Shared Mobility for Sustainable Urban Development

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Abstract: In the era of rapid urbanization and ever increasing demand for moving people and goods, transport systems play a key role in sustainable urban development. With the promotion of sustainable mobility, the traditional personal mobility choices have strongly opposed each other. There is an active call to shift from car-oriented mobility to more sustainable mobility options like public transit and non-motorized modes. Assuming that urban society will not give up from the flexibility of personal vehicles, the concept of shared mobility has entered the scene. A range of new services falling under the system of shared mobility enables improving capacity utilization either by sharing vehicles or sharing rides. The benefits from the sustainable development perspective are open to debate. The impacts of various shared mobility schemes on urban sustainability are outlined. The mutual complementarity of shared mobility and urban public transport makes multimodality concept a sound alternative to owning a car.

Key-Words: cities, sustainable mobility, sharing economy, carsharing, ridesharing, multimodality

1 Introduction

The growth of urban population and spatial expansion of cities are among the largest global transformations of modern society. An increasing demand for moving people and goods is creating a growing pressure on urban transport infrastructure. Congestion, air and noise pollution, road traffic accidents and excessive use of public space, remain a huge challenges to the sustainable development of urban settlements around the world. The comittment for sustainable urban transport systems is declared in UN's Sustainable Development Goals (SDGs), Goal 11, Target 11.2: „By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons". The vision of sustainable mobility has questioned the use of personal vehicles and called for shift to more sustainable transportation forms like public transit and non-motorized modes. In some way, the traditional personal mobility choices - private vehicles on one, and all other mobility options on the other side, have opposed each other. Although it may seem that there is a tendency to push out cars from the future urban transportation

settings, we should rather talk about the way we use personal vehicles. Assuming that urban society will not give up from flexibility of car-based trips, the concept of shared mobility has entered the scene.

The idea of sharing mobility is strongly related to the broader concept known as sharing economy, which is an upcoming socio-economic model. The system of access to resources rather than their ownership is the essence of this stream. A noticable success of the sharing economy in general, comes primarily from the potential savings or profit gain - renting is often cheaper solution than buying, while at the same time, sharing your own resources can be a source of additional revenue. In this way, an individual becomes both a potential user and a supplier. Unlike traditional models of economy, sharing economy favors direct communication between users / participants on the principle of the so-called peer-to-peer interactions, and is named as peer-to-peer (P2P) economy as well. Development of Internet and mobile applications has enabled the creation of platforms for direct communication between people who need certain goods / services and those who have them. The global expansion of sharing economy has opened up, however, a space for the emergence of companies that have assumed an intermediary role and are managing the processes

of exchange and sharing, partly distorting the original interpretation of the model. Examples of the supply-demand relationship based on the principle of sharing economy exist in a number of segments of the economy and society-from the financial sector, education, health care, to transportation and accommodation as the most vibrant areas.

As regard transport sector, the rise of sharing instead of owning, would make a revolutionary change of individual mobility possible. Moving away from the idea of having car as a symbol of status and prosperity is the first step towards sustainable urban development. Sustainable transport planning is based on accessibility, since access to goods and services is the main goal of transportation activities [1]. New, share-based movement patterns blur distinctions between public and private transport and between what is shared and what is owned. Shared mobility schemes tend to 'sell' mobility by puting vehicles (cars or bicycles) at public disposal or offering rides on demand. The benefits from the sustainable development perspective are open to debate, and some of the issues are discussed in this paper, which proceeds as follows: various forms of shared mobility are presented in Section 2, followed by a short view on market characteristics in Section 3. Section 4 presents the possible impacts of shared mobility on passenger demands, while Section 5 discusses the role of sharing in multimodality of urban transport. The paper ends with concluding remarks.

2 Shared Mobility Domains and Basic Features

Shared mobility can be formulated as „the shared use of a vehicle, bicycle, or other mode that enables users to gain short-term access to transportation modes on an 'as-needed' basis" [2]. Depending on what is been shared, there are two principal fields of shared mobility. The first refers to sharing a vehicle, while the second relates to sharing a ride. Each includes multiple sub-systems (Fig.1), whose main characteristics will be described in the following text. The most common forms of sharing vehicles are carsharing and bikesharing while scootersharing is recently developed and therefore less represented on the mobility market [3].

