CiViTAS
Cleaner and better transport in cities

POLICY NOTE

Smart choices for cities

Cities towards Mobility 2.0: connect, share and go!

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Preface

The objective of the CIVITAS WIKI project is to provide information to European city planners, decision-makers and citizens on clean urban transport and on the CIVITAS Initiative. With its policy notes, WIKI wants to inform people in cities on a number of topics that currently play an important role in urban mobility.

This policy analysis focuses on the topic of shared mobility. The concept of "sharing" is shaking up the global economy. Every day people all over the world share an increasing number of material objects and non-material services (from clothes and tools to houses, working spaces and professional skills). This revolution has an effect on all economic sectors, and albeit at a different pace, the mobility sector is without any doubt one of the sectors facing the greatest and most revolutionary changes.

This new mobility paradigm has relevant impacts on cities and their mobility planning strategies and plans, and gives rise to several questions. How can cities best manage the emergence of these new shared-mobility services? How can the relationship between private and public interests best be managed? What benefits and opportunities can be identified and exploited at city level? What challenges and potential negative impacts need to be taken into account?

This CIVITAS WIKI policy note provides cities with a comprehensive overview on shared-mobility concepts and practices. It also offers guidance to decision/policy makers and urban mobility professionals in identifying opportunities and challenges of shared mobility for their cities and some potential actions to be taken by public authorities in order to better deal with this new paradigm of mobility.

We hope you will enjoy reading this policy note,

The CIVITAS WIKI team

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Summary

In recent years, shared-mobility services have had an increasing impact on urban mobility in many countries around the world. The wide spread of information and communication devices (smartphones in particular) and of social media and web platforms, together with the sharing economy that is growing into a cultural consumption approach for an increasing number of people, are at the basis of this revolutionary development.

Megatrends related to demographic, economic, social and technological aspects of life are creating disruptive factors within the mobility sector. The growing number of single-person households and longer life expectancy, the scarcity of resources, the rise of a new consumption culture, namely an increased focus on the activities achievable through the use of goods rather than on the goods themselves, and the increasing digitalization (especially of the younger population) are all factors that contribute to the major changes which are occurring.

We are moving from a present status where individually-owned cars together with public transport are the dominant forms of transport, towards a new mobility paradigm where individually-owned cars will probably be one of several alternative forms of multimodal on-demand transport options. In such a scenario, public and private operators will probably cooperate (but also compete) to offer customers multiple real-time transport options and higher service levels.

Shared-mobility services have developed in many forms: some of them are already tried and tested, while others are relatively new and have yet to achieve their full potential. This note aims to deal with those shared-mobility services that are most relevant from a local authority point of view. They range from the more traditional car sharing, ride sharing and bike sharing services to more innovative solutions of ride sourcing services and car park sharing. Also, novel shared-mobility services are becoming increasingly available for goods and urban freight deliveries. In this note, each service concept is defined, and suggestions for better implementation in the urban context are given. A case study of practical application is provided for each service.

Knowledge of the real effects of newer services is limited, as several are at an initial phase of introduction. However, the more mature services such as car and bike sharing have already started to produce evidence of their effects on the urban mobility system. Even in these more mature services, the potential for their more rapid development, is substantial because of the rapid spread of new technologies and web platforms. Nonetheless, public authorities need to be aware of the changes in the mobility paradigm in order to better steer their political decisions towards the achievement of a sustainable urban mobility. There are some actions that political authorities should consider, such as providing physical and virtual spaces and infrastructures for these new services. Also, they need to manage their role in the whole urban mobility system to fully exploit possible synergies with other transport modes (especially with public transport), and set clear rules for private operators to ensure a fully efficient and sustainable transport system for residents and users.

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Introduction

Mine, yours, ours: in cities especially across North America and Europe people are increasingly sharing tools and equipment, welcoming guests into their spare rooms, eating food prepared in people's home kitchens, and paying for rides in the cars of people they do not know. Businesses are hosting others in their office space, industries are sharing the transport of goods along their supply chains, and municipalities are offering public land for shared food production. The idea of sharing and borrowing goods and services is now part of the daily routine for an increasing number of people.

While "sharing" has always been a part of city life – through public libraries and community spaces, for example – the past few years have seen a significant revival and acceleration of the principle of sharing. New business models have been developed, with fast growing customer numbers and revenues. Although the sharing of resources is not a fundamentally new model of social interaction, a "sharing economy" is a growing and innovative concept. The sharing economy is an economic model based on sharing assets between groups of people rather than on individual ownership and usage. Individuals have joined forces to fund films, music albums, games and many other activities (e.g. Kickstarter[1]). These shared activities have occurred across many sectors such as accommodation (Airbnb[2], Couchsurfing[3]), mobility (bike sharing and car sharing) and skills (TaskRabbit[4]), and at individual, institutional, business and community levels.

While many of the most visible platforms of the sharing economy have begun in the United States, sharing has become a global phenomenon, both because of the expansion of platforms to other countries and because the idea of sharing has caught on around the world. Platforms are proliferating throughout Europe, where cities are becoming centres of "sharing" practices. For example, Paris has become the annual home of the "OuiShare Fest".

Technological, economic and social factors are driving the rapid growth of the sharing economy:

- Digital technologies and web platforms increase the ease and convenience of transactions while reducing costs and facilitating the connection of distributed networks of people and assets. Social networking supports reputation systems that build trust and share risk, allowing sharing among people who do not know each other.

- Economic drivers include responses to major recessions including the 2008 financial crisis and growing income inequality. This leads to an increased interest in activities that supplement income and provide access to goods and services, rather than ownership, because of the lower costs involved. Decades of stimulation of economic growth and of the consumer society has led to an accumulation of an abundance of idle capacity of many goods and services that can be shared and become monetized.

- Socially, the sharing economy is a lifestyle trend, particularly among the Millenials[5], for whom affordable living is a priority and social networking is an inherent behaviour. The dense population of people in an increasingly urban society enables sharing with less friction while a desire or necessity for more independent lifestyles with part-time work attracts people to the sharing economy. Altruistic and sustainability mind-sets also drive some sharing activities.

Similar considerations may be applied in relation to the mobility sector. The term "shared mobility" encompasses a range of transport options. The shared use of a vehicle, a bicycle, a parking space or a freight facility is an innovative transportation solution that enables users to have short-term access to modes of transport on an as–needed basis without the burdens of ownership.

Although there have always been options of sharing transport, first with public transport and taxis and more recently with car-sharing or bike-sharing and carpooling services, what has happened over the last few years is a real change in the way people have started to think about their mobility habits.

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1   https://www.kickstarter.com/
2   https://www.airbnb.it/s/Europe
3   https://www.couchsurfing.com/
4   https://www.taskrabbit.com

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5   People with birth years ranging from the early 1980s to the early 2000s

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Sharing Economy

Thanks to highly–advanced communication technologies (Internet, social media and Intelligent Transport Systems - ITS) and their integration, it is now easier and quicker to find opportunities to share rides, vehicles (cars and bikes) and parking spaces. Smart technology, such as apps, smartcards, online booking systems and mobile phones, have made choosing, booking and using shared transport easier. Thanks to this, easy access to transport can become even more important than owning vehicles as assets. The new communication technologies are enabling a much better coordination between transport modes with travellers offered different and flexible solutions depending on the transport service availability, the time of day, or the number of people travelling together.

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Mobility services are increasingly being coordinated, leading to the generation of a "mobility ecosystem". Thus, mobility is starting to be considered as a single consistent service rather than as a series of different and separate mobility services. Many people across European cities search for their best mobility options (or a combination of them) on a daily basis – a hitherto unknown flexible approach. One might argue that, in the future, innovative mobility services will focus more on the integration between transport modes than on improvements of individual ones.

In addition, a new consumer culture (also determined by lower levels of income and expense) is emerging especially among young people who are content with using a product instead of owning it. The main example is the car: people have started to consider that it is more convenient (and more on trend) to share cars (or rides) rather than to own one. In parallel, due to ICT (Information and Communication Technologies) a constant connection between people, machines (the Internet of Things) and systems is possible, and this has enabled people to rediscover the pleasure of being part of a community, of sharing with others and of making friends worldwide and not only within their neighbourhood. People, machines and systems are now constantly connected and communicate with each other in real time.

A new understanding/paradigm of mobility is emerging that is also referred to as Mobility 2.0 (using a term derived from the computer world – "2.0"). It addresses the higher level of interaction that characterizes the use of mobility services and that is typical of the latest information technologies. Users are now part of mobility itself as they can share their resources (cars), their time, opinions and feedback about services with other users and thereby contribute to building a supply of mobility services in a way that has not existed before.

The sharing economy is in the process of evolving into a significant element of the economic cycle and will almost certainly achieve a much more important position in the years ahead. The development will continue because the sharing economy provides real opportunities to unlock the idle capacity found in the untapped social, economic and environmental value of underutilized assets. It promotes access to goods instead of ownership in many, but not all, of its transactions.

There are a number of estimates of the scale of the sharing economy:

- According to PricewaterhouseCoopers, five sharing economy sectors (peer-to-peer finance, online staffing, peer-to-peer accommodation, car sharing and music/video streaming) alone could generate up to EUR 300 million in revenues globally by 2025[6];

- Non-monetized transactions are also being measured, such as the rapid growth of Couchsurfing with more than 10 million members around the world;

- In major cities across North America, Europe and Asia, shared mobility today accounts for around 10% of public passenger transportation, up from less than 1% in 2014[7];

- According to a survey conducted in the U.S. in 2015[8], 8% of all adults have participated in some form of mobility sharing and 1% of them have served as providers under this new model, chauffeuring passengers around or lending their car by the hour, day or week.

Shared mobility is arguably the most rapidly growing and evolving sector of the sharing economy[9]. This is largely due to the increasing attraction that the shared-mobility sector has for economic operators. Though initially developed by ordinary people as a "bottom-up" solution, the shared-mobility sector is now one of the most promising economic sectors in terms of growth. Many operators have entered the market attracted by the possibility of profits. However, the most innovative aspect of shared mobility, and the one which is likely to have the most disruptive impact on traditional transport providers, remains the sharing of vehicles and mobility services between private individuals (P2P services). This is undoubtedly the real revolution within the sector.

6   http://tinyurl.com/pwc-blogs
7   Freese C., (2014)
8   PricewaterhouseCoopers LLP, (2015)
9   Cooper R., (2015)

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The new paradigm of Mobility 2.0: trends and challenges

Mobility has a number of substantial benefits, such as providing access to jobs and a sense of personal freedom. But it also carries with it persistent challenges in terms of pollution and congestion. Congestion is close to being unbearable in many cities and can cost as much as 2% to 4% of national GDP[10], if one takes into consideration the lost time, wasted fuel, and increased cost of doing business. Worldwide, the growth in urban travel needs is fast outpacing the development of transport infrastructure and expected trends are not encouraging: passenger travel distance is expected to double by 2050 (over 70 trillion kilometres per year) and per capita commuting delay is also expected to double by 2050 (to over 100 hours per year)[11]. In Europe, travel passenger distance is expected to increase by 50% by 2050[12]. The existing urban infrastructures in Europe cannot support such an increase in vehicles on the road, and various stakeholders, ranging from city administrations and transport companies to telecom operators and shared-mobility companies, are now considering a variety of alternatives to the current options of transportation.

