This project has received funding from the European Union's Horizon 2020 research and innovation Programme under grant agreement No 101006598.

FUTURE-HORIZON D2.1

Factsheet collection on RTR in established markets

Deliverable status: Final (rev.)
Submission date: 2022-12-19

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Table of contents

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Abbreviations list

AD	Automated Driving
ADS	Autonomous Driving Systems
AI	Artificial Intelligence
APRA-C	Advanced Research Projects Agency-Climate
ARPA-E	Advanced Research Projects Agency-Energy
AV	Autonomous Vehicles
BAIC	Beijing Automotive Group Co
BYD	Beyond Your Dreams
CALT	China Academy of Launch Vehicle Technology
CINEA	Climate, Infrastructure and Environment Agency
C-ITS	Cooperative Intelligent Transport Systems
CCVT	Coupling Capacitor Voltage Transformers
COVID-19	Coronavirus Disease 2019
CSIT	Computational Science and Information Technology
CRAES	Chinese Research Academy of Environmental Sciences
DIVP	Driving Intelligence Validation Platform
DOE	Department of Energy
DOT	Department of Transportation
EERE	Office of Energy and Renewable Energy (DOE)
E-GMP	Electric Global Modular Platform
ERTRAC	European Road Transport Research Advisory Council
EU	European Union
EV	Electric Vehicles
FHWA	Federal Highway Administration
FOT	Field Operations Tests
FCV	Fuel cell vehicle
5G	Fifth-generation wireless
4G	Fourth-generation wireless
GAC	Guangzhou Automobile Group
GHG	Greenhouse Gas
GGS	Green Growth Strategy (Japan)
GPS	Global Positioning System
HD	High Definition
ICEs	Internal Combustion Engines
ICT	Information and Communication Technology
IGE	Institute for Global Economics (Korea)
ITS	Intelligent Transport Systems
ITS-JPO	Intelligent Transportations Systems Joint Program Office (US)
IoT	Internet of Things
JAC	Jianghuai Automobile Co.

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JMCG	Jiangling Motors Corporation Group
JSPS	Japan Society for the Promotion of Science
JST	Japan Science and Technology
L4	Level four automated driving
L5	Level five automated driving
METI	Ministry of Economy, Trade and Industry (Japan)
MEXT	Ministry of Education, Culture, Sports, Science and Technology (Japan)
MIT	Massachusetts Institute of Technology
MLIT	Ministry of Land, Infrastructure, Transport and Tourism (Japan)
MOE	Ministry of Environment (Korea)
MOLIT	Ministry of Land, Infrastructure and Transport (Korea)
MOTIE	Ministry of Trade, Industry and Energy (Korea)
MSIT	Ministry of Science and ICT (Korea)
NEDO	New Energy and Industrial Technology Development Organization (Japan)
NEDP	New Energy Vehicle Industrial Development Plan (China)
NTCAS	National Technical Committee of Auto Standardization (China)
NEV	New Energy Vehicles
NYC	New York City
ODOT	Ohio Department of Transportation
OEMs	Original Equipment Manufacturers
PHEVs	Plug-in Hybrid Electric Vehicle
SAKURA	Safety Assurance Kudos for Reliable Autonomous vehicles
SDI	Samsung Digital Interface
SIP-adus	Strategic Innovation Promotion Program-Automated Driving for Universal Services
SMEs	Small and Medium Enterprises
SOC	Social Overhead Capital
REFUEL Projects	Renewable Energy to Fuels Through Utilization of Energy-Dense Liquids
R&D	Research and Design
R&I	Research and innovation
RTR	Road Transport Research
TaaS	Testing-as-a-Service
UC Davis ITS	Institute of Transportation Studies at UC Davis at the University of California, Davis
U.S	United States of America
USDOT	U.S. Department of Transportation
V2I	Vehicle-to-infrastructure
V2V	Vehicle-to-Vehicle
V2X	Vehicle-to-everything
VECC	Vehicle Emission Control Center

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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://vdivde-it.de/de/publication/future-horizon-country-factsheets-road-transport-research.

