



Carsharing in China

A Contribution to Sustainable Urban Transport?

On behalf of

Published by

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

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Sino-German Cooperation Project

on Electro-Mobility and Climate Protection in China

www.electro-mobility.cn

www.sustainabletransport.org

Design and layout

Klaus Neumann, SDS

Photo credits

©Tomasz Zajda

As at

October 2014

On behalf of

Federal Ministry for the Environment, Nature Conservation,

Building and Nuclear Safety (BMUB)

Division IG I 5 – Environment, Traffic and Transport, Electric Mobility

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Preamble

In the past decade, China underwent a rapidly increasing motorisation rate and growth in traffic volume, especially in the individual urban transport sector to be continued or even accelerated in the future. These developments lead to increased dependency on oil imports, congestion, air pollution, as well as negative impacts on the global climate.

Against this background, the Chinese government endeavours both to increase the energy efficiency in the transport sector as well as to foster the development and marketisation of new energy vehicles (NEV). With regard to the latter, the Chinese government (partly motivated by industry-policy considerations) puts particularly strong emphasis on electric vehicles (EV). In this context, the 12th Five-Year Plan elevates the NEV sector to the status of one of seven strategic emerging industries. Integrated strategies and a conducive political environment need to be developed in order to fully utilise the capacity Electro-Mobility offers to solve global climate protection questions. These strategies and political solutions will be crucial in incorporating renewable energies in the national grid and integrating electric vehicles with sustainable urban transport concepts. While such strategies are currently being developed worldwide, they are mostly and at best in the drafting process. Germany and China, on the other hand, have taken concrete steps and bilaterally agreed to develop the potential contributions of Electro-Mobility to environmental protection.

On behalf of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety of the Federal Republic of Germany (BMUB) and the Ministry of Science and Technology of the People's Republic of China (MoST), the Sino-German Cooperation Project on Electro-Mobility and Climate Protection^[1] is jointly implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and the

China Automotive Technology and Research Center (CATARC). The overall objective of the project is to provide the relevant Chinese ministries as well as related institutes and think tanks access to conceptual and technical background to introduce Electro-Mobility in China in a climate-friendly and environmental sound way.

In order to implement this objective, the Sino-German Cooperation Project on Electro-Mobility and Climate Protection is structured into 4 components.

The first component aims to identify and analyse the environmental impacts of Electro-Mobility in China. To this end, participatory scenario analyses will be performed, which quantitatively describe the market penetration of electric vehicles and take into account the share of renewable energies in the grid mix. Based on these scenario analyses, policy recommendations will be forwarded to the Chinese government to assist in the design of the regulatory framework. Moreover, the results will be used to design pilot and demonstration projects for efficient charging systems and the integration of renewable energies to fuel electric vehicles in a climate and environmental sound way.

In the second component, joint studies and workshops will build the methodological and technical capacities to integrate electric vehicles into the environmental regulations governing the transport sector in China. The focus will lie on standards and solutions that lower greenhouse gas emissions, such as Chinese Fuel Economy Standards beyond 2015.

In the course of the third component, studies will be performed to analyse the feasibility of an environmental sound and resource efficient pilot system for traction batteries of electric vehicles. On the basis of these feasibility studies, policy recommendations for the design of pilot recycling projects will be formulated.

The fourth component investigates possible applications of electric vehicles in sustainable inter- and multi-modal urban transport patterns. The work in this component establishes an active exchange of practical experience as

[1] For further information about the Sino-German technical cooperation project 'Electro-Mobility and Climate Protection in China' please visit <http://www.electro-mobility.cn> or <http://www.sustainabletransport.org>.

well as scientific research on pilot projects and fleet tests in Germany and China. Moreover, guidelines on how to develop climate and environmental sound Electro-Mobility solutions and integrate them with sustainable urban transport patterns will be developed. Finally, the component will analyse the feasibility of different uses of electric vehicles that incorporate novel driving patterns, such as carsharing.

As several international projects and business models already indicate, carsharing is a promising concept to promote the market entry and penetration of electric vehicles with the potential to unleash positive environmental impacts. The mobility service denotes the professionally organised joint use of one or more automobiles, with the distinguishing principle being that the advantages of motorised individual mobility are provided without the disadvantages of owning a vehicle. In this way, carsharing can serve as an option to contribute to the overall diffusion of electric vehicles. In addition to its potential to integrate electric vehicles in urban transport, carsharing systems in Europe and North America proved to be an innovative mobility solution, which contributes to a shift from motorised individual transport towards more efficient and sustainable public and non-motorised transport modes.

The GIZ Working Paper “Carsharing in China – A Contribution to Sustainable Urban Transport?”, prepared and published by the Sino-German Cooperation Project on Electro-Mobility and Climate Protection, aims to give an overview of the functionality and development of carsharing services as well as the challenges and opportunities in terms of the Chinese carsharing market. Moreover, the paper discloses specific options and recommendations for governmental authorities to support the development of carsharing in China. This publication resides in the fourth component of the Sino-German Cooperation Project on Electro-Mobility and Climate Protection, as this component is engaged in the integration of electric vehicles in new mobility services for individual low carbon urban transport.

