GOVERNANCE FOR NEW MOBILITY SOLUTIONS

KNOWLEDGE BANK

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Author(s): Ping-Jen Kao, UCL
Yannick Bousse, UITP
Arthur Cormier, UITP
Valerio Lubello, UB

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FOREWORDS

Disruptive innovations have the power to redefine the transportation industry and change users' behaviours. Over the last decade, a variety of new mobility services and technologies have been developed, such as autonomous vehicles, drones, and mobility-as-a-service. These innovations are critical to the development of sustainable urban mobility planning. Therefore, there is a need to understand more about disruptive new mobility services and technologies.

This knowledge bank is to review the knowledge state-of-the-art on new mobility services and technologies and develop a more comprehensive guidance for policy makers. It enables the public sector to design regulatory and governance frameworks that integrate and foster the implementation of new mobility services and technologies. Specifically, this knowledge bank:

(1) categorizes all disruptive innovations the in transportation industry into four innovation categories (i.e., connected, cooperative, and automated mobility, infrastructure, network, and traffic management, MaaS and MaaS platforms, and shared on-demand mobility), .
(2) provides an inclusive review on new mobility services and technologies, including market analysis and cooperation models among public and private parties.
(3) analyses the business models of the four innovation categories and explores their value creation, value delivery, and value capture mechanisms.
(4) investigates the regulatory responses of each innovation categories in order to recommend policy makers to enable adaptive and anticipatory regulatory schemes and governance with novel policies that contribute to sustainable mobility goals.

LIST OF ACRONYMS

AGV - Automated Guided Vehicle
API - application programming interfaces
AV - Automated Vehicle
B2B - Business-to-Business
B2C - Business-to-Consumer
B2G - Business-to-government
CAGR - Compound Annual Growth Rate
CAM - Connected and Automated Mobility
CAV - Connected and Automated Vehicle
CEF - Connecting Europe Facility
DG - Directorate-General
EFSI - European Fund for Strategic Investments
EU – European Union
E-VToL - electric vertical takeoff and landing
GPS - Global Positioning System
ICT - Information and communications technology
IDF - Île-de-France
IoT - Internet of things
IT – Information technology
ITS - Intelligent Transport Systems
MaaS - Mobility-as-a-Service
MSP - Mobility service providers
PT - Public transport
SSB - Stuttgarter Straßenbahnen
TEN-T - Trans-European Transport Network
TFL - Transport for London
TRL - Technology readiness level
UAS - Unmanned-aerial systems
UNECE - United Nations Economic Commission for Europe
VToL - Vertical take-off and land

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1.INTRODUCTION

1.1. Four Innovation Categories

GECKO has categorized four transport innovation categories that are most disruptive in today's transport sector. These categories are: 1) cooperative, connected, and automated mobility, 2) infrastructure, network, and traffic management, 3) MaaS and MaaS platform, and 4) shared and on-demand mobility. Each innovation category has various disruptive innovations. Table 1 provides the definitions and summarizes all these innovations.

Table 1 Four Innovation Categories: Definitions and Examples

Innovation Categories	**Definitions and Examples of Disruptive Innovation**
1. Connected, cooperative and automated mobility	**Definition** A connected vehicle is defined as a motor vehicle "that connects to other vehicles and/or devices, networks and services outside the car including the internet, other cars, home, office or infrastructure" .[1] In the future, they might directly interact with each other and with the road infrastructure. This interaction is the domain of cooperative mobility, which is enabled by digital connectivity between vehicles and between vehicles and transport infrastructure. An automated vehicle is defined as "a motor vehicle which has technology available to assist the driver so that elements of the driving task can be transferred to a computer system". [2] In contrast, an autonomous vehicle is defined as "a fully automated vehicle equipped with the technologies capable to perform all driving functions without any human intervention". [3] **Examples of disruptive innovations** • Connected and automated vehicles • Passenger urban air mobility • Drone last mile delivery

[1] Gowling WLG, Are you data Driven?
[2] European Parliament, Briefing January 2016, Automated Vehicles in the EU.
[3] European Parliament, Briefing January 2016, Automated Vehicles in the EU.

2.	Infrastructure, network and traffic management	**Definition** Infrastructure can be defined as innovations in infrastructure management, pricing, taxation and finance, digitalization and integration.[4] Network and traffic management "provides guidance to the European traveller and haulier on the condition of the road network. It detects incidents and emergencies, implements response strategies to ensure safe and efficient use of the road network and optimises the existing infrastructure, including across borders.[5] **Examples of disruptive innovations** • Big data for mobility • Hyperloop
3.	MaaS and MaaS platforms	**Definition** "Mobility-as-a-Service (MaaS) is a user-centric, intelligent mobility management and distribution system, in which an integrator brings together offerings of multiple mobility service providers, and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility".[6] "The MaaS Platform is the IT structure that is used by the MaaS Operator to provide the final service of mobility to the end-users". **Examples of disruptive innovations** • MaaS • MaaS platforms
4.	Shared and on-demand mobility	**Definition** Shared mobility and on-demand mobility are two trends which emerged as a response to the change in traveller need for cheaper transport (e.g. sharing the cost of travel) and the need for easy access to a transport (service) at a given moment. Shared mobility can be defined as usage of shared resources, in this case vehicles, which are made available to registered users at various locations in the city. On-demand mobility is service provided 'on-demand', when requested by the customer. **Examples of disruptive innovations** • Car-pooling • Bike sharing • E-scooter sharing/micromobility • Ride-hailing and TNC • On-demand ridesharing • Crowd shipping

[4] Transport Infrastructure Expert Group.
[5] Intelligent Transport Systems, Traffic Management
[6] The MaaS Dictionary

1.2. How To Use the Knowledge Bank

In this knowledge bank, each innovation category has three main sections. Section 1 presents different disruptive innovations and introduces the definition, market analysis, and the example of cooperation models among public and private parties. Section 2 and 3 discuss the business model and regulatory responses of the particular innovation category. All these contents are extracted from GECKO deliverables. The following is the snapshot of three sections and their linkage with GECKO deliverables. If the readers are interested in specific areas, they can find more details in the deliverables on the GECKO website here: http://h2020-gecko.eu/resources/publications

2. CONNECTED, COOPERATIVE AND AUTOMATED MOBILITY

2.1. Innovation 1: Connected and Automated Vehicle

New mobility service and technology

Connected and Automated Mobility (CAM) refers to autonomous/connected[7] vehicles or self-driving cars/vehicles that can guide themselves without human intervention.[8] Connected vehicles use different communication technologies to communicate with the driver: vehicle-to-vehicle, with roadside infrastructure, and with the "Cloud". CAM can improve vehicle safety and efficiency and reduce commute times. [9] Some autonomous vehicles are also referred to as self-driving, driverless or robotic. Indeed, given that the majority of crashes is due to human error,[10] CAVs can bring to car accident elimination, as vehicles can monitor the environment continuously and compensate for lapses in driver attention. Also, traffic congestion could benefit from CAM. CAM can eliminate stop-and-go waves caused by human behaviour and consequently, as experimented, smooth out the traffic flow for all cars.[11]

However, the systems underlying CAVs (sensors, radar, and communication devices) are expensive compared to older vehicles which leads to the questions about the affordability of CAM technology.[12] Other barriers include liability, licensing, security and privacy concerns.

