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The leading role of public transport for successful MaaS deployment in Europe

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Abstract

Although some "Mobility as a Service" (MaaS) initiatives have been piloted across Europe, so far most of them had problems reaching a significant scale and stable business operation, and there is still a lack of a solid MaaS experience replicable at the EU level. Achieving the appropriate balance between public and private components in the combined mobility scheme is a major issue, with the need of compromising between different business roles, objectives and attitudes within the same ecosystem. The adoption of viable policies for information and service sharing is also a barrier to overcome. To remain the "backbone of mobility" for liveable and sustainable cities, *Public Transport should embrace the emergence of those new mobility services and concepts*, together with the development of the autonomous vehicles, as great opportunities to enhance the efficiency and capacity of its services and systems and to gain new customers. This paper analyses the opportunities and the challenges for the public transport sector to play a leading role in providing mobility as a service, with the autonomy revolution as a key enabler.

Keywords: Mobility as a Service; Public Transport; shared mobility; Autonomous Vehicles

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1. Introduction

Although some "Mobility as a Service" (MaaS) initiatives have been piloted across Europe, so far most of them had problems reaching a significant scale and stable business operation, and there is still a lack of a solid MaaS experience replicable at the EU level. Experiences such as UBIGO in Gothenburg and Hannovermobil launched already a decade ago in Hannover, have highlighted some of the biggest barriers MaaS schemes are facing.
Achieving the appropriate balance between public and private components in the combined mobility scheme is a major issue, with the need of compromising between different business roles, objectives and attitudes within the same ecosystem. The adoption of viable policies for information and service sharing is also a barrier to overcome. Handling business-sensitive data, commercially exploitable user-related information and privacy aspects present at the same time opportunities and threats for the MaaS success.
In order to be successful and sustainable in the long run, a MaaS scheme should scale up fast to reach a critical mass of addressed customers' segments and volumes, and to offer customised and competitive mobility packages to users. This growth will generate additional opportunities to expand the coverage of the MaaS and, in a further step, to consolidate it to become globally accessible similarly to roaming in communications.
Today, MaaS schemes are often seen as disruptive start-up initiatives with great potential, but due to the implied challenges of public/private mobility integration, information handling and sharing, service interoperability and scalability requirements there is a need for specific actions to be taken to accelerate an appropriate and sustainable take off.
To remain the "backbone of mobility" for livable and sustainable cities, Public Transport should embrace the emergence of those new mobility services and concepts, together with the development of the autonomous vehicle, as great opportunities to enhance the efficiency and capacity of its services and systems and to gain new customers.

The cooperation between traditional mobility players and new ones is then essential to address new mobility needs and the necessity for even more integration and seamlessness between all modes and services.
IMOVE project, funded by the European Commission within the H2020 framework, aims to accelerate the deployment and unlock the scalability of MaaS schemes in Europe, ultimately paving the way for a "roaming service" type for MaaS users at the European level. UITP, as partner of IMOVE, looks in particular at the role that Public Transport will play in the implementation of this service. UITP wants to create a momentum and will take the opportunity of its participation to IMOVE to accelerate the required actions to ensure this cooperation.
This paper analyses the opportunities and the challenges for the public transport sector to play a leading role in providing mobility as a service, with the autonomy revolution as a key enabler. Analysis is supported by the recent results of European MaaS pilots and the living labs within the IMOVE project.

2. Evolution of the transport sector

There is a number of evident transformative trends. The pace of urban life is increasing rapidly; modern dense urban economies are reliant on excellent connectivity and citizens want to move around freely whenever and wherever they need to. The demand for high quality connectivity is increasing, not least as the world urban population is expected increase by 50% by 2050. But congestion, poor air quality and lack of space resulting from an over-reliance on private cars as the predominant mode of transport are choking our cities, leading to a decline in quality of life and threatening economic growth and productivity.
In parallel, trends show that younger generations are less interested in owning a car or getting their driving licence. Citizens are now seeing new mobility solutions emerging, making personal car ownership particularly in developed countries less attractive. So the relationship with the private car is fundamentally changing and this opens up new opportunities. On top of this demotorisation trend in many industrialized countries and the growing importance of cities, advances in the take up of digital solutions, environmental pressure and changing consumer spending due to the difficult economic context are also impacting the urban mobility landscape.
In fact, a digital tsunami is hitting the transport sector: mobile broadband, location detection, smartphone penetration and social media are enabling new services to develop. For example, in the medium term to long term, autonomous driving is likely to play a key role in urban mobility. New players are entering the mobility market