In vehicle sharing business models, vehicles are rented primarily occasionally, for a short time.
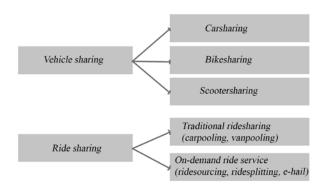

Fig.1 Main domains and subsystems of shared mobility

Carsharing is usually carried out using a car fleet owned by a company/operator. In recent practice, the P2P model, which includes privately owned vehicles (cars or bicycles), is also applied with a monetary compensation (peer-to-peer carsharing or peer-to-peer bikesharing).

Sharing a ride is another form of shared mobility. Unlike the sharing of vehicles, which basically increases its time utilization, the ridesharing model is based on the idea of better utilization of capacity through vehicle occupancy increase. A joint ride can happen spontaneously, based on acquaintances - among friends, work colleagues or within family members. When the pairing of drivers and passengers having the same starting point and/or destination is done via an online platform, ridesharing becomes organized, whereby passengers commonly "compensate" the driver for a part of his trip costs.

Ridesharing occurs in two forms-carpooling, if a joint ride is done by passenger car, or vanpooling when driving is done by van. Both forms are considered and named as 'traditional' [3], to distinguish from the latercoming concept. Namely, the beginning of the second decade of the 21st century marked the emergence of a new ridesharing model, which is encountered under the term 'on-demand ride service'. This form is characterized by two specificities. First, the request for transport is sent through the appropriate mobile application (on smart phones), by which the payment is made. Second, similar to taxis, drivers perform a service for profit [4]. As regard terminology, ridesourcing and ridehailing terms are equally used to refer to "on-demand" ride, while the term Transport Network Companies (TNCs) is used for companies that establish service or manage on-line platforms. Some companies (Lyftline, UberPOOL) have gone a step further in achieving driving efficiency by allowing pooling passengers, i.e simultaneous
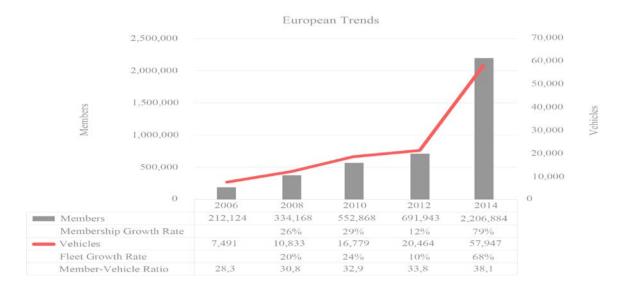
Fig.2 An increase in the number of users and carsharing vehicles in Europe [6]

transport of more passengers moving in the same direction. For this model, the term ridesplitting is used. In contrast to ridesourcing, which is conceptually closer to taxi operations, ridesplitting is more in the spirit of sharing the ride as it works according to the original idea of collecting passengers into a single vehicle. However, both forms differ from the traditional ridesharing, because drivers and passengers do not have the same destination. In response to great competitiveness of ridesourcing, the taxi industry is introducing a mobile application to schedule and pay for a ride, which is the so-called e-hail model.

3 Market Characteristics

Even where shared mobility is well established, it is still a niche market, with small participation in total number of trips. For the time being, the largest markets for shared mobility are the United States, Europe and China. In Europe, the dominant forms are vehicle sharing and traditional ridesharing, while "on demand" sharing options dominate in China and the United States. Many companies that have launched various mobility sharing programs, most often as start-up companies, are now operating in large world markets. The current state and the growth potential of two car-based services are outlined in subsections.

3.1 Carsharing

The first carsharing programs appeared in the 1940's, but the number of users was rather limited. Only when the development of information and communication technologies in the 80's and 90's

brought the companies and users an improvements in booking, payment and fleet management systems, carsharing could be developed towards more flexible services (primarily in terms of the ability to take the vehicle without the obligation of its return to the same location). In relation to the number of inhabitants, Europe and North America are the largest markets, but in the countries such as Japan, Australia, South Korea, New Zealand, China and Malaysia, there are more and more those who regularly or occasionally opt for carsharing [5].