As mobility is a demand derived from other needs, understanding the key drivers and trends behind it is fundamental for sustainable and integrated urban mobility planning. Therefore, it is necessary to gain an awareness of these drivers in order to help cities to better face the changes affecting every aspect of our daily life.

The mobility sector is moving towards a scenario of shared use driven by some megatrends, including:

- **Rise of a new consumption culture**: in the industrialized nations and other highly-developed countries, a new generation of consumers has emerged who are often content merely to use a product rather than to own it. Especially among young people, cars are nowadays seen more as a mean of transport rather than a status symbol: this factor is also undoubtedly due to the cost of car ownership.

- **Scarcity of resources**: this trend comprises three distinct dimensions. Firstly, scarce raw materials are pushing up energy prices and increasing the demand for

efficient mobility services and technologies. Secondly, many cities today lack the space to substantially expand their transport infrastructures. Thirdly, they mostly lack the money they would need to invest in new and expensive infrastructures.

- **Digitalization process and continuous connectivity**: innovation in the area of ICT continues at a rapid pace, creating ever more extensive ways of connecting things and processes over the web. "Millennials" exhibit a desire to stay connected through social media while showing significantly less interest in driving. Advanced ICT ensures a continuous connectivity, supporting a shift towards a "work anywhere, anytime" mentality, with an increasing number of people wanting to be able to work while travelling. In parallel, the spread of the digital sharing economy has prompted a broader acceptance of access to goods over ownership and the ability to access jointly-owned goods through information technologies.

- **Demographic trends**: an influx of new residents is accelerating the size of cities around the globe. Cities are being forced to address traffic congestion, noise and air pollution, and are therefore looking for intelligent, low-carbon mobility solutions. Secondly, the growing number of single-person households and longer life expectancy is causing demand to shift towards individual mobility services that can be adapted to users' specific life circumstances.

The combined effect of these factors will increasingly impact on car ownership and usage. Cars are, generally, used for less than one hour a day (and rarely for 10% of the day) so they are increasingly seen as being an inefficient and underused asset. Much of their capacity is underused because of low levels of occupancy on each trip (often with only one occupant). But these are not the only factors paving the way towards new conceptual mobility schemes.

Other major technological trends are converging to shape the new mobility system, among them:

1. *In-vehicle connectivity*: the broad adoption of in-vehicle connectivity, either through mobile phones or through an embedded system, is opening up new possibilities in optimizing traffic flows.

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10 Ernst&Young, (2013)
11 Ernst&Young, (2013)
12 OECD-ITF, (2012)

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2. **Electrification**: while shorter-term sales forecasts for electric vehicles (EV) remain significantly lower than those for their less expensive fossil-fuel counterparts, battery costs are falling faster than even the most optimistic predictions, meaning that the economic trend is shifting in favour of EVs in the mid- to long-term.

3. **Autonomous driving cars**: the introduction of fully autonomous or driverless vehicles is approaching. Some new luxury car models already feature sophisticated driver-assistance systems offering a degree of autonomy. It is difficult, however, to predict how soon autonomous cars will make their way into the marketplace, especially given the uncertainty about regulation. By reducing the human factor behind the wheel, autonomous vehicles could cut accidents and could also increase the capacity of roads because vehicles would be able to travel closer together and at higher speeds. As accident rates will be lowered, the weight and mass of autonomous vehicles can be reduced significantly — particularly in urban areas where speeds are generally low. Taking weight and mass out of the vehicle allows for electrification so battery-powered or electric vehicles can become more viable options: large batteries are no longer needed and longer distances can be covered with a single charge.

With respect to autonomous driving, a recent study conducted by Deloitte Consulting "The evolving mobility ecosystem"[13] predicts that the intersection of two actual critical trends — *driver versus autonomous* vehicle control and *private versus shared* vehicle ownership — may lead to four interdependent and concurrent possible future states of personal mobility in the next 10-15 years:
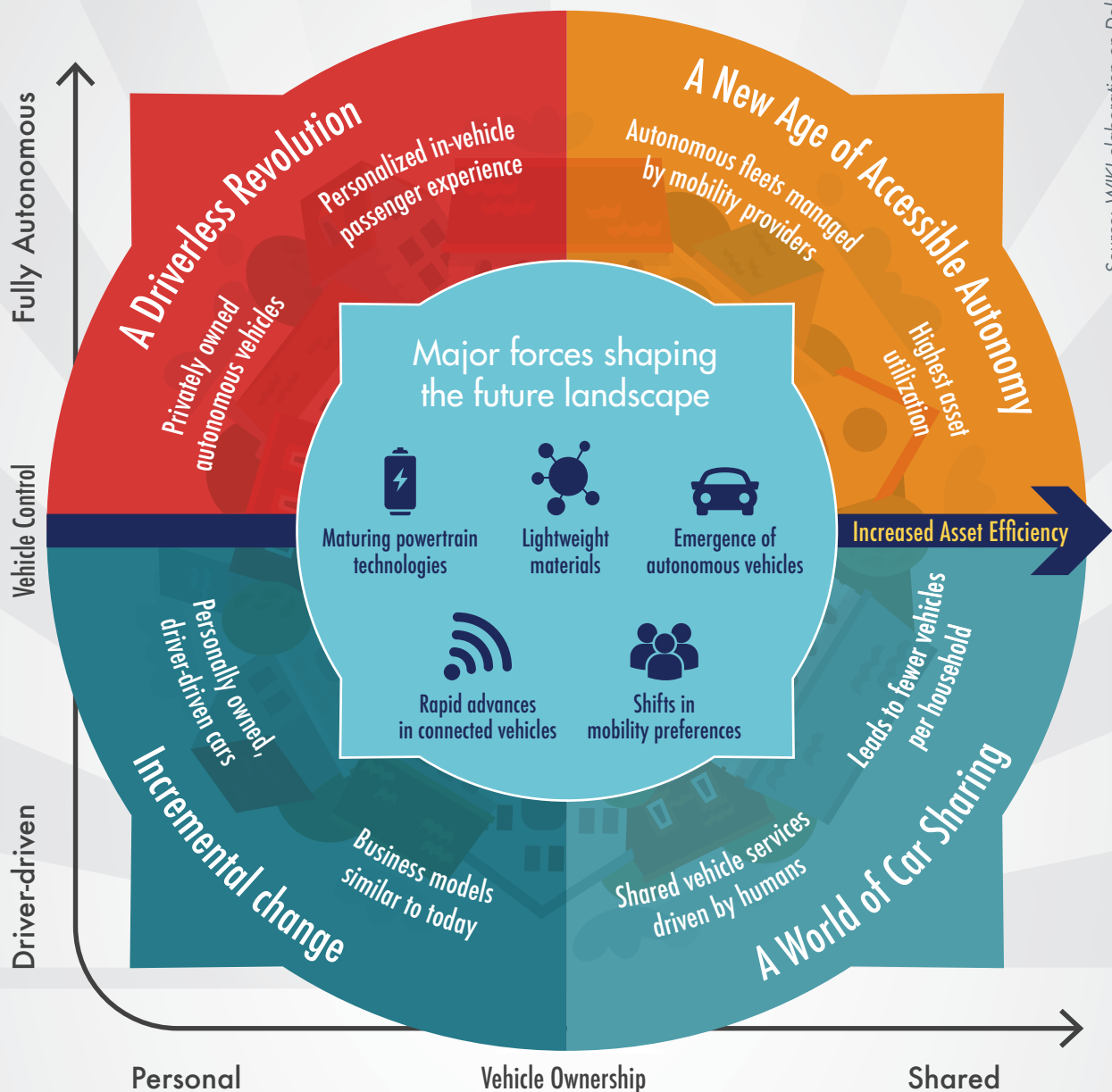
1. **Incremental change**: This first state operates very much as it has for the past century. Private ownership of vehicles remains the predominant form. This future state assumes that while driver-assisting technologies continue to advance, completely autonomous driving will not be a reality anytime soon.

2. **A world of car sharing**: The second future state anticipates continued growth of shared access to vehicles. In this state, shared vehicle services become ubiquitous as greater scale and increased competition leads to a more expanded range of services and to tailored customer experiences at lower costs.

3. **The driverless revolution**: It is the third future state in which autonomous driving technology is anticipated to become viable, safe, convenient and cost-efficient yet private ownership continues to prevail. Individuals seek the driverless functionality for its safety and other potential benefits but continue to own cars for many of the same reasons they did before the introduction of autonomous driving.

4. **A new age of accessible autonomy**: The fourth future state anticipates a convergence of both, autonomous driving and shared mobility. In this future, mobility management companies offer a range of passenger experiences to meet widely varied needs at different prices. Over time, as smart infrastructure expands and driver usage nears tipping point, fleets of autonomous shared vehicles are likely to become ubiquitous and widespread in urban centres.

13 Deloitte Consulting, (2015)a

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Future of Mobility

A Driverless Revolution

Privately owned autonomous vehicles

Personalized in-vehicle passenger experience

A New Age of Accessible Autonomy

Autonomous fleets managed by mobility providers

Highest asset utilization

Fully Autonomous

Vehicle Control

Driver-driven

Major forces shaping the future landscape

Maturing powertrain technologies

Lightweight materials

Emergence of autonomous vehicles

Rapid advances in connected vehicles

Shifts in mobility preferences

Increased Asset Efficiency

Personally owned, driver-driven cars

Incremental change

Business models similar to today

Leads to fewer vehicles per household

Shared vehicle services driven by humans

A World of Car Sharing

Personal

Vehicle Ownership

Shared

The study predicts that the sequence of states will be to firstly transit through the scenario of car sharing, and then through the driverless revolution. The fourth scenario of a new age of accessible autonomy is likely to be the most probable final outcome, building on the continued development of the earlier steps.

As far as public transport is concerned, some advanced cities worldwide are investing heavily in the improvement of mobility. Cities are also increasingly digitalizing their public transport systems and offering new operational models by making transportation ever more multimodal, on-demand and shared as well as increasing consumer choice and convenience. Because of improved data and analytics capabilities, a more digitalized transportation system will become more efficient by better matching demand and supply in the short- and mid-term. However, public transport is to likely face increasing competition from new mobility solutions provided by emerging private operators.

The extent of the role of shared mobility within the urban mobility system is not fully understood at present because of the pace and innovative nature of the services. However, in general, we can expect that the social, economic and technological trends mentioned above will act as important drivers in shifting the mobility system from what it is now to a very different future. It is not possible to specify the pace at which these changes will occur, but it can be reasonably argued that the change will come. The mobility system is likely to move from ownership to sharing where systems act in cooperation; i.e., from an unconnected and inefficient system to a more efficient and on-demand system based on data sharing. This is described in the table by Bouton S. (2015), reproduced below.

The present and future of urban mobility

From...	Toward...
Individual car ownership as dominant form of transport	Individual car ownership part of multimodal, on-demand, and shared transport
Limited consumer choice and few service levels	More consumer choice and many service levels
Government-funded public transport	Public and private transport operate in parallel
Unconnected, suboptimal, transportation systems	On-demand, connected systems that use data to unlock efficiencies

Source: Bouton S. (2015)

Shared-mobility concepts and experiences

All shared-mobility services operate differently, but all are based essentially on a common set of principles/factors:

■ They rely on mobile solution applications enabling users to enter into the rental/lease or usage contract anytime, anywhere;

■ They have a strong social component since users can share their evaluation of the hired services or mobility options used, and are able to collect positive or negative feedback from others. This in turn increases the pressure to improve the overall reliability of the services;

■ They provide transport that can be easily customized to specific demands. Each economic actor (both supplier and user) can act according to his/her specific need following market logic, thereby significantly cutting down losses and inefficiencies;

■ Existing research findings suggest that shared-use transportation modes require a minimum level of population, household density, mix of uses, percentage of transit commuters and walkability to flourish;

■ Shared mobility benefits most from a dense, mixed-use environment, and also supports this kind of development by reducing the need for personal vehicles and parking spaces.