and citizens are reconsidering their mobility options. But not only are urban development, market and technology-driven factors changing the mobility landscape but also the political agenda which is now increasingly reflecting concerns about air quality, physical health and wellbeing. For example, municipalities and governments are actively developing mobility policies to favour active modes, encouraging citizens to walk and cycle more.

3. Overview of urban mobility trends and solutions

For most cities with long standing infrastructure, increasing road space to accommodate greater car usage is not an option. Optimising the efficient use of existing road space is therefore a key principle to appraise the requirements of competing user groups.

In cities with strong public transport, complemented with services like car-sharing, bike-sharing, bicycle parking, shared taxi services, ride-sharing etc. one can more easily move around. This model of urban mobility offers citizens the travel flexibility and convenience of the private car, without its negative externalities, such as congestion, emissions and wasteful parking requirements. In fact, it is the offer of an integrated combination of sustainable urban mobility services that most effectively challenges the flexibility and convenience of the private car.

A broader mix of mobility services is the answer to ever more complex and intense mobility needs. Therefore, the backbone of every mobility strategy remains an efficient public transport system. Public transport has the broadest customer base and as a sustainable public service it is the natural integrator of all these services. Nevertheless, there will always be situations where car usage is not only necessary but also justified. In these situations, car-based services and especially car-sharing are the obvious services that complement public transport as they offer the benefits linked to car usage without the need to own the car.

In a fast moving environment, access to information about options for travel that is instant, easy to use, attractive to customers, and authoritative is vital and therefore a one-stop-mobility shop acting as personal mobility assistant is the key to offer our citizens an alternative that challenges car ownership. But it will not work without an efficient public transport system.

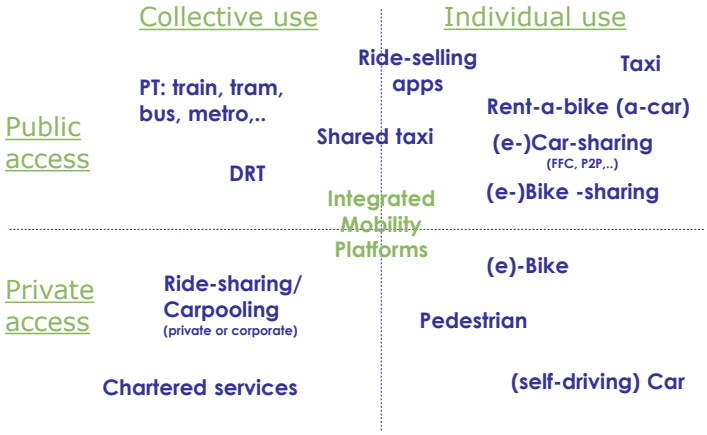

Fig. 1 Urban mobility solutions

Walking, cycling but especially new urban mobility services such as ride selling apps (Uber, Lyft), free floating carsharing (car2go) or ridesharing apps (Blablacar) to name but a few are on everyone's lips. They form an important part of the solutions in the urban mobility system, but on their own these new mobility services do not have the capability or capacity to meet citizens' mobility needs or solve traffic congestion. As an example, in San Francisco, well established home market of Uber and Lyft, they represent only 1-2% of all trips. They need an

efficient public transport system to work well, particularly where mass transit is required between locations across densely utilized urban spaces.

Urban space is one of the most precious resources in a city. Private cars are parked 95% of their lifetime and waste that valuable urban resource. For instance, a car takes up the parking space of at least three bikes. And during the 5% of the time that they are driven, they are much less efficient users of road space than bus, cycle or walking.

Yet citizens need to move and the growth of cities will mean increasing numbers of journeys: daily trips in urban areas worldwide are forecast to rise from 7.5 billion in 2005 to 11.5 billion in 2025. Public transport is the easily most efficient in terms of capacity and space consumption on the scale required to enable modern urban economies to function productively. In particular on major corridors and during peak hours, high capacity public transport services are - and will remain – the only viable solution and this should be reflected in the long term planning of urban areas. Currently public transport accounts for 1.2 billion trips per day.