[1] https://www.ertrac.org/index.php?page=ertrac-working-groups

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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 in 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)

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2. Factsheets

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INTERNATIONAL ROAD TRANSPORT RESEARCH

FACTSHEET U.S.A.

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 US and the EU for the next 10 – 15 years. This is an activity of the EU project FUTURE HORIZON.

Strategic Innovation Policy Goals and Programmes

2030: Carbon reduction by 50% (cmp. to 2005) 2050: Carbon-Neutrality[1]	Bipartisan Law: Hydrogen hubs for production & delivery (9,5 b$, DOE)[2]
Alternative Fuel Corridors: e.g. hydrogen, propane charging (DOE)	NEXTCAR: Automated driving for energy reduction (18 m$, ARPA-E)
End-to-end domestic battery supply chain (7 b$)[2] & Next-Gen Batteries	Energy Storage Grand Challenge[3]
	IRA: Large investment in energy & climate initiatives (369 b$)[4]
2030: Half of U.S. sales to be zero emission vehicles; no ICE phase-out[5]	Bipartisan Law: Clean busses/trucks (3.7 b$) & EV chargers (7,5 b$)[2]
2035 - 2040: Some federal states like California phase out ICE	Promotion of PHEVs (e.g. through DOE accelerator programme, 20 m$)
Technology-neutrality to allow the industry to find the best solutions[5]	Connected Vehicle Pilot Program (Phase 3, DOT)
Become AD market leader & safeguard cyber-security & ensure privacy[6]	CARMA: Collaborative driving open source development (FHWA)
Freedom of choice for consumers (manually/ automated driving)[6]	Chips and Science Act: Funding R&D/production of autom. chips (2 b$)[4]
Enhance inclusivity and accessibility, e.g. through automated driving[6]	Complete Trip Programme: Intermodal transport (40 m$, ITS JPO)
Support consumer choice for mobility	Inclusive Design Challenge: Inclusive automated vehicles (5 m$, DOT)
2045: 100% electric trucks sales in California	Supertruck 3: i.a. new-energy vehicle development (199 m$, DOE)
Automation in logistics shall improve the health of labour[6]	Oklahoma Advanced Mobility Pilot: Automated Delivery (ODOT)
	Exploratory Advanced Research Programme (FHWA)
Safe System Approach: Speed reg., safe vehicle design and infrastructure	
Guarantee safety of automated driving[6]	

Research Activities

Energy & Environment

- 2019: Apply the ARPA-E NEXTCAR AV algorithms to offload computing 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)

Electrification

- 45% reduction to $80/kWh manufactured cost for a battery pack by 2030 for a 300-mile range electric vehicle (DOE[3])
- High-power traction inverters for EVs
- Social acceptance studies of PHEVs
- EV-battery recycling and second-use for EV-batteries (60 m$, EERE, DOE)
- 10 min quick charge cells for 500 miles coverage (SK innovation U.S. research)

Automation & Connectivity

- Connected Vehicle Pilot Programme (USDOT): Advanced Driver Assistance System tests, collaborative driving with road side units for passenger and heavy duty vehicles in Wyoming, NYC, NY and Tampa, FL addressing environmental and safety (Phase 3 tests finished in 2021)
- RTR for vehicle automation pushes research in advanced manufacturing, and vehicle-based decision making using AI & quantum computing
- Reduce overall amount of energy use through automated driving (DOE[3])
- Private sector-driven standardisation of automated driving levels and technical requirements through SAE International
- V2V and V2I demonstration with 5G (CARMA, FHWA)
- Driverless taxi pilot by Waymo One (Phoenix, AZ)

Urban Mobility

- Explore transfer potentials of AV for duty vehicles and busses for public transit
- 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