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Abstract

Although the level of motorisation in China is still low compared to developed countries, there is increasing private car ownership concentrating in megacities and metropolitan regions. Many Chinese major cities have already reached saturation point with respect to individual motorised transport volume, resulting in a variety of negative consequences. High congestion levels, parking pressure, inefficient land use, traffic accidents as well as severe air pollution and energy dependency are far reaching implications of China's hyper-growth over recent decades. Consequently, increasing vehicle population poses a risk to the sustainable urban development in China and exacerbates the pressure on political decision-makers to find innovative and demand-oriented solutions to the ongoing mass motorisation.

As experience in Europe and North America shows, many nations adopted carsharing as part of an overall strategy to mitigate the negative impacts of increasing private car ownership and individual transport volume in densely populated urban areas. Professionally organised carsharing services separate car use from vehicle ownership and complement the existing network of public and non-motorised transport modes by offering on-demand, self-service, short-term and pay-per-use access to automobiles. Based on these characteristics, carsharing unleashes the potential to reform automobile usage and to significantly contribute to a shift of mobility patterns towards more efficient and sustainable eco-modes – A change that appears to be a necessity to reduce air pollution and space consumption in Chinese megacities.

While the impact of carsharing on urban transport and environment is gaining growing importance on an international scale, carsharing systems in China are still in an initial phase. Since comprehensive large-scale carsharing systems could contribute to the sustainable development of China's urban transport sector, the GIZ working paper on carsharing in China aims to give a general overview of this mobility service as well as its challenges and opportunities on the Chinese market. In addition, the paper provides an insight into specific options for governmental authorities to support the development of carsharing in China.

Glossary

ATG	Auto Teilet Genossenschaft
BEV	Battery Electric Vehicle
CCTV	China Central Television
EU	European Union
FCEV	Fuel Cell Electric Vehicle
Ha:Mo	Harmonious Mobility
ICS	Iniciativa Car Sharing (Carsharing Initiative)
ICVS	Intelligent Community Vehicle System
momo	More Options for Energy Efficient Mobility through Car-Sharing
MIIT	Ministry of Industry and Information Technology of the People's Republic of China
MoF	Ministry of Finance of the People's Republic of China
MoT	Ministry of Transport of the People's Republic of China
MoST	Ministry of Science and Technology of the People's Republic of China
NDRC	National Development and Reform Commission of the People's Republic of China
NEV	New Energy Vehicle
STIB	Société des Transports Intercommunaux de Bruxelles (Brussels Intercommunal Transport Company)
SUMP	Sustainable Mobility Plan
TfL	Transport for London
Udo	Use it, do not own it!
UITP	International Association of Public Transport
VKT	Vehicle Kilometres Travelled
WTO	World Trade Organization

1. Introduction

As one of the fastest growing economies and the largest automobile market in the world, China's landscape of urban transport is characterised by significantly increasing motorisation. Mainly driven by rapid urbanisation, rising per capita income and the establishment of a local automotive industry, private car ownership is continuously growing since the early 1990s. According to Figure 1, China's accession to the World Trade Organization (WTO) in 2001 substantially supported this trend due to the abolition of import quota for foreign car manufacturers and the decrease of customs duties (Weider 2004).

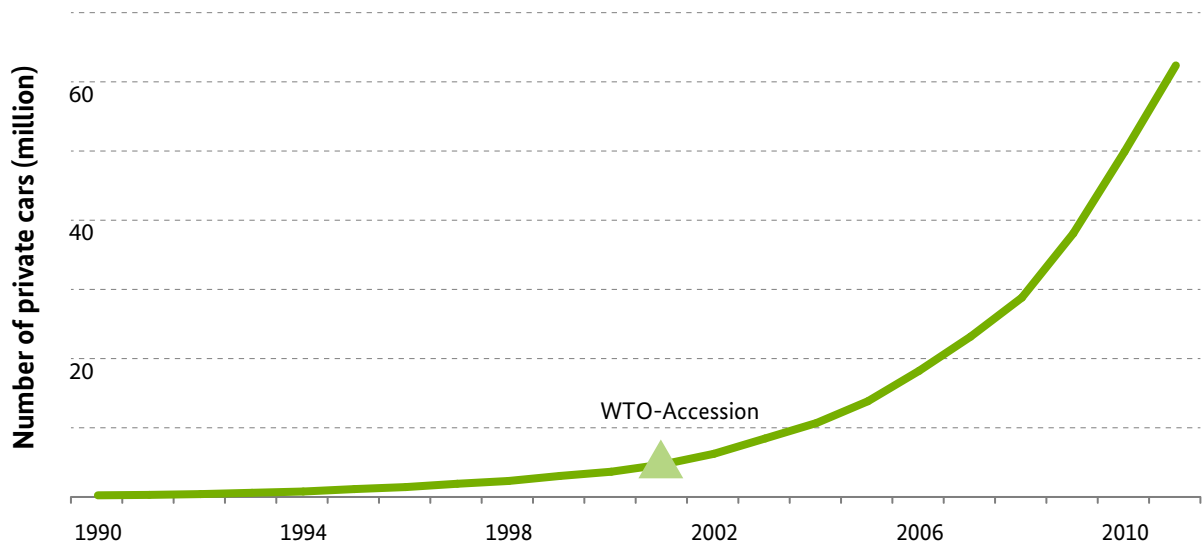


Figure 1: Stock of private cars in China from 1990 to 2011.
Source: Website NBS; Ye Wu (2014)