In recent years, the number of carsharing users across European cities has almost exponential growth (Fig.2) [6], and this trend is expected to continue, with the most intensive rise expected in the densely populated urban areas of the Asia-Pacific region [7].

3.2 Ridesourcing

Thanks to efficient and reliable matching platforms, as well as lower price in relation to taxis, ridesourcing has been strongly positioned in the transport market in a relatively short time. There are however legal barriers due controversial status of service providers and hence an unfair competition in relation to taxi operators. Namely, there are opposing views on whether those who establish the relationship between drivers and passengers are legal entities (companies), or it is only about an innovative information platform.

Despite the restrictions, the largest TNC, Uber, that started operating in 2009, is expierenced accelerating growth. According to Uber Statistics Report 2017, Uber is already present in more than 80 countries and nearly 700 cities around the world.
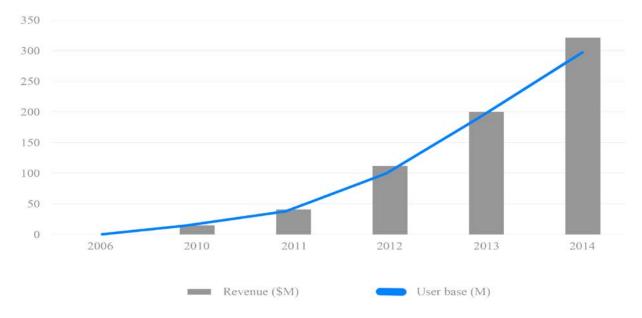
Fig.3 Growth of revenue and number of Uber users [10]

The number of users as well as the company's revenues have an exponential growth. From two million users in the starting year, Uber has attracted over 300 million users by 2014 (Fig.3).

4 The Effects of Sharing on Transport Demand Transformation

A number of studies have investigated how and to what extent mobility sharing programs can change urban travel patterns. One of the most comprehensive survey was conducted by the Transportation Sustainability Research Center (TSRC). Thousands of members of various shared mobility schemes across US, Canada and Mexico were studied to come up with some evidence on travel patterns.

As for bikesharing, a half of members have reduced personal vehicle use and 5.5 percent have sold or postponed vehicle purchase. Carsharing members also reported reducing personal car usage. A quarter of respondents sold a personal car after joining carsharing, while another quarter postponed its purchasing, from which it can be further determined that each carsharing vehicle removes up to 13 cars from the road. Reduced driving is reported among ridesourcing users as well [8]. A recent study conducted for the American Public Transportation Association (APTA) has reported that ridesourcing is frequently used at night when transit is less available [9].

Generally, the substitution of vehicle ownership by vehicle using, reduces the total number of journeys and vehicle-kilometers traveled. This is largely a consequence of the cost transparency, that is, the 'pay as you drive' principle, which stimulates more careful planning of transportation activities. Another observation is that regardless of what kind of scheme, the users of shared mobility are more willing to walk and cycle.

Research conducted in several US cities has shown that significant savings in transport costs (up to $ 400 per household annualy) can be achieved by participating in mobility sharing programs in combination with public transport. If an annual mileage is lower, both carsharing and ridehailing are more competitive solutions than owning a car (Fig.4) [7]. Therefore, it should be expected that shared mobility will shift a part of urban transportation demand to public and non-motorized modes.

When it comes to the impact of sharing mobility on the automotive industry, no significant drop in demand is expected. Less demand for ownership is supposed to be partially neutralized by faster vehicle replacement, due to their more frequent use. Technology could play a major role in boosting shared mobility, especially ridesharing forms. Autonomous vehicles will eliminate the cost for the driver and enhance competitiveness of sharing rides.
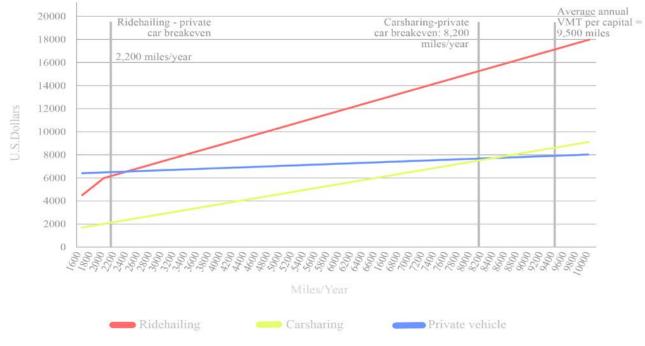
Fig.4 Annual transport costs per mileage [7]