Freight & Logistics

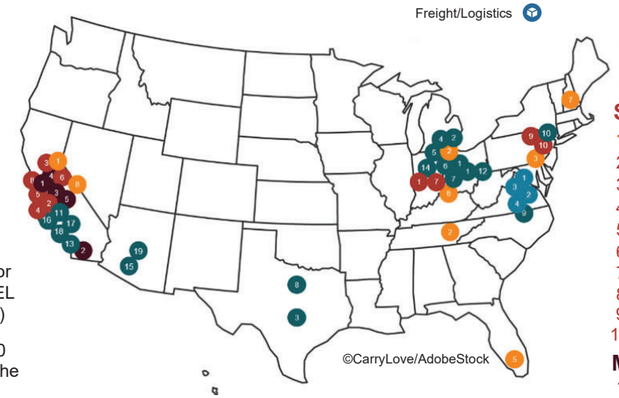
- Truck platooning demonstrator cooperative adaptive cruise control on Interstate 66, (Exploratory Advanced Research Programme, FHWA)
- Automated delivery with light duty vehicles and drones (ODOT)
- UDELV: The start-up delivers groceries and goods for Walmart for mid- and last-mile by its automated, modular container pods.
- 2019: Semi-automated postal trucks service on a 1000 miles route in Texas by the U.S. Postal Service

Road Safety

- Pedestrian & bicyclist communication through headlights projecting signs
- Research for redundancy in mobility systems and definition of systems that accommodate mistakes (Save System Approach)
- 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 (USDOT//NYCDOT)
- Voices: Virtual Open Innovation Collaborative Environment for Safety between the state and private sector for innovation in safe AD (DOT)

Main Players

Electrification
Automation & Connectivity
Freight/Logistics



Research Institutes

1. Stanford University
2. Oak Ridge National Laboratory
3. MIT
4. American Center for mobility
5. Freight Mobility Research Institute
6. Argonne National Lab
7. VOLPE
8. UC Davis ITS

Suppliers

1. Bosch
2. Proterra
3. Ridecell
4. GATIK
5. Embark trucks
6. Intel
7. Bollinger
8. NVIDIA
9. Borg Warmer
10. Panasonic

Mobility Service Providers

1. Waymo
2. TuSimple
3. Ridecell
4. Veniam
5. Aurora

Innovation Policy

1. DOE
2. DOT
3. ARPA-E
4. ITS JPO

OEMs

1. Ford
2. GMC
3. Tesla
4. Chevrolet
5. Chrysler
6. Buick
7. Jeep
8. Toyota
9. VW
10. BMW

Start-up OEMs

11. Zoox
12. Lordstown
13. Canoo
14. Optimal-EV
15. Local Motors
16. Next Future
17. Nuro
18. UDELV
19. Nikola

Socio-Economic Developments

- Car-centric mobility system
- Strong IT-industry and start-ups as drivers for innovation
- Cost-intensive, usually governmental tasks like provision of charging infrastructure are carried out in some cases by the private sector
- Shortage of about 60.000 drivers in the logistic sector

Impacts of COVID-19

- United Auto Union and the three Detroit OEMs neglected bailouts
- 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 pharmaceutics and medical goods

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 APRA-C could possibly foster research and development to use synergies of automation and electrification.

References
1 Whitehouse (2021). ICYMI: President Biden Signs Executive Order Catalyzing America's Clean Energy Economy Through Federal Sustainability
2 Whitehouse.gov (2022). Bipartisan Infrastructure Law
3 DOE (2020). Energy Storage Grand Challenge. Roadmap
4 Whitehouse.gov (2022). Inflation Reduction Act and Chips and Science Act
5 Whitehouse (2021). FACT SHEET: President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Trucks.
6 DOT (2019). Automated Vehicle Leadership 4.0

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V.2.2 (11th November 2022)

INTERNATIONAL ROAD TRANSPORT RESEARCH

FACTSHEET CHINA

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.