Although China holds one of the world's largest vehicle populations, the nationwide motorisation level is still low compared to developed countries, such as Germany or the USA. Nevertheless, increasing private car ownership concentrates in densely populated Chinese megacities and metropolitan regions, where it poses one of the major problems. Many megacities and metropolitan regions have already reached saturation point with respect to

traffic volume, resulting in a variety of negative impacts. Severe air pollution, high congestion levels, parking pressure, inefficient land use and traffic accidents are far reaching consequences, which accompany the growth of the last decades. If China continues to follow this trend, especially critical air pollutants and greenhouse gas emissions will impair the quality of urban life and cause notable implications beyond the local level.

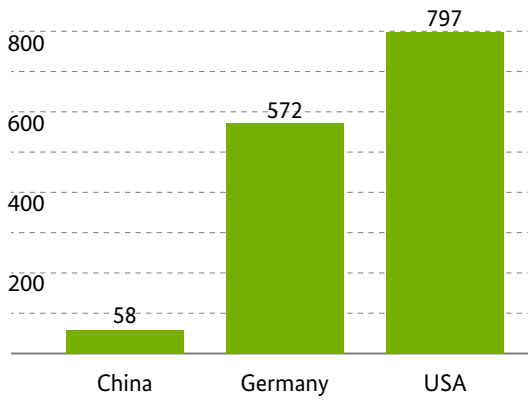


Figure 2: Motorisation level (cars/1 000 people) in China, Germany and the USA in 2010.
Source: Website The World Bank

Considering the consequences of ongoing urban mass motorisation in China, new and innovative mobility services appear to be a necessity to reform private car use and to shape inter- and multi-modal mobility patterns, which include the most efficient transport modes. Since comprehensive carsharing applications, such as station-based, free-floating or corporate carsharing, could slow down the mid- and long-term demand of private car ownership and contribute to the sustainable development of China’s urban transport sector, this GIZ working paper aims to raise the overall awareness of this mobility service as well as to give an insight into the functionality, the positive impacts and the feasibility of carsharing services in China. Moreover, this paper provides good practice guidance to local authorities with the aim to find suitable solutions to decrease the problems caused by motorised individual transport. The working paper exceeds a mere descriptive level of the potential of carsharing systems in China, as it also formulates a first conceptual approach on a promising carsharing application, which overcomes a variety of currently existing market barriers.

2. Introducing Carsharing

Carsharing can be characterised as a member-based mobility service, which provides on demand, self-service, pay-per-use and short-term access to a fleet of vehicles maintained by a professional carsharing company. In general, members pay a single registration fee, a monthly membership fee and a usage fee according to time and/or distance of the rental period. Since carsharing tariffs include all incidental expenses associated with a car (fuel, maintenance, insurance, etc.), this mobility service provides the benefits of motorised individual mobility without the costs and responsibilities of owning a private vehicle. With its potential to fill existing gaps between public and individual transport, carsharing is conceived to cover the occasional car demand of people, who mainly use public and non-motorised transport modes to organise their daily mobility. For this reason, carsharing is usually offered in densely populated urban areas with a well-established public transport system and a low level of car dependency (Cohen *et al.*, 2008).

There are different variations in how carsharing can be organised. While conventional station-based carsharing is the most common business model, other known carsharing schemes are free-floating and peer-to-peer carsharing.

Station-based Carsharing

Station-based carsharing companies operate by offering vehicles at designated carsharing stations within a defined service area. Depending on their availability, the cars can be reserved spontaneously or in advance via phone call, website or smartphone app. Most of the station-based carsharing companies offer round-trip usage, requiring the customers to pick up and return the vehicles at the same location. Station-based carsharing fleets often consist of different types of vehicles (*e.g.* small compact cars, sedans or mini vans) to meet the individual mobility needs of their users. The rental fee of station-based carsharing vehicles is usually charged by the hour (Cohen *et al.*, 2008).



Figure 3: Station-based carsharing ("mobil.punkt") in Bremen, Germany.

Source: Michael Glotz-Richter

Figure 3 shows a carsharing station in Bremen (Germany) operated by the German carsharing company Cambio. Other examples for large-scale station-based carsharing services are Zipcar (USA, Canada, UK, Spain, and Austria), Mobility (Switzerland) and Flinkster (Germany, Austria, Switzerland, and the Netherlands).

Free-floating Carsharing

Free-floating carsharing services stand out by providing vehicles without designated carsharing-stations. The cars, which can be localised via service hotline, website or smartphone app, are parked on legal public parking spaces, parking garages or underground car parks within a geographically defined service area. Members of free-floating carsharing services can pick up and return the vehicles at any legal parking space without being dependent on a specific carsharing station. As reservations are not required and only possible for a short time (usually 15 to 30 minutes), free-floating carsharing offers a high flexibility while using one of the vehicles, but limits the

possibility to schedule a trip in advance. Other significant differences to station-based carsharing services are minute-based pricing and less diverse carsharing fleets (most providers offer only one vehicle type). For this reason, free-floating carsharing is mainly conceived to provide spontaneous car access for short trips within urban areas (Lytton and Poston 2012).