5 Shared mobility as a multimodality driver

Diversity and connectivity of urban mobility options is of great importance for making cities liveable. Operating on their own is getting less acceptable for any transportation option, since there is no single one having enough resources to fulfill mobility needs in a sustainable way. Regardless of sharing forms, or vehicle technology (electric, autonomous), public transit remains the backbone of the urban mobility vision. In terms of transport capacity/space utilization, public transit, especially rail-based is far the most efficient solution.

There are certain dillemas whether shared mobility is complement or substitute for public transit. Some evidence show that car-based shared modes substitute more for car and taxi than for transit trips [9]. Even if shared modes may compete with public transit on some routes and/or at a certain time, they are much more mutually supportive than they are competitors. Shared mobility solutions can overcome the shortcomings of public transport in providing door-to-door access, i.e. first and last mile connectivity. In that sense, shared modes together with walking and cycling have "feeding" function for mass transit systems. This is gaining importance in sprawling cities, with low density zones, where mass transit is not economically viable.

On the other hand, without public transport, car-based mobility sharing models would be much less competitive. The exclusive use of ridehailing system can be several times more expensive on an annual basis, than using privately owned car.

A 2016 policy document of the International Association of Public Transport (UITP), underlines the complementary role of walking, cycling and shared modes and expresses the view that public transport operators should have the leading role in providing integrated solutions. An involvement of shared modes in multimodal integration would include:

- Physical connectivity-providing parking lots for sharing modes at or in the neighbourhoods of public transit stations/stops;
- Joint traveller information system – providing assistence and real time information on fares, routes, vehicles availability, transfer options;
- Fare integration – providing integrated booking and payment systems;

At the moment there are examples of various kinds of cooperation between public transport operators and shared mobility providers. It's mostly about partnership between two companies, but in some cases public transport operators are shareholders of shared mobility services. The largest public transport operator in Brusells, MIVB-STIB, is a shareholder of carsharing company Cambio. Their shareholder is Belgian railways (NMBS holding) as well, which offers parking places at many railway stations in Belgium. Public transport

provider in Munich-MVG has grown into multimodal operator. It has developed its own bikesharing service and has agreements with carsharing providers such that they operate as a part of the public transport service. An example of institutional support is the Greater Hannover Transport Association (GVH) which brings together different mobility providers in Hannover. In 2004, it has enabled the purchase of mobility package, meaning that public transport subscription can be upgraded for bikesharing, taxi or carsharing. To inform its users about transit systems schedules, Uber is integrating with a Transit app in a number of cities across United States. The project EasyGO, launched in 2016 in Reading (UK), integrates fares for local bus transport, carsharing and bikesharing. The transport association network and public transport provider in Cologne facilitate combining carsharing and bikesharing with light rail transport and buses by integrated payment systems.

Apart from physical, information and fare integration, full-scale multimodality should bring all transportation providers together. On the trail of this idea, a new concept, called Mobility-as-a-Service (MaaS) has emerged. The main idea behind is to tailor mobility to individual needs, thus being a sound alternative to owning a car. The users may purchase a "mobility package", submit requests, choose between transport options and always have access to those modes that, physically and operatively suit them most.

6 Concluding Remarks

Shared mobility has potential for fast transformation from niche market into mainstream. At present, the main markets are cities in the developed countries, where citizens are generally more receptive to the idea of sharing economy.

Each shared mobility form removes a certain number of cars from the roads. Great environmental benefits can not be observed yet, since the participation in modal split is still low.

What makes sharing mobility a promising solution for sustainable urban development is its capability to overcome some operational limitations of urban public transit. At the moment, there are some examples of integration of shared modes with other transportation options, but this is the field where still much has to be done to achieve full-scale multimodality.

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