilot public services e.g. autonomous mass transit, street cleaning cars, autonomous patrol cars
- 108 platforms utilizing CCTV for traffic management
- Urban mobility operating system (By 2022 – Taasl startup)
- Smart city challenge
- Sejong Smart City
- 2022: 50 units of autonomous shuttle buses in cities & towns

**Main Players**

- Electrification
- Automation & Connectivity
- Freight & Logistics

**Socio-Economic Developments**

- Economic growth & industrial development is more important than technology application or solving social issues within South Korea
- SME & Start-up culture is very slowly developing

**Impacts of COVID-19**

- Production support (simplifying import procedure for auto parts; allowing more than 52 working hours per week)
- Liquidity support (employment retention subsidies; R&D support for localisation of auto parts; loan & credit guarantee program for SMEs; Extension of debt maturity periods)
- COVID-19 has sped up AV legislation & adoption

**Conclusions**

South Korea’s objective is to commercialise AV products and components to become international export leader. AV policy has therefore been mainly established for economic growth & industrial development. South Korea wants to use this push in technology expertise to increase the domestic supply ratio up to 80%. South Korea has an excellent 4G coverage supplemented by 5G services, which enables connected mobility applications and leads to a strong focus on C-ITS.

South Korea promotes H₂ technologies over battery technology research.

**References**

1. MSIT (2017) Innovation Growth Engines
2. IEA (2021) HEV TCP Annual Report 2021
5. MOLIT (2022) Report on 22nd Land Transport Innovation Fund

**Suppliers**

1. LG Energy Solutions
2. SK Innovation
3. Samsung SDI
4. MORAI
5. Seoul Robotics
6. Bistening
7. Mando Corp.
8. Smart Raider Systems Inc.
9. Hyundai Mobis
10. Hyundai Autron
11. Chemtronics

**OEMs**

1. Hyundai
2. KIA
3. Daewoo
4. GM Korea
5. Daewoo
6. Renault Samsung Motors

**Mobility Service Providers**

1. Mobility
2. Proxense
3. Mobiltech
4. Waylay
5. ThorDrive
6. FESCARO
7. Sonnet.ai
8. Unmanned Solutions
9. 42dot
10. Autocrypt
11. Mappers
3. Summary & Outlook

The factsheets provide a comprehensive overview on strategic innovation policy goals and programmes and the corresponding RTR activities as well as socio-economic developments and the impacts of COVID-19.

3.1. United States of America

Automated driving research funding is a high priority across governmental departments due to its potential for road safety, insurance, availability and health of workforce, energy savings, military and farming. Due to challenges to provide mobile data coverage in some regions in the U.S., vehicles need to apply most of decision-making capabilities in-vehicle, though some projects aim to strengthen V2I. In most cases, the government does not set specific, timely goals for the industry, since the U.S. aims at fostering market-driven innovation. The U.S. still focusses both research on ICEs and electric mobility. Regional solutions, pilots and legal „patch-work“ for automated or electric mobility hinder nation-wide scale-up. Activities of new initiatives and offices, like the Joint Office of Energy and Transport or ARPA-E and the upcoming APRA-C could possibly foster research and development to use synergies of automation and electrification.

3.2. China

Start-ups are driving the automation of vehicles and provision of intelligent infrastructure, whereas OEMs focus more on electrification. Synergies between automated driving and electric mobility are not particularly pushed through state goals, but are occasionally considered. The uptake of automated driving might possibly happen according the goals at similar speed as for electrification due to the economic connection between cities/regions and major enterprises. Overall, the government strives to reduce the amount of cars, causing congestion, emissions and safety issues, through credit-based nudging, the diffusion of Mobility as a Service and the promotion of resilient public transport as well as public-private partnerships on smart cities. Big-data companies advance AI and their application in smart cities. However, despite the focus on connectivity and smart cities there are no trials of linking automated vehicles to the cloud (e.g. city brain).

3.3. Japan

The Japanese government emphasizes industrial competitiveness as well as solving societal issues of an aging society with their AV policy. Hereby, the research and development is often initiated from the application side, following a mixed approach between technology development (e.g. platform technologies) and the testing of AVs as well as the implementation of real-life applications. Furthermore, Intelligent Transport Systems (ITS) and connectivity are considered a prerequisite for the effective implementation of AVs, which are also tested and implemented within different field operations tests (FOT) and model cases. Due to Japans many experiences with crisis and catastrophes, the country aims for a preventive and resilient development also in the road transport sector, giving a little less priority to disruptive innovation technologies.

Electrification research is mainly focused on charging and refuelling infrastructure as well as hydrogen generation. Additionally, energy related research has high importance since the island wants to stay independent during crisis. The Japanese transport landscape is shaped by a strong cooperation between public authorities and companies. The COVID-19 pandemic accelerated the development and implementation of next-generation mobility, e.g. smart cities, AVs, robotics and unmanned platooning as well as the digital transformation, e.g. by founding a digital agency. Furthermore, a local public transport plan has been elaborated as a reaction to the pandemic.
3.4. South Korea

South Korea mainly focuses on commercializing AV products and components to become an international technology and export leader. The country's AV policy has therefore been mainly established to achieve economic growth and industrial development. South Korea wants to use this push in technology expertise to increase the domestic supply ratio up to 80%. Furthermore, South Korea has an excellent 4G coverage supplemented by 5G services, which enables connected mobility applications. One additional focus is Cooperative Intelligent Transport Systems (C-ITS), tested in various pilot and test projects. Beside AV technologies, South Korea has a strong focus on H2 technologies compared to battery research. The road transport sector benefitted from an accelerated uptake of AV legislation and adoption during COVID-19. Furthermore, the Korean government provided certain production and liquidity support measures, simplifying import procedures for auto parts and allowing more than 52 working hours per week as well as employment retention subsidies, R&D support for localization of auto parts, loan and credits guarantee program for SMEs and extensions of debt maturity periods.

3.5. Outlook

In the next step, the RTR goals and strategies for the considered countries will be assessed in further detail and compared to the European approach. Therefore, the strengths and weaknesses in terms of technical innovation, legal frameworks and socio-economic conditions are identified for the EU and each of the focused countries. Afterwards, opportunities and risks for road transport research will be determined in view of current and potential crises. This will cover a benchmark of RTR competences and development potentials. Based on the challenges, necessary RTR strategies can be derived that update the ERTRAC roadmaps.