Within this framework, the concept of "Mobility as a Service" (MaaS) is emerging where mobility is considered as a single consistent service rather than as a group of different and independent mobility services. The MaaS concept envisions a seamless, door-to-door combination of all transportation modes where a "Mobility Aggregator" gathers and sells all services through a single smartphone app, allowing easy fare payment, one-stop billing and the integration of subsidies, if any. Following this logic, MaaS can dissolve the boundaries between different transport modes by providing a customer-centric experience while improving the efficiency of the entire transport system. The paradigm shift from infrastructure- to mobility-based services requires full integration of the different operators and modes of transport. Despite the availability of new information and communication technologies, this is difficult to implement and develop.

While any form of transport that is shared could be counted as shared mobility, e.g. traditional public transport and taxis, this analysis focuses on the emerging forms of on-demand transport. These include car sharing, bike sharing, ride sharing (carpooling, vanpooling), ride sourcing, car park sharing, and shared freight mobility.

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Shared freight mobility

Car sharing

Park share

Bike sharing

Ride sourcing

Ride sharing

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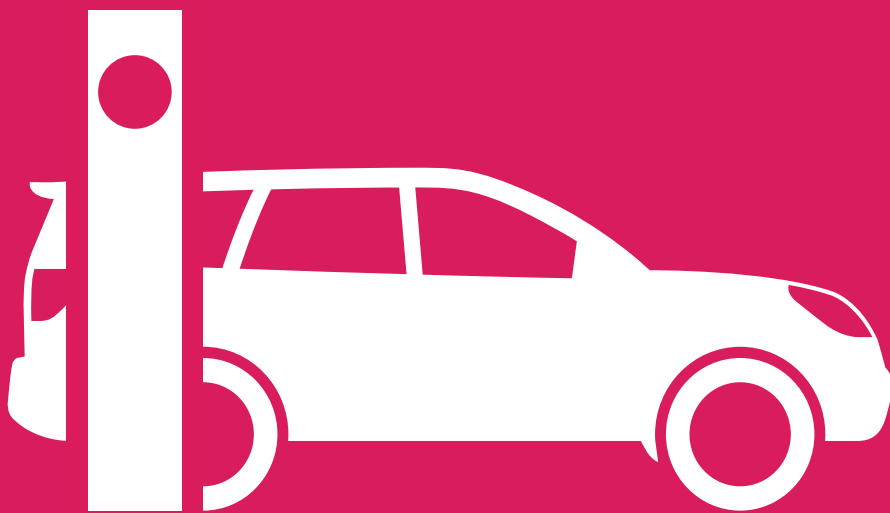**Cities towards Mobility 2.0:
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CAR SHARING

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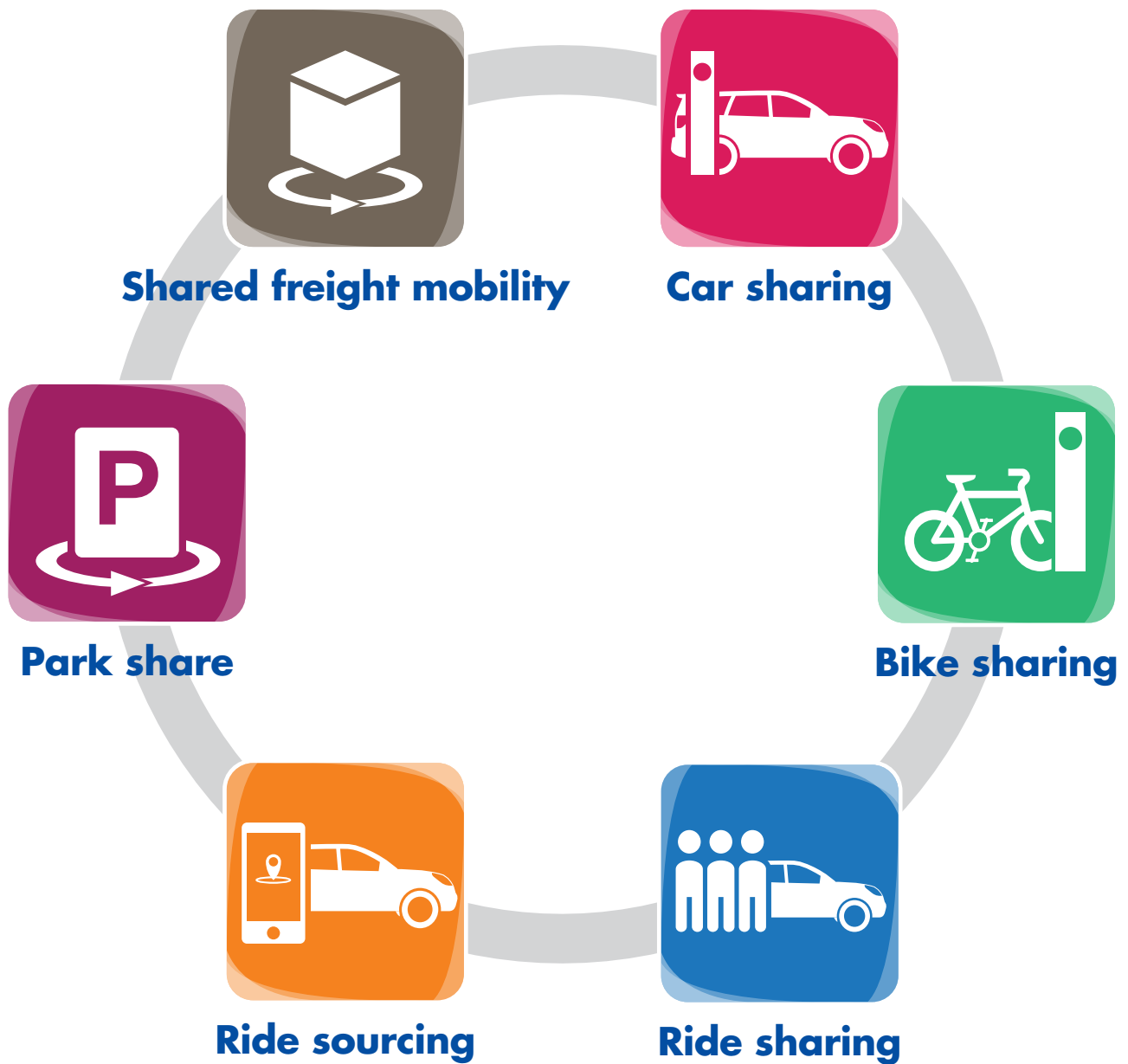
Car sharing

Car sharing is the term used throughout most of the world to refer to mobility services where the user, after registration, is able to access a car provided by the service without interacting with a member of the staff each time. The vehicle is driven by the user in the same way as in traditional car hire: usage is billed in time increments (minutes or hours) or on the basis of distance travelled and vehicles are typically available from distributed locations within a service area.

Car sharing gives individuals access to the mobility benefits of a car without requiring them to own one. According to recent statistics on car sharing by users in Europe, Germany has by far the highest number of people using car sharing with over 700,000 users, followed by Italy (130,000 users) the UK and France (16,000 users).

A recent analysis from Frost & Sullivan[14] estimates the current number of vehicle-sharing fleets in the European market at about 20,000 vehicles, and forecasts that by 2020 there could be between 75,000 and 100,000 of such vehicles in operation, with the potential to replace about 1 million of vehicles.

There are different types of car sharing, which include:

- **Station-based (traditional or round-trip) car sharing** requires customers to pick up and drop off vehicles at the same location. Round-trip is the earliest model of car sharing. With round-trip car sharing services, vehicles are parked in designated parking spots throughout a city, often within walking distance of dense residential or commercial areas. Registered members of the service use the Internet or a smartphone application to locate and reserve available cars nearby. They can access the car using an RFID card or a smartphone app. Cars are available for use 24 hours a day, with hourly or daily rental rates which appeal primarily to drivers making longer trips, including those that go beyond city boundaries.

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14 Leveque F. (2011)

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■ **Point-to-point car sharing (one-way)** allows customers to pick up a vehicle at one location and drop it off at another. It can be *free-floating* or *station-based*.

■ ***Free-floating***: often referred to as flexible car sharing, it enables one-way journeys within a specified geographic zone.

■ ***Station-based***: some point-to-point services are station-based, meaning that the user picks up a car from one parking station and returns it to another. Fixed infrastructure, such as charging points for electric vehicles and kiosks for customer service, may be located at the parking stations.

One-way car sharing is the fastest-growing car sharing model. It has some similarities with bike sharing, with drivers often relying on it for first and last mile connections to public transport and providers working to rebalance vehicles in areas where demand is high. With their rates per minute, one-way services are designed to facilitate short trips within cities.

■ **Peer-to-peer (P2P) car sharing** uses an Internet-based service to allow personal car owners to rent their cars to other drivers on an hourly, daily, or weekly basis at rates they set themselves. In this way, car owners can monetize the excess capacity of their vehicles by enrolling them in car sharing programs. While P2P represents the smallest share of the current car sharing market, it has evolved significantly over the past years. Rental service by the day is quite widespread. New technology enabling renters to access cars by using their mobile phones, as opposed to exchanging keys with the car owner in person, has also helped its growth. Some niche car sharing services fall under this category. They are set up as closed network car sharing systems that serve specific communities, such as apartment blocks or universities.

While electric car sharing is not a different business model in itself, it plays a transversal role in all car sharing models. In principle, electric car sharing is a station-based service since the vehicle needs to be charged. In order to guarantee that customers can cover the distance required, the booking and the recharging platform need to be integrated. In addition, the recharge status should be checked before each hire in order to guarantee adequate reliability of the service. These two factors currently limit the service, and there are fewer electric than traditionally–fuelled shared vehicles. However, the increasing number and distribution of charging points and electric vehicle developments will be fundamental drivers for a spread of these services.

Density parameters (expressed both in terms of population in the catchment area and availability of services) are generally used as primary predictors of the potential for success of car sharing services. Shared vehicles benefit from being located within walking distance and from the presence of a mix of residences and businesses, ensuring that vehicles are used throughout the day and night as well as at weekends.

Station-based (traditional) car sharing works best in dense neighbourhoods with low car ownership and good public transport services. Point-to-point (one-way) car sharing works best as a first-last mile strategy in larger cities with limited and expensive parking opportunities.

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MULTIPLE CAR SHARING IN MILAN (ITALY)

Milano — Comune di Milano

In the city of Milan, car sharing has boomed. In early 2016, five different car sharing operators provide their services to a large number of residents and city users (commuters but also tourists). The services cover the city, its surrounding metropolitan boundaries and the wider regional area. The operators are competing for increasing market shares between customers. The different services, from round-trip to free-floating car sharing, provide multiple and flexible shared-mobility services. This situation has been made possible thanks to the strong commitment of the municipal authority.