Market analysis

CAV solutions exist at the "Testing" market readiness level. Guidelines have been developed by some governments (e.g. USA, UK), and cooperation is being sought by some others, such as in the Netherland. Whereas Uber recently restarted its testing again, some developers like Google and Tesla are thinking about developing self-driving vehicles suitable for existing infrastructures. However, at the current stage road infrastructure support seems to be not well prepared, setting barriers for CAV development[13]. Therefore, infrastructure planning processes among transport policy makers, planners and engineers are not keeping pace with CAV developments within the automotive and tech industries.

Tesla, Uber and Alphabet Among are the main players in the CAV industry, together with some auto brands, start-ups in the auto tech market, technology and telecommunications companies.

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[7] SAE has set 5 "Levels of Driving Automation". According to which, only autonomous cars of level 4 or 5 can be self-driving.

[8] Connected and automated mobility in Europe

[9] Connected and Automated Vehicles

[10] Li, T. & K. M. Kockelman, Valuing the Safety Benefits of Connected and Automated Vehicle Technologies

[11] 10 Advantages of Autonomous Vehicles

[12] The Cost of Self-Driving Cars Will Be the Biggest Barrier to Their Adoption

[13] Liu, Y. and Tight M., A systematic review: Road infrastructure requirement for Connected and Autonomous Vehicles (CAVs)

As an example, Amazon recently announced their investment in Rivian, a competitor to Tesla, and in Aurora, an independent automotive start-up.
Although CAV infrastructure development is still a technological barrier, the CAV market is supported by many factors including efforts from governments and consumers to ensure road safety. Moreover, factors such as transition from car ownership to MaaS, and revenue generation opportunity for different layers of the automotive ecosystem can create opportunities for the market growth. However, factors such as AV reliability, inadequate infrastructure, cybersecurity threats due to increasing data, limit market growth.

Cooperation models among public and private parties

The S3 Shared Shuttle Services Project in Gothenburg is part of the Swedish Government's Innovation Program "Next Generation Travel and Transport" and is partly financed by Vinnova through Drive Sweden. The actors involved are Autonomous Mobility, a Danish operator, the city of Gothenburg and the Swedish Transport Agency. The project was created with members of the Drive Sweden Platform and initiated by the RISE Viktoria research institute. The collaboration was perceived as logical, as each actor's objective is different but benefits from a cooperation scheme. For instance, the project was initially running in a campus, which allowed to create a connection between public transport stops. The second location chosen will create a link between a car park and central office buildings. The regional authority is currently studying the possibility to implement the service in a hospital. Thanks to this cooperation, an update of the regulatory framework should also be proposed to cope with the innovation.

2.2. Innovation 2: Passenger Urban Air Mobility

New mobility service and technology

Urban air mobility refers to the use of aerial autonomous vehicles or vertical take-off and land (VToL) vehicles to transport people living in populated urban areas. The key technologies that influence the successful implementation of urban air mobility are the advanced automated technologies, and infrastructures as a dedicated 5G network. In this vein, systems based on automated operations are essential to enable the external environment to be detected and to automatically calculate the best and safest routes for passengers. The use of 5G technology is crucial for future air traffic control.[14] For transportation to the sky, robust and integrated city infrastructure will be essential, such as weather and GPS satellite, uninterrupted power supply, and vertiport.[15] In addition, fast charging infrastructure is needed for urban air mobility because most VToL will be electric vertical takeoff and landing (E-VToL) in the future. Without the support of well-developed infrastructure, the implementation of urban air mobility will become less possible.

Market analysis

[14] Urban Air Mobility Will Not Succeed Without a Dedicated 5G Network
[15] Infrastructure barriers to the elevated future of mobility

Urban air mobility market is expected to grow over the next few decades. The current market readiness level might be 4 (i.e., small scale stakeholder campaign). Some enablers might enhance the urban air mobility market readiness, such as advanced automated technologies and integrated city infrastructure. Some barriers could discourage the technology's commercialisation in different cities, such as safety, privacy, environment, noise and visual disruption[16].

Regarding market positioning, from a B2B perspective, there are more than 70 manufacturers worldwide, including Boeing and Airbus. These manufacturers not only sell their products to the service providers but also develop brand new services in different cities.[17] From a B2C perspective, they will increase service providers offering customized services for different sectors (e.g., health care and tourism). To maintain competitive advantage, firms should develop robust urban air mobility ecosystems and well-designed business model. They should start with clear market positioning and use a niche strategy to acquire early adopters and build brand reputation.

As for maturity, this market is at the introduction/development stage, with few competitors. Nonetheless, it is growing steadily.

Cooperation models among public and private parties

No cooperation model for service can be determined.

2.3. Innovation 3: Drone Last Mile Delivery

New mobility service and technology

Drones are vehicles remotely driven, relying on several sophisticated technologies. These drones can support the development of various services (e.g., medical deliveries, cross-border emergency situations and goods delivery). The technology and infrastructure of drones still have to be improved to render drone delivery common practice. Among these technologies, autonomous flight is still in a testing phase, even though some drones are already able to fly without the support of a user who controls its route. Currently the most mature unmanned-aerial systems (UAS) applications involve short-range surveillance and associated photographs or videos. Another technology is battery performance, which is improving as the energy density of lithium-ion batteries grows year-by-year and their lifespan is expected to double by 2025. Furthermore, detect-and-avoid technologies, use to help drones avoid collisions and obstacles, are not yet mature even though they are used in drones currently available. Strong solutions are expected to emerge by 2025. Finally, location technologies will allow drones to identify their position even in areas where GPS signals are limited, such as densely built cities and remote locations. The widespread rollout of a GPS alternative is more than ten years in the future.

Market analysis

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[16] NASA: URBAN AIR MOBILITY (UAM) MARKET STUDY

[17] UAM Executive Briefing

Drones Technological Readiness Level might be 9, even if further progress is being made (e.g. battery performances and Detect-and-avoid technologies). From a market perspective, the Market Readiness Level of the delivery service with drones, in its most advanced applications, is 6 (*Proof of traction*), as consistent feedbacks from customers does not yet seem to be available. However, some questions regarding the adoption of drones for delivery services have been raised, for instance, those concerning vehicle relocation or the building of new fleet stations. Nonetheless, numerous investments and research show that companies are considering this technology.
In this market, the main players are big companies such as Amazon (U.S.), United Parcel Service (U.S.), Airbus S.A.S (France), Alibaba (China). On the other hand, several public sector entities perceive delivery by drones as a potential opportunity. As for its maturity, according to Giones and Brem (2017)[18] UAVs for small package deliveries is still in the first stage (*concept validation phase*).

Cooperation models among public and private parties

No cooperation model for service can be determined.