So far, free-floating carsharing systems are primarily offered in Europe (Germany, Austria, Italy, UK and the Netherlands) and North America (USA

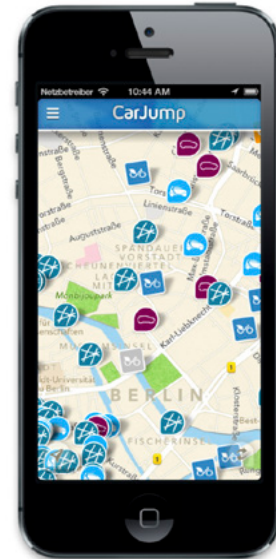


Figure 4: App-based localisation of free-floating carsharing vehicles.
Source: CarJump – GHM Mobile Development GmbH

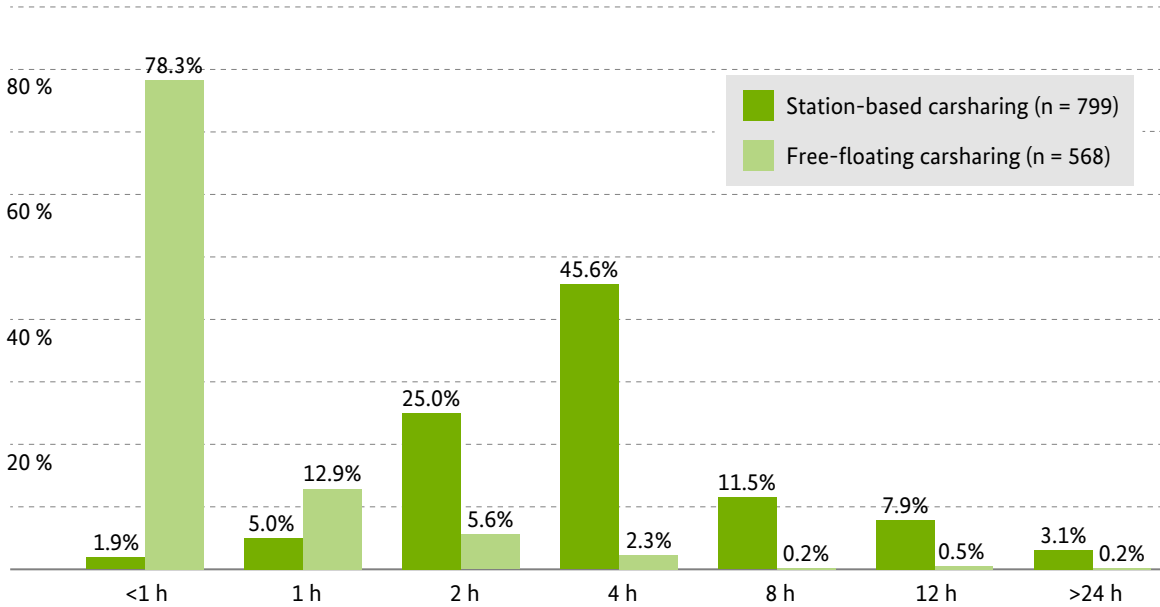


Figure 5: Average rental period of station-based and free-floating carsharing in Germany.
Source: AIM 2012

and Canada). Exemplary services are car2go (operated by Daimler and Europcar), DriveNow (operated by BMW and SIXT) and Multicity (operated by PSA Peugeot Citroën and DB Rent). Especially popular with a younger online experienced generation, free-floating carsharing has been growing on a tremendous level since its inception in 2008. Currently, more than 700 000 people worldwide are registered with free-floating carsharing services, leading to a market share of almost 40% (Website car2go; Website DriveNow).

As one of the latest developments in the carsharing sector, the level of sophisticated scientific research on free-floating carsharing is limited and opinions differ whether it can contribute to a reduction of private car ownership in the same way as station-based systems. However, due to its minute-based pricing, free floating carsharing offers the potential to complement station-based concepts. Especially for short distances and rental periods below one hour it can provide car access at a lower price level. Figure 5 illustrates the average rental period of both free-floating and

station-based carsharing according to an empirical survey among 1 200 carsharing customers in Germany.

Peer-to-peer Carsharing

The non-profit equivalent to professionally organised carsharing is known as peer-to-peer or private carsharing. Privately organised carsharing involves one or more individuals, who share a car that is either owned by one individual or all of the participants collectively. In most cases private carsharing users mutually conclude a contract to cover legal issues, such as insurance or liability. In contrast to professionally organised carsharing, private carsharing users have to meet in person to exchange the car keys. Peer-to-peer carsharing can be organised on a local level among acquaintances within a neighbourhood as well as on a regional or national level based on web services, such as Tamyca and Autonetzter (Gossen and Scholl 2011).