In recent years, the municipality has successfully introduced a congestion charge system (called "Area C") with the aim of reducing congestion and limiting the negative effects of motorized private transport, especially in the inner urban area. In parallel, the municipality has promoted and paved the way for the increase of shared services, with the aim of offering a valuable alternative to private car use. Clear and efficient regulations have contributed to attracting operators to the new expanding market, thus creating a thriving environment for innovative enterprises providing shared-mobility services. In addition to traditional car sharing, the city of Milan offers electric car sharing as well as (unique in Italy) a scooter-sharing service.

The following is a list of the five operators offering car sharing services from traditional round-trip (the first to be launched by ATM – Azienda Trasporti Milanese) to the latest free-floating services.

Round-trip car sharing

GuidaMI - http://tinyurl.com/guidami-milano - The service formerly managed by ATM, the public transport provider of local transport in Milan. Users can drive in Italy, other EU countries and also Switzerland.

Free-floating car sharing

Car2go – http://tinyurl.com/car2go-milano - The company exclusively offers Smart cars for two and features one-way point-to-point rentals.

Enjoy - http://tinyurl.com/enjoy-milano - Enjoy offers different solutions for different mobility needs. From a traditional Fiat 500 (4 seats) to a Fiat 500L for up to 5 people.

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Electric car sharing

E-vai - http://tinyurl.com/e-vai-milano - the fleet is composed of full electric vehicles or low emission vehicles. The service operates in the city of Milan but also in the regional area of Lombardy, including the three airports of Malpensa, Linate and Orio al Serio.

SHARE'nGo - http://tinyurl.com/sharengo-milano - Together with the EXPO Exhibition 2015, Milan has adopted SHARE'nGo, an electric and zero impact car sharing service. The cars of SHARE'nGo, named "Equomobili", are fully electric, charged and ready to use.

Free-floating scooter sharing

Enjoy – http://tinyurl.com/enjoy-milano-sharing – from July 2015, Enjoy offers the possibility to rent scooters (three wheels MP3 by Piaggio) with the same app as is used for renting cars.
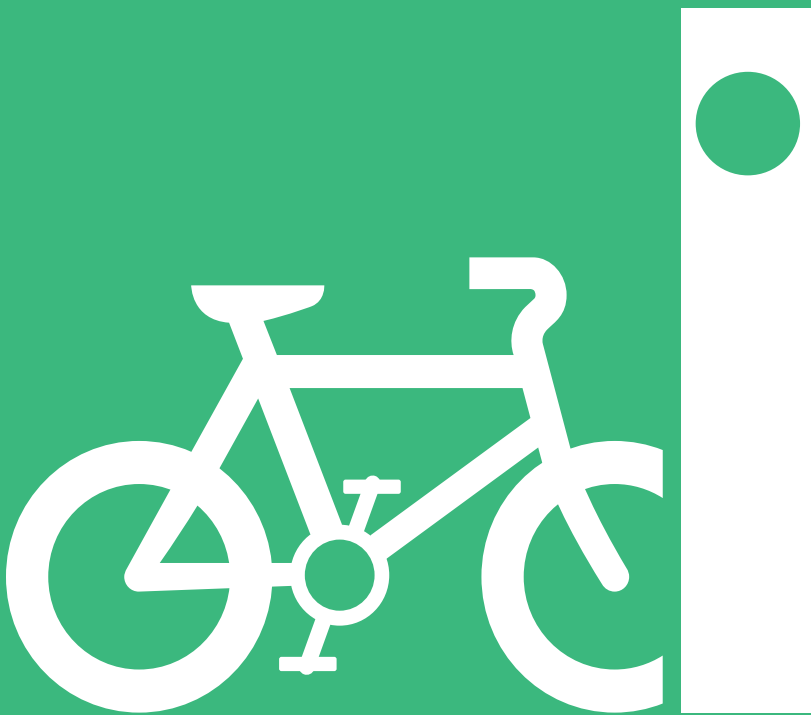
Further info @ http://tinyurl.com/comune-milano

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BIKE SHARING

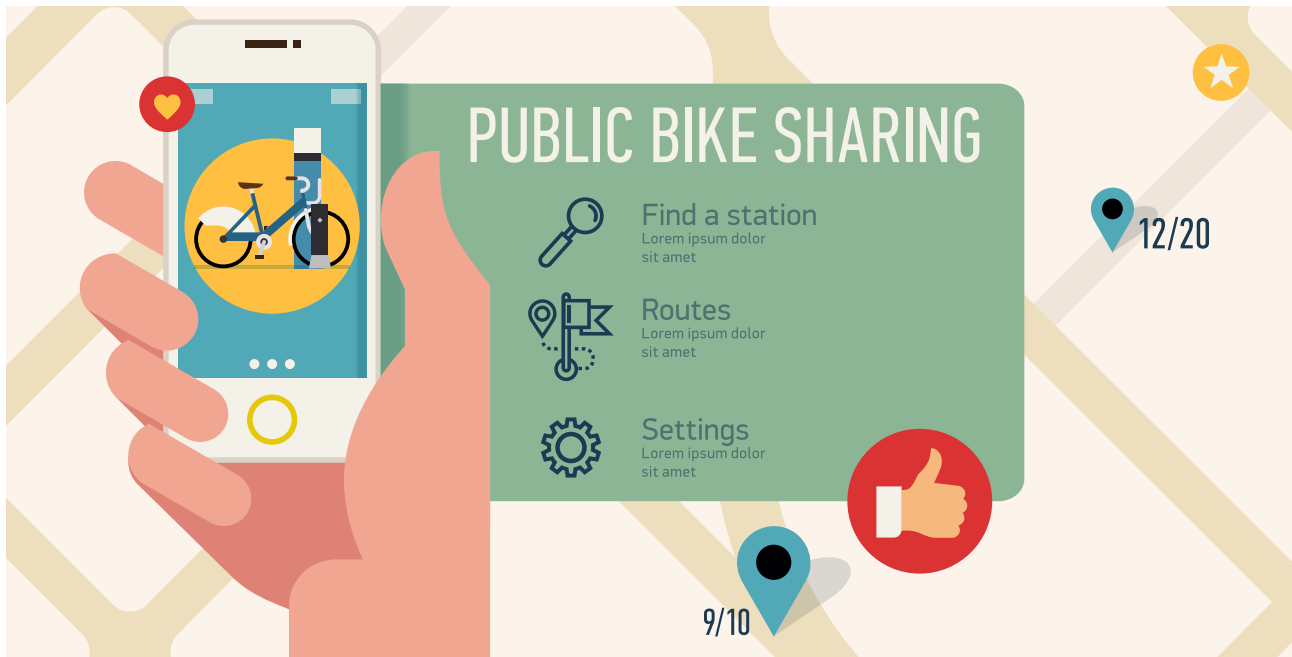Smart choices for cities
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Bike sharing

First established in Amsterdam in 1965, public bike sharing schemes have recently gained prominence due to their expansion into new locations and the increased scale of operation. Modern bike sharing programs, such as that launched in France in 2005, use communications technology to hire out bikes to members who pay membership and usage fees. Bikes are often fitted with "location aware" technology. These additions help to prevent theft and facilitate system management. Today, there are nearly 1,000 bike sharing systems worldwide, which fall into the following categories:

■ **Dock-based systems** allow users to pick up and return bikes from IT-enabled docks or stations located throughout a service area. This is the most widespread form of public bike sharing.

■ **Dockless or GPS-based systems** put GPS technology directly into the bikes themselves as opposed to docks. Bikes often have their own locks, allowing users to secure them to any public bike rack within a predetermined service area.

■ **Low-cost, tech-light systems** do not place technology in the bike or the dock. Instead, users often sign up online and then receive a text or email with a code to open the bike's lock or access a lock box with a key.

■ **Peer-to-peer bike sharing** allows users to rent or borrow bikes hourly or daily from individuals or bike rental shops. Despite growing in popularity, nowadays peer-to-peer bike sharing does not seem to have potential to become one of the most common modes of shared transportation.

Electric bike sharing systems are also emerging (with the Bycyklen[15] in Copenhagen and the BiciMAD[16] in Madrid as two first pioneer cities in Europe). An e-bike works just like a regular bike with the added bonus of an electric motor that kicks in to help with pedalling and, most importantly, gives an extra push up on hills.

Bike sharing works best as a first-last mile transportation strategy in mixed-land-use neighbourhoods and near public transport hubs in walking corridors with high pedestrian traffic. The availability of a good bike infrastructure, such as protected bike lanes, is another key determinant of bike sharing success.

15 http://bycyklen.dk/en/
16 http://tinyurl.com/bike-share-madrid

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PROMOTING SHARING E-MOBILITY IN STUTTGART (GERMANY)

Stuttgart is located in the centre of a thriving economic region with high levels of traffic. Every day about 800,000 cars enter and leave the city. The high level of car traffic, in combination with the very busy city centre, leads to major air quality problems.

The city of Stuttgart has developed a set of various measures for promoting sustainable mobility in the city and in its surrounding area, first with its SUMP (Sustainable Urban Mobility Plan) and then with CIVITAS II and CIVITAS Plus II. In particular, the "Mobility Information and Service Centre Stuttgart" is intended to help reduce the number of car trips by influencing the personal mobility behaviour of people travelling within Stuttgart.

The idea is to encourage and promote new forms of transport like **sharing concepts for cars, bicycles and e-vehicles** as mobility management strategies for companies and housing communities.

Within the CIVITAS "2MOVE2" project, information and training events for the elderly, for young people and for migrants have been organized, and the Stuttgart Tourist Office has developed a cycling app.

The "Call a bike system" has been in operation since 2009 and nowadays comprises 450 bicycles and 100 pedelecs with 44 stations. Each terminal has two plugs for charging on the back. The use of the bicycles is free of charge for 30 minutes, then they cost 8 cent/minute. Pedelecs cost 12 cent/minute and there are special rates for frequent PT users and students.

Some other pedelecs (Stuttgart Pedelecs) are reserved for city employees. Many companies in the city offer secured bike parking, showers and wardrobes for employees who commute by bike.