Strategic Innovation Policy Goals and Programmes

Energy & Environment

- Until 2040: Provide half of global green energy capacity (5yrs-Plan)[1]
- 2060: Net-Zero Emissions (5yrs-Plan)[1]
- Become a leader in biofuel production (5yrs-Plan)[1]

Electrification

- 2025: 80% of the public fleet to be electric[2]
- 2025: 20% EV fleet; 2035: fleet half electric, half hybrid (NEDP)[2]
- No phase out planned yet[2]
- 2035: Commercialisation of FCVs (NEDP)[2]

Automation & Connectivity

- 2035: Scale-up of highly automated & connected driving (NEDP)[2]
- 2025: AD technology ready (in-vehicle + infrastructure) (NEDP)[2]

Urban Mobility

- Digitising transport: AI, Big Data, Cloud Computing (5yrs-Plan)[1]
- Promotion green travelling (Green Travel Action Plan)[4]
- Increase traffic & parking efficiency; reduce car-ownership[1]
- Nat. 1-2-3 Travel Circle: 1h/city, 2h/rural and 3h/city-to-city commute[3]

Freight & Logistics

- Smart, integrated intermodal logistics[3]
- Global 1-2-3 Logistics Circle: 1d/city;2d/China; 3d/internat. delivery[3]

Road Safety

- Safe, smart transport, infrastructure and logistics[3]

Research Activities

Energy & Environment

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

Electrification

- 2025: Improve battery swapping technology
- 2035: Produce NEV core technologies at world class levels
- 2025: Reduce energy consumption to 12 kWh/100 km

Automation & Connectivity

- 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)
- Innovation in AI, connectivity and automated vehicles driven by various startup companies
- Different automation approaches being under testing to find out, how far automated driving coordination and computing processes can be centralised
- Bo'ao Dongyu Island V2X project: Smart city trial with intelligent bus stations, robotaxis and robobuses with 5G test tracks in Hainan

Urban Mobility

- Demonstrate GPS-controlled parking in dedicated zones for shared bicycles
- Develop on-demand bus transport to reduce car-ownership
- Nudging to steer behaviour is used by companies and governments, e.g. to reduce usage of cars at rush hour through credits
- MaaS-pilots based on digital platforms that integrate green, smart and multimodal transport in Beijing, Guangzhou and Shenzhen Bay-Echo-Tech-Park
- Didi's traffic management and prediction platform Smart Transformation Brain currently develops intelligent traffic lights to reduce commuting hours and CO2 and advanced indoor navigation
- Test the Beijing Bicycle Highway 6,5 Km (Green Travel Action Plan)
- Hangzhou-City: Alibaba tests ET City Brain to decongest the city (already moved from rank 5 to 52 of congested cities in China) through traffic management based on IoT, traffic light control, camera vision e.g. to search for illegal parking

Freight & Logistics

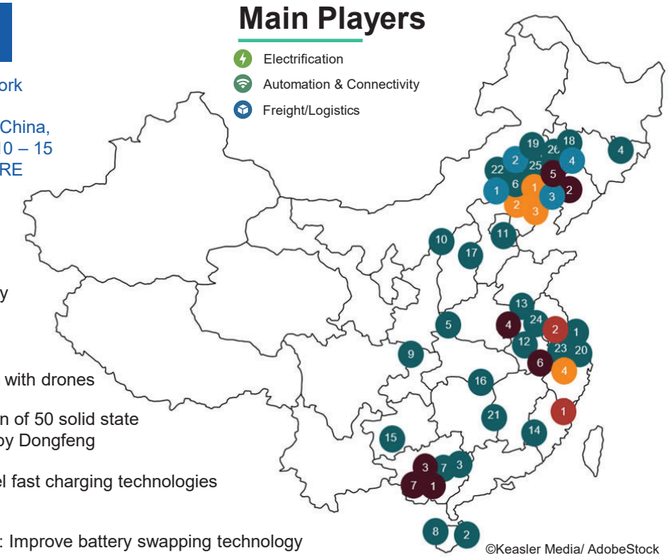
- 52 Pilot for integrated passenger and freight transport connecting urban-rural areas