Scenarios exploring future urban mobility with shared and autonomous vehicles developed by the International Transport Forum show that the most effective combinations of modes – with respect to the number of cars removed from the road or kilometres driven - always include high capacity public transport at their core. Public transport will continue to outperform all other modes in the efficiency of the use of space for moving a maximum number of people.

Berlin is considered as the capital of free-floating car-sharing with three providers (Drive-now, car2go and Multicity) boasting the largest operating area and the largest free-floating car-sharing fleet. Yet, according to the Civity study it only represents 0.1% of the Berlin modal split. But this is exactly the point: although the number of car-sharing customers are growing very fast, kilometres driven by car decrease as with car-sharing people walk, bike and use public transport more and use a car only when it is absolutely necessary. These new mobility solutions are not going to cover the main part of the citizen's trips, but they provide the key to less car ownership and in aggregate less car use. Whilst shared modes are excellent in complementing public transport in providing a door-to-door offer, they cannot provide a substitute form of transport for the bulk of mobility requirements. Without public transport, other sustainable and innovative mobility services cannot offer an affordable alternative to car ownership. Ride- and car-sharing work best where public transport is strong and to work well, these services need to be well known and they need a critical mass of customers. Public transport has a large customer database with clients who are also potential customers for ride- and car-sharing. Furthermore, coordinating cycling and walking with public transport is mutually beneficial, encouraging more bicycling and walking as well as more public transport use. Access to public transport helps cyclists and pedestrians make longer, more complex trips and can also provide convenient alternatives when people encounter bad weather, difficult topography, gaps in the bikeway network and mechanical failures. So investing in active travel modes, not only supports public transport use but contributes to health agendas that seek to increase levels of citizens' physical activity.

In New York, Uber and taxi have the highest pickup rates where public transport is a good option. In Paris, 65 % of Uber trips start or end within 200m of a metro station. To facilitate the use of carpooling or ride-sharing services, especially dynamic ride-sharing, public transport hubs not only offer the critical mass of potential customers but are also convenient and easily accessible meeting points. In addition, whenever customers use ridesharing to travel to another city, they often rely on local public transport upon arrival.
In Berlin, the free floating car-sharing hotspots are located within the city's rapid transit ring (S-Bahn), meaning that the highest vehicle use is made in an area that is also very well served by public transport. This is another indicator showing that ride- and car-sharing rely on efficient public transport.
A further important aspect is the need to offer our citizens affordable mobility. The price structure of car- and ride-sharing services offers the opportunity to use a car when it is needed, but it is not affordable to satisfy all the mobility needs of citizens, hence affordable public transport is a necessary complement of such bespoke service provision.

Further, in order to become really attractive, the different sustainable modes need to be coordinated, planned and delivered in an integrated way. From a physical perspective (coordinated network planning, stations, urban planning) but also from an information perspective: a one-stop-mobility shop acting as personal mobility assistant offering travel information, booking and ticketing. Transport authorities and operators are experts in organising urban mobility solutions and thus fully capable to take the lead in the coordination of new mobility schemes.

Regarding electric mobility, keep in mind that any urban rail system is already e-mobile and can act as charging infrastructure network for e-mobility services, making public transport also the technical backbone. In cities like Hannover, Munich, Brussels, Vienna or Montpellier, public transport companies are initiators or also shareholders of shared mobility services.

4. MaaS deployment

Overall, nowadays MaaS schemes can be seen as disruptive startup initiatives with great potential, but due to the implied challenges of public/private mobility integration, information handling and sharing, service interoperability and scalability requirements, specific actions to accelerate an appropriate and sustainable take off are needed.
The following key operational tasks are needed to reach the overall objective:

- Create solid and resilient business models, adapted to the specific segments of mobility users, local frameworks, transport operator cooperation models, able to adjust service offering and business operation in response to behavioural changes and tendencies detected through continuous monitoring and real data collection about user needs, habits and preferences.
- Develop Open APIs enhancing the interoperability of MaaS proprietary platforms with other relevant third-party ITS services (e.g Journey Planners, Travel Booking tools, mobile Apps) and allowing users to keep using their preferred applications when interacting with MaaS services, thereby widening their accessibility and outreach.
- Enable roaming between different MaaS schemes by supporting business cooperation between MaaS operators through the exchange of an "agreed minimum amount" of information, and improving user experience through enhanced user profiling and unique identification across multiple services, applications and MaaS providers.
- Unlock the potentials of a very valuable set of integrated information about mobility choices and behaviour obtained connecting existing data (e.g. across a journey, a day, months, etc.) that today can be hardly related to the same user and used to improve MaaS operation and provide value-added user services.