There are also other pedelecs providers that cover the Stuttgart region (www.e-bike-stationem.de).

http://tinyurl.com/mobility-center-stuttgart
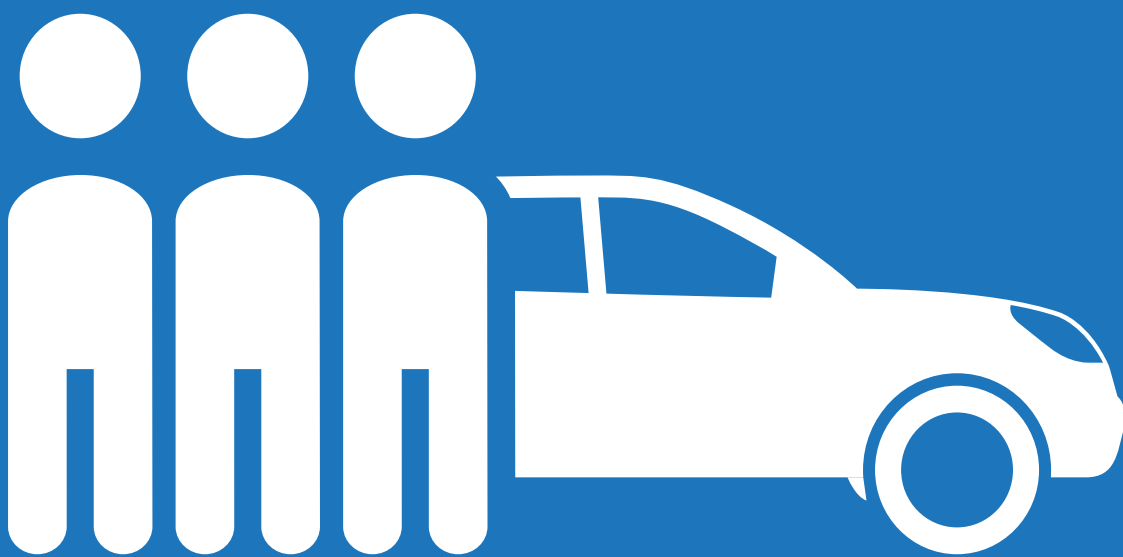
http://tinyurl.com/electro-mobility-stuttgart

More info @ Forderer W. (2015)

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RIDE SHARING

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CIVITAS**
Cleaner and better transport in cities

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Ride sharing

Sharing a ride with a friend or a colleague has long been a way for people without cars (or those simply looking to save on fuel cost or share companionship on the ride) to work to get where they are going. According to some operators car pooling can save drivers who live 20 km from their place of work €1,500 a year. With the emergence of mobile technology, ridesharing can be arranged easily and with less advance planning. Moreover, with hundreds or thousands of users, the chance of finding a driver or passenger who is "going your way" has hugely increased. At its core, ridesharing involves adding additional passengers to a pre-existing trip. Such an arrangement provides additional transportation options for riders while allowing drivers to fill otherwise empty seats in their vehicles. Unlike ride sourcing (see below), ridesharing drivers are not "for hire", but may be compensated for their time and mileage.

Traditional forms of ridesharing include:

■ **Carpooling** typically involves travellers sharing a ride in a privately owned vehicle to save on fuel and vehicle–operating costs. Often used for commuting, carpools can be arranged between parties who know each other and those who do not know each other.

■ **Vanpooling** is often run by collective transport operators and allows groups of commuters (often co-workers) to share a ride travelling to/from their work place. Van-

pooling is similar to carpooling, but using larger vehicles often provided by employers.

■ **Real-time or dynamic ridesharing**: Real-time ridesharing matches drivers and passengers based on destination through a mobile app, such as BlaBlaCar,[17] before the trip starts. The passenger is usually expected to pay a share of the costs of the trip.

Car and vanpool participants are often part of commute trip reduction programs, which can provide economic and time-saving benefits, including:

■ Discounts on parking permits,

■ Access to shared parking spaces reserved for carpool or vanpool vehicles,

■ Shared vehicle expenses and tolls,

■ Use of dedicated carpool or vanpool high-occupancy vehicle (HOV) lanes on major roadways, tunnels, or bridges, and

■ Waived or reduced tolls.

17 https://www.blablacar.com/

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CAR POOLING AT LARGE INSTITUTIONS IN ZAGREB

Within the CIVITAS ELAN project, Zagreb implemented carpooling to facilitate commuting in large companies and institutions. Since many large systems, such as business parks, hospitals, PT depots and university campuses, are located outside the city centre, long daily trips to and from work are necessary for most employees and users. Promoting a carpooling scheme was one of the bigger tasks of this measure.

The CIVITAS ELAN project successfully implemented a carpooling scheme in eight institutions despite the fact that no similar efforts had previously been undertaken.

The following key data (basic units) was collected on the demonstration corridor: modal split, number of vehicles, vehicle occupancy, carpooling, etc. An analysis of the data collected determined user needs and outlined the basis required for sustainable traffic mobility management in Zagreb.

An online survey on travelling to and from work was conducted in 23 companies in Savska Street in April 2010 (before data) and eight target companies in October 2011 (after data). Before data was crucial in preparing transport and carpooling plans (scheduling) for eight companies located on the demonstration corridor. An analysis of the results of the online survey for the period after the implementation of transportation and carpooling plans has been conducted to enable the city to assess the impact of the actions taken. The project succeeded in contributing to an increase in carpooling arrangements. The number of carpooling arrangements within the target group "employees" increased from 8 in 2009 to 36 in 2012; within the target group "students", this number increased from 26 in 2009 to 74 in 2012. A carpooling application/portal, "Car-for-All", was also developed: (http://tinyurl.com/mobility-management-zagreb).

In addition, three research events took place, covering the following themes:
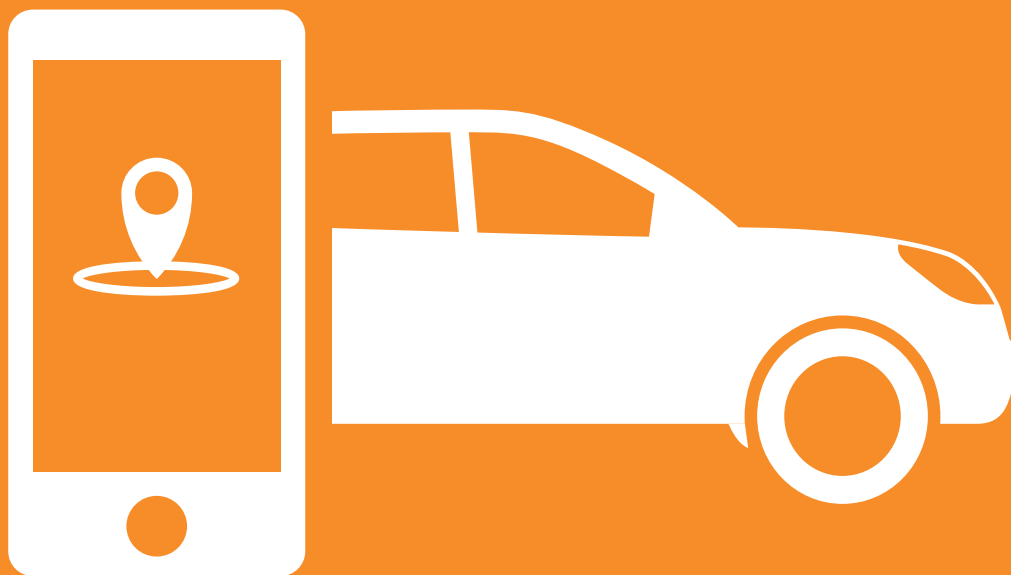
- Mobility management for the Borongaj University campus;

- Influence of teleworking on transport demand; and

- Teleworking and e-learning systems in higher education institutions.

More info @ http://tinyurl.com/car-pooling-zagreb and http://tinyurl.com/car-pooling-zagreb-eltis and http://tinyurl.com/car-pooling-zagreb-eltis-video

In most cases, each of them is occupied by one person, having four free seats on average.

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RIDE SOURCING

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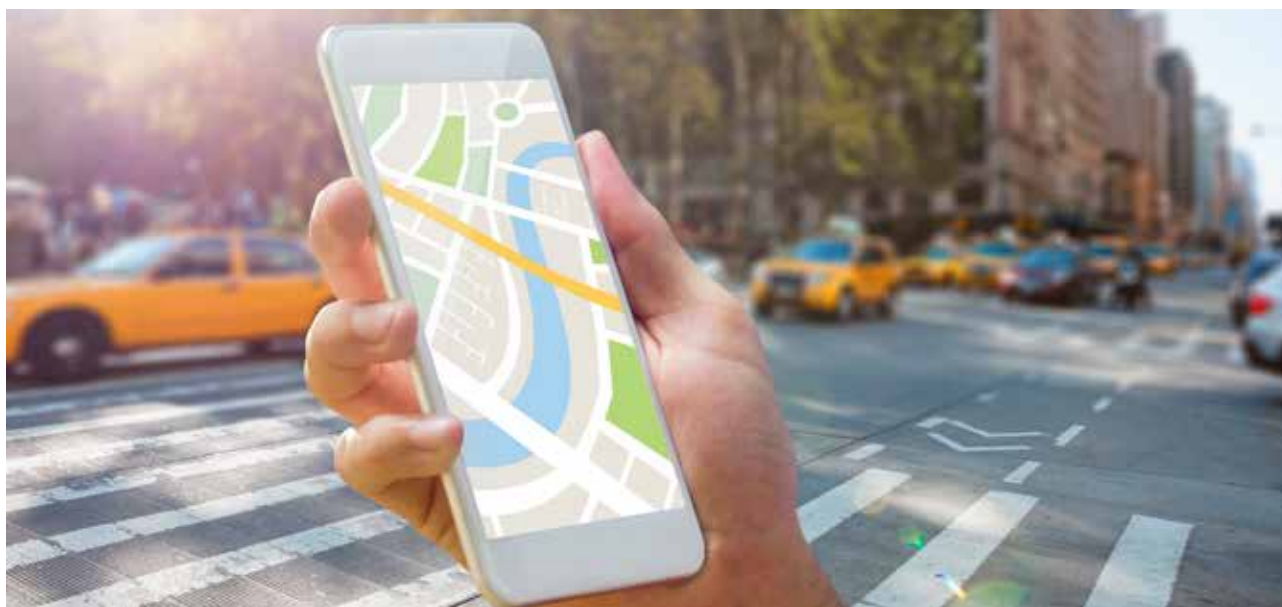connect, share and go!

Ride sourcing

Ride sourcing has become one of the most recognized and ubiquitous forms of shared mobility and a new fast-growing type of transportation service. It can be defined as a service that allows passengers to connect with and pay drivers who use their personal vehicles for trips. It is based on Geographic Information Systems (GIS) and Global Positioning Systems (GPS) technologies on Internet-enabled devices (typically smartphones) that allow people to organize ride sharing in real time. By using the apps, drivers are enabled to post their trips as they drive and potential riders are able to request rides right before their desired departure time. Uber[18] and Lyft,[19] are forerunners who have revolutionized the way people look for a solution for their short trips in urban areas. This new form of mobility is emerging from common people: some survey data reveal that two-thirds of Uber drivers in large metropolitan areas in U.S. have another job[20].

The concept has developed further and now special apps like UberPOOL and Lyft Line allow drivers to add additional passengers to a trip in real time. Since passengers split the costs of the trip, these services are known as "ride-splitting" and are evolving under various models. Recently, new specialized ride sourcing services have also been developed, as for example one option using certified medical personnel to safely transport elderly passengers (Lift Hero[21]).

In the US, where these innovative mobility options have spread and are growing at fast rates, the companies providing the services have been categorized as Transportation Network Companies (TNCs). TNCs are ride sourcing companies that connect users and drivers through smartphones and peer-to-peer networks. TNCs allow prospective passengers to download an application to their smartphone, from which they can view and select drivers available nearby and request the ride of their choice. Once a passenger asks for a ride virtually, his/her GPS location is sent to the driver, who can then easily proceed to pick up the new customer. The smartphone app also allows passengers to track the location of their rides, to manage payments or to save and show reviews of both drivers and customers.

The introduction of these innovative services and business models in Europe and in many other countries around the world raises a number of regulatory issues (conflicts with taxi operators and compliance with labour and tax laws, just to mention a couple) that still have to be resolved and which are in many cases outside the competence of local authorities.