2.4. Business Model

Value creation mechanism

Three value propositions are generally proposed in connected, cooperative and automated mobility category: 1) the offering of more environmentally friendly, economical, and efficient autonomous vehicles and drones, 2) the combination of advanced services and technologies which satisfy unmet needs, and 3) the integrated solutions with various technological functions and services.

Value delivery mechanism

Most of innovations in this category have not been formally commercialised in the market. They are still in the experimentation stage. Therefore, the proposed value of these innovations is delivered mainly through their website. Presenting at international conferences and exhibitions is also a key channel to deliver value.

Value capture mechanism

The current value capture mechanism is quite conventional for these innovations. They capture value mainly through selling products or services or by the way of subscriptions. However, selling an integrated solution, which combines technological functions to solve customer needs with value added services, is the future direction for connected, cooperative, and automated mobility.

[18] Giones, F. and A. Brem (2017) From toys to tools: The co-evolution of technological and entrepreneurial developments in the drone industry, Business Horizons, 60 (6) 875–884

2.5. Regulatory Responses

The Vienna Convention of 1968 set up obligations for a vehicle to be homologated on public roads, such as having a driver on board of the vehicle and respecting certain requirements to run a vehicle on a public area. Many of the road regulations around the world are based upon this convention. Automated vehicles represent a disruption in regards to the agreement signed, which tends to slow down the adoption of regulations on cooperative, connected and automated vehicles.

On a European level, these innovations are not directly regulated by the EU. Some existing regulations can apply to them (Mobility Packages, Digital Single Market) and communications have been published by the institutions on these topic. As a non-binding text, the declaration of Amsterdam (14th April 2016)[19] set up goals between the European Commission and the private sector to facilitate the introduction of connected and automated driving in the EU.

Despite the lack of regulations from the EU, countries have adopted frameworks and laws to allow the testing of automated vehicles in different conditions. France has set up a strategic framework for French government policy actions on the development of automated or driverless vehicles (May 2018)[20] while the UK founded the Centre for Connected and Autonomous Vehicles (CCAV30)[21] in 2015 to ensure the UK's position as an AV frontrunner. Austria has also released an action programme on Automated Mobility[22] in 2019.

Countries also developed the possibility to test the vehicles in real-life conditions. Germany authorised 15 test beds around the country for different road categories in real traffic situations and under real-life conditions. Finland also adopted the development of automated vehicles on a test section of a public road. Greece decided to allow fully automated driverless vehicles in urban areas and on public roads in the context of research/pilot implementations. Each project has to be analysed against the criteria established by the framework. Further developments to facilitate the permanent circulation of vehicles are awaited from the Greek government. Outside of the EU, Singapore introduced the Road Traffic (Autonomous Motor Vehicles) Rules 2017[23] clarifying the necessary approval and authorisation needed to run trials.

An ongoing test of automated vehicles on public roads encouraged Sweden's government to create a framework. There were no pre-existing processes on the approval of these vehicles before. A consensus between different stakeholders enabled a new regulatory framework for public road tests of AVs to be built. The entire road regulation was reviewed and some limitations were identified for autonomous vehicles.

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[19] Declaration of Amsterdam, 14th April 2016
[20] Development of autonomous vehicles, the French strategy
[21] Center for Connected and Autonomous Vehicles's website, UK
[22] Automated Mobility Action Package (2019-2022), Austria
[23] Road Traffic (Autonomous Motor Vehicles) Rules

In Luxembourg, the Ministry of Transport gave a temporary ‘essai scientifique’ permit. This is a special authorisation to allow testing in an open environment, which could not have been allowed without an individual approval from the Ministry. The country will not set up its own regulation on the matter, it will follow EU regulation in the future.

The Port of Rotterdam developed its own project on automation with automated guided vehicles and automated terminals. The AGVs can run freely as the port’s roads are not public. In 2018, an amendment to the Dutch Road Traffic Act of 1994 has allowed tests without drivers on board of the vehicles.

The question of liability has still to be solved. If a driver is on board, he is usually considered responsible for an accident if avoidable by human intervention. If the vehicle is entirely driverless, regulation is still awaited to determine liability. It could be based on results of investigations after an accident to determine if the manufacturer is responsible or not.

Regarding urban air mobility (passenger and drone delivery), regulations are still at an early stage. On the EU level, the regulations previously mentioned impact as well urban air mobility innovations. Reykjavik has also authorized deliveries by drones from shops and restaurants. Customers use an app and have to get the permission from their neighbours for flights.

3. INFRASTRUCTURE, NETWORK AND TRAFFIC MANAGEMENT

3.1. Innovation 1: Big Data for Mobility

New mobility service and technology

Rapidly changing customer demands and preferences are creating new demand patterns for the commercial freight transportation and logistics industry. Fleet operators can have major gains from advanced analysis of data collected from the vehicles in their fleet, such as location, mileage, fuel consumption, driving behaviour, in order to improve fleet management but also to eliminate vehicle misuse by drivers. However, the major obstacles are the large amounts of data generated, and the various formats in which they are provided.[24]

Market analysis

Currently a market exists at the "Traction" market readiness level, as the analysis *via* big data are in place to develop services/products for consumers. Indeed, management and e-commerce companies have been investing in big data to gain insight into their businesses and their customers, in order to optimise their processes and customer experience. Their need to optimize and simplify their procedures will boost this market evolution.

As for the main players, Amazon has been investing in pioneering technologies disrupting traditional and online retailing, including the use of big data in their fleet management operations. Amazon has therefore moved away from being a pure e-commerce player to a major big data company. Alibaba has also been focusing on big data to expand market growth and build logistics networks to reach even remote rural areas.

When it comes to the use of big data in logistics, there is a huge untapped potential for improving operational efficiency and customer experience and creating useful new business models. One example is the integration of supply chain data streams from multiple logistics providers which could eliminate current market fragmentation and powerful new collaboration and services.[25]

Cooperation models among public and private parties

Data sharing is a critical factor for cooperation in this transport innovation. Cooperation between public and private parties can facilitate private parties gaining access to open datasets. For services there are various cooperation models available. An American company Kepler51 has been using advanced predictive analytics technologies to build a real-time logistics tool to increase the efficiency of delivery vehicles. Their big data solutions - the LiveRoad Geospatial Analytics Platform - allows for the real-time monitoring and forecasting of risks and delays based

[24] Search Results Web results Artificial Intelligence and Automotive Fleet Security Go Hand-in-hand

[25] Transforming Logistics Using Big Data

on a range of factors (such as weather, temperature, road conditions, departure time, historical analysis, etc.), in order to dynamically route or schedule vehicles for efficient movements.

Kepler51 is a US public benefit corporation, which means that the public benefit dimension is included in the charter of the company, in addition to the corporate goal of profit maximization. It relies on an open data for its functioning. Google Buffers, Cassandra Database and Spark Realtime Processing Network are providing data to this service. These providers interact with the US Government Services which are providing Open Datasets. Obtaining the data is usually not a difficulty. However, the lack of interoperability between some different US states' database was identified as an issue for further development of the service. The project could benefit from better access to real-time data and greater collaboration between public entities in the country.