In order to implement the above mentioned key operational tasks, the EU-funded project IMOVE will boost the MaaS concept and initiatives through two main strands of activities and corresponding results:

- Investigating and developing a set of Scalability Unlockers, as sets of measures, organisational frameworks, operational and business models enhancing the framework conditions for MaaS development and operation, behavior change strategies, user engagement schemes, long-term roaming strategies and support.
- Designing and implementing a set of novel Software Enablers (SW Enablers) that will significantly advance current MaaS supporting technologies enhancing interoperability and integration of MaaS schemes in the landscape of ITS and other mobility services.

Both areas and sets of results will be developed and implemented during the project and their transferability will be ensured in order to support other existing as well as future MaaS initiatives beyond IMOVE. Both sets of results will be complementary and interconnected: the SW Enablers will allow monitoring the performance and improving the relationships among the three main stakeholders involved in a MaaS (the users, the MaaS Operators and the Transport Operators); this information will be exploited by the Scalability Unlockers to support the deployment and development of the MaaS schemes.

4.1. MaaS Living Labs in Europe

IMOVE concepts and solutions will be investigated, validated and evaluated in 4 different Living Labs: Berlin, Gothenburg, Manchester and Torino. Both Scalability Unlockers and SW Enablers will be deployed in all participating pilot sites and will be validated and assessed in real-life conditions involving users and stakeholders through the set-up and operation of local Living Labs. As an additional validation element, a particular attention will be paid to roaming between different MaaS schemes, with organizational and technical elements being identified and selected to set-up and run cross-site experiments and validation in Roaming Living Lab. Overall, IMOVE sites have been selected due to the variety and complementarity of local conditions, transport environment and engagement in the domain of combined mobility services.

4.2. Berlin

Berlin possesses an outstanding local public transportation network. The network of regional trains, SBahn (city train), U-Bahn (subway), trams and buses has a total length of around 1,900 km – roughly equivalent to the distance between Berlin and Moscow. Passengers can get on or off at over 3,100 stations and stops. In addition, several other mobility services such as vehicle-sharing (free-floating and fixed), bike-sharing, taxies, etc. is available for the citizens. URBI are currently providing access to most of these mobility services in a single app, and plan to extend the offering towards the MaaS concept which can be introduced in the framework of the IMOVE project.

4.3. Göteborg

The Public Transport authority in the region of Västra Götaland, Västtrafik, was an active part in the GoSmart/UbiGo trials in Göteborg. Since the finalization of that project, Västtrafik has been working with designing the process in which MaaS (or combined mobility services) shall be introduced in the region. Their decision to stimulate commercial actors to participate in this introduction trough a procurement process, will result in the start up of a publicly supported, commercial MaaS operator which will be launching the service during 2017 according to current planning. The service is expected to combine public transport, car-pool, bike-pool and taxi, but the full coverage of the awarded service will be decided by the tendering parties. The approach taken by Västtrafik, is combining two of the approaches for MaaS currently discussed in the MaaS community, and is of great interest as one of the four sites of IMOVE.

4.4. Manchester

Transport for Greater Manchester is the regional transport authority responsible for coordinating and facilitating transport services in Greater Manchester (GM) area, the fastest growing UK region with population of 2.7 million residents. Urban, national (intercity) and international (cross-border) trips that start or end in this area will be investigated in order to assess how a MaaS service could work on different geographical levels and a common payment account system. This will bring together different public and private mobility service providers including bus, tram, metro, taxi, car-sharing, rail, coaches, electric vehicle charging infrastructure, and parking operators using the TfGM smart card platform already in operation."