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

Main Players

Electrification
Automation & Connectivity
Freight/Logistics



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Research Institutes

1. National Technical Committee of Auto Standardization (NTCAS)
2. Vehicle Emission Control Center (VECC) of the Chinese Research Academy of Environmental Sciences (CRAES)
3. Electronics and Telecommunications Research Institute
4. Tongji University

Suppliers

1. CATL
2. Gotion

Mobility Service Providers

1. WeRide
2. Pony.ai
3. Baidu
4. T3 Mobile
5. Didi
6. Alibaba
7. Tencent

Innovation Policy

1. MOT
2. MPS
3. MIIT
4. MOST

OEMs

1. SAIC Motor
2. Sinotruk
3. BYD
4. FAW Group
5. Dongfeng
6. BAIC
7. GAC
8. Geely
9. Changan
10. Shaanxi
11. GWM
12. Chery
13. JAC
14. Fujian
15. Liuzhou Wui.
16. JMCG
17. Yutong Gr.
18. VW

OEMs Startups

19. NIO
20. Xpeng
21. Li Auto
22. WM Motor
23. Byton
24. Singulato
25. Neolix

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 insurances
- China became the biggest EV market (more than 5 million NEVs) and the world`s biggest producer of EVs and batteries
- Chinese big-data companies thrive the smart city development

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).

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References
1 Five-Year Plan (2021-2025)
2 New Energy Vehicle Industrial Development Plan for 2021 to 2035
3 China Academy of Transportation Science (2021). Report on Sustainable Transport in China.
4 Green Travel Action Plan (2019-2022)

V.2.1 (31st May 2022)

INTERNATIONAL ROAD TRANSPORT RESEARCH

FACTSHEET JAPAN

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.

Strategic Innovation Policy Goals and Programmes

- 2030: Cut emissions by 46 % from 2013 levels[2]
- 2050: Reduction of GHG by 70 % compared to 2010 (GGS[1])
- 2050: Carbon-neutral society (GGS[1])
- 2035: 100 % of the fleet are electric or hydrogen vehicles[1]
- 2030: Increase production capacity for in-vehicle batteries to 100 GWh[1]
- 2020: Legal recognition of AVs[5]
- 2024: Renovation of regulatory framework & infrastructure to fit AD[5]
- Strengthening of industrial competitiveness[2]
- Advanced transport system for elderly & disabled people[2]
- Creation of smart & comfortable living spaces[2]
- Innovative streamlining of logistics in era of population decrease[2]
- Reduction of traffic accidents by V2X technologies
- 2030: Society with world's safest & smoothest road transport[3]

- Green Innovation Fund: 17 b$ (NEDO)[1]
- 2025: Installation of 320 H_2 stations; 2030: 1,000 H_2 stations[4]
- 2030: Domestic introduction of up to 3 Mio t H_2 2050: 20 Mio t H_2[4]
- 2030: Installation of 150,000 charging stations, incl. 30,000 quick chargers
- Subsidies & reduced taxation for EVs, PHEVs, FCVs[1]
- SIP-adus (106 m$ 2018-2022, NEDO & CSTI)[6]
- 2027: Promotion of commercialisation of Level 4 AVs[5]
- SIP-adus (106 m$ 2018-2022, NEDO & CSTI)[6]
- Building decarb. regional system for delivering goods (8 m$, METI)[1]

Research Activities

Energy & Environment

- R&D on water electrolyser
- Promotion of renewable energy use
- Research on hydrogen generation & other alternative fuels
- Development of wireless power supply technologies
- Promotion project to develop charging infrastructure for next generation vehicles
- R&D on Metal-air / All-solid-state batteries

Electrification

- Data convergence between virtual & real space
- Smart city driverless vehicle pilot for healthcare services in the cities of Kamakura and Fujisawa
- 2020: Installation of inspection regime & permit system for AVs

Automation & Connectivity

- Since 2019: FOTs of AD technology in mixed traffic in Tokyo waterfront city area with a focus on connectivity and ITS
- Traffic environmental data framework & distribution of data
- "RoAD to L4" project: Promotion of driverless AD services by METI & MLIT (2021-03.2026) – 40 locations in rural areas with AVs by 2025
- New cyberattack techniques & countermeasure technologies
- Automated driving architecture for geographical data & high precision 3D maps (PLATEAU project)

