

## VEHICLE SHARING

# Urban mobility in a financially-constrained world: vehicle-sharing systems as a viable alternative

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The rising costs of car-ownership have forced urban travelers to seek alternative mobility solutions. Vehicle-sharing offers a viable alternative that is gaining traction, and still has a lot of potential for growth.

The title of this article paraphrases the title of a very interesting book by Andreas Schäfer, John Heywood, Henry Jacoby and Ian Waitz called *Transportation in a Climate-constrained World*. As additional constraints are being added to the difficult problem of urban transportation, creativity and flexibility must be used to respond in constructive ways.

Urban transport habits have been redefined during the last decade. The cost of purchasing and maintaining a car, the ever-increasing fuel prices and the restricted available parking space in urban areas, leads people to look for alternative ways to travel. When car ownership becomes a luxury and public transport restricts the freedom and quality of travel, car and bike-sharing schemes seem to be the alternative solution. Additional to the transport needs of people, the pressure on world governments to reduce greenhouse gases (GHG) in order to fulfill their obligation towards environmental protocols – a target that becomes more and more difficult to reach mainly because of the increasing emissions by transport – makes them encourage investing on alternative, sustainable urban transport schemes, such as conventional or electric car-sharing and conventional or electric bike-sharing. These new ideas are emerging either with the support of government funding, or by being pursued by ambitious entrepreneurs willing to exploit these new opportunities. Relevant initiatives like Getaround ([www.getaround.com](http://www.getaround.com)) and Whipcar ([www.whipcar.com](http://www.whipcar.com)) offer peer-to-peer solutions through websites and smartphone applications. Through these systems, car-owners can rent their vehicles for the time they don't use it. In any case vehicle-sharing systems are meant to be complementary to public transport.

## Bike-sharing

From the first scheme in Amsterdam to the more recent one in France (Velib), significant experience has been gained in bike-sharing planning management, Intelligent Transport Systems (ITS) applications and bike redistribution (Shaheen, 2010). The system organization is based on three aspects: 1) bikes and stations must be distinguishable; 2) interface technology facilitates the security and usage and should be used for checking-in and checking-out the bicycles, 3) docking stations should be located at reasonable and predictable intervals (400-700m) within the area of operation. Prerequisite for bike-sharing, for safety reasons, is the existence of a network of bike-lanes, a requirement that can be difficult (and costly) for many cities to implement.

Shaheen et al. (2011) examined the adoption and behavioural response of the users of the largest bike-sharing system in the world, in Hangzhou (China). Among others the study found that the scheme captured modal share from the bus transit, cars, taxis and walk, while its acceptability could be improved by providing more information about bike and parking availability, increasing the number of stations, improving the bike maintenance and extending the time of operation.

More effort is currently being made by the European Union in order to promote bike usage in European cities. The (recently completed) OBIS project (<http://www.obis-project.com/>) aimed to evaluate a number of European bike-sharing systems and publish a handbook to offer guidance to decision makers for the efficient implementation of these schemes, while the PRESTO project (<http://www.presto-cycling.eu/>) aims to promote electric bicycles.

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Currently, there are more than 150 bike-sharing schemes in more than 30 countries – 19 of which are European – in the world (Shaheen, 2010).

### Car-sharing

Car-sharing offers to its users the benefits of privacy and the flexibility of privately owned cars, at a much lower cost. These systems may charge a combination of 1) a registration fee, 2) a monthly fee and 3) a cost per km or hour of usage or both. Fuel, insurance and sometimes congestion charging costs are included in the price, while a number of parking slots owned by the company minimize the parking-time/cost. Finally, car-sharing users do not underestimate the travel costs (Shaheen and Cohen, 2007), something they usually do when travelling with privately owned cars. Car-sharing was introduced in Zurich in 1948 but expanded in the early 1990s in Europe and the USA, while nowadays such systems are operated also in Israel, Japan, Singapore, China, Malaysia, Australia and other countries. In total, approximately 348,000 members in 600 cities of 18 countries use such systems (Shaheen and Cohen, 2007).

Burkhardt and Millard-Ball (2006) found that, in North America, car-sharing users are usually well-educated and environmentally aware, while most of them are young (between 25 and 35 years old). They are affluent (50% have more than 60,000\$ income), while 72% live in a household without cars; however, car-sharing remains a good choice for students and low-income households. Car-sharing companies suggest its use particularly with those that do not drive more than 10,000 to 16,000 km

per year (Shaheen and Cohen, 2007). Zhou et al. (2011) found that in Austin (Texas, USA), adults of higher income that own a car do not wish to join the scheme, while the education level does not determine the possibility of becoming a member. In Germany, Switzerland and USA the ratio of members-to-vehicle is high because of the number of inactive members.