The screenshot displays the website interface for Autonetzter.de. At the top, the logo 'autonetzer.de' is visible. The main heading reads 'MIETE PRIVATE AUTOS IN DEINER NÄHE'. Below this is a search bar with the text 'Ich suche ein Auto in' followed by a location input field 'Ort/PLZ, Straße' and a blue 'Jetzt suchen' button. The background of the banner shows a man in a blue t-shirt handing keys to a woman in a patterned top next to a black car. Below the banner, there are four car listings, each with a photo of the car, the car model, the owner's name, their location, a star rating, and the starting price:

Car Model	Owner	Location	Rating	Price (€)
VW GOLF IV	Benjamin	Stuttgart	5 stars	ab 19,90€
OPEL CORSA	Thorbas	Düsseldorf	5 stars	ab 24,90€
VW Caravelle	Jonas	Freiburg	5 stars	ab 25,30€
PEUGEOT 206	Katrin	Hamburg	5 stars	ab 31,90€

Figure 6: Peer-to-peer carsharing web service.

Source: Website Autonetzter

2.1 Principles of Carsharing Usage

Although the specific business models of carsharing companies usually differ from each other, the procedure of how to use a carsharing vehicle is broadly similar. The following steps illustrate the common principles of station-based carsharing usage:

❖ Registration

After the conclusion of a frame contract with a carsharing provider, registered customers receive an access medium, in most cases a RFID smart card, which can be used to unlock and lock the carsharing vehicles. Depending on the carsharing company, members have to pay a security deposit, a single registration fee and/or a monthly membership fee. Follow-up costs are limited to an all-inclusive usage fee that covers expenses such as fuel, insurance and maintenance.

❖ Vehicle Reservation and Usage

Carsharing allows self-service access to cars at any time of the day. Once the registration process is finished, members can choose a vehicle at one of the carsharing stations and make a reservation via phone call, website or smartphone app. The reservation can be done either far in advance (some station-based carsharing providers offer pre-bookings of up to one year) or spontaneously, depending on the availability

of the vehicles. Since carsharing is a member-based mobility service, registered users do not have to sign a rental contract before they use a carsharing vehicle.

One of the most common carsharing key management systems is a stand-alone solution. Stand-alone carsharing vehicles can be unlocked with a personal access card and used with the car keys stored inside the car (see Figure 7). While it is possible to park the cars during the rental period at any legal parking space, station-based carsharing vehicles need to be returned at the same station where they have been picked up. A fuel card inside of the vehicle can be used to refuel at no additional charge and a service hotline can be contacted in case of an accident or problem.

❖ Return of Vehicle and Payment

In order to finish the rental period, the vehicle has to be returned at the carsharing station and locked with the access card. Since succeeding customers can rate the vehicles in terms of cleanliness and damages, carsharing users should always make sure to leave the vehicle in a proper condition. Damages or other impairments need to be reported immediately. Most of the cars are equipped with an on-board unit, which collects and transmits the user data (for instance time and distance travelled) to the carsharing operator. The payment usually takes place monthly, according to the actual usage of the cars.



Figure 7: RFID card access to a carsharing vehicle.

Source: Website BCS



Figure 8: Carsharing on-board unit with car key storage.

Source: Website Auto-Medienportal

2.2 Benefits and Impacts of Carsharing

Recent scientific research and empirical studies indicate two different directions of carsharing impacts. While individual-related benefits increase the user acceptance of the mobility service, broader impacts, mainly caused by changes in the mobility behaviour of carsharing users, can lead to improved conditions for urban transport and environment. In this context, carsharing is often mentioned as a cost-saving mobility service, which enhances the mobility options of sustainable urban transport systems and supports a lifestyle that does not build on private car ownership.

2.2.1 Individual Impacts

Individual impacts of carsharing systems are user-related benefits, such as avoiding the necessary effort to purchase, park, insure and maintain a vehicle, as well as the availability of a broad range of different vehicle types. Moreover, carsharing users have the possibility to decrease the expenses of private transportation by avoiding car ownership.

The total cost of car ownership consists of variable costs (fuel, maintenance, etc.) as well as fixed costs (purchase price, insurance, etc.). About 60 % of the total costs of car ownership are fixed and need to be covered regardless of how much a vehicle is used. Consequently, owners of a private vehicle tend to cover the major share of their mobility needs by car. Using carsharing instead of a private vehicle shifts the cost ratio towards variable costs and changes the transport related expenses from total costs of car ownership to total costs of mobility. In this way, carsharing users can avoid the fixed costs of owning a car and access vehicles on a pay-per-use basis, which provides the opportunity to save costs (Bundesverband CarSharing e.V. 2010).

Nevertheless, using a carsharing vehicle is not necessarily an inexpensive alternative to private car ownership. The savings potential of carsharing mainly depends on the utilisation of a car. Measured by costs per vehicle kilometre travelled (VKT), owners of a private vehicle with a high annual mileage pay less than owners of a vehicle with a low level of annual VKT. Since a high mileage decreases the

costs per VKT, carsharing loses its price-competitiveness in case of frequent and extensive car usage. Although it is not easy to quantify an average breakeven point of carsharing and car ownership (the point where carsharing is more expensive than car ownership), various research studies estimate cost savings at an annual mileage of less than 10 000 km (Cohen *et al.*, 2008).