3.2. Innovation 2: Hyperloop

New mobility service and technology

Hyperloop can be defined as an ultra-high-speed - both above ground and underground - transportation system, a new means of ground transportation potentially able to carry passengers and cargo at speeds over 1.000 km/h inside low-pressure tubes[26].

The capsules are supported on a cushion of air, featuring pressurized air and aerodynamic lift. The capsules are accelerated via a magnetic linear accelerator affixed at various stations on the low-pressure tube with rotors contained in each capsule. Passengers may enter and exit Hyperloop at stations located either at the ends of the tube, or branches along the tube length. Technical challenges arising from this technology development are barriers to Hyperloop development. Currently there is only one test track existing in the world, built by Virgin in the Nevada desert and 500 meters long. So far, the highest speed recorded on this test track is 386km/h.

Market analysis

Hyperloop is currently unready for the market, because of technological barriers such as interoperability, speed and safety, and the lack of testing possibilities. Nonetheless, its attractiveness for investors could become an enabler.

As for market segmentation, Hyperloop has a one of a kind segment. Potential competitors are planes and high-speed trains. The main player in the market is the Virgin Hyperloop One company[27]. The main customers targeted by Hyperloop are people living in big cities or suburbs and people who are frequent travellers for work. The main competitive advantage promised by the Hyperloop is the price: it is meant to be way cheaper than planes and high-speed trains. It is still a bit early to discuss a potential scale up, but a cross border Hyperloop could potentially be foreseen.

[26] ZELEROS
[27] Hyperloop one

Hyperloop is still at the introduction phase. The level of research is very high considering, as previously mentioned, the fact that several companies national and private are working on this project. There is no consumer testing yet as Hyperloop only has a very short test track so far.

Cooperation models among public and private parties
Only 6 companies are testing Hyperloop worldwide and two countries on a national level, China and Korea. Interoperability is identified as one of the key elements for the use of this technology, which implies collaboration between a wide range of actors to implement testing projects.

Under the supervision of the European Commission, an agreement on a common standard approach was signed between Poland, Canada, the Netherlands and Spain, on harmonization and interoperability of the infrastructure. Private companies are also collaborating with the DGs MOVE, GROW and RESEARCH of the European Commission.

In Spain, a collaboration was developed between the company Zeleros and public actors, initially established in order to develop the most suitable regulatory framework to obtain authorization for testing. The project is supported by public authorities on a regional and city level and by the Ministry of Science and Infrastructure on a national level. In general, it was observed that public authorities are willing to adapt their regulatory framework for Hyperloop testing.

3.3. Business Model

Value creation mechanism
The value propositions for infrastructure, network, and traffic management generally are: 1) higher efficiency and speed with lower maintenance cost, and 2) lower emission with new technologies and taxation measure.

Value delivery mechanism
The value is mainly delivered through online channels. Some transport manufacturers sell their products through traditional B2B relationships.

Value capture mechanism
The value is captured via different ways. It depends on the nature of services or products in the category of infrastructure, network, and traffic management.

3.4. Regulatory Responses

The main challenge for transport infrastructure on an international level is usually related to harmonization and standardization, especially in the EU where the networks are well connected to each other. In the framework of new mobility services, it represents an important issue for the implementation of autonomous mobility or for intermodality. The EU has several programmes to encourage cooperative infrastructure investments such as CEF, EFSI, TEN-T policy, etc. Directives are also meant to create a common ground for road infrastructure safety, spatial information, interoperability or on digital infrastructures. Some agreements were also signed between European countries in the framework of the United Nations Economic Commission for Europe (UNECE) on main traffic arteries, railway lines, combined transport lines and related infrastructures and inland waterways.

Initiatives can also be undertaken by national governments, as infrastructure investment is linked with the deployment of other technologies such as autonomous vehicles and e-mobility. It depends on the willingness of member states to invest on infrastructures. For instance, the UK announced early 2018 that it will boost its digital infrastructure with public investment, while the Smart Road Decree in Italy is allowing tests of the 5G infrastructure for autonomous vehicles.

National transposition of the EU regulation on Intelligent Transport Systems for traffic management has encouraged national projects and brought to light different regulation challenges. Several regulatory texts were implemented, on road infrastructure, devices for traffic monitoring or traffic management centres (PEREX 4.0 in Belgium, the Automatic Traffic Monitoring Center CANARD in Poland).

The Traffic management 2.0 is an innovative platform by ERTICO to create a collaborative and Interactive Traffic Management System. In the development of these synergies between the public authorities, private providers and the drivers, issues regarding the legal barriers existing on data reliability and security were identified. These barriers should be overcome by EU regulations.

The Spacetrain[28] start-up in France is working on regulatory issues related to Hyperloop. The start-up is researching and developing a freestanding shuttle powered by air cushions. In terms of regulation, issues can be spotted in hydrogen and security measures, tender processes which are too restricted and not open for this new innovation, regulatory frameworks not adapted to innovative measures and the difficulties to get authorization for testing. However, the French regulatory framework is granting financial support and tax credit to start-ups like this. The Mobility Law of April 2nd 2019 is granting investments for this project.

In another Hyperloop project in Spain, Zeleros, the disruption came from the infrastructure. An agreement was signed between 4 countries on a harmonized and interoperable infrastructure, under the supervision of the European Commission. For the test track in Spain, it is classified as a research facility which means the project needs to be in close collaboration with universities and researchers.

[28] Spacetrain

4. MAAS AND MAAS PLATFORMS

4.1. Innovation 1: MaaS Platform

New mobility service and technology

The MaaS platform(s) is the IT structure that is used by the MaaS operator(s) to provide the final mobility service to the end-user. The MaaS Platform is split into two elements: the front-end and the back-end, all of which are made up of components developed by the IT Providers.[29] This platform manages all the data and functionalities needed for MaaS operators to offer services.[30] The MaaS platforms can be developed by MaaS operators or IT providers.

In general, a MaaS platform has multiple functions: including 1) information and availability (e.g., information about mobility service providers and integrated transport service providers, journey details and location details), 2) journey planning (e.g., trip suggestions, route planning and time constrain filter), 3) booking and payment (e.g., management and cancellation of booking), and 4) reporting (e.g., aggregated reports to MaaS operators, to MaaS end-users, and to MaaS mobility service providers). To support these functions, relevant application programming interfaces (APIs), real-time data, and ICT infrastructure (e.g., mobile network coverage and smart ticketing infrastructure) need to be available.

Market analysis

The market readiness for MaaS platform might be in the level 6 (*proof of traction*), whereas the technology readiness of MaaS platform might be in level 8 or 9. Automated technologies, internet of things, and 5G enable the market readiness of MaaS platform. Moreover, the advanced methods on data collection and analysis helps IT providers to develop real-time decision function (e.g., journey planning, booking and payment, and reporting). The main barrier for the market readiness of MaaS platform is the integration of different transport and service operators.