Operators usually face difficulties with insurance of the vehicles, because insuring companies are still hesitant of offering their services to such systems. Pay As You Drive (PAYD) schemes may offer a solution to this challenge. Advanced user interface technologies such as internet/telephone registration/reservation and smartcards/smartphones to check-in and checkout, but also GPS transmitters for navigation, security and control of the fleets, are used as standard equipment of these systems. This technology can support applications such as PAYD, but on the other hand could lead to concerns e.g. about privacy.

Understanding the perceptions and attitudes of potential system users

can be crucial to the success of any possible deployment. One common way to assess the perceptions of the potential users is to perform a stated-preference survey, the results of which could help guide the implementation of the system in a city. A recent stated-preference study in Greece (Efthymiou et al., 2012) – one of the countries most affected by the current debt crisis – shows that people in the second lowest group of the income scale (15.000€-25.000€ p.a.) are more likely to join bike-sharing or car-sharing schemes. In addition, car-sharing seems to be a substitute for taxi when it is used for trips to social activity and for car in

		Bike-sharing	Car-sharing	Electric Car-sharing
<b>Factors Affected</b>				
Transport	Traffic	■	■	■
	Parking demand	■	■	■
Social-Environmental	Emissions	■	■	■
	Time	■	■	■
	Cost	■	■	■
	Urban design	■	■	■
Personal	Physical health	■	■	■
	Psychological health	■	■	■
<b>Before and After Installation Concerns and Amenities</b>				
Installation	Infrastructure	■	■	■
	Parking	■	■	■
	Insurance	■	■	■
Information Technology	GPS tracking	■	■	■
	Internet booking	■	■	■
	Telephone booking	■	■	■
Movement	Gasoline	■	■	■
	Electricity	■	■	■
	Human power	■	■	■
Other	Flexibility	■	■	■
	Access	■	■	■

Table 1 | Comparison of car-sharing and bike-sharing

the case that respondents drive 100 to 150 km per day. On the other hand, bike-sharing is considered as a substitute for public transport (bus/trolley/tram) in the case of work or school trips, while younger (18-25 years old) and less educated respondents are more willing to join bike-sharing than older (26-35 years old) and more educated respondents. Furthermore, Ciari and Axhausen (2012) examined two data groups collected by stated-preference experiments and found that there is unexploited potential for carpooling in Switzerland.

### Car-sharing and bike-sharing impacts

The scorecard presented in Table 1 compares the social, environmental, personal and transport effects, but also other characteristics of bike, car and electric car-sharing systems. The “traffic signal” convention has been used: the green colour has a positive meaning, red denotes a negative effect and yellow is somewhere in the middle (unclear or insignificant).

Alternative sustainable transport systems have multi-dimensional benefits for the users, the environment and the economy. All these systems alleviate traffic congestion and parking demand, effects that imply lower emissions, less time and cost spent for transport, but also better psychological state. Many people either cancel the purchase of a car or sell one after joining a car-sharing scheme, while it has been calculated that each car-sharing vehicle replaces between 4 and 23 cars (Millard-Ball et al., 2006). Another study (Martin et al., 2010) has shown that because of car-sharing in North America, 90,000 to 130,000 vehicles have been removed from the road. An additional advantage of bike-sharing is the physical benefit it offers to its users. In the long-term, such schemes may define and influence the urban design of a city, so an examination of different scenarios considering sustainable policy indicators is needed before their implementation.

Concerning the need of infrastructure, bike-sharing is more demanding as it requires the existence of bike-lanes, but also the implementation of docking stations with advanced interface technology. On the other hand, the difficulty in car-sharing operation is limited to the need of reserving parking slots especially in cities where curb-side parking is limited, while no extra infrastructure is needed at the station. If the system is electrified, electricity supply needs also to be provided.

### Discussion

The current financial hardships can offer a unique opportunity for the deployment of vehicle-sharing systems.

Already in Greece there is a spike in the number of people using bicycles for their daily travel, while many more abandon their cars and start using public transport. Vehicle-sharing systems need critical mass to attract a lot of users (and therefore be effective and profitable), but users will not join them in large numbers until they are widely available. Even in the large US market, zipcar and flexcar had to merge, in order to remain in business. Ingenious entrepreneurs can develop vehicle-sharing schemes and try to find the necessary backing for these. However, in order to break this vicious cycle, authorities (in Greece and elsewhere) must also support these initiatives in two ways: 1) by investing in research for the development of car-sharing and bike-sharing systems and 2) by subsidizing individuals for the establishment of relevant companies.

The larger cities in Greece (Athens, Thessaloniki) and in the rest of Europe are fertile ground for such initiatives. The small steps that have been taken to date need to be made bolder and move towards the generation of new ideas, in order to revitalize the economy and create synergies with different sectors. For example, the struggling car manufacturers/importers could find an outlet to use their surplus vehicles through the participation in car-sharing schemes, while the tourist/hotel industry could offer new, attractive packages. ★

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