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18 www.uber.com
19 https://www.lyft.com/
20 Hall J.V. and Krueger A. B. (2015)
21 https://www.lifthero.com

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PARK SHARING

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Park sharing

The concept of shared mobility not only affects the way people move around but also other aspects, such as parking. In some cities, nearly 30% of city-centre traffic at any given time is due to drivers searching for a parking space. Parking guidance systems have helped to reduce these inefficiencies, but the new concept of park sharing may bring some additional positive effects and benefits. Parking spaces can be shared with private car parks managed by operators through online platforms, increasing the overall parking supply in cities. Although this is still at an early stage, sharing car parking is becoming a familiar concept around the world, including in European cities. To date, the most common typology is the peer-to-peer model: service and invoicing are handled by online platforms.

PARK-SHARING FOR SUSTAINABILITY IN FLORENCE (ITALY)

An innovative project, based on the idea of sharing available parking spaces, has been approved and funded in Italy's Tuscany Region, with the support of some municipalities.

The basic idea has derived from the sharing economy: the owner of a parking lot, a garage or an area shares the space online with drivers looking for a place to park their car in that area.

Users register free of charge to find and to offer a parking space in real time. Payment is made by credit card. A small amount of the sum is guaranteed as a fee to the project developers.

Sharing a parking space allows owners to increase their personal monthly income, allows drivers to save up to 70% in parking fees and avoid fines and allows cities to reduce congestion, air pollution and land use.

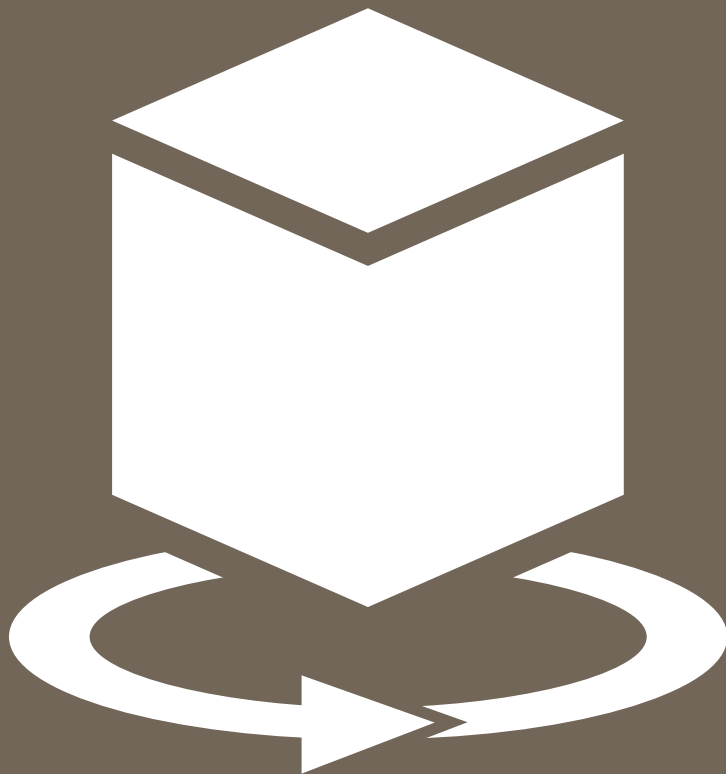The Sparky (www.sparky.club) app gives access to an entire digital community with the aim of changing the way of parking, making use of the full potential of the Internet.

More info @

http://tinyurl.com/park-share-firenze and @ http://tinyurl.com/parksharing

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SHARED FREIGHT
MOBILITY

Shared freight mobility

People are experimenting with new ways of moving goods as well as people around the city. Flexibility, speed and efficiency are essential in the modern supply chain. This is why innovative logistics infrastructure and sharing models (e.g. consolidating and pooling techniques, urban consolidation centres) are increasingly becoming part of the urban logistics scenario. Under the influence of the sharing economy, the logistics sector is undergoing a twofold process of transition:

- **From own-based to collaborative/shared logistics:** More and more carriers in the freight transport sector adopt a new transportation model called collaborative transportation (CT) or shared logistics, to improve logistics performance, reduce system-wide inefficiencies and cut down on operational costs. The most popular collaborative strategy is that of logistics sharing: this can take place at the transport level, but also in warehousing, inventory and other operations. These strategies are based on collaborative decision-making and information sharing[22]. They usually take the form of agreements and partnerships. Instead of each partner distributing their own products separately, collaboration between shippers allows a reduction in distribution costs of between 9% and 30%. Collaborative strategies are considered effective to reduce overall cost and pollution emissions, and improve social management of the supply process. A crucial factor for an efficient collaboration is the sharing of real-time information among the partners, and "big data" therefore plays an important role in this field.

- **From traditional deliveries to crowd-sourced deliveries:** As for ride sourcing, a parallel development is emerging in the area of package delivery which is based on the idea of deploying private individuals with the delivery of packages and merchandise, thereby making deliveries quicker and cheaper than deliveries by traditional couriers. By sharing vehicles and combining point-to-point private user trips with parcel delivery there is an opportunity for quicker and more efficient logistics. Known as crowd-shipping or crowd-sourced delivery, this new class of logistics does not require processing facilities or fleets of trucks and can be scaled quickly and cheaply.

The main drivers of what is known as "crowd-sourced deliveries" are the rapid growth in online retailing, the desire to find new ways of overcoming the traditional problems of "last mile" delivery and increasing interest, in some socio-economic groups, in supplementing earnings with casual work.

But how do these deliveries work? People (couriers) offer themselves to carry parcels and those wishing to use the service download the app and register with the website. The user enters details of the parcel, its collection and delivery points and, in some cases, the amount they are prepared to pay for delivery. Potential couriers then bid for the work, competing on delivery time and cost. The user decides which bid to accept. The online platform gives the successful courier a parcel number, address details and access to a messaging service for communication with the user. Once the parcel is delivered, the recipient confirms receipt through the platform and the courier's account is credited with the agreed fee.

As far as insurance aspects are concerned, as with existing couriers, the people who want to ship a parcel can decide to insure their shipments. This service is provided for an additional cost. Some crowdsourcing services allow users to choose the delivery person. So by reading the online profiles carefully, it can be easy to see how the shipper measures up in categories such as speed, package care and overall satisfaction. Some profiles might even track how many deliveries couriers have made, giving you a sense of their level of experience.

Crowd-sourced delivery, however, can also be sustained and implemented by traditional logistics operators as an additional service, as is the case in Stockholm. In Sweden's capital DHL is experimenting with a crowd-sourced parcel delivery service. Using an app[23] people can deliver parcels to consumers who specify the time and place for delivery as well as the fee offered.
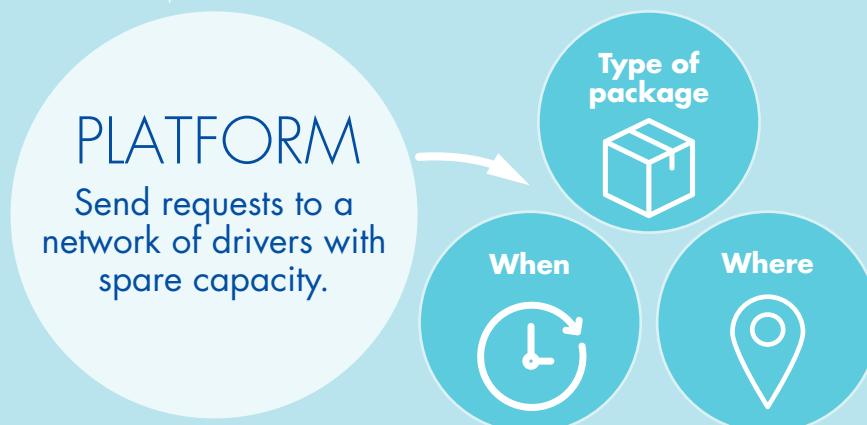
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22 Gonzalez-Feliu J. (2011)

23 https://www.myways.com

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HOW CROWDSHIPPING WORKS

I NEED SHIPPED

PLATFORM
Send requests to a network of drivers with spare capacity.

Type of package

When

Where

I CAN DELIVER

Mike B.
50 €
★★★☆☆

Jamie S.
30 €
★★☆☆☆

Dan T.
55 €
★★★★☆

Source: WIKI elaboration on Botsman R., Crowdshipping: using the crowd to transform delivery

Crowd-sourcing delivery, similar to ride sourcing, is a P2P service where cities are not directly involved in the provision of the service itself, so the following case studies focus instead on what cities can really fund or promote.

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VAN SHARING FOR SUSTAINABLE LOGISTICS IN IMOLA (ITALY)

Within the "Town Centre Management Project" for the development and promotion of the historic centre of the city of Imola, the city has launched the Van Sharing Project, with the idea of enhancing the urban environmental quality and of promoting the commercial attractiveness of the area.

The project "C'entro con trasporto" includes the van sharing service and a network of loading/unloading bays.

The service is intended to allow those economic operators with non-compliant vehicles to enter the low emission zone (ZTL - Zona a Traffico Limitato). Low emission commercial vehicles can be hired to make deliveries in the inner city area under specific conditions.

At registration, the conclusion of a contract and a EUR 50 payment (as a fee for subscription) are required in order to access the service. An identification card gives the right to book the vehicles. The hourly rate is then debited from the available amount straight away. Upon return of the vehicle, the fee for the kilometres travelled is charged.

Within the ZTL area, operators can book one of the three loading bays by paying EUR 10 for an annual subscription or EUR 0.50 for 30 minutes of parking at a time.

More info @ Regione Emilia Romagna (2013)

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SHARED CARGOCYCLES FOR URBAN LOGISTICS

The city of Graz has launched an innovative service for goods transportation in urban areas.

Involved in the Cyclelogistics Ahead project (http://www.cyclelogistics.eu/), the city is focused on promoting green and sustainable logistics in its urban area. The concept is simple and involves a cargo bike, free to use for all citizens. If you choose to, you can make a donation which is used for repairs and server costs, but this is not mandatory. The concept of "free cargo bikes" was born out of the idea of sharing resources but it also tries to change the way we transport goods in the city.

The idea was conceived in Germany in 2013 with the KASIMIR bike. Now, after almost 3 years, there are already over 30 initiatives in cities across Germany and Austria developing similar projects – with "Daniel" (Munich),

"Rudolf" (Dortmund/Bochum) and "Freies Lastenrad Graz" (Graz, Austria) among the first to have been established.