The market positioning of a MaaS platform is the customizable comprehensive platform supporting MaaS operators in offering and managing their services. Moreover, a MaaS platform also enables public authorities of cities to better analyse and orchestrate the activities of service providers. It can therefore be seen as a new product in new market and/or a new product in the existing market, placing this service. And indeed, the current market size is small, with low sales, so the market maturity is at the introduction/ development stage, although the many suppliers operating in there. Due to the relatively low adoption of this service, its competitiveness level is currently low.

Cooperation models among public and private parties

MaaS platforms can collaborate with a wide range of actors to share data and revenue. Concerning the models for different actors as integrators, the platforms can commercially, use an

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[29] MaaS Dictionary

[30] Mobility as a Service (MaaS) and Sustainable Urban Mobility Planning (SUMP)

open back-end platform and or have transport as the integrator[31]. The IT infrastructure can also be developed directly by the MaaS provider itself or delegated to an external company. The selected model will influence differently the cooperation between the actors and have an impact on the solution proposed to the customers. Data sharing is a critical factor for cooperation in this transport innovation. Cooperation between public and private parties can facilitate private parties gaining access to open datasets. For services there are various cooperation models available. UbiGo, developed and tested in 2014 in the Gothenburg region in Sweden, is including several public agencies, such as the City of Gothenburg, Lindholmen Science Park, the Swedish Transport Administration and the Swedish Innovation Agency. In this case, the new players also interacted with the public actors. Other examples of MaaS platform companies are being developed in Finland with Whim App, SMILE in Austria and HannoverMobile in Germany.

4.2. Innovation 2: MaaS

New mobility service and technology

MaaS is a new concept aiming to provide consumers with flexible, efficient, user-oriented and ecological mobility services covering multiple modes of transport on a one-stop-shop principle. MaaS could offer multimodal route planners and different services under one fare and on the same ticket[32].

As an intermediate between mobility service providers (MSPs) and users, MaaS operator uses the data that each MSP offers, buys capacity from the MSPs to propose the ideal combination of transport modes to answer user's need within the possibilities offered by the network in real time. MaaS can involve the integration of ticketing, integration of payment, ICT support and it can rely on different payment methods such as monthly package subscription and pay-as-you-go. However, integration is often only partial. Wireless networks, especially, provide a key enabling technology fulfilling the physical requirements.

The MaaS idea is built on IT and on machines capability to handle a huge amount of data in real time. Thus, IoT is a starting point for building a new and smart mobility ecosystem. Following this line of reasoning, MaaS encompasses the public transport system as well as all the sharing and automated transportation services that are growing all over the world.

Market analysis

MaaS readiness suffers from the fragmentation of transport mode availability, and legislation. Juniper[33] ranked 15 world cities based on their readiness for large-scale MaaS service deployment, considering the existing/planned stage of deployment, cohesion of public transport services and infrastructure development. The top 5 ranked cities were: Helsinki, Stockholm, Vienna, Amsterdam, Austin. Among them, Helsinki's winning position is due to collaboration between government and MaaS vendors and Finnish legislation requiring mobility service operators to open their sales channels to third party vendors.

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[31] UITP Mobility As A Service Report, April 2019
[32] About MaaS concept
[33] Helsinki Ranked as Leading City for Mobility-as-a-Service Implementation

An enabler can be the public transport (PT) providers/operators, whereas the integration of road operators or private transport organisations such as motorist associations constituted only minor importance.
Apart from a few particularly virtuous cases, MaaS is still in the Introduction/Development stage of the market lifecycle though technology that makes MaaS work is already available (e.g. smartphones and 4G/5G networks, deep learning and artificial intelligence, dynamic routing). Therefore, in the first place it would be necessary to use existing technology to better use already existing infrastructure and services. In principle, MaaS is about integrating transport modes through the internet[34]. However, the achievement of a potential market share is still strongly hampered mainly by the lack of data sharing between organizations.

Cooperation models among public and private parties

MaaS solutions imply a cooperation between a wide range of actors. Firstly, governments and authorities are acting as legislators, enabling tests, financing infrastructures, issuing permits, etc. Secondly, the cities and regions are providing plans for the organization and management of the public transport, traffic management, local infrastructures, strategic plans etc. Lastly, transportation providers and operators are providing schedules, fares and ITS applications, transport content such as data on drivers and passengers etc.

The nature of the collaboration can be different depending on the MaaS solution model chosen. Three models can be identified: the commercial integrator model with different MaaS providers in an unregulated market; the open back end platform sharing all the information with the MaaS and transport providers; the transport as the integrator, where the MaaS is run by the public transport operator.

In Helsinki, Whim allows for instance a collaboration between local, national authorities and private operators. Sharing a common goal on reducing car use and improve mobility as a whole made the collaboration easier. The aim of the Finnish Transport Infrastructure Agency is to share the data collected by the different services openly to everyone[35]. In order to facilitate the deployment of this new solution, the regulatory framework in Finland was adapted accordingly.

4.3. Business Model

Value creation mechanism

The value propositions to create value in MaaS and MaaS platform category are: 1) the seamless and integrated planning, payment, and ticketing interface, 2) enhanced end-to-end customer experience with multi-modal transport choice, and 3) custom-made mobility package based on sufficient data analysis.

Value delivery mechanism

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[34] ICT-based tools supporting Value-Added Services implementation-Solez Interreg 2018
[35] https://vayla.fi/web/en/open-data#.XYx6nlUzZ9M

The app is the main channel for MaaS to deliver value to customers. The process of value delivery includes complex data collection and analysis to support customers' real-time decision making.

Value capture mechanism

MaaS has various value capture mechanisms, including contracts with B2G and B2B customers, subscription fees with frequent MaaS users, and pay-as-you-go with other users.

4.4. Regulatory Responses

Regulatory responses to MaaS have been limited until today. MaaS solutions can be quite different depending on which actor is the integrator. In any case, collaboration has to be fair between the different mobility services proposed. From an EU perspective, the promotion of fairness and transparency is addressed throughout the regulation for business users of online intermediation services[36]. A study has also been commissioned by the European Commission (EC) on the Remaining Challenges for an EU-wide Integrated Ticketing and Payment Systems (February 2019)[37].

Nationally, the institutional fragmentation can be a barrier to the overall quality of MaaS solutions. Some countries are aiming to overcome the issue. For instance, Finland agreed in 2018 on the Act on Transport Services which brought together legislation on transport markets. It ensures that operators provide an open interface, standardized and up-to-date data and all the minimum operational information for the implementation of a MaaS solution. The Netherlands also implemented an umbrella framework agreement for MaaS. Seven projects were chosen for regional pilots and were co-financed by the central government and the regions.

Political willingness on a regional level is also facilitating the overall implementation of MaaS solutions. The Gothenburg region in Sweden has implemented a directive to force public transport operators to facilitate third-party ticket sales. On a city level, Madrid developed a MaaS solution for optimising travel organisation and developing a smoother mobility infrastructure. It was set up by Madrid City Council's Air Quality and Climate Change Plan, which was a catalyser for further developments. Antwerp's MaaS solution (Smart ways to Antwerp) was also an initiative led by the mayor and the vice mayor in charge of mobility.