In this context, carsharing can not only be an alternative to private cars, but also to corporate fleets from private companies and the public sector. Especially if company cars are needed on an infrequent basis, corporate carsharing decreases the expenses of purchasing and maintaining a corporate fleet. As a result of the steadily increasing business usage of carsharing vehicles, many carsharing companies are already offering specific schemes and tariffs to meet the mobility need of business customers.

2.2.2 Impacts on Transport and Environment

Although scientific research on carsharing related impacts on transport and environment often varies in its quantitative results, major studies agree in one aspect: carsharing can unleash the potential to reduce car ownership and VKT by shifting the mobility behaviour of its users towards public- and non-motorised transport modes – a characteristic that impacts on urban transport, for instance in terms of traffic volume, parking, space consumption, local air pollutants and greenhouse gas emissions.

The dependency on a private vehicle is mainly determined by the quality of public- and non-motorised transport and the availability of alternative mobility options. Carsharing complements the different modes of public- and non-motorised transport and allows a broader range of inter- and multi-modal mobility patterns, which are impracticable without the flexibility of an automobile. Consequently, carsharing facilitates the usage of public and non-motorised transport modes, diversifies the personal choice of transport and therefore contributes to the reduction of private car ownership (Bundesverband CarSharing e.V. 2010). Figure 9 illustrates the complementary role of carsharing in a sustainable urban transport system.

In addition to its potential to reduce or prolong private car ownership, carsharing promotes a modal shift away

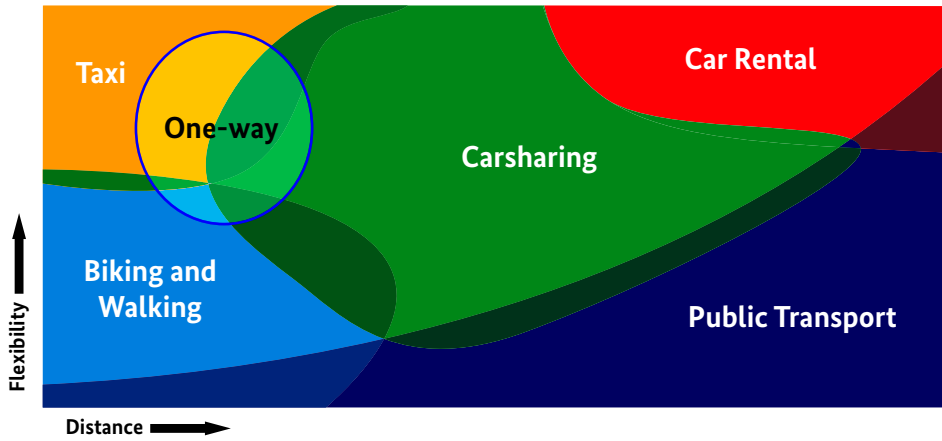


Figure 9: Carsharing: A complementary component of sustainable urban transport.
 Source: Marco Viviani, CommunAuto

their mobility patterns towards public and non-motorised transport, the mobility service does not only support a decrease in private car ownership, congestion and space consumption, but also in transport related local air pollutants and greenhouse gas emissions (Martin and Shaheen 2010).

from motorised individual transport. While owners of private vehicles are often not fully aware of the total costs of car ownership, carsharing users are directly confronted with the total costs of mobility. Not being tied to the high fixed costs of a private vehicle enables carsharing users to rationalise the choice of transport by selecting the most efficient and cost-saving transport mode or combination of transport modes prior to every single trip. Thus, the transparent pay-per-use cost structure of carsharing schemes provides an incentive to reduce the overall level of VKT and to increase the usage of less expensive transport modes. As carsharing users tend to significantly shift

of scientific quantification of carsharing impacts on transport and environment.

Despite its positive impact on the reduction of private car ownership and VKT, an increasing share of trips made by car cannot be excluded among certain user groups. Especially members, who did not own a private vehicle before joining a carsharing company, will increase their VKT by using carsharing. Nevertheless, carsharing can prevent or prolong the purchase of a private vehicle among this group of users, which in turn is a contribution to the overall development of a sustainable urban transport system (Martin and Shaheen 2011).

Table 1: Impacts of Carsharing Usage in Europe and North America

Impact	Europe	North America
Number of vehicles replaced per carsharing vehicle	4–10	6–23
Users which sold private vehicles after joining carsharing schemes	16–34 %	11–23 %
Participants who postponed or avoided a vehicle purchase due to carsharing	23–26 %	12–68 %
Vehicle kilometres reduced due to carsharing	28–45 %	8–80 %

Source: Cohen and Shaheen, 2006

3. Development of Carsharing

The development of commercially organised carsharing systems can be classified into different stages. The initial market entry in the late 1980s in Switzerland led to the worldwide diffusion of professional carsharing services, which concentrated in Europe and North America. After a phase of substantial growth and technological progress, the carsharing market started to diversify and new business models emerged. Particularly the implementation of free-floating carsharing in 2008 raised the overall awareness of this mobility service and led to a growth spurt for the whole industry.