4.5. Torino

The municipality of Turin (through its PT company and its ITS company 5T) is running a MaaS service integrating: Public Transport, Bike Sharing, Traditional Car Sharing, Free Floating car sharing (Car2go), Electric car sharing (One Way), Carpooling (with 3 different operators to be integrated) and it is already starting a public-private cooperation with the IMOVE partner URBI which already acts as facilitator for commercial partnerships and mobility aggregator (currently for Car sharing services) by replicating its schemes used in other European cities. The MaaS scheme was introduced in 2012 (with the integration of the PT and the Car Sharing) with an integrated ticketing scheme BIP – Biglietto Integrato Piemonte) covering a greater area around the city. The scheme grew up along the years including more transport modes. As further step, the municipality has already approved a plan and now is going to implement a C02 certifications aiming at rewarding with credits the sustainable behaviours of citizens: this environmental accounting will be included IMOVE Living Lab as added value service: by using the Mobility Tracker SW Enabler (see Task 2.4) all transport modes will contribute in measuring the individual mobility footprint for providing incentives to sustainable behaviours.

4.6. Data analysis

The above mentioned living labs contributes to the identification of the opportunities and barriers for data sharing across all MaaS actors in the IMOVE Living Labs and beyond. On this purpose a reference information model (meta-model) will be designed which will contain and describe all the data required by the MaaS actors in a structured way, incorporating existing information representation. The necessary interfaces and data translators will be defined between MaaS actors, thus enabling interoperability between different MaaS schemes which will directly support the roaming of the end user (traveler) mobility portfolio across Living Labs.
The living labs will support the analysis of end user mobility patterns so as to understand the customer expectations, study behavior changing strategies and identify further business potential for MaaS actors.

5. Automated vehicles in the MaaS scheme

Recent studies by MIT (New York), ITF (Lisbon) and the VDV (Stuttgart) have shown that it would be possible to take every citizen to their destination with at least 80% fewer cars. Removing four out of every five cars would have a significant positive impact for cities and affects not only the environment, traffic efficiency, and parking but also frees up a lot of urban space. In many cities, on-street parking accounts for a vast amount of land, which could be freed for other uses. Fewer cars would also lower the cost of building and maintaining roads and generate less noise whilst having a smaller environmental impact. Driving patterns of vehicles could be algorithmically optimised, but most importantly: self-driving vehicles would also provide much safer roads as today 1.2 million worldwide a year die in automobile-related deaths and 90% of the accidents are due to human error. However, this will only happen if Autonomous Vehicles (AVs) are introduced in fleets of driverless shared autonomous vehicles of different sizes reinforcing an efficient high capacity public transport network supporting walking and cycling.

Indeed, the above-mentioned studies clearly state that these results are only obtained if autonomous vehicles are shared and they complement an efficient high-capacity public transport system.

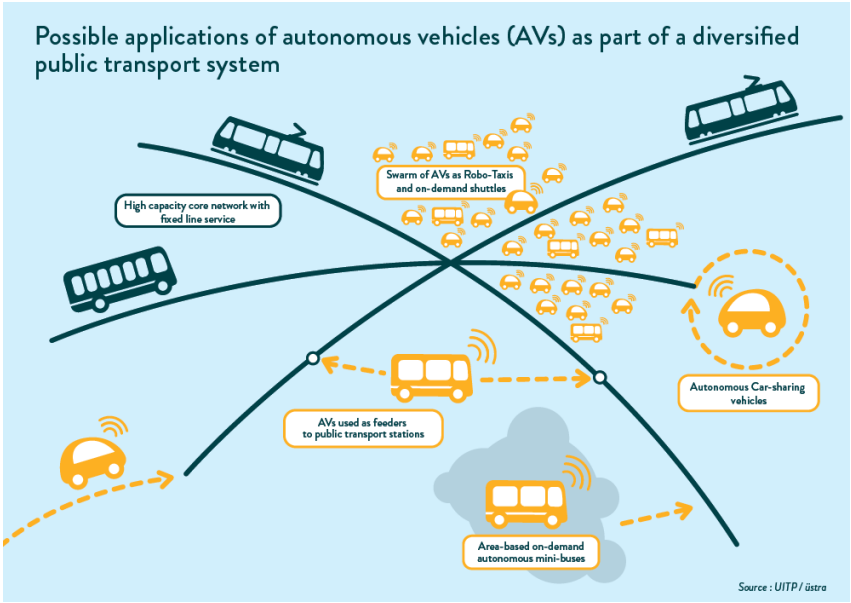

Fig. 2 Urban mobility solutions (source: UITP/üstra)