[36] Regulation (EU) 2019/1150 of the European Parliament and of the Council of 20 June 2019 on promoting fairness and transparency for business users of online intermediation services

[37] Remaining Challenges for EU-wide integrated ticketing and payment system, Feb 2019

5.SHARED AND ON-DEMAND MOBILITY

5.1. Innovation 1: Car Pooling

New mobility service and technology

Ride-sharing or carpooling is the sharing of car journeys so that more than one person travels in a car. Ride-sharing happens mostly spontaneously; however, technology is used to connect people to share their rides. The ride-sharing can be split in planned journeys and dynamic journeys. Dynamic ride-sharing is real-time or instant (not planned) ride-sharing. It's the new hitch-hiking, using your thumb on the smartphone instead of using the thumb as a sign for drivers on the road. (Examples: Car.ma, Flync)

This type of carpooling generally makes use of three recent technological advances: GPS navigation devices to determine a driver's route and arrange the shared ride, smartphones for a traveller to request a ride from wherever they happen to be, social networks to establish trust and accountability between drivers and passengers.

These elements are coordinated through a network service, which can instantaneously handle the driver payments and match rides using an optimization algorithm.

Market analysis

Carpooling can be considered at 8th (*Proof scalability*) Market Readiness Level. Indeed, it is one of the most visible and rapidly evolving solutions of shared mobility[38] with many companies already providing the service. For example, the platform BlaBlaCar has reached 70 million members.

Thus, the market is already existing and highly concentrated. Though there are many emerging players around the world, the leading brands occupy a large market share. The top 5 accounted for more than 74% of the global market in 2017[39]. Currently the average of distances travelled by carpoolers is high, less attractive to be used in urban areas. Nonetheless, it is argued that there are huge potential in urban areas due to the disruptive technologies in the future, such as the autonomous driving cars[40].

After driving alone, carpooling is the second most common travel mode for getting to work in the USA[41], notwithstanding the decline in recent decades. Consumers do not use carpooling because of time constraints, privacy needs, and safety concerns. Among consumers who carpooled, most—71 percent—did so to save money.

Cooperation models among public and private parties

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[38] Galizzi M.M., The Economics of Car-Pooling: A Survey for Europe, 2004

[39] At 15.2 % CAGR, Carpooling Market Size will reach 11400 million US$ by 2025

[40] Carpooling: facts and new trends, Chiara Bresciani, Alberto Colorni, Francesca Costa Alessandro Luè Politecnico di Milano

[41] The Benefits of Carpooling

Starting from October 1st 2017, Île-de-France (IDF) Mobilités has integrated carpooling services into the IDF regional mobility information system, with the objective of encouraging this practice. The traditional, local and community-based carpooling operators were brought together in the itinerary search engine of the region. Each carpool company is subsidised in order to increase driver compensation and reduce the passenger price. The tool is also available to other cities and regions, according to an open source development strategy. The initiative is coordinated by Ile-de-France Mobilités, Transdev and Cityway.

Such an initiative relies on the building of comprehensive datasets, composed of real-time and predictive data collected from connected individual cars, car-pooling vehicles and public transport modes. This integration will support evaluation of travel flows within the territory and knowledge of mobility behaviour, which can inform the development of the mobility strategy. The partnership has contributed to a significantly growth in carpooling trips in the region. By way of next steps, 10 000 more carpooling hubs should be created in the region by 2020. Carpooling is also used as an alternative to public transport during strikes, as users of the app are fully reimbursed for their trips to work.

5.2. Innovation 2: Bike Sharing

New mobility service and technology

Self-service bikes allow users to access a means of travel for short trips (mostly urban) that is faster than using public transport and greener than using a car. It is a collaborative mobility practice because the bikes are used by several users. They belong either to private operators or to public operators.

Today, we can differentiate three services that use different technology. The first is the self-service bike, in a station provided for this purpose. The operation involves unlocking the bike by paying at a terminal, and then being charged once the bike is locked again at a station (which can be a different station from the first one). The second is similar, but the self-service bike is available anywhere within a predefined perimeter and geolocatable via a smartphone ("free-floating"). The third is the "semi free-floating" option, which requires users to leave their bike in places that are provided for this purpose (parking, bike racks, etc.). They are also generally better secured (with a chain) to try to prevent damage and theft.

In the case of self-service electric bikes, three obstacles to cycling are eliminated: parking at home, theft and maintenance.

Market analysis

The global bike sharing market is expected to have its Compound Annual Growth Rate (CAGR) increased by about 6.54% during the period 2019 – 2024[42]. The trend started in China and spread out globally with the aim to reduce car and motorbike use in favour of bike-sharing. Thus, it can

[42] Bike sharing market

be assessed that bike-sharing technology is at the traction stage and can be placed at Level 7 (“*Proof of satisfaction*”) in the TRLs hierarchy.
As for market positioning, bike-sharing is an existing market, shaped in its current form since 2013[43]. The market is characterized by competitiveness between public and private companies (such as Mobike, Ofo, Lyft), the latter relying on M&A to expand their business[44].
The market is thus already existing, but also growing (Level II of Market Maturity – Growth level). Indeed, whereas the fleet size should increase up to 35 million bikes from 2019 to 2025, the worldwide industry revenue should exceed 10 billion USD for the same forecast period[45].

Cooperation models among public and private parties

Public authorities at the city level are working with private companies to provide bike sharing services. The public agencies with which these providers interact can differ from one city to another. The cooperation is therefore different in each city.

Cities provide licenses to operate, which are reviewed during operation. In Brussels, the private operators of free floating bikes have to provide service usage data to the administration, such as the routes taken by the users, the places where the vehicles are being dropped off and removed, the number of users and the routes travelled and vehicles used on an hourly, daily, weekly and monthly basis. This allows the city to assess better bike sharing needs.

As of February 2019, a regulatory framework has been created in Brussels setting up rules for the operators of rental services. Each operator with more than 50 bicycles, scooters or two-wheeled vehicles need a license to operate. Technical requirements are also listed in the framework and the operators have to provide real time information on the number of vehicles available in the region. In this case, the cooperation is at the initiative of the city and with little consultation of the bike sharing services.

5.3. Innovation 3: E-scooter Sharing

New mobility service and technology

Electric scooters give users access to a means of travel for short trips (mostly urban) that is faster than using public transport and greener than using a car. It is a collaborative mobility practice because scooters are used by several users. They belong to private operators. The technological operation is similar to the "free-floating" bike, available anywhere within a predefined perimeter and geolocatable via a smartphone. Three obstacles to soft mobility are eliminated through this service: parking at home, theft and maintenance.

