INNOVATION TREND REPORT
SMART MOBILITY

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Our lexicon, like everything else, has been turned upside down by COVID-19. Everything used to be smart, sustainable and Green, but we were looking at a future form which we had taken away a variable: uncertainty.

Now we are back to fundamentals and this means studying, analyzing, pondering and deciding, it means making conscious and competent choices.

That is where the true importance, the real usefulness of this report resides. Based on solid assumptions, this book provides elements of true knowledge, precise scenarios and figures. This book offers us a map, a legend that helps us understand the deep changes we are going through in the mobility space. Mobility, a concept that goes far beyond the mere meaning of the word itself, the meaning we knew until artificial intelligence and, more broadly, new technologies took the center stage and became the main characters.

It is not by chance that artificial intelligence is the focus of a previous book in this same series, a series that should be looked at in its entirety. This series is a guide in a more and more interconnected, and therefore complex world.

Enjoy the reading.

Maurizio Montagnese
Chairman
An incredibly rich research, a document that does not spare stimuli. The reader can take her or his own perspective and point of view to form an opinion about the trend we are moving along. Talking about smart mobility could take us to very different and apparently irreconcilable and separate scopes. This is why this book is a powerful tool, a compass that does not deceive us.

The content is the result of an outstanding and thorough analysis that enables each reader to reach a synthesis, a summary point. However, contrary to what most of us believe, synthesis does not always mean brevity, levity or superficiality. Ours is a synthesis that enables us to make the most important and most relevant ideas emerge, building solid foundations for solid, individual thinking.

The research experience so far accumulated by Intesa Sanpaolo Innovation Center guarantees quality. Ours is a team that has been gaining a well-deserved credibility by being able to deep dive into phenomena and trends, reading them through original lenses, while always looking into the future.

Enjoy your reading.

Guido De Vecchi
Executive Managing Director
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The mobility of the future
“Roman roads are a factor of incalculable importance in the very history of mankind. Rome became a mobile source of civilization and mistress of the world precisely because, through her roads, she had managed to systematically control a great part of the Earth’s surface.”

Thus Victor von Hagen describes, in his work “Le grandi strade di Roma nel mondo” (1978), the mobility infrastructure created by the Roman Empire that would extend for over 100,000 km across the continent of Europe.

Beyond the expertise and mastery underlying the planning and construction of these road projects, with thoroughfares that would be used regularly up to, and right through, the medieval period, and with bridges still in function today, emphasis is rightly placed on the strategic value of an infrastructure permitting the rapid movement of men and goods, for both military and commercial purposes.

Sliding the time axis along the timeline of the centuries preceding and then following the Roman Empire, we can always observe the role played by the mobility of men and means of transport, and by the development thereof in underpinning the role and geopolitical growth of those indi-
Individual nations that had become, in time, hegemonic in their own historical spaces.

It is sufficient to think of the Silk Roads built in Imperial China, which connected the ancient capitals Xi’an and Luoyang to Central Asia and beyond to Europe, and of how these have entered the collective imagination more, even, as an archetypal intercultural journey than as a trade route.

Through this evolution in time and up until roughly the middle of the second millennium of Christian civilization, the development of mobility coincided with the development and enhancement of infrastructures that permitted swifter and safer transit of means of transport that, in contrast, did not follow a corresponding innovation curve.

A first strong sign of discontinuity, perhaps more conceptual than actual, would be observed in the 15th century thanks to the visionary and creative genius of Leonardo da Vinci.

An extremely innovative designer, albeit one not adequately supported by suitable technology, which, incidentally, would take another four hundred years to arrive, Leonardo laid the ideological foundations of the machine-innovation coupling.

In a world in which the power available for travel was constituted by the muscles of quadrupeds, Leonardo devised projects for the creation of four-wheeled automatons, machines capable of vertical take-off and robot soldiers. We are in the 1400s but, nonetheless, a modern terminology speaking of drones, robotics, and self-driving vehicles would be quite fitting.

Four centuries later, in the second half of the 19th century, when the industrial revolution had already begun to inject into mankind an almost unlimited faith in its own capacities to progress, a French writer born in Nantes in 1828 would make commonplace to the masses the concept of mobility as a driver for dreams, explorations and gaining knowledge.

Jules Verne, one of the most translated authors in the whole world, left us masterpieces capable of awakening dreams in the child and also in the adult, masterpieces all developed around the multiple facets of the concept of travel, in which technology always plays a key role as an enabling factor for travel itself.

Machines that make it possible to cross the skies and the depths of the ocean, machines that cancel the distance between us and the moon, journeys that in a matter of weeks take us across the entire surface of the earth and acquaint us with nations and cultures. Man is, insofar as he knows, insofar as he meets, insofar as he travels.

Today, in this moment in history, we have at our disposal a technology that brings to maturity the futuristic designs of Leonardo and the visionary machines of Jules Verne. Today, and increasingly over the next decades, and less, we will witness a profound transformation in our very conception of mobility, with powerful impacts not only on “what” we will use to travel about but also on precisely “how” our journeys will be organized.

Just as the magnetic compass was indispensable to the navigators for charting routes and keeping their bearings within the four cardinal points, we too will equip ourselves from here on with a conceptual compass that will permit us to classify, analyze and represent, in an effective fashion, the transformations underway in the ecosystem of the means of transport and their related support infrastructures.

The Mobility compass, too, has 4 cardinal directions:

- Electric
- Connected
- Autonomous
- Shared

The approach that we have adopted in the development of this treatise moves sequentially along each of these axes, providing individual examinations since each dimension has its own significance, with different degrees of maturity in terms of the technological substratum, of...
Innovation trend report – Smart mobility

The ecosystem that sustains its development and of the adoption and varying levels of acceptance and familiarity in common thinking.

These profound vertical analyses are also complemented by a holistic vision, which considers all the combined phenomena in play and highlights the synergies that make each dimension not only an independent phenomenon but an enabling factor in the growth of the other dimensions too.

Beginning the exploration along the Electric Mobility axis, it will soon become apparent that the transformation underway, extremely topical in terms of media coverage and of debate among enthusiasts, is, in truth, a predominantly technological and organizational phenomenon: when vehicles with electric powertrains no longer suffer from shortcomings in autonomy and ease of charging compared internal combustion engine vehicles, the drivers of choice will be merely ones of economy and environmental ethics, with relatively few differences in the user experience.

The model of use of the vehicle does not change, nor do the services that are provided on board or around it and nor does the driving experience in terms of vehicle control.

It is not so, however, for the other three dimensions of analysis.

How many times in the course of a day do we hear repeated that we live in a hyperconnected world? The transport sector is no exception, rather, thanks to the imminent introduction of 5G in mobile networks, it will soon undergo a marked acceleration and a radical transformation.

Communicating in real time with tens of other vehicles whose paths cross at every moment and maintaining a constant exchange of data with the roadside control systems present, in the subsoil and in the stratosphere, not only enables intelligent and predictive management of the vehicle and of traffic flows, but also opens up the way to high-value services provided to the occupants who, on any occasion, are on board a specific vehicle or transiting a particular area, on the basis of a record of decisions taken and journeys made by each of these in any chosen time range.

No less of a breakthrough will be represented by Autonomous Mobility, perhaps currently the least mature of the four dimensions. Knight Industries Two Thousand, alias KITT, in the early 1980’s ‘embodied’ on the small screen the cinematic feats of a car well beyond Level 5 in the current scale of autonomous vehicle classification, as, apart from enjoying total driving capacity, it was also possessed of full consciousness.