From the very start, the feedback has been very positive from press, users and stations. But it was the requests from initiatives all over Germany and Austria that really expanded the project's scope, prompting the project to establish new tools and networking platforms – all in the spirit of the open source community. The dein-lastenrad.de is an online WIKI serving both as a directory of initiatives and as a knowledge database.

http://tinyurl.com/free-nomadic-cargo-bikes

http://tinyurl.com/civitas-cyclelogistic

http://tinyurl.com/cargobikes-graz

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SHARED WHAREHOUSING SPACE IN THE LBCC (UK)

The London Boroughs of Camden, Enfield and Islington serve a diverse community and require a wide range of goods and services for their several hundred separate addresses including municipal buildings, libraries, schools, care homes, depots, offices, hostels, day and sports centres, commercial premises and households. Their supply chain used to consist of suppliers delivering their goods directly to addresses in the area, using their own transport or parcel delivery and courier companies. In 2012, the Chief Procurement Officer of the London Borough of Camden embarked on a project to further explore the consolidation centre concept and the feasibility of such a solution for Camden and its borough partners. The London Boroughs Consolidation Centre (LBCC) project secured funding from two sources, the European Union with the LaMiLo project (http://www.lamiloproject.eu/) and the Mayor's Air Quality Fund. The consolidation centre opened in January 2014 and is transitioning from project stage to a permanent solution. The consolidation centre is located in Edmonton and is operated by a FORS[24] accredited operator. It is open Monday to Friday from 6.30am to 6pm and receives goods on behalf of the councils from its suppliers. The centre collates and consolidates the range of goods received and prepares them for onward delivery to the council's sites on planned and optimised delivery routes, utilising two low emission capable trucks. The consolidation activity is performed utilising 185 m^2 of shared-use warehousing space and employs two drivers, one warehouse person and part-time (12 hours/week) administrator. In March 2015, 87 suppliers and 19 delivery companies were using the facility. The centre is capable of handling a wide variety of goods, ranging from library books, furniture, gym equipment, retail products, facilities equipment, ICT equipment, documents, mail and cleaning supplies to records, linen, ambient foods, office supplies, stationery and public health furniture. Benefits achieved are:

- a 57% reduction in vehicle trips

- 69% fewer kilometres travelled

- a 72% reduction in empty vehicle running

- reductions in NOx (71%), PM (87%) and CO_2 (67%) emissions

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25 Fleet Operator Recognition Scheme - https://www.fors-online.org.uk/cms/what-is-fors/

More info @ Transport For London (2015a), LaMiLo Project (2015), Transport For London (2015b).

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Impacts and benefits

As the sharing economy increasingly impacts on our daily life, we need to consider how it may transform our cities. According to some enthusiastic approaches the sharing economy can have only positive impacts. However, a more prudent approach takes a different view in relation to activities that form part of the sharing economy. At city level, the sharing economy does not automatically advance urban sustainability and may have indeed also negative effects on the urban environment. However, in relation to mobility, the potential benefits and advantages deriving from sharing activities are more evident because of the great inefficiencies affecting the mobility sector itself. According to different studies, the new mobility services can offer significant and wide-ranging opportunities, such as:

■ Provide more mobility choices;

■ Encourage greater use of public transport and offer first and last mile solutions to help riders connect with PT: shared modes can extend the catchment area of public transport, bridging gaps in existing transportation networks;

■ Reduce traffic congestion, vehicle miles travelled and greenhouse gas emissions;

■ Lessen parking pressures and free up land for new uses;

■ Create independence for those who cannot afford to buy and maintain a vehicle;

■ Reduce transportation costs for households;

■ Reduce car ownership rates;

■ Provide new opportunities to earn extra income by renting out excess vehicle capacity;

■ Help improve users' health by encouraging biking, walking and other forms of active transportation;

■ Increase efficiency and convenience, especially when modes are linked together.

While the future of shared-use mobility looks promising, the changes are occurring at such a pace that it is difficult, at present, to gain a wide and full picture of what the effects and impacts on urban mobility system may be.

From the point of view of local administrations, many questions arise regarding the shared mobility; these can essentially be grouped under three main topics:

■ Which kind of relationship should be established between shared-mobility services and public transport? Are they in competition or do they cooperate?

■ Could these new services offer a real opportunity to increase mobility for those with limited access to transport for different reasons (economic status, dispersed location or physical impairments)?

■ Does the growth of shared mobility exert a positive influence on the achievement of better environmental sustainability?

To identify the most relevant impacts that shared-mobility services have on cities, three main categories have been identified, which are related to the three main fields of sustainability:

■ Environmental,

■ Social,

■ Economic.

Environmental impacts: is shared mobility the green option?

It can be argued that, if steered properly, shared mobility has the potential to counteract some negative effects of transport and to limit others by increasing transport efficiency.

When looking at positive impacts we expect that car sharing will be a real opportunity for reducing car ownership levels, especially in large urban areas. According to the results of some researches and surveys[25] it is not only car sharing schemes that are expected to lower car ownership rates,

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25 UC Berkeley's North American Bikesharing Survey, completed in 2014 in Parzen J. (2015)

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but bike sharing schemes can also significantly reduce car use. In some cases, bike sharing is cited as the reason for deciding to sell one of the household's vehicles. Against this background, car sharing could help to substantially reduce congestion in cities and thereby lower emissions. Moreover, since members of car sharing schemes often dispose of older vehicles, new shared fleets are generally more efficient, resulting in lower fuel costs and greenhouse gas emissions. Furthermore, shared mobility (in relation to car and bike sharing schemes) might also help to give electric mobility its long-awaited breakthrough. The provision of car and bike sharing fleets appears to be a suitable market for this kind of traction technology, and a greater introduction of such vehicles may contribute to people becoming more confident about electric traction and about its potential as a real alternative to traditionally fuelled vehicles. This can further contribute to decrease pollutant emissions.

Negative effects are mainly related to two aspects. Firstly, there is a possible growth in waste and depletion of resources, since shared cars are used much more frequently than private cars. They generally last only three to four years before having to be replaced. This uses resources, generates waste and increases greenhouse gases and other pollutants emitted by car manufacturers. On the other hand results from a study conducted on a modelling simulation of a future shared-fleet urban scenario[26] found that the much longer distances travelled by cars imply shorter life cycles for the shared vehicles and this can enable faster uptake of newer, cleaner technologies and can contribute to more rapid reduction of CO_2 emissions from urban mobility. Secondly, the ease of finding a car (due to the easy availability of car sharing schemes) and of undertaking a trip (by driverless cars) may encourage increased mileage. Additionally, when considering the possibility of increased car travel it is important to recognise that environmental impacts remain tied to per-kilometre emissions, so their reduction will still rely on the adoption of fuel-efficient and less polluting technologies.

At this stage it is not possible to say with certainty that shared mobility would be the solution to the majority of the negative environmental consequences of urban transport in our cities; without a doubt, however, it has great potential.

26 ITF, OECD (2016)

Does shared mobility expand social benefits and equity in transport accessibility?

Currently, there is little evidence to show that shared-mobility services are really improving accessibility and expanding benefits to society as a whole. However, they do represent a solution that can potentially be within the reach of the majority of the population.

Accessibility to the transport system is expected to improve for two main reasons.

Firstly, the prevalence of shared-mobility services has the potential to offer those on low incomes the opportunity of travelling, at a low cost, in the comfort that individual mobility provides (thanks to car sharing, bike sharing or ride sharing). However, it is also true that the large majority of customers who use shared-mobility services are young well-educated people on a good income. This is why the current use of shared-mobility systems among low-income communities still remains lower than its use by the general population. This is the case not only with regards to services provided by private operators, but also with regards to public bike sharing. A way forward to maximize the potential of shared-mobility strategies to benefit individuals on a low income is to better understand their current travel needs and patterns, to streamline and expand successful strategies and to encourage new opportunities of reducing barriers.

Secondly, the multiple and expanded options for travel (but also for receiving goods) offered by new shared-mobility services can help to meet the transport demand of residents in low density or suburban areas, characterized by a generally low level of public transport services. Shared mobility can be used in particular to provide direct access from origin to destination or to address "last mile" problems (the potentially long distance from a PT station to a final destination). Many bike and car sharing users report using shared mobility to extend their trip when PT services at their point of origin or destination are poor. Thus, while shared mobility may take riders from PT for some trips, it would increase mobility in more places without resorting to car use. Also, it may create a new group of PT users on new routes by providing connections between less common destinations and bringing new mobility options to areas with limited levels of public transport service. Shared-mobility systems are low-volume transportation alternatives that cannot ultimately compete

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with the efficiency of high-volume mass transit. Public transport will continue to play a key role in urban mobility transport by bypassing congestion and efficiently moving a large number of people in and out of dense urban areas.

Other possible benefits to society as a whole are that, thanks to autonomous cars, especially in urban areas, the rates and the severity of road accidents are expected to decrease, though these effects are currently still some way off. Last but not least, other social benefits that can be expected are those that do not only relate to transport *per se*, but those that go

beyond the transport system and affect the level of liveability of citizens on the whole (thanks, for instance, to freed up space from car parking that can be used as green space and public space).

Economic impacts of shared mobility

The economic impacts of shared mobility on local administrations are difficult to identify and predict because of the complex interaction of private and public interests.

The number of private operators entering the market for shared-mobility services is constantly increasing. From the users' point of view, having different operators affords them the opportunity of choosing the most convenient one. From the point of view of the municipality, the advent of shared-mobility services will not mean a decrease in transport investment. On the contrary, investments in public transport have to remain high; this is essentially due to the fact that shared-mobility services cannot replace public transport but, on the contrary, these two mobility options will need to be integrated. Integration entails a harmonization of infrastructures, fares and tickets, information, etc. The alignment of all these aspects will be costly. Of course some form of partnership between public and private parties can be of help, but public administrations should be aware that economic efforts as well as clear regulations of legal/regulatory of services, will be required.

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Role of public authorities

The main goal of any effective urban mobility strategy is to satisfy the travel needs both of people and of businesses in such a way that it improves the quality of life for residents and travellers alike, and increases the competitiveness of the city and its region. Ensuring that this goal is achieved involves a rigorous multi-stakeholder approach that takes into account governments and local authorities, citizens/residents, public transport operators and other mobility providers, businesses, community organizations such as trade unions and NGOs (Non-Governmental Organizations) cycling associations as well as the media.

Shared mobility may be an efficient and economic option of helping cities to quickly expand services, meet increased demand, improve access to low income and low density areas, reduce air pollution as well as traffic congestion, and decrease pressure on parking space supply. But shared mobility can be considered the meeting point between private and public mobility so the interaction between these two parties is very relevant.

Economic operators and private citizens can enter the market of urban mobility offerings as transport suppliers. Private industry has a large role to play, but the full potential of these new mobility services will only be realized if policy makers take appropriate steps to integrate them into a broader spectrum of a multifaceted transportation system.

Against this backdrop, public authorities have a key role in taking decisions and implementing actions to plan a reliable, efficient, competitive, equal and sustainable urban mobility system. Public authorities can take some of these actions alone, while others require a dialogue with the private sector. The table summarizes the main part responsible for each of the actions, bearing in mind that, however, these actions usually involve interactions between the two parts and participation of private sector and civil society.

ACTIONS	PUBLIC AUTHORITIES	PRIVATE SECTOR
Adopting a planning vision	X	
Infrastructure and land use planning	X	X
Public transport management	X	
Transport data acquisition and sharing	X	X
Increase knowledge	X	
Public-private partnership	X	X
Regulatory and legal aspects	X	

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Adopt a planning vision to be developed and executed: incorporate shared mobility into long-term transportation planning and develop a long-term mobility vision that includes shared-use mobility and also defines mode-split goals to focus attention on what can be done now and how it can be done. Local authorities should consider how to better integrate shared-use transportation modes into mobility planning, encourage the integration of public transport, bike sharing, ridesharing and car sharing around bus stops, including the electric vehicle infrastructure.

Adjusting infrastructure and land use planning to make space for new mobility services: make/reserve spaces in city streets for cars, buses, bicycles, pedestrians and shared-mobility operators; this can be achieved, in particular, by allocating special parking spaces for car sharing and bike sharing services, giving users confidence that these mobility tools will be a stable option for getting to and from PT stations. Local authorities should adjust municipal policies, including planning and zoning rules, to encourage the use of these services, which may include allocating curb space for shared vehicles, reducing parking fees for shared-use vehicle users and reducing minimum parking requirements for new developments that incorporate shared-use services. They should also adopt parking policies that support car sharing, such as reduced parking costs for car sharing vehicles in streets and in public garages. One of the most evident effects of the spread of shared mobility options is that significant amounts of space in a city are freed up.