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[43] The Global Rise of Bike-Sharing
[44] Bike Sharing Market Size By Type (Conventional Bikes, E-Bikes), By Model (Station-based, Free Floating, P2P) Industry Analysis Report, Regional Outlook, Application Growth Potential, Price Trends, Competitive Market Share & Unit Forecast, 2019 – 2025

This service lets as many people as possible move around the city at a reduced price. The improvement of this service could result in highly increment the use of electric scooters in cities, with social (accessibility, health) and environmental benefits (however, we would still need to pay attention to pollution and the recycling of abandoned scooters).
Degradation and theft would still be a major problem. Electric scooters have a lifespan of only three months. The intensive use, rough handling and vandalism that the users inflict on them considerably reduce the durability of these machines.

Market analysis

E-scooter sharing services are competing with the more run-in bike sharing services. The use consumers make of this service is so relevant that recently a debate has arisen among city administrations to set some rules on the conduct users must undertake. Thus, the TRL of this technology can be placed at 7, namely *"Proof of satisfaction"* level.
As for market positioning, e-scooter sharing services take place in a totally new market. This market is mainly characterized by operators acting specifically in it (Bird, Lime, Spin, Skip, and so on). The dominant regional market is the Asia Pacific one, due to the presence of the major service providers and attempts to reduce pollution – followed by North American[46].
The developing market is also helped by the zero-emissions policies adopted by governments. Nonetheless, operators have and will have to face some challenges, such as cities regulations, the expenditure in maintaining software up-grades and in re-distributing recharged scooters in every part of the city[47].

Cooperation models among public and private parties

In contrast to many cities, Lisbon has chosen a consensus approach to manage micromobility on a citywide level. In addition to a Memorandum of Understanding that all micro mobility providers must agree to, the city set up a 'sharing community' with all the operators, which are meeting monthly to facilitate discussion and assure the resolution of issues of concern for the city and for the operators. Set up at the initiative of the City of Lisbon, three meetings are held monthly, one with carsharing and eMotorbike operators, one with eScooter and bike sharing operators and another common meeting.

Thanks to this cooperation, operators now work jointly on various initiatives, such as awareness campaigns on safety, the creation of a brand for their community, a joint promotional website and discussion on a common vehicle redistribution service with external companies. The operators are also supporting the city in achieving its objective on reduction of private car usage. However, some issues regarding e-scooters still need to be managed by regulations.

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[46] Electric Scooters Market Size, Share & Trends Analysis Report
[47] Electric Scooter Sharing Market in US and Europe 2019-2024

5.4. Innovation 4: Ride-Hailing

New mobility service and technology

These emerging platforms in the mobility market evolved from the concept of carpooling, which as such has already existed for a while in the form of online platforms. The main difference is that ride-hailing service works more like taxi services, where the journey is not shared by different users. The journey is requested and only taken because of this request.
Some resemblance to taxi services can be identified, by offering a ride in exchange for a fare. For ride hailing platforms though, anyone with a driving license and a private car who fulfils the specific criteria set up by the company can sign up as a driver to chauffeur people around, meaning the companies behind the ride-selling application do not own a fleet of cars. This allows these companies to expand rapidly.

Market analysis

Besides being a disruptive technology, competing with and undermining traditional taxi-cab service, ride hailing is currently a consolidated technology, to the extent that the number of users are expected to reach 1.531,5m by 2023[48]. Moreover, major players are investing in a shift toward electrification of the fleet[49]. Thus, due to the understanding of the market and of the revenue projections, the TRL for this technology is at a scaling level (level 8- *Proof of scalability*).

As for the market positioning, notwithstanding the strong competition with taxi-cab services, ride-hailing is a new market. Its consumers are mainly in the 25-34 years' age range, at 37,7%, and most, at 70%, are on medium or high incomes. Most revenues are generated in USA and China, and accordingly the operators are located in these countries (Uber and Lyft from USA, Alibaba - currently projecting its entry in the market - from China).
The market is still growing, and it is expected to expand at a 5-year CAGR of 15% starting in 2019[50]. Among the growth factors, ride-hailing can rely on the shifting of preference from driving a car to being driven[51].

Cooperation models among public and private parties

In Innisfil city, Canada, an on-demand transport service is managed by Innisfil Transit, an entity set up by the city to oversee the provision of the service. The operator has entered into a partnership with the ride-hailing company Uber.

The on-demand service was set up in 2017, after a transit feasibility study evaluated the transport needs of areas of low population density. It concluded that running a bus service would not be beneficial and that an extensive on-demand system would constitute a better solution.

[48] Ride Hailing
[49] Electrifying ride-hailing companies: strategies and models
[50] Ride-hailing and new businesses to fuel $7tn+ global mobility market
[51] Ride Hailing Services Market Size, Share & Trends Analysis Report

The municipality subsides the service (Uber fares included), sets fare level depending on the origin and destination of the trip, grants cheaper trips towards commuting points, offers discounts to specific groups of people and provides alternative payments methods.

In terms of collaboration, if special fares apply, Innisfil Transit is filling the financial gaps for Uber and in return, the ride-hailing app shares information about trips, by means of a heat map showing the pickups and drop-offs as well as the total number of trips, average trip cost and length. Some measures were also implemented to limit a too extensive use of the service, which proved detrimental to active mobility.

5.5. Innovation 5: On-demand Ridesharing

New mobility service and technology

On-Demand ridesharing involves a system matching riders and drivers, so to share transportation at random times and locations. This system makes use of recent technological advances, such as GPS navigation devices to determine routes and arrange shared rides, smartphones to request a ride, social networks to establish trust and accountability between drivers and passengers, and E-payments systems. These elements are coordinated through a network service. On-Demand ridesharing involves a diverse set of phenomena, involving vehicles such as cars of different sizes, bicycles and others, last-minute demand, set pick-up and drop-off points.
Barriers for this technology are the low flexibility in adaptation to local conditions of density and transport network, belief that private cars bring convenience and flexibility, and lack of good urban public and complementary transport to ease first mile travel. At the same time On-Demand ridesharing is enabled by its advantages such as lower prices, shorter waiting times and higher safety.

Market analysis

Being an established service, on-demand ridesharing technology can be placed at level 7 of TRL scale, namely "*Proof of satisfaction*". Its CAGR is expected to grow by 19,87% from 2018 to 2025[52]. As for the market positioning, on-demand ridesharing is a new market. The most significant geographical share for this market is in North America. As for the players, the market is fragmented and highly competitive, with new entrants trying to succeed by differentiating their services[53]. Among the major players we can find Didi, Zimride, Carpool, Grab, Liftshare.
As for the market maturity, on-demand ridesharing is a growing market. Such growth is also witnessed by the entrance of traditional automakers in the market, such as Ford in the USA[54]. The growth is expected to happen also in other segments where there is a little application of this

[52] Ride Sharing Market
[53] Ride sharing market: growth, trend, and forecast
[54] Ride sharing market: growth, trend, and forecast

service, as long distance commutes[55]. Also, the number of users is expected to increase to 97,4 million by 2023[56].

Cooperation models among public and private parties

Stuttgarter Straßenbahnen (SSB), the public transport operator of Stuttgart, launched a new service called SSB Flex on June 1st, 2018. The service aims to provide additional, more flexible journey options in high-traffic areas or at specific times, in order to supplement the existing transportation services. A permit was granted by Stuttgart's Regional Council to operate the service, under the regulations applied to regular bus services.