Four decades have passed and, even though the commercial products currently available do not go beyond Level 2, means of transport that move in total autonomy are no longer merely a chimera or something from science fiction.

Progressively, as the driving function increasingly becomes a practically atrophied instrument, cars will assume the appearance and functions of a living room, favouring relaxation and entertainment.

Broadening our field of vision to the entire transport ecosystem, next we can see that already today there are large commercial vehicles that can move in platoons and currently being designed we have not only largely small drones for last mile deliveries, but also totally crewless enormous container ships able to sail the seas in complete autonomy.

If, in what has been covered so far technology plays a key role in the evolution of mobility, the fourth dimension along whose axis we focus our analysis is, instead, mainly cultural and behavioural in nature.

Last but not least, Shared Mobility is going to turn on its head the very concept of the car as a personal possession.

Viewing the car as no longer an object to purchase, to personalize, to take care of over time, to show off to one’s...
circle of friends and acquaintances, but rather as a tool that makes more sense the less it is left idle and thus the more it can be shared among different users and that it can, on any occasion, be chosen in different types to meet the specific needs of the moment.

This, then, is, more than anything, a cultural shift and a profound change in social behaviours and in the hierarchy of values.

If we now leave the four examples of horizontal analysis covered to board a drone and send it up into the air to obtain an overview of the situation, just as the road arteries of a city become visible and reveal its topology, similarly the technological and functional connections among the four dimensions of mobility manifest themselves in their extended ramifications and complexity.

We will not be able to have swarms vehicles moving about in total autonomy without these being tightly and constantly connected together and with the control systems.

A zero-emissions mobility will make it possible to shift traffic flows underground, on several levels and over long distances.

And many other correlations are developing before our very eyes.

By the middle of the current century, little more than 30 years from now, a third of a person’s life, the world will be inhabited by almost ten billion individuals. 70% of these will be concentrated in urban agglomerations that, if they are not to implode, will have to fundamentally change the rules and modes of access and movement applied therein.

In the excursus that follows, we attempt to provide some readings of how such a transformation may come about.
Electric mobility
**Electric mobility**

### The electric vehicles market

Interest in electric mobility was rekindled by General Motors thanks to its EV1 model launched in the mid-1990's: an electric car with an autonomy of approximately 150 km.

The “Tesla effect” is spoken of following the 2008 entry into the market of the futuristic Roadster, a sports model powered by a lithium-ion battery.

Despite the interest surrounding electric vehicles today, these only represent approximately 1% of total new car registrations.

The electric vehicles market is driven by China, which is the country at the top of the global ranking in terms of total sales of electric vehicles.

China is the country at the top of the global ranking in terms of total sales of electric vehicles.

### New propulsion technology

- **Series Hybrid**: Optimal use of the vehicle in urban settings also if suitable for long distances, provided these are not to be covered at high speed.
- **Parallel Hybrid**: Vehicle very versatile in use.
- **Mixed Hybrid**: The hybrids that are most efficient in all types of driving.
- **Full Electric**: These are zero-emissions vehicles, ideal for urban settings and valid outside urban areas if equipped with superior battery packs.
- **Fuel-cell vehicles**: Full-cell vehicles are ideal for long-distance journeys, even if there is a lack of a hydrogen-refuelling network.

### Enabling Technologies

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<th>TYPE OF BATTERY</th>
<th>Cost €/kWh</th>
</tr>
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<tbody>
<tr>
<td>Lead-acid batteries</td>
<td>50</td>
</tr>
<tr>
<td>Nickel-metal hydride batteries</td>
<td>300</td>
</tr>
<tr>
<td>Lithium-ion batteries</td>
<td>200</td>
</tr>
<tr>
<td>Solid state batteries</td>
<td>310</td>
</tr>
<tr>
<td>Flywheel batteries</td>
<td>10,000</td>
</tr>
<tr>
<td>Flow batteries</td>
<td>250</td>
</tr>
<tr>
<td>Graphene supercapacitors</td>
<td>1,000</td>
</tr>
<tr>
<td>Aluminum-ion batteries</td>
<td>200</td>
</tr>
<tr>
<td>Life-polymer batteries</td>
<td>200</td>
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<tr>
<td>Lithium-air batteries</td>
<td>100</td>
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</tbody>
</table>

A medium-sized electric vehicle costs up to 40% more compared to a traditional vehicle with the same characteristics.

China is the country at the top of the global ranking in terms of total sales of electric vehicles.

By 2040 approximately 56% of the light commercial vehicles sold in China, in the United States and in Europe will be electric.
Connected mobility
**Connected Mobility**

Audi has been the first car maker, in 2014, to offer “in vehicle” access to 4G LTE networks and Wi-Fi hotspot.

**HARDWARE CONNECTIVITY**

The first level of connectivity permits the driver and passengers to access data and view the information relating to real-time vehicle use and to the state of the vehicle and its components.

**INTEGRATED CONNECTIVITY**

The second level of connectivity, which also goes by the name of “individual connectivity”, is based on the possibility of incorporating into the vehicle connectivity and digital application services, such as smartphone applications, music and multimedia content.

**PERSONALIZED CONNECTIVITY**

The third level of connectivity requires advanced passenger and driver profiling functions, with the objective of personalizing driver and passenger preferences and of improving the experience.

**CONNECTIVITY FOR AUTOMATION**

In the most advanced stage of vehicle connectivity, the massive use of Artificial Intelligence will enable sophisticated predictive capacities to be deployed. Passengers may not only be offered services on the basis of the needs expressed but needs not yet understood will be identified.

**INTERACTIVE CONNECTIVITY**

The fourth level of connectivity permits passengers and driver to interact with the vehicle’s infotainment systems using “multimodal live dialogue”. Interaction is made possible by using, for example, voice commands, the advanced dashboard and the recognition of driver and passenger biometrics.

**CURRENT SCENARIO**

- In-vehicle operational data is collected to analyze potential causes of failure
- Early warnings/notifications are sent to the user and the dealership
- Repair/maintenance cycles are completed quickly

**CONTRIBUTING FACTORS**

- Driving style analysis
- Advanced on-board computers
- Artificial intelligence
- Machine learning algorithms
- Cloud data+real-time analytics
- Crowdsourced data
- Telematics data
- Increased sensors usage
- Nano technology

**FUTURE SCENARIO**

- Cars will be able to self-repair in certain scenarios
- Dealer/human intervention is partially or fully eliminated for minor issues
- Automation of service stations will optimize part procurement and inventory

**Real-time information for Traffic Management**

Most connected navigation systems are based on more than one data source.

Since 31st March 2018 all new vehicles registered in the European Union must be equipped with technology emergency call (eCall). It can be used in vehicles across the European Union (the 28 EU member states, Iceland, Norway and Switzerland) and is capable of automatically making a free call to emergency number 112.

**CONTRIBUTING FACTORS**

- Diagnostic maintenance
- Predictive maintenance
- Descriptive maintenance
- Prescriptive maintenance

**US market**

- Greatest prospective of growth
- $6.4 Bn in revenues

**Chinese market**

- $23 Bn

**Globally, the car sensor market, valued at 23 billion dollars in 2019, is growing at a CAGR of 6.71% and it is anticipated that it has the capacity to reach 36.5 billion dollars by 2022.**

**By the end of 2003, connected vehicles in Italy will represent around 53% of the total vehicles in circulation for a market that will be worth more than a billion dollars.**

**12.7 million connected vehicles in circulation by 2023**

**53%**

**V2X allows the vehicle to see beyond the “physical” limits of the on-board devices, offering the possibility to identify, detect and predict rapidly and accurately the actions of surrounding vehicles:**

**MOST CONNECTED MARKET**

US market

**MOST CONNECTED MARKET**

Chinese market

**Greatest prospective of growth**

**+18%**

**Connectivity Management**

**GPS (Global Positioning System) was introduced by the United States Department of Defence in 1973 with the intention of overcoming the limits of the previous navigation systems.**
Autonomous mobility
In the field of computer vision, VisLab, a spin-off of the University of Parma acquired by the American Ambarella in 2015, has, since its foundation, focused on all aspects related to self-driving vehicles.