Urban Mobility

- 2024: Model case of smart, automated city build by Toyota
- Realization of smart automated mobility services
- Public transportation priority system
- Local public transportation network linked with urban development
- Dynamic traffic information

Freight & Logistics

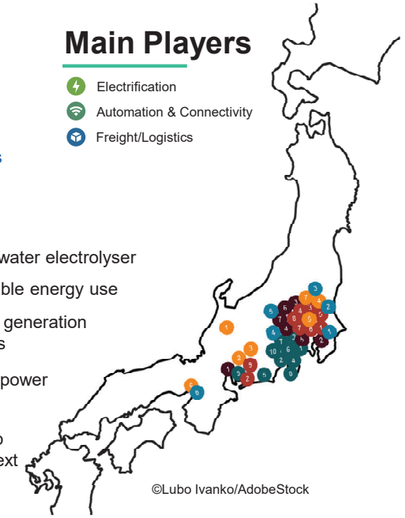
- FOTs for social implementation of mobility & logistics services in local regions & other areas
- 2023: Unmanned AD delivery services in specified areas
  - Logistics digitization
  - Last mile delivery stream-lining with robots & drones
  - Cyber port
- By 2025: Fully AD of trucks on expressways
- FOT for truck platooning on expressways with focus on applying infrastructure based sensors

Road Safety

- Sophisticated driving safety support system
- C-ITS pilot project for V2X connectivity
- SAKURA: Safety Assurance Kudos for Reliable Autonomous vehicles (METI, 2018-2025)
- Virtual validation platform for ADS safety assurance – Driving Intelligence Validation Platform (DIVP™)

Main Players

Electrification
Automation & Connectivity
Freight/Logistics



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Research Institutes

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

Suppliers

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

OEMs

1. Toyota
2. Mitsubishi Motors
3. Honda
4. Daihatsu
5. Nissan
6. Subaru
7. Mazda
8. Lexus
9. Hino Motors
10. Terra Motors

Mobility Service Providers

1. Tier IV
2. Dynamic Map Platform
3. Ascent Robotics
4. Argus Cyber Security
5. 4R Energy Corp.
6. NExT-e Solutions
7. Smart Drive

Innovation Policy

1. METI
2. MEXT
3. MLIT
4. NEDO
5. JSPS
6. JST

Socio-Economic Developments

- Society 5.0[6]: 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, AV, use of robots & unmanned platooning)
- Accelerated digital transformation → Foundation of a digital agency
- Formation of local public transport plan

Conclusions

The Japanese government emphasises 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 between public authorities and companies with their traditional value chains.

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[2] MLIT (2021) Summary of the white paper on land, infrastructure, transport and Tourism in Japan
[3] Automobile traffic subcommittee et al (2021) The Future of vehicle safety for a traffic accident-free society
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[5] Cabinet Office (2021) Cross-ministerial Strategic Innovation Promotion Program (SIP) Automated Driving for Universal Services
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V.2.0 (31st May 2022)

INTERNATIONAL ROAD TRANSPORT RESEARCH

FACTSHEET SOUTH KOREA

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

Strategic Innovation Policy Goals and Programmes

- 2030: 35 % reduction of GHG emission compared to 2018
- Hydrogen economy policy as a key field of future economy & IGE[1]
- 2030: Installation of 660 H_2 refuelling stations
- 2023: Increase of EV & FCV sale to 10 % 2030: 33 % increase[3]
- 2025: 15,000 rapid charging stations & 30,000 slow chargers[3]
- 2024: Legislation, transport systems & infrastructure for L4 on main roads[3]
- 2021: L3 AV deployment 2027: L4 AV deployment[3]
- 2030: World leader in AV technology[2]
- 2021: Master plan for intelligent transportation system 2030 (MOLIT)[5]
- Safe, affordable & environmentally friendly transport system
- Establish smart logistics & distribution systems
- 2030: Reduction of road death by three quarters
- Guarantee of Automobile Accident Compensation Act