The decisive factors that will determine the realisation of the above vision are the shared usage of AVs in fleets and the use of fully driverless operation. If fully automated operation cannot be accomplished, AVs will not be able to form a new mode of transport and thus could not enhance existing public transport. Therefore cities and countries must actively shape the introduction of AVs now to prepare the authorisation of driverless operation. An integrated effort of all authorities concerned (mobility, road safety, urban planning, traffic control, etc.) must be put in place. Otherwise we will miss the chance for a fundamental change in urban mobility and end up in a

scenario where vehicle automation will even further increase the amount of private car and vehicle miles travelled with all the associated negative externalities.

The first point is to ensure autonomous vehicles are shared and that people are ready for this idea of sharing and switching between different modes of transport. Therefore, all forms of shared mobility, mainly car- and ride-sharing, need to be actively promoted and incentivised as of today. Tax incentives for shared rides or shared ownership of vehicles, shared vehicle zones, promotional campaigns, priority parking places, promotion of pilot projects. Preparing citizens for shared autonomous vehicles in the future goes hand in hand with more car- and ride-sharing today. Measures to limit single car occupancy need to be taken as well as measures to avoid having empty private autonomous cars on the roads.
The second point is to ensure that these fleets of shared AVs are integrated into a complete mobility solution with high capacity public transport as a backbone in densely utilised areas to fulfil the lion's share of trips complemented by walking and cycling. In order to become really attractive and form a credible alternative to (autonomous) car ownership, the different sustainable modes need to be coordinated, planned and delivered in an integrated way. From a physical perspective (coordinated network planning, stations, urban planning, and algorithmic optimisation of autonomous fleets) but also from an information perspective: a one-stop-mobility shop acting as a personal mobility assistant offering travel information, booking and ticketing.
The creation of multimodal mobility platforms, including AVs and offering Mobility as a Service is the way to connect urban mobility services now and in the future.

6. Conclusions

The challenge the transport sector has to face in the near future is to offer an affordable, convenient alternative to car ownership and preserve high quality of life to stay attractive for citizens and businesses. Without public transport, other sustainable and innovative mobility services cannot offer an affordable alternative to car ownership and the public transport sector should take the lead of this transition to the combined mobility up to Mobility as a Service schemes. UITP as representative of the sector provides a set of recommendations for authorities and relevant players:

- Plan carefully to optimise the use of finite road space
- Develop high quality public transport solutions, as a viable alternative for mass transit as opposed to low capacity car journeys.
- Use the innovation offered by technology to provide high quality, instant authoritative information systems, on which the travelling public can rely to plan their unique journeys that incorporate multiple modes.
- Recognise that no single solution exists for connectivity and ensure that the planning framework includes public transport at its core.
- Determine the right regulatory framework for local circumstances.
- Grant public transport the capacity to test and develop new services so that it can drive changes in the mobility market.

In order to trust an integrator and join an integrated mobility platform, business partners expect neutrality, independence, fairness, an innovative strong brand with a positive image, and an integrator that is stable enough to stay for a long time. The service offered should fit local or regional political objectives and all business partners should be treated as equals. Moreover, it should be a high-quality easy-to-use digital service that is cashless and offers the customer a single sign-on. From the customer side, the key expectations of an integrated mobility service are trustworthiness, simplicity, neutrality, and flexibility.
In order to trust a service it should guarantee a high level of quality, offer correct real time information, have a strong reputation-brand and be reliable. It should also be simple, meaning an easy, user-friendly, convenient service offering a single sign-on access. Neutrality is another requirement as it should present all available mobility options in a transparent way. Last but not least, flexibility is important, as the service must be able to adapt to changing customer needs.

In this context, IMOVE is a key project at European level – and not only – for the real deployment of MaaS solutions in engaged cities and to understand the viable business models and organizational processes that can make such a disruptive scheme successful.

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