Google as early as 2009 had started its first tests of a driverless car. Google’s project is by far the longest running.

Google has developed an embedded client for smart signal and insurance data processing and, in particular, crash detection, predictive maintenance and autonomous driving, using edge data extraction and processing thanks to machine learning algorithms and artificial intelligence models.

Israeli Cognata has developed a 3D simulation platform that virtually recreates existing cities and superimposes artificial-intelligence-based traffic models to simulate real-world conditions.

The distance covered by autonomous delivery vehicles will reach 78 billion miles per year by 2040.

Nuro has presented autonomous vehicles for local commerce. They are small, efficient and can be loaded by end users or merchants with groceries, packages, gifts or other goods for short distance cargo.

Self-driving buses are also expected to be seen widespread use in transport passengers over long distances.

Self-driving shuttles are also expected to be seen to transport passengers over long distances.

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Shared mobility
In the 2010-2016 period traffic congestion rose by 14% in London, by 30% in New York and by 9% in Beijing and Paris, with relative consequences for atmospheric pollution and for the health of citizens.

In this scenario, Europe registers an average of 505 cars for every 1,000 inhabitants.

In the United States alone, 121 billion dollars, or more than 1% of total GDP, were lost in 2010-2016 due to traffic congestion.

In 2019 the German colossuses Daimler - Mercedes-Benz and BMW finalized the merger of their respective car-sharing services, Car2go and DriveNow, thus creating Share Now, a European giant in the sector with 4 million customers.

The global market for shared transport has registered a markedly positive trend during the last two-year period, with forecasts for the European Union set to reach a total value of $451 billion by 2030.

In Europe between 2000 and 2025 the private car still represents the dominant means of transport, despite the fact that the use of shared vehicles is constantly rising and it is predicted that it may reach 9% of total mobility in 2025.

Europe

In 2018 this type of sharing allowed Italians to save in environmental, economic and distance travelled terms a total of 33 million trips.

In 2016 it launched the first tests with self-driving taxis, supported by an investment of $500 million from General Motors.

One of the first start-ups in the sector is the Chinese Mobike, which, founded at the beginning of 2015, registered exponential growth in its first two years, reaching a valuation of approximately $3 billion in 2017 with services active in over 200 cities and 19 countries around the world.

Lyft is pursuing the same goal as Uber, which is to put onto the market a level-4 autonomous vehicle, for which no human interaction will be required.

Uber is the most-financed ride-hailing company in the world ($24 billion in 2019).

Founded in 2009 in California its official launch took place in San Francisco in 2010.

In 1995, Byciklen, launched in Copenhagen, was the first large-scale station-based bike-sharing project in the world.

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Infrastructures and business models
Innovation trend report – Smart mobility

Infrastructures and Business Models

Projected infrastructure spending from 2016 to 2030, by region or country (in trillion U.S. dollars)

- China: 14.24 trillion
- United States and Canada: 10.8 trillion
- Western Asia: 5.89 trillion
- Latin America: 3.44 trillion
- Developed Asia: 3.44 trillion
- Other emerging Asia: 2.95 trillion
- India: 2.95 trillion
- Middle East: 2.46 trillion
- Eastern Europe: 1.96 trillion
- Africa: 0.98 trillion

Smart Road

Smart road means a road infrastructure, which through a connected system is capable of interacting with other systems in order to improve traveler experience.

Percentage of projects submitted per port infrastructure category

1. Sites for port related logistic and manifacturing 3%
2. ICT/digital infrastructure 4%
3. Road Transport connection 4%
4. Intermodal/multimodal terminals 5%
5. Rail transport connection 7%
6. Energy-related infrastructure 7%
7. Equipment en superstructure 8%
8. Other 8%
9. Infrastructure for smooth transport flows 8%
10. Maritime access 8%
11. Basic infrastructure 37%
12. inland waterway transport connection 1%
13. Infrastructure for reducing environment footprint 1%

The transformation of the electricity sector will produce $2.4 trillion of value by 2030 in terms of “clean” energy generation, job creation and greater opportunities for consumer choice.

Impact of 5G on the future of transport

The next generation of 5G network will offer mobility services new features, which will go beyond simply achieving better operating performance.

Mobility-as-a-Service (MaaS)

MaaS describes a new business model based on the provision of multimodal transport services.

Failure, destruction or tampering with critical infrastructure by hackers or attackers can have a devastating impact on a State's physical and economic security and on public health.

Payment services

The new platforms will guarantee an increase in the volume of online payments.
The intelligent transport system meets the smart city
A phenomenon of mass urbanization is well under way, and as a result of this the number of megalopolises in the world is constantly increasing.

In 2016, the global number of vehicles in circulation—cars, trucks, and buses—stood at approximately 1.4 billion units. By the middle of the century, the percentage will rise to only slightly less than 70%.

Managing mobility in a “smart” way means having a significant effect on the critical issues which have emerged. Experiments under way in various European countries and in the United States have demonstrated that the application of the “Intelligent Transport System” (ITS) reduces travel times by an order of 20% and increases the network’s capacity from 5 to 10%.

ITS cuts the number of accidents by 10–15%, traffic jams by 15%, polluting emissions by 10% and energy consumption by 12%.

By the middle of the century, the percentage of private vehicles and traffic between information relating to private vehicles and traffic conditions. The city has been considered the “smartest” in Italy for years.

The city of Saskatoon, launched in August 2018 a “multimodal trip planner” allowing its citizens to combine different means of travel. An app launched in Berlin in February 2019 allows travelers to access all forms of public and private transport in the city.

Barcelona has integrated some technological solutions intended to monitor the traffic in certain areas and to design a new more efficient network of public transport.

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By the middle of the century, the percentage of private vehicles and traffic between information relating to private vehicles and traffic conditions. The city has been considered the “smartest” in Italy for years.

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The intelligent transport system meets the smart city

**Smart parking**

The search for a free space in city car parks undertaken by many vehicles at the same time, aside from generating driver stress, is a cause of traffic congestion and atmospheric pollution. Technology can reduce this problem, because, thanks to the installation of sensors on the road surface, it is possible to know which spaces are available and which occupied.

A Smart City must be able to facilitate its own citizens movements and simplify all operations connected thereto, including the search for parking, the management of sharing services, the recharging of electric vehicles etc., but also payment procedures for those services which it makes available.

**ITS - Intelligent Transport System**

Intelligent Transport Systems, grounded in the interaction between information technology, telecommunications and multimedia, allow public and private mobility problems to be tackled in an innovative way, by developing organically and functionally solutions based on safety, efficiency, efficacy, affordability while fully respecting the environment.