For almost 30 years, carsharing has passed through an extraordinary development with carsharing companies, vehicles and membership growing on an exponential level. According to the latest surveys, the total number of carsharing members has increased more than five-fold within the last six years, reaching almost 1.8 million members across the globe in 2012. With a share of 90% of worldwide carsharing membership, Europe and North America are the predominant markets of carsharing activities (Cohen and Shaheen 2012). As carsharing develops

on a highly dynamic level, recent projections on worldwide carsharing membership already exceed two million members in 2014 (Website Navigant).

3.1 History of Carsharing

Although first attempts to establish carsharing in a more organised structure can be traced back to 1947, professional carsharing systems initially emerged in the late 1980s. The basis for the commercial mainstreaming of the mobility service was founded in Switzerland, where the first two carsharing companies, ATG (Auto Teilet Genossenschaft) and Sharecom Genossenschaft, were established in 1987. After a period of continuous growth until 1997, both companies merged into the cooperative Mobility Genossenschaft, which is currently ranked among the largest carsharing companies worldwide. Together with the 1988 founded German carsharing provider StattAuto, Mobility is recognised as one of the most influential carsharing companies, and often mentioned as the pioneer of professional carsharing (Cohen and Shaheen 2006).

Based on its success in Germany and Switzerland, carsharing began to popularise largely across Europe and spread in a short time to other countries such as the Netherlands, Belgium or the United Kingdom. With membership rates steadily growing in the double-digit percent range, carsharing was finally established as a professional mobility service and viable business venture.

Similar to the development of carsharing in Europe, North American carsharing was initiated by small-scale projects in Canada and the USA. The first professional North American carsharing company Auto-Com started its operations 1994 in Quebec, Canada. Implemented as a non-profit organisation, Auto-Com quickly changed to a for-profit business due to its commercial success. In 1998, the USA followed the Canadian carsharing movement by introducing CarSharing Portland. While CarSharing Portland remained to operate on a smaller scale, Flexcar and Zipcar paved the way for the nationwide expansion of carsharing systems starting from the year 2000. Both companies coexisted as the largest competitors on the US market until Flexcar merged in Zipcar in 2007. Today,

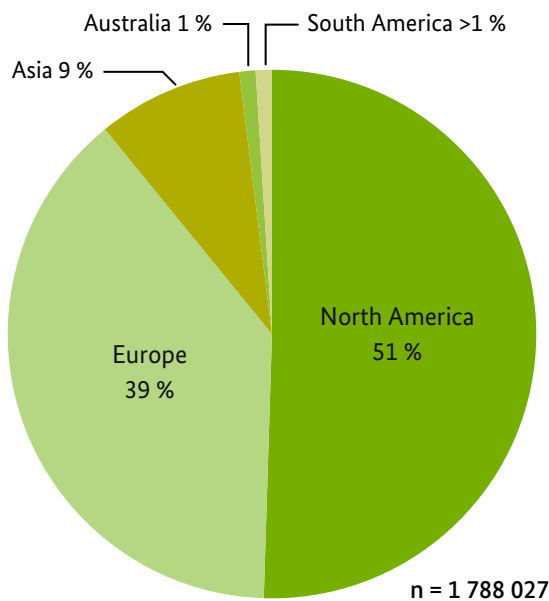


Figure 10: Percentage distribution of worldwide carsharing membership in 2012.

Source: Cohen and Shaheen 2012

Zipcar represents the world’s largest carsharing company with more than 700 000 members in the USA, Canada, Spain and the United Kingdom (Chung *et al.*, 2009).

After the carsharing market was already firm in Europe and North America, the mobility service started to develop in Asia as of 1997. Asian carsharing activities primary concentrated in Japan and Singapore, where well-developed public transport networks, a low level of car dependency and high costs of private car ownership are providing a fruitful environment for the acceptance and development of the mobility service. In August 1997, NTUC Income Insurance, a life and general insurance company, established the first Singaporean carsharing company Car Club (previously known as Car Co-Op). Similar to the importance of Mobility in Europe, Car Club pioneered for the following carsharing providers in

Singapore, such as WhizzCar and Kahshare (Barth *et al.*, 2006). Smove, the latest Singaporean carsharing scheme, was introduced by the company Clean Mobility Singapore in 2012. The carsharing provider exclusively offers electric vehicles, which can be booked with an optional driver service (Website Smove).

In Japan, carsharing initially served as a test platform for alternative vehicle concepts, such as electric vehicles. In 1998, the domestic car manufacturer Honda jump-started the Japanese carsharing market by introducing the demonstration project ICVS (Intelligent Community Vehicle System), which offered four different types of low-speed electric vehicles as shuttles for the Twin Ring race track at Motegi. Due to the success of the pioneering carsharing service, the Japanese Ministry of Construction (merged with the Ministry of Transportation in 2001)