Prior experiences indicate that this space must be proactively managed in order to ensure that these benefits are fully reaped. Management strategies can include the restriction of access to this space by allocating it to specified commercial or recreational uses, such as delivery bays, bicycle tracks or enlarged footpaths. Freed-up space in off-street car parks could be used for urban logistics purposes such as distribution centres; this might be achieved by preserving an adequate quantity of public space in streets and without ceding too much space to private operators. When redesigning and adapting public spaces, local authorities should take the opportunity to integrate shared-mobility planning with new street designs, accounting for shared mobility in traffic safety initiatives and promoting/sustaining road safety approaches and planning.

Public transport management: local authorities should experiment with new ways of integrating new shared-mobility modes with PT and should encourage integration between existing and emerging mobility tools. Developing common payment systems for various shared-use modes and providing real-time multimodal information online and at bus stops can help create a seamless transportation network that takes full advantage of the strengths of each new technology-enabled tool. Additionally, creating access to technology-enabled services in transportation "hubs" near PT stations can help users make "first mile/last mile" connections between PT stations and their homes or businesses.

Another relevant action related to the management of PT is to leverage marketing to build awareness and provide support to attract new users, engage them (together with the private operators) in cross-promotions such as discounted car-share rates for PT users and explore the potential of new tools to meet the mobility needs of those currently poorly served by the transportation system (including the young, the elderly, disabled people and those in low-income households).

Transport data acquisition and sharing: adopting open data and open source software policies benefits not only transport operators but also developers who want to integrate that data into apps and services, as well as current and prospective users of those apps and services. Data available to the public should be expanded. When negotiating regulatory arrangements with providers of new transportation services, local authorities should insist on sharing service data, which allows the impact of the services to be understood better and which helps local authorities to integrate these services into mobility plans. It is fundamental that providers share their data so that it is possible to assess the impact of new services on transportation plans and to integrate these services.

Increase knowledge: local authorities should invest resources in studying the changing relationship between technology and transportation and expand their research into the impact of new transportation services, in particular into the effects of these new tools, in order to incorporate the findings into transportation models. Technology-enabled transportation services create new options and conditions that have not yet been factored into transportation modelling and planning. On the other hand, transportation decision-makers need better data on the impact of shared mobility on

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public transit, travel behaviour, and consumer preferences. There is a need to improve the quality and consistency of transportation data in general in order to take advantage of the potential benefits of "crowd-sourced" information from transportation system users.

Public-private partnership: municipalities should pursue public-private partnerships and pool information to support innovation, for example by testing new approaches to meet the mobility needs of the population. They should support the creation of universal payment and trip planning systems for the use of multiple modes of transport. Public authorities can guide the ways in which shared mobility might improve mobility to low-income areas. For shared-use transportation to thrive, public authorities and transport operators need to collaborate with each other and with private companies to find the right mix of policies at local and national level. Public funding is usually best spent on improving existing public transport services by ensuring a good state of repair, as well as the predictability and reliability of service.

Regulatory and legal aspects: local authorities (but also national governments) should adopt clear regulations for new services such as "ride sourcing" which protect the public while still allowing those services to operate and while supporting innovation. Local authorities should use their mobility vision to decide on the number and types of modes they want to attract and at what scale, and they should set rules for accessible vehicles and service availability to all residents and neighbourhoods. Local task forces may be of help to "review and address" regulations related to the sharing economy. Even though this is not an issue at the moment, shared self-driving car fleets will certainly compete directly with urban taxi and public transport services, as they are currently organized. Such fleets might effectively become a new form of low-capacity, high–quality public transport. The management of transport services, including concession rules and arrangements, will have to be adapted. There is an impending need to identify new ways to address barriers such as insurance issues. Additionally, local authorities should guide and regulate shared-use mobility companies to assist them in complementing rather than competing with public transportation. Incentives (fiscal but also regulatory, for example) could be provided for shared-mobility services to connect poorly–served areas, to extend the reach of public transport, and to increase accessibility.

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Conclusions

The rise of a new era of mobility (Mobility 2.0) represents one of the most exciting challenges for the mobility sector since the introduction of the car, although it is still at an initial phase and some uncertainty remains concerning the scale and nature of the impacts. However, although many shared-mobility systems are in their initial phases of development, the available research and experience has shown positive effects that are expected to increase further in the future.

It is important to explore the initial implications of shared mobility, and begin to see how its development can be used to support sustainable, people-centred cities. By offering diverse transport options for different kinds of trips, shared mobility can facilitate a shift away from reliance on personal vehicles and encourage non-motorized mobility. By shifting travel away from personal vehicle use, shared mobility can lead to a reduction in vehicle kilometres and in CO_2 emissions. Shared mobility generally works best in a dense, mixed-use environment. Also, it supports this kind of land use by reducing the need for personal vehicles and parking spaces, and given the choices available in shared-mobility services it may represent a benefit for people on lower incomes. However, shared-mobility services cannot replace public transport (in particular mass rapid transit options) but are complimentary. Planners need to remain focused on expanding and improving mass rapid transit to meet the needs of today's growing cities in order to maintain passenger volumes and economies of scale.

There is great potential for data on trip patterns to be tracked by shared-mobility service providers and applications to support and transform transport planning, but this data needs to be shared with (local) governments and not be kept in private hands. If data is shared, then cities can reinvent their transport systems with a view to more efficiency, convenience, and modernity.

Critical issues relating to legal and labour factors need to be addressed; other concerns to be considered include the up-scaling of shared-mobility systems.

Against this backdrop, cities and public authorities need to consider how to adapt their political orientations, legislative frameworks and planning methodologies to this new scenario. Cities need to rethink their transport and land use policies with an increased focus on sustainability; they need to make the most out of the benefits of shared-mobility services and need to limit their shortcomings and possible barriers. Even though shared mobility can never replace the ridership efficiency of public transport, it will play a strong role in complementing public-transport-network planning. A response to an increasing demand for urban multimodal mobility requires cities to extend their public transport services and adapt them from "delivering transport" to "delivering solutions". Planners should seek to coordinate with shared-mobility companies in order to encourage integration with public transport by developing a long-term mobility vision; this should include leveraging mobility marketing tools to build awareness and attract new users by testing innovative solutions to meet the mobility needs of those traditionally excluded from transport (young, elderly, disabled and low-income people).

Cities should integrate shared mobility into the urban landscape with the help of multimodal PT hubs, conscious street design, mixed-use and PT-oriented development, making it easier for city residents to choose the transport mode best suited to their needs, be it walking, cycling, public transport or car, and reducing or avoiding private vehicle use. All these elements have to be considered and addressed properly in long-term urban mobility planning. Shared mobility, integrated with urban design, will benefit the urban environment: shared mobility can support a mixed and sustainable development. Integration can be achieved by way of multimodal stations, the preservation of public space and by way of regulations that use shared mobility to encourage a reduction in car use and ownership.

Finally, the mutual relationship between the public sector and the private sector has to be addressed. To fully realize the benefits, public and private sector actors must work together especially to address those challenges related to issues such as regulation, insurance, business models and equity. Cities must ensure that they do not lose control over their public streets by unnecessarily ceding space to private companies. However, the private sector may need support and/or subsidies from the public sector to expand services to lower income neighbourhoods. Through cooperation between actors, shared-mobility systems can have a positive influence on cities.

Many solutions are city-specific but better public sector collaboration and awareness can help spotlight innovative policies and practices for other cities to follow.

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Working together with other cities can help to create and share policies, develop common data standards and make coordinated data requests to shared-mobility providers.

Local governments need more information to be able to decide how to allocate scarce resources, integrate shared modes into transportation management plans and provide incentives to encourage a greater uptake of shared-use mobility. As it is hard to find special funding in cases where a city wants to run a new shared-mobility project, external financial support may be essential.

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2020 CiViTAS — Cleaner and better transport in cities

The sharing economy

The sharing economy sectors could generate globally up to

€ 300 million

in revenues by 2025

In major cities across North America, Europe and Asia, shared mobility companies handle **~10%** of public passenger transportation

According to a survey conducted in the U.S. in 2015, **8%** of all adults have participated in some form of mobility sharing

Background

Congestion can cost as much as **2%** to **4%** of national GDP

Passenger travel distance is expected to double by 2050 (over **70 trillion km** per year)

Per capita commuting delay is expected to double by 2050 (**100 hours** per year)

EU travel passenger distance is expected to grow up to **+50%** by 2050

- are an underused asset
- are generally used for less than 1h/day
- displays low levels of occupancy

The new paradigm of mobility 2.0 – Actual trends

NEW CONSUMPTION CULTURE   DIGITALIZATION PROCESS/PERMANENT CONNECTIVITY

SCARCITY OF RESOURCES   DEMOGRAPHIC TRENDS (1-PERSON HOUSEHOLDS/ELDERLIES)

IN-VEHICLE CONNECTIVITY   ELECTRIFICATION   AUTONOMOUS DRIVING CARS

The new paradigm of mobility 2.0 – The future

From...

Individual car ownership as dominant form of transport

Limited consumer choice and few service levels

Government-funded public transport

Unconnected, suboptimal, transportation systems

Toward...

Individual car ownership part of multimodal, on-demand, and shared transport

More consumer choice and many service levels

Public and private transport operate in parallel

On-demand, connected systems that use data to unlock efficiencies

Mobility as a Service

NEW!
- **seamless** and **door-to-door** combination of all transportation modes
- the boundaries between different transport modes are **dissolved**
- **customer-centred experience** improving the efficiency of the system

Thanks to an urban consolidation centre:
57% reduction in vehicle trips
69% less kilometres travelled
72% reduction in empty vehicle running

Germany 700,000 users
Italy 130,000 users
UK and France 16,000 users

From own-based to a collaborative/ shared logistics. From traditional deliveries to crowd-sourced delivery

Car sharing gives individuals access to the mobility benefits of a car without requiring them to own one

Shared freight mobility

Car sharing

1.000 bike sharing systems worldwide

Park share

Bike sharing

Private parks shared through online platforms thanks to smart communications

Bike sharing programs rent bikes to members who pay membership and usage fees

Sharing a parking space allows drivers to save money up to 70%

Ride sourcing

Ride sharing

Ride sourcing is a service that allows passengers to connect with and pay drivers who use their personal vehicles for trips facilitated through a mobile application

Sharing a ride is a way for people without cars - or those simply looking to save on fuel cost or share companionship on the ride to work - to get where they are going

2/3 of drivers have another job

Car pooling can save drivers who live 20 km from their place of work €1,500 a year

Most likely impacts for cities

The role of public authorities

Environmental

▼ Car ownership, congestion, per-km emissions
▲ Waste and resource, travelled km

Social

▲ Accessibility for low-income people and low-density areas
▼ Rates and severity of road accidents

Economic

▲ Investments in PT
▲ Opportunity to choose a convenient operator
▲ Cost to align infrastructure, ticketing, information

Adopt a **planning vision** & make space for new mobility services

Manage **public transport**

Acquire and share **transport data**

Start **Public Private Partnership**

Adopt **clear regulations**

For more information, please download the "Cities towards mobility 2.0: connect, share and go!" CIVITAS publication from **www.civitas.eu**

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POLICY NOTE