1. **Connectivity technologies**
   - Various standards for long-range and short-range wireless communication, are used for the implementation of “smart” services linked to mobility
2. **Physical connected devices**
   - and the Internet of Things (IoT)
   - Cloud-based IoT applications, which can receive, analyze, manage and transmit data regarding traffic
3. **Territorial information systems for the georeferencing of objects and users (GIS)**
   - Smart cities make use of GIS for purposes of planning and mapping, as well as of artificial intelligence for optimizing traffic flows and public transport fleets

Globally there has been an emerging interest on the part of many cities in testing “pioneering” solutions based on data collected from vehicles and users on the move and on a subsequent reprocessing of the same with the aid of artificial intelligence.

**Italian cities** see a daily circulation of 1.9 million motor vehicles transporting 2.5 million people, with an average of 1.33 persons per automobile (1.7 EU average).
How the mobility of the future changes cities

According to WardsAuto estimates, in 2016 the global number of vehicles in circulation - cars, trucks and buses - stood at approximately 1.4 billion units. If growth in vehicle numbers remains stable at +200% on a twenty-year basis, by the mid-2030’s almost 3 billion vehicles will be in circulation around the world.

In parallel, a phenomenon of mass urbanization is well under way, and as a result of this the number of megalopolises in the world is constantly increasing: if, as of today, roughly half of the world’s population resides in urban areas, OECD forecasts estimate that by the middle of the century the percentage will rise to only slightly less than 70%. In this context, public and private mobility which leaves behind current inefficiencies will be able to make a significant impact on improvement of quality of life and optimal use of economic resources.

To understand how much work needs to be done, it is sufficient to consider that private vehicles are currently unused 95% of the time, on average. This fact, when viewed in the light of the 25 square meters required to park an automobile, and of the billion and half of vehicles in circulation, paints a picture of extreme inefficiency in terms of use and optimization of urban spaces and of vehicles themselves.

According to research conducted by Anci concerning home-work and home-study journeys, Italian cities see a daily circulation of 1.9 million motor vehicles transporting 2.5 million people, with an average of 1.33 persons per automobile (1.7 EU average). If every car transported two people, there would be 628 thousand fewer vehicles in circulation and each year €360 million euros would be saved in fuel costs and 660 thousand tonnes of CO2 emissions would be eliminated in Italy alone.

The cities with the biggest traffic jams
Major world cities where the average commuter spent the most hours in congestion in 2018

<table>
<thead>
<tr>
<th>City</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOGOTÁ</td>
<td>254</td>
</tr>
<tr>
<td>ROMA</td>
<td>246</td>
</tr>
<tr>
<td>DUBLIN</td>
<td>237</td>
</tr>
<tr>
<td>PARIS</td>
<td>237</td>
</tr>
<tr>
<td>ROSTOV-ON-DON</td>
<td>237</td>
</tr>
<tr>
<td>LONDON</td>
<td>237</td>
</tr>
<tr>
<td>MILAN</td>
<td>237</td>
</tr>
<tr>
<td>BORDEAUX</td>
<td>237</td>
</tr>
<tr>
<td>MEXICO CITY</td>
<td>237</td>
</tr>
<tr>
<td>MOSCOW</td>
<td>237</td>
</tr>
<tr>
<td>BELO HORIZONTE</td>
<td>237</td>
</tr>
<tr>
<td>SAINT PETERSBURG</td>
<td>237</td>
</tr>
<tr>
<td>RIO DE JANEIRO</td>
<td>237</td>
</tr>
<tr>
<td>FLORENCE</td>
<td>199</td>
</tr>
<tr>
<td>BRUXELLES</td>
<td>195</td>
</tr>
</tbody>
</table>

Source: Statista

The inefficiencies associated with mobility in urban areas, such as the limited per-vehicle use of parking spaces, the excessive allocation of urban lots for car parking (albeit limited in relation to the demand), and the capacity of road infrastructures, which struggle to keep up with the increase in numbers of cars in circulation, are, in turn, causing one of the greatest problems for urban centers: traffic congestion. According to the INRIX 2018 Global Traffic Scorecard, drivers in Rome spend 254 hours a year stuck in traffic, thereby earning the European record.

Managing mobility in a “smart” way means having a significant effect on the critical issues which have emerged. Experiments under way in various European countries and in the United States have demonstrated that the application of the “Intelligent Transport System” (ITS) reduces travel times by an order of 20% and increases the network’s capacity from 5 to 10%; lastly it cuts the number of accidents by 10-15%, traffic jams by 15%, polluting emissions by 10% and energy consumption by 12%.
ITS and technologies for the mobility of the future

By ITS, or Intelligent Transport System, is meant a technology, application, advanced platform or set of tools for the management of transport networks and of services for travellers, developed to improve traffic management and mobility (both public and private), road safety, management of the transportation of goods and automatic payments. ITS is based on processes of acquisition, processing and integration of data and manages the information chain to be provided to transport system users.

Such systems thus permit the enabling of added value services in the management of urban mobility: they can, for example, provide users with information concerning traffic and local transport in real time, concerning the availability of spaces in car parks and seats on public transport, with the objective, for example, of reducing commuters’ journey times and of improving safety and comfort.

Although ITSs may refer to all modes of transport, the European Union’s 2010/40/EU directive, defined ITSs as systems in which information and communication technologies are applied particularly to road transport.

Intelligent Transport Systems, grounded in the interaction between information technology, telecommunications and multimedia, allow public and private mobility problems to be tackled in an innovative way, by developing organically and functionally solutions based on safety, efficiency, efficacy, affordability while fully respecting the environment.

ITSs acquire and process data by leveraging various technologies and infrastructures operating in synergy:

- Connectivity technologies
  Various standards for long-range and short-range wireless communication, from GSM to 802.11 protocols, right up to the more recent 5G are used for the implementation of “smart” services linked to mobility.

- Physical connected devices and the Internet of Things (IoT)
  Cloud-based IoT applications, which can receive, analyze, manage and transmit data regarding traffic, by exploiting connectivity technologies, can be used to provide information on the traffic in real time in a specific area of the city.

- Territorial information systems for the georeferencing of objects and users (GIS)
  Smart cities make use of GIS for purposes of planning and mapping, as well as of artificial intelligence for optimizing traffic flows and public transport fleets or for making the parking of private vehicles simpler and more efficient.
Among the other technologies used for the identification of vehicles and for data collection on the move, worthy of mention are: floating cellular data for the identification of public transport vehicles on the move and their speed; Vehicle-to-Vehicle networks, allowing dialogue between moving vehicles; and Vehicle-to-Infrastructure allowing dialogue between moving vehicles and fixed infrastructures.

Last but not least we have sensors, installed on roads and physical infrastructures, devised, for example, for speed detection, but also for the enabling of connected mobility and autonomous mobility services. Roads may in fact be equipped with sensors able to trace vehicle transit data in order to extrapolate flow models of traffic, of road blocks, of road works, etc.

Furthermore, ample use is made of smart video cameras capable of, amongst their other functions, of recognizing moving vehicles and their number plates, but also driver behaviour, through advanced computer vision and artificial intelligence technologies.

For the observation of vehicles on specific roads or at dangerous crossings, inductive ring sensors are also used: the simplest detectors count the number of vehicles which pass over the circuit in a given unit of time, while more sophisticated sensors estimate speeds, lengths, types of vehicles and distances between them. Other types of sensors embedded in the road surface also make it possible to identify which parking spaces are available or occupied.

Many of the technologies for the enabling of “smart” services linked to mobility are housed on public transport and in vehicles for private transport. On-board electronics is indeed one of the main components of vehicles in circulation and these vehicles carry sensors, “embedded” smart platforms, operating systems and software applications of varying degrees of sophistication. These, taking advantage of the vehicles’ own computational capacities are able to process much of the information gathered in real time and send it to centralized data collection centres for further processing.

Many smart mobility systems are born, moreover, as instruments to aid decision making, by integrating predictive technologies for modelling and comparison with series of records relating to specific factors (traffic flows, meteorological data, public transport journey times at specific times of day, etc.).

Global IoT transportation and logistics spending in 2015 and 2020 (in billion U.S. dollars)

Source: Statista
ITS applications for urban areas

Globally there has been an emerging interest on the part of many cities in testing “pioneering” solutions based on data collected from vehicles and users on the move and on a subsequent reprocessing of the same with the aid of artificial intelligence. Many cities have been transformed into authentic “test-beds” for testing and, where functioning, developing solutions on a large scale which involve the four dimensions of the mobility of the future – electric, connected, autonomous and shared.

Information management of public and private mobility data

The transmission of data and processing thereof in (practically) real time are the starting point from which to offer citizens and Public Administrations innovative services for urban mobility. A Smart City may indeed be defined as a “data-driven” city, where public administrators, decision-makers and citizens have an ever more detailed understanding of the conditions of mobility in the areas in which they live or work.

The agencies designated to optimize transport systems, whether public or private, are approaching the study of flows, of vehicles and of people, on the basis of a “smart” interpretation of data, and encountering, in the process, no few difficulties of management.

The data which fall within the extended perimeter of mobility are in fact fragmented and not very homogeneous and are managed by multiple parties who should ensure inter-operability for a transport system which is really inter-connected. In reality, however, most services are offered and managed by different entities using proprietary technological platforms which frequently do not communicate with each other. The market and technological management would require, in contrast, the presence of “aggregators” offering unified and more efficient services both to consumers, and to Public Administrations which must manage city mobility.

The technologies present on the market today, what is more, not only do not bring with them particular restrictions on aggregated data collection for a single individual, but rather they facilitate it: it is no longer necessary, in fact, as it was in the past, to “physically” collect data through the counting of cars in circulation or through the administering of interviews, it is, if anything, the cars themselves which communicate their own data and also those of their drivers, through insurance company black boxes, smartphones, IoT sensors, which communicate directly with a traffic management centre. Once the data have been pro-
cessed, the latter provides users with updates on traffic conditions, journey times, delays, road traffic accidents, or on any road works.

By way of example, the city-state of Singapore has promoted the Smart Nation Sensor Platform (SNSP) initiative, that is to say, a sharing platform for aggregated data serving to guarantee efficient management of public services through the promotion of open data.

In Italy, one example of a company born to make mobility “smarter” is InfoBlu. Italian market leader in infomobility, it offers information on the road and traffic conditions of the major Italian highways, but also data on traffic in the main metropolitan areas, to the principal players in the sector: car manufacturers, navigation systems, television and radio broadcasters, telephone service providers, call centres and mobile applications, as well as public bodies and road network operators.

Once more in Italy, an interesting case of integration between information relating to private vehicles and traffic conditions, on the one hand, and real-time information about public transport, on the other, is the Milan City Council's Mobility Portal. The Lombard capital is in the vanguard in terms of the analysis of mobility data and of the use which it makes thereof, also for its long-term planning: the city has in fact been considered the “smartest” in Italy for years. Multimodal transport for mobility on demand

The term Smart Mobility encapsulates concepts linked to technology, to infrastructures for mobility (car parks, recharging networks, road signs, roads and bridges, etc.), to solutions for an efficient, economical and sustainable management of mobility and lastly to models of consumer use of varying degrees of innovation. The integration of public and private transport, the sharing of the vehicles, “green” transport, are all aspects which combine to render urban mobility “smart”, with the ultimate goal of creating flexible, integrated, safe, on-demand and cheap travel experiences.

The European Commission has, since 2010, supported, including financially – the creation of platforms capable of promoting intermodal travel solutions at a European, regional and local level, by integrating different modes of transport ranging from rail travel to bicycles, from public transport to car sharing.

An intermodal route planner uses digital maps, dynamic traffic data, timetables and vehicle positions in real time and an algorithm able to calculate the best routes. The objective of these planners is in fact, on the one hand, to provide citizens with a single information tool, thus facilitating “door-to-door” journeys (for example, home-work, home-school, etc.), and, on the other, to promote new models of Mobility-as-a-Service (MaaS) which envisage an all-inclusive, “on-demand” service customized according to the circumstances and allowing a single pass or book of tickets to be used for the payment of a bundle of public and private transport services, accessible through a multi-mode mobility app.

By way of example, Be-Mobile's intermodal route planner is available to the citizens of Antwerp (Belgium): it is able to calculate up to 250 different transport solutions for each route, its algorithm filters the most relevant and presents users with the options from which to choose. An app launched in Berlin in February 2019 allows travellers to access all forms of public and private transport in the city. The service, named Jelbi and created by the technology company Trafi for BVG – Berlin’s transport company-, allows users to plan and purchase travel solutions with scooters, bicycles, taxi and car-sharing and ride-hailing services.

Across the ocean too, the city of Saskatoon (Canada) launched in August 2019 a “multimodal trip planner” allowing its citizens to combine different means of travel: those who move mostly by bicycle can cover the first or
last mile on buses or else use ride-hailing services, in both cases transporting their personal bikes on public transport.

Smart parking

The search for a free space in city car parks undertaken by many vehicles at the same time, aside from generating driver stress, is a cause of traffic congestion and atmospheric pollution.

Technology can reduce this problem, because, thanks to the installation of sensors on the road surface, it is possible to know which spaces are available and which occupied. One of the possible applications of the ITS in the area of “smart parking” makes it possible to have these IoT sensors communicate in real time with a centralized cloud platform, which positions on a map available parking and then shows drivers the closest spaces through an app. These technologies also allow public officials to check in real time if a car is parked in points in the city in which parking is not permitted or if the parking ticket has expired, thus aiding the issuing of penalties, even remotely.

Barcelona has integrated some technological solutions intended to monitor the traffic in certain areas and to design a new more efficient network of public transport. In particular, at El Prat airport it has exploited Sensefields technology to implement traffic control in the “express parking” areas for short stops, situated both outside the terminal, and in the taxi ranks, with the objective of collecting data over time on the number of vehicles in transit and stationary at each point monitored, of reducing traffic congestion and ensuring a constant availability of taxis in the areas involved.

In the area of self-driving vehicles, in July 2019 Bosch and Daimler obtained authorization from the relevant authorities in Baden-Württemberg for the first autonomous unsupervised car park. “Automated valet parking” will be provided at the Mercedes-Benz Museum in Stuttgart, where drivers may leave their own cars at the car park entrance and, through an app, instruct the car to park itself, moving around the museum car park and selecting a space without additional assistance.

Digital payments for Smart Mobility

A Smart City must be able to facilitate its own citizens movements and simplify all operations connected thereto, including the search for parking, the management of sharing services, the recharging of electric vehicles etc., but also payment procedures for those services which it makes available.

Technology helps to speed up and simplify mobile payments: in the area of Smart Mobility the trend is in fact to eliminate the need for the use of cash in favour of (predominantly contactless) safe and internationally-accepted payment services, which facilitate citizens’ and tourists’ access to trains, buses, ferries, public car parks, and make the use of systems of bike and car sharing and of chargers for the recharging of electric cars easy.

In many cities around the world “smart” services for mobile payment have been active for years now. In Shanghai, since 2018 and thanks to the collaboration of the public transport company and Alipay, it has been possible to pay to access the underground by using a cellphone and the reading of the QR Code on passing the turnstiles on entry and on exit. From 2020 the Hong Kong MTR will also provide the possibility to pay the underground fare with a QR Code through Alipay. WeChat took steps in 2018 to enable, in Beijing and in other Chinese cities, the smart ticketing and payment service for public transport through the use of NFC (Near Field Communication) smartphone technology.

The same NFC technology has also been used in Milan, where it is possible to use any credit card or PayPal to enter and exit the underground in an easy and contactless fashion.

Since May 2019 New York too has had an active collaboration with the Metropolitan Transportation Authority (MTA) and Apple Pay for the payment of subway fares
In Europe, the aforementioned Be-Mobile, a Belgian operator providing advanced services for Smart Mobility in Belgium, Netherlands, France, Finland and in other countries, provides an integrated platform for mobile payments not only for the payment of public transport fares and car parks through apps or text messages, but also of recharging sessions for electric cars.

In Switzerland a single card – called SwissPass - is available and provided by the public transport authority, which makes it possible to get around (and pay) on all forms of transport, ranging from train journeys to car sharing. Besides being a public transport pass, it allows access to services offered by numerous partners: it can in fact be used to access and pay for the services of car sharing or of bike sharing, but also to open the turnstiles at ski stations or to experience certain self-driving bus routes.

In Italy with Telepass Pay it is possible to pay to park in the on-road “blue lines” areas and in some car parks: in Milan this method of payment has been available since as early as 2015, but this service has now been activated in many other Italian cities too. Telepass Pay also makes it possible to pay for fuel, to pay the toll for Milan’s Area C (an area in the city centre with specific restrictions for certain types of vehicles), for tickets for ships and ferries for the main maritime routes, for ski passes in some ski stations in Northern Italy, road tax, for car washes – in collaboration with the startup WashOut -, for instant insurance which can be activated at the moment of departure, for scooter hire in some locations on the Romagna coast and in future for car, scooter and bike sharing, as well as for rail tickets.

Technology can also serve town councils for controls and sanctions, tackling fare dodging on the part of many users of public services. Since June 2019 Barcelona has been experimenting with an advanced solution exploiting artificial intelligence, and, in particular, “machine vision”, by processing images from video cameras in train stations, asking to see tickets only of “suspect” users and thus speeding up controls.

Indicators for smart mobility and governance

Many urban areas are facing an increase in the population and an increase in the volumes of goods, with a consequent increase in traffic congestion, lower quality of life, a loss of economic potential and negative health outcomes. The boundaries of many cities have changed when compared to their initial configuration and to how they looked in the period in which the specific public transport systems were established, often decades before. Nonetheless, in many cases, the transport networks serving these areas have basically remained unchanged and inadequate for the great current volumes of traffic.

If one thinks, however, that transport plays a key role in the growth and economic prosperity of a city, it is easy to deduce that a not wholly effective management of mobility can lead to significant losses in economic and social terms.

New technologies, if well integrated, however, can aid the resolution of this problem and assist urban areas to face these challenges. With the emergence of autonomous and shared mobility, of connected infrastructures and of Smart City technologies, the possibility of creating a faster, cheaper, cleaner and safer intermodal urban transport ecosystem appears to be more realizable than ever.

To achieve this, however, an integrated long-term vision is necessary, which is not merely the sum of a series of initiatives and timely experimentations; it is then essential that there be a systemic intervention, capable of acting on governance and on the planning of interventions. This is possible through the identification of the right mix of...
collaborations, which take into account and, if opportune, also involve the private sector. To support authorities in the management of Smart Mobility, the BCG Henderson Institute has drafted some indications useful for the adoption of “good practices” and solutions serving to improve the management of urban mobility:

1. Identifying indicators for “smart” mobility, that is to measure the validity of initiatives and to target policy: in order to understand what the advantages or disadvantages connected to the implementation of innovative solutions in the field of mobility can be, it is crucial to employ right measurement tools. The table here below contains a list of suggestions on the parameters to monitor and evaluate.

<table>
<thead>
<tr>
<th>ECONOMIC PERFORMANCE</th>
<th>Traffic congestion</th>
<th>Busiest times and routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability of public transport</td>
<td>% of delays, service continuity</td>
<td></td>
</tr>
<tr>
<td>Safety</td>
<td>Number of accidents/victims linked to traffic</td>
<td></td>
</tr>
<tr>
<td>Integration of technologies</td>
<td>Collection and use of open data</td>
<td></td>
</tr>
<tr>
<td>ENVIRONMENT</td>
<td>Climate impact</td>
<td>CO2 emissions, air quality</td>
</tr>
<tr>
<td>Use of the asset</td>
<td>User-km and vehicle-km ratio</td>
<td></td>
</tr>
<tr>
<td>Initiatives for environmental sustainability</td>
<td>Sustainability plans and incentives for electric transport</td>
<td></td>
</tr>
<tr>
<td>LEADERSHIP</td>
<td>Strategy</td>
<td>Number of collaborations and joint initiatives with the private sector and the academic world</td>
</tr>
<tr>
<td>Investments</td>
<td>Percentage of budget allocated to the transport sector (as a proportion of local authorities / city total budget)</td>
<td></td>
</tr>
<tr>
<td>Planning regulations</td>
<td>Ad hoc regulations for innovation in the mobility sector</td>
<td></td>
</tr>
<tr>
<td>SOCIAL IMPACT</td>
<td>Accessibility</td>
<td>Accessibility indices by area</td>
</tr>
<tr>
<td>Inclusivity</td>
<td>% of inhabitants who do not travel, due to the lack of services</td>
<td></td>
</tr>
<tr>
<td>Versatility</td>
<td>Presence of alternatives, connections among the various types of mobility</td>
<td></td>
</tr>
<tr>
<td>Satisfaction</td>
<td>% of users satisfied, overall and by type of transport</td>
<td></td>
</tr>
</tbody>
</table>

2. Investing correctly and stimulating development. It is necessary to constantly remain up to date with the possible applications of technologies in the area of mobility and with the added value which these can bring, in such a way as allocate adequate investments during intervention planning. The planning of interventions will be all the more effective, the more this takes into account the peculiarities of the area and the needs of the community.

3. Regulating and rethinking policy, by valuing flexibility and public-private integration. Fragmented and rigid governance risks finding itself in difficulty when faced with current multiple and “multimodal” transport systems. Conversely, a compact and adaptive governance, focused on the user and able to have the public sector engage flexibly with the private sector, may be more appropriate in managing a multiform and heterogeneous situation. A number of analysts recommend adopting integrated policies operating with public interventions at specific stages in the value chain (as regards, for example, the sharing of data, parking and safety), preserving the flexibility of private operators (as regards, for example, the detailed structure of prices and user interfaces).

4. Learning and progressing “by experimenting”. Experimentations represent a key driver for opening up to innovation, and innovation feeds on trial and of error. Adopting intermediate and “open” solutions, not necessarily final ones, and using these as moments for experimentation, makes it possible to progress albeit allowing for a certain margin of error. Cities have before them the opportunity to learn by experimenting, even if occasionally some experiments fail; and precisely through failure and the sharing of experiences with other cities and within public-private partnerships can trigger “good practices” and initiatives to be replicated on a giant scale.
The “Smarter London Together” plan and the partnership for smart mobility

London, the largest city in western Europe, with around 9 million of inhabitants, possesses a system of transport which is recognized internationally as being effective, safe and integrated. Due to its size and to the number of its inhabitants, every day millions of vehicles clog its roads and, according to the Ford City Data Report, it is estimated that costs for the public and private sectors attributable to city traffic amount to € 10.8 billion.

In 2018, the Mayor of London announced an integrated strategic plan designed to make London the “smartest city in the world” and named “Smarter London Together”.

In collaboration with the districts of the capital, the programme’s objective is to enhance sustainability and improve the quality of life of citizens. Programme initiatives range from increased availability of public Wi-Fi to the distribution of “smart parks” which permit data collection on emissions and on the quality of the air.

The collection and enhancement of data represent key drivers for TfL – Transport for London – the company responsible for transport and for the maintenance of public vehicles, which has implemented technological solutions ranging from the control of rail travel to road planning through the use of virtual reality. The data generated by moving vehicles merge into an open proprietary database, which the developers use to create innovative products and services to improve city mobility. The exploitation of the data extracted generates an annual economic benefit for the city of about € 147 million.

London is also home to the TRL, global centre for innovation in the sector of transport and mobility, which supports organizations in the creation of systems of safe, economic and efficient transport. The main areas of action concern ITS, sustainable mobility, vehicle safety and technological research in the area of Smart Mobility. Investments are directed towards connected, shared and autonomous mobility, the reduction of the emissions and, on the technology front, the exploitation of big data and artificial intelligence to improve traffic conditions.

In the context of partnerships, the Smart Mobility Living Lab (SMLL), launched in 2018 by TRL in collaboration with universities, with Cisco and with Transport for London, intends to create the most advanced connected test environment in the United Kingdom. The SMLL project, subdivided into various sub-projects of research focused on the four paradigms of mobility - electric, connected, autonomous and shared-, fosters collaboration among private firms for the testing of new types of service. Living Lab’s ultimate goal, achieved in June 2019, was to create specific city routes for the testing of self-driving cars. These are over 24 km of public roads equipped with technologies for the monitoring of moving vehicles and which can be customized according to the needs of the tester company.

In 2019 Bosch chose London as the location for the new innovation hub, London Connectory, born to meet the future technological needs of urban transport, to co-create and develop smart mobility solutions. The hub will host a network of start-ups, tutors, investors and developers in a space of co-innovation the objective of which is to devise smart solutions for mobility and to achieve the goals set by the “Smarter London Together” programme. Ford, too, through Ford Smart Mobility, its global organization which designs, develops and invests in Smart Mobility services and connectivity solutions for smart vehicles, supports “Smarter London Together”. The solutions implemented concern:

- the identification of the best locations and positions for recharging stations for electric vehicles EV;
- the identification of sensitive areas for road safety, encouraging citizens to avoid some stretches at particular times and helping urban planners during the planning stage;
- an app which shows which routes are more efficient if taken on public transport;
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with information with which to plan the best route in real time.

As further proof of the city’s green and digital vocation, mobility policies have been reinforced once more by the “Smart Mobility Amsterdam” programme, which, for the years between 2019 and 2025, is promoting the designing and experimentation of new modes of shared and electric mobility and of traffic management both in real time, and predictively, in order to build an environmentally-friendly and smart city, free from traffic and with emissions of CO2 reduced.

Since the beginning of 2019, the city council of Amsterdam has boosted the collection and management of data, working in close collaboration with research institutes and public and private companies: some data sets produced, for example, by the mobile application for mobility “Waze”, are used to determine where accidents, closures and other disruption on the roads occurs. In the context of the mobility-as-a-service model, the eHUBS - Smart Shared Green Mobility Hubs have been created as dedicated places on the road, in which citizens can choose between various options of sustainable electric transport (e-bikes, e-cargo bikes, e-scooters or e-cars) for shared use.

As far as electric mobility is concerned, public policies have been so effective that the administration has calculated that to charge the ever-growing number of electric vehicles (17,000 in 2019), up to 23,000 recharging points might be required in the city by 2025. In this regard, experimentally, two Vehicle-to-Home systems have been installed- which fits in with the more general Vehicle to Grid (V2G), that is to say the technology which allows the electric vehicle to function not only as user, but also as an accumulator of energy, to be passed on to electric devices inside a building. The project, under way since March 2013, makes it possible to use the electric car as a back-up charger during power cuts, thus providing storage solutions for renewable energy in the Netherlands. Since 2017 the experimentation has also included Vehicle-to-Office systems, similar to Vehicle-to-Home technology.

In terms of the initiatives for the experimentation of “self-driving” vehicles, according to the Autonomous
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The ultimate goal is to enhance road safety: the combination of the two technologies, in a hypothetical emergency situation, makes it possible, for example, to create openings in the traffic for emergency vehicles.

The development of Smart Mobility technologies is moreover devised for the settlement of payment of road use charges thanks to the support of analyses of the data extracted. Big Data are, in fact, also employed in the calculation of Singapore’s road tolls. This calculation takes into consideration the route taken, the time of day of the journey and the level of traffic: knowing the position of the vehicle in real time makes it possible to collect accurate data for the calculation of the amounts. By 2020, Singapore will have become the first city in the world to introduce a system of road pricing via satellite.

Further analyses are carried out on the anonymous Open Data obtained from commuter passes and on the identification of hotspots for the management of public transport fleets. The Singapore transport authority (LTA – Land Transport Authority) is able to manage its public fleets efficiently, by providing services for the community which revolve around people.

The results of these analyses have permitted a 92% reduction in the number of overcrowded buses and have reduced the average commuter waiting time to four minutes.

Other projects on the mobility of the future, still being studied and not yet implemented in 2019, regard the creation of an air network with a series of routes and trajectories dedicated to journeys by drone-taxis.

2019 saw the beginning of the Lamppost-as-a-Platform (LaaP) experimentation, which is based on the installation of sensors on the city’s lampposts. The LaaP programme will make it possible to obtain, in addition to real-time measurements of air quality and noise pollution, data relating to traffic flows: by using artificial intelligence algorithms, the data gathered will be analyzed for the purposes of improving the definition of urban policies and the provision of services for the citizen and for the territory’s enterprises.

Readiness Index drawn up by KPMG, the Netherlands is the country most ready to face the challenge of autonomous vehicles, thanks, above all, to the investments made in the IoT (Internet of Things) field. Amsterdam is in fact home to heterogeneous experimentations in self-driving vehicles, which involve different categories of vehicles (public transport, heavy goods and boats).

2018 also saw the first trials of autonomous boat prototypes, on a scale of 1:4, according to the directives provided by the Roboat project, which sees the collaboration of the Massachusetts Institute of Technology (MIT) and the Amsterdam Institute for Advanced Metropolitan Solutions (AMS Institute). Roboat intends to design and implement a fleet of autonomous city boats which will have different fields of application, among which the transportation of refuse and the distribution of food.

Singapore, the city-state of V2X communication

Singapore, the city-state populated by roughly 5.5 million inhabitants, is genuinely an “open-air laboratory” dedicated to digital and technological transformation, whose strength is represented by the perfect synergy between administration public, universities, enterprises and start-ups.

In the sector of mobility, research and innovation are focused on the development of “vehicle to everything” (V2X) systems and on the management of traffic flows, with significant investments directed towards the smart transformation of public transport.

In particular, under experimentation currently is communication:

- from vehicle to vehicle (V2V), to make possible, for example, communication between self-driving cars;
- between vehicle and infrastructures (V2I), to permit dialogue between the vehicle and, for example, the city’s traffic light system.

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Thanks to the implementation of open data and to the sharing of geospatial data, several portals have been created which make it possible to support the urban mobility system.