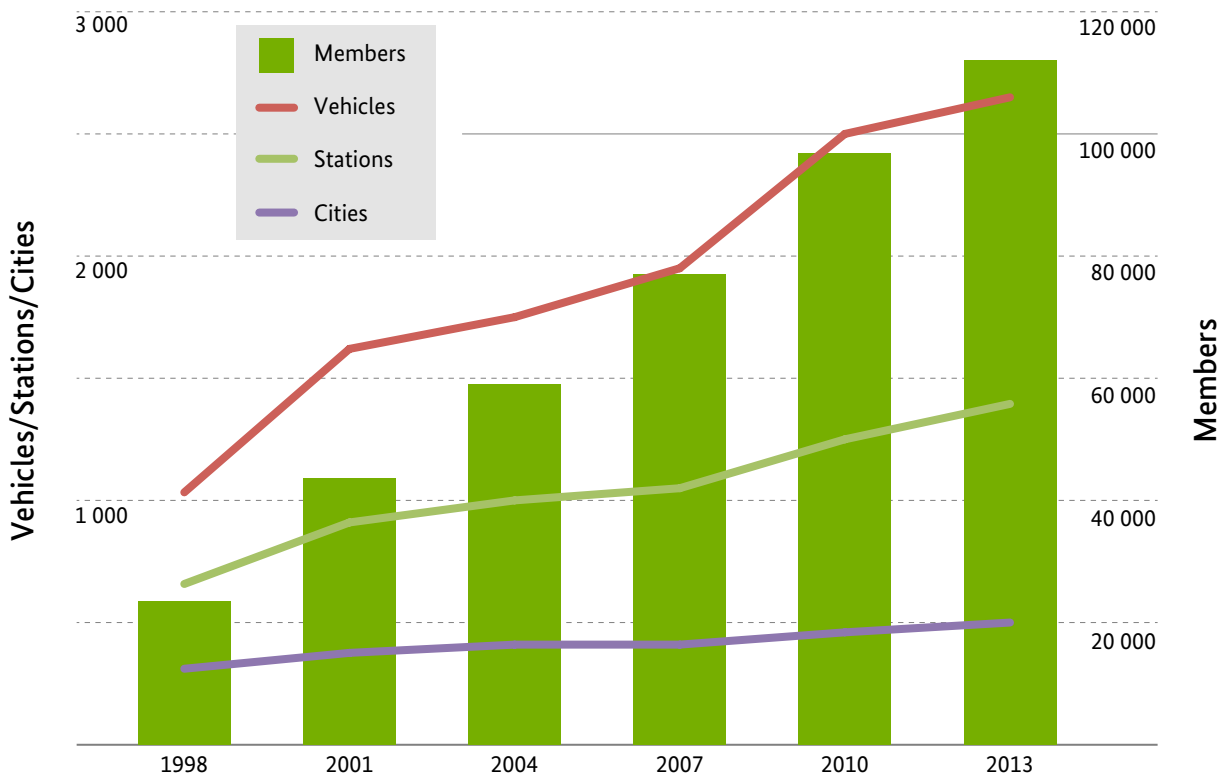


Figure 11: Development of the Swiss carsharing provider mobility from 1998 to 2013.

Source: Website Mobility

started to promote the mobility concept by sponsoring the carsharing systems ITS Mobility System (1999 in Osaka), Tourist Electric Vehicle System (1999 in Kobe) and Eco-Park & Ride (2000 in Ebina). Nearly at the same time, the Japan Association of Electronic Technology for Automobile Traffic and Driving (formed by the Japanese Ministry of Trade and Industry) substantially supported the introduction of the carsharing systems EV-Car Sharing (1999 in Inagi) and MM21 (2002 in Yokohama) (Barth *et al.*, 2006).

One of the latest Japanese carsharing systems was introduced by Toyota in 2012. The carsharing project Ha:mo (“Harmonious Mobility”) provides ultra-compact electric cars, which are integrated in the co-modality app Ha:mo NAVI. Similar to the mobility app moovel^[1], this online tool allows customers to choose the most efficient and cost-saving transport mode or combination of transport modes to meet their mobility needs (Website Toyota).

[1] The mobility app moovel is offered by moovel GmbH, a subsidiary of Daimler AG. For more information see: <http://www.moovel.com>.



Figure 12: Ha:mo NAVI combines carsharing with public and non-motorised transport modes.

Source: Website Toyota

More recently, first professionally organised carsharing activities started in Australia and Latin America. In 2003, Newton Carsharing introduced the mobility service to Australia by providing a station-based system in the suburban area of Sidney. The company, which launched the service with three cars and 12 members, changed its name to GoGet in 2004 and expanded to other Australian cities, such as Melbourne and Brisbane. Altogether, more than 20 000 GoGet members are currently sharing 800 vehicles (Website GoGet CarShare). Six years after the introduction of carsharing in Australia, the Brazilian carsharing provider Zazcar followed by offering the mobility service in South America as of 2009. Zazcar is a station-based system in São Paulo with about 2 000 members, 60 vehicles and 45 stations (Website Zazcar).

While the fundamental steps in the development of worldwide carsharing activities have been made with station-based systems, the implementation of free-floating carsharing led to a significant upturn for the whole industry. Mainly provided by automobile manufacturers, such as BMW, Citroën and Daimler, free-floating carsharing has been growing on a tremendous level since its inception in 2008. The flexibility of using a carsharing vehicle without the dependency on a designated station attracted new and previously unexploited user groups and led to a quick diffusion across Europe and North America. Although conventional station-based systems are still dominating the international carsharing market, free-floating carsharing had a lasting effect on the mobility service by introducing one-way trips, instant access and open-end bookings (Le Vine 2012).

Figure 13 gives a brief overview of the different carsharing development stages.