The app was implemented thanks to the cooperation with Reach Now (formerly Moovel). The cooperation relies on the complementarity of the core business of each partner. On the one hand, SSB brings its assets in terms of regulatory approval, control centres, drivers, fleet management and customer service. On the other hand, Reach Now provides its on-demand platform's algorithm, routing, fleet control (software), B2C and Driver App, with ticketing and payment.

From the strategic point of view of SSB, the ownership of the platform is not essential, but having access to the customer master data and their role as a customer contract partner are considered as important. From Reach Now's perspective, the collaboration helped the service to thrive in the city and to develop their brand. The collaboration has enable a more agile approach to the service and customer benefit.

5.6. Innovation 6: Crowd Shipping

New mobility service and technology

Crowdshipping, or crowdsourced delivery, is a method that uses free capacity available in various transport modes, leveraging on non-professional couriers to perform freight delivery. Thus allowing to cut delivery costs and maximizing supply chain efficiency[57].
Crowdshipping involves "not necessarily an additional trip but a trip that leverages the typical travel patterns of the courier. The selected courier may be the closest to the delivery route, offer the cheapest delivery fee, or have the best reputation in the system"[58].
Crowdsourcing is an app-based platform, therefore relying on the application's efficiency in managing offer and demand. The use of apps offers customers the possibility to select a time slot and GPS track their order in their smartphones or choose to receive an alert SMS.

Market analysis

[55] Ride sharing market: growth, trend, and forecast
[56] Ride Hailing
[57] Shelagh Dolan, Business Insider, Crowdsourced delivery explained: making same day shipping cheaper through local couriers, May 21, 2018
[58] Le, T., Ukkusuri, S., Review of crowd-shipping services for last mile delivery: current business model, challenges, and opportunities. Submitted to the Transportation Research Part E. 2018.

Crowdshipping is already operational for several delivery services (such as grocery and take-away delivery). The service therefore can be considered at 8th (*Proof scalability*) level of the Market Readiness Level.

The crowshipping service is an existing market. Indeed, numerous crowdshipping companies have been founded and to date they already provide the service (eg, Postmates, Zipments). Big companies such as Amazon, DHL, have experimented city-level pilot projects. As it has been argued[59], crowdshipping platforms are essentially intermediaries. Therefore, "Amazon's entry into the crowdshipping market could prove a game-changer, so long as it is able to entice sufficient numbers of self-employed 'partners' into its Flex operation". On the other side smaller retailers rely on crowdshipping platforms to guarantee fast delivery services to compete with large e-commerce companies[60].

Crowdshipping can also be considered in the growth phase in the market lifecycle. But various questions are emerging regarding the exploitation of couriers, their discontent and the consequent quality of the delivery service[61]. Ultimately, according to McKinnon, the scalability of crowdshipping will depend on three-way inter-dependence in the growth of supplier, courier and customer numbers.

Cooperation models among public and private parties

No cooperation model for service can be determined.

5.7. Business Model

Value creation mechanism

The value proposition in shared and on-demand mobility category is to offer a travel experience that combines the advantages of private vehicles (i.e., immediate availability, end-to-end travel, comfort, and privacy) with those of the collective transport (i.e., no car ownership, pay-per-use, and easiness in parking). The value is created through diverse services.

Value delivery mechanism

The value is delivered through app-based channels and websites, with the support of personal assistance in specific situations.

Value capture mechanism

Pay-as-you-go is still the main mechanism for shared and on-demand firms to capture their value. Some firms have considered providing monthly subscription services for their members.

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[59] McKinnon A., Crowdshipping: A communal approach to reducing urban traffic levels?

[60] How crowdsourcing shipping through technology will make last mile delivery

[61] Missing wages, grueling shifts, and bottles of urine: The disturbing accounts of Amazon delivery drivers may reveal the true human cost of 'free' shipping

5.8. Regulatory Responses

The new shared mobility services are developing rapidly around the world, while cities and countries struggle to follow the rapid expansion with specific regulations. It can also be seen that these regulations are managed at different institutional levels throughout the world.

Regulation on car sharing is a good example on the difference of management, between a municipal, regional or national level. At the national level, the regulation can focus on different aspects. Sweden and France are pushing for the use of electric vehicles in free floating car fleets, while Germany is regulating the allocation of parking spaces for car sharing nationwide, in the 'Car-Sharing Law'[62].

Bike sharing is also managed on a national level in some countries. The Ministry of Transport of Singapore set up a regulation obliging operators to hold a license and to ban their users who are refusing to park bikes in the dedicated spots (Active Mobility Act)[63]. In China, the Ministry of Transport published in August 2017 a regulatory framework to limit the clogged public spaces with shared bikes[64]. E-scooter regulations also follow the same path, especially concerning their permitted usage. Germany, Italy and France are regulating the zones where scooters can drive. In France, legislators are also considering a law which would require e-scooter users to hold an A1 driving licence and implement along a penalty system in case of infraction.

However, the free floating vehicle services are often managed by the city itself. Beijing published a regulatory framework on bike sharing to tackle issues by limiting the oversupply of vehicles and geo-fencing some areas to prohibit parking. Operators also have to provide an insurance and their vehicles have to respect certain standards set by the local government. The number of vehicles available on the streets are also regulated by the city, such as in Barcelona. The city sets a flat rate for companies to pay for each vehicle in service and obliges the operator to distribute the vehicles between the different areas of the city.

Many cities are also requiring licenses for micromobility companies to operate their vehicles in order to ensure a level playing field and impose rules, such as in Brussels or Madrid. The city of Madrid revoked all operating licenses before setting new rules and asked the operators to renew their application. Different rules also apply to the different categories of micromobility vehicles, depending on their speed, weight, etc.

Ride-hailing services are also facing different realities around the world. In Germany, drivers have to hold a specific licence to pick up passengers and to set up a fare structure. France merged the 'Collective Transport Permit' with the 'Chauffeur License' to make it more difficult to obtain.

[62] Germany enacts car-sharing law

[63] Active Mobility Act regulations 2018, Singapore
[64] Chinese Cities Aim to Rein in Bike-Sharing Boom

Denmark set up a new taxi law in February 2017[65] comprising mandatory fare meters, video-surveillance and seat occupancy detectors to activate airbags. In most countries, taxis operators and drivers are reacting strongly to the implementation of ride-hailing services in their city, which bring cities to regulate strongly. TFL (Transport for London) recently banned Uber from London's streets because of safety issues[66]; California changed drivers' working status from contract workers to employees[67]; while in Dubai, a fare surcharge is applied to ride-hailing apps by the public authority and drivers need to hold a limousine license to operate in the city[68].

[65] New taxi law in Denmark reduces regulation and control

[66] Uber loses London licence after TfL finds drivers faked identity

[67] California Bill Makes App-Based Companies Treat Workers as Employees

[68] Dubai introduces fees for using ride-hailing apps

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