- The MyTransport.org portal provides public transport users with information regarding bus lines and related stops in the main tourist spots and train stations;
- The Beeline platform makes it possible to book and purchase the tickets for public transport. The data which derive therefrom ensure monitoring of the lines of transport and, consequently, a more efficient service.

 Dubai and futuristic modes of transport

Since 2005, which saw the birth of the Roads and Transport Authority (RTA), Dubai’s urban mobility has registered rapid growth in terms of efficiency of the public service. The number of passengers using public transport has risen significantly, rising from 168 million in 2006 to over 588 million in 2018, with an increase of 11% in only 13 years. Such a significant milestone is the result of a series of targeted policies, which can be traced back to the Dubai Smart City programme, launched in 2014 with the objective, amongst other things, of increasing to 25%, by 2030, the respective shares of public transport and shared mobility.

The Dubai’s Smart Autonomous Mobility Strategy also falls within this programme and places autonomous mobility at the centre of its attention, with the ambitious project of raising to 25%, by 2030, its share of journeys in autonomous vehicles. This strategy should raise 22 billion AED in annual economic benefits (roughly 5.5 billion euros), thanks to the reduction in transport costs, and contribute to a saving of 1.5 billion AED a year, thanks to the reduction in environmental pollution by 12%, by 2030.

Transport company RTA, in keeping with Dubai’s Smart Autonomous Mobility Strategy, is concentrating its resources on the research and development of futuristic modes of transport such as the autonomous transport capsules, automated air taxi and the Dubai Sky Pod, a high-speed cable transport system. For the latter RTA has signed an agreement with skyTran, a company which seeks to provide magnetic levitation transport systems, for the development of suspended transport systems.

The trials of the air taxi, first autonomous means of transport with completely electric vertical take-off began in 2017 following the agreement between the Dubai Roads and Transport Authority and the German company Volocopter.

Transport company RTA has also created its Enterprise Command & Control Centre (EC3) which processes Big Data on mobility on a daily basis, with records totalling 75 million, for the purposes of identifying the best strategies for regular and efficient mobility.

Big Data and artificial intelligence support all operations on Dubai’s underground, from automated planning to the prevention of the risk of collisions. The result of this application is a 7% reduction in operating costs and a greater efficiency in terms of punctuality of 6.4%.

For the benefit of residents and tourists a route planning app was introduced which permitted an increase in user satisfaction of 11% in 2018.

Lastly, RTA’s Innovation Lab has launched the installation of a network of computer-controlled, 2 and 4-person “jet-like” vehicles and cargo pods employing state-of-the-art, passive skyTran MagLev (STML) technology. skyTran systems will transport passengers and cargo alike in a fast, safe, green, and economical manner.

SkyTran

SkyTran is the developer of the patented, high-speed, elevated, levitating, energy-efficient skyTran Personal Rapid Transit (PRT) and Cargo Rapid Transit (CRT) system. skyTran consists of a network of computer-controlled, 2 and 4-person “jet-like” vehicles and cargo pods employing state-of-the-art, passive skyTran MagLev (STML) technology. skyTran systems will transport passengers and cargo alike in a fast, safe, green, and economical manner.

- Total Funding: $51.7 mln
- Last Round: Oct 2018 Series B
- $5.9 mln
- Country: United States
- skytran.com
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Toronto and the communities of the future

The long-term strategies of the Toronto Transit Commission (TTC), already in place in 2019, are focused on the expansion of the transit networks to support the installation of smart transport systems.

Metrolinx, an Ontario government agency coordinating and integrating road and public transport, is an integral part of the regional transport plan (RTP) 2041. The programme seeks to connect the municipalities in the Greater Toronto Area through rapid transit corridors for express trains, light metro and fast buses. This programme represents a model for a system of multimodal regional transport, the focal point of which is centred on user needs. The particularity of RTP 2041 is to be found in its indirect advantages for companies such as, for example, support for employers in the fostering of teleworking amongst their employees, collaboration with civic organizations and schools to encourage the use of public transport.

One of these systems of “social” transport is represented by the “Smart Commute” programme, supporting users in the identification of alternative and smart travel options while reducing city traffic.

Innovative projects regard all the paradigms of mobility. Connected and autonomous vehicles will soon enter the market; by 2030 robo-taxis will represent 27% of vehicles used by passengers for the same types of journey.

In 2017 the company Sidewalk Labs, an Alphabet (Google) subsidiary, and the government of the city of Toronto announced a plan of technological regeneration based on Smart City concepts for a district of the city on the banks of Dynamic Messaging Signs (DMS), that is, interactive road signs, for the transmission of information on traffic conditions in real time. These installations are part of the ITS project, which in 2019 has reached a 65% completion point, with final total coverage of 60% of Dubai’s roads.

In the near future more than a hundred video cameras will be installed for traffic monitoring and data acquisition, alongside an equal number of systems for the surveying of traffic, and twenty or so systems of weather information for the roads. In addition, the fibre-optic network for communication between devices will be extended.

One of the key factors, which have contributed to stimulate Dubai’s “smart” revolution, is without doubt, the upcoming Dubai Expo 2020. The government has planned to spend over 7 billion euros on projects relating to Expo infrastructures.

One of these is the futuristic Hyperloop: by 2020, it will be possible to cover the distance between Dubai and Abu Dhabi in 12 minutes (the current journey time by car is about an hour and a half). This revolutionary system of transport aims to use magnetic levitation to allow the transport capsules to reach a speed of up to 300 metres per second. The particularity of the Hyperloop TT supersonic capsule resides in the elevated containment tunnels: these will be covered with solar panels supplying all the electricity necessary to create the pneumatic vacuum within. The system will be self-sufficient in energy terms or may even produce more energy than it consumes.
of Lake Ontario, with the objective of creating a community which “combines the best of urban design and the latest digital technologies”. The possible new mobility initiatives, once implemented, should lead to the need to own a car being eliminated, thus permitting a family to save about 4,000 $/year, by providing valid electric and shared alternatives for use with travel passes.

The future developments for mobility in Toronto also concern the use of Big Data and machine learning for implementing a system of mobility management capable of processing data and information in real time and thus coordinating vehicle flows and the various road infrastructures. One such example is the traffic light system which gives priority to pedestrians who require more time to cross from one side to the other.

For the project managed by Sidewalk Lab, to be launched in 2022, 980 million dollars will be invested with the implementation of, amongst other things, smart traffic lights, dynamic footpaths, cycle paths and heated road surfaces for the bitter winter temperatures. In the Sidewalk Labs’ vision of the future, since in the district of the future the need for parking spaces for private vehicles will be reduced thanks to the diffusion of autonomous or shared vehicles, car parks may be transformed into green spaces and shopping areas.
Intesa Sanpaolo Innovation Center

Exploring the business models of the future to discover the new assets and skills needed to support the long-term competitiveness of its customers and of the Group as we become the driving force of the New Italian Economy, this is the mission of Intesa Sanpaolo Innovation Center which aims to create the assets and develop the necessary skills that guarantee the competitiveness of the group and its customers through the promotion of new technology use and the support of corporate transformation projects where responsible business models can reconnect business and society.

Intesa Sanpaolo Innovation Center supports the growth of start-ups in domestic and international markets through programs in acceleration and networking and has created laboratories and Competence Centers to generate know-how and develop new assets and businesses.

Intesa Sanpaolo Innovation Center invests in start-ups with its Corporate Venture Capital NEVA Finventures to encourage new business growth and to support the champions of tomorrow.

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