- Green new deal (60 b$, MOE & MOTIE)[3]
- 2025: Provision of 200,000 H_2 vehicles
- Government plans for performance improvements of EVs (300 m$)[2]
- Incentives, subsidies for EVs & PHEVs (600 m$)
- R&D plan for commercialisation of L4 AVs (cross-ministry, 900 m$)[3]
- Land transportation innovation fund – AV (28 m$, MOLIT)[6]
- Digital new deal: Integration of data, network & AI (32 b$, MSIT)[4]
- Land transportation innovation fund – Smart city (28 m$, MOLIT)[6]
- Land transportation innovation fund – Smart logistics (28 m$, MOLIT)[6]

Research Activities

Energy & Environment

- 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 H_2

Electrification

- Battery leasing project: 80,000 units per year by 2029
  - Carbon Free Island 2030 project: EV trial on Jeju Island
  - Adaptable electric vehicle platform "E-GMP" by Hyundai

Automation & Connectivity

- 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$)
  - K-City: Mock city build for testing AVs (10 m$)
  - Digital Twin Project (1.5 m$, 2020-2025)
  - C-ITS pilot projects in Sejong-Yusung (2017), Seoul & Jeju (2019), Ulsan & Gwangju (2020) Sejong – Urban Connected Automated Shuttle Systems (2021)

Urban Mobility

- Smart City Songdo: Planned city with focus on innovative urban mobility
- Management of urban infrastructure using ICT & utilisation of city data
  - 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 42dot – TaaS startup)
  - Smart city challenge
  - Sejong Smart City
  - 2022: 50 units of autonomous shuttle buses in cities & towns

Freight & Logistics

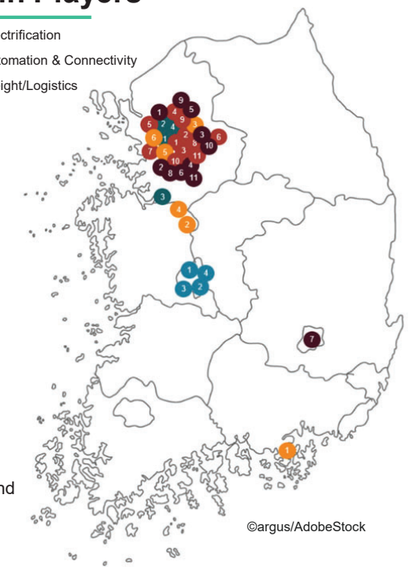
- Test bed for AD & truck platooning of commercial vehicles in Gunsan
  - Pilot projects for flying cars (2025)
- R&D on logistics technology e.g. delivery systems utilizing robotics, IoT & big data
- Building smart logistics & distribution system with 11 smart distribution centers (2020-2025)

Road Safety

- Guarantee of Automobile Accident Compensation Act: Liability standard, obligation to attach AD data recorder, accident investigation committee

Main Players

Electrification
Automation & Connectivity
Freight/Logistics



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Research Institutes

1. Korea Electrotechnology Research Institute
2. Korea Transport Institute
3. Electronics and Telecommunications Research Institute
4. Korea Automotive Technology Institute
5. Korea Automotive Testing & Research Institute
6. Korea Institute for Advancement of Technology

Suppliers

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

Innovation Policy

1. MOTIE
2. MOLIT
3. MSIT
4. MOE

OEMs

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

Mobility Service Providers

1. StradVision
2. Prosense
3. Mobiltech
4. Wayties
5. ThorDrive
6. FESCARO
7. Sonnet.ai
8. Unmanned Solutions
9. 42dot
10. Autocrypt
11. Mappers

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 it 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 H_2 technologies over battery technology research.

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V.2.0 (31st May 2022)

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.

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3.4. South Korea

South Korea mainly focusses on commercializing AV products and components to become international technology and export leader. The countries 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 H_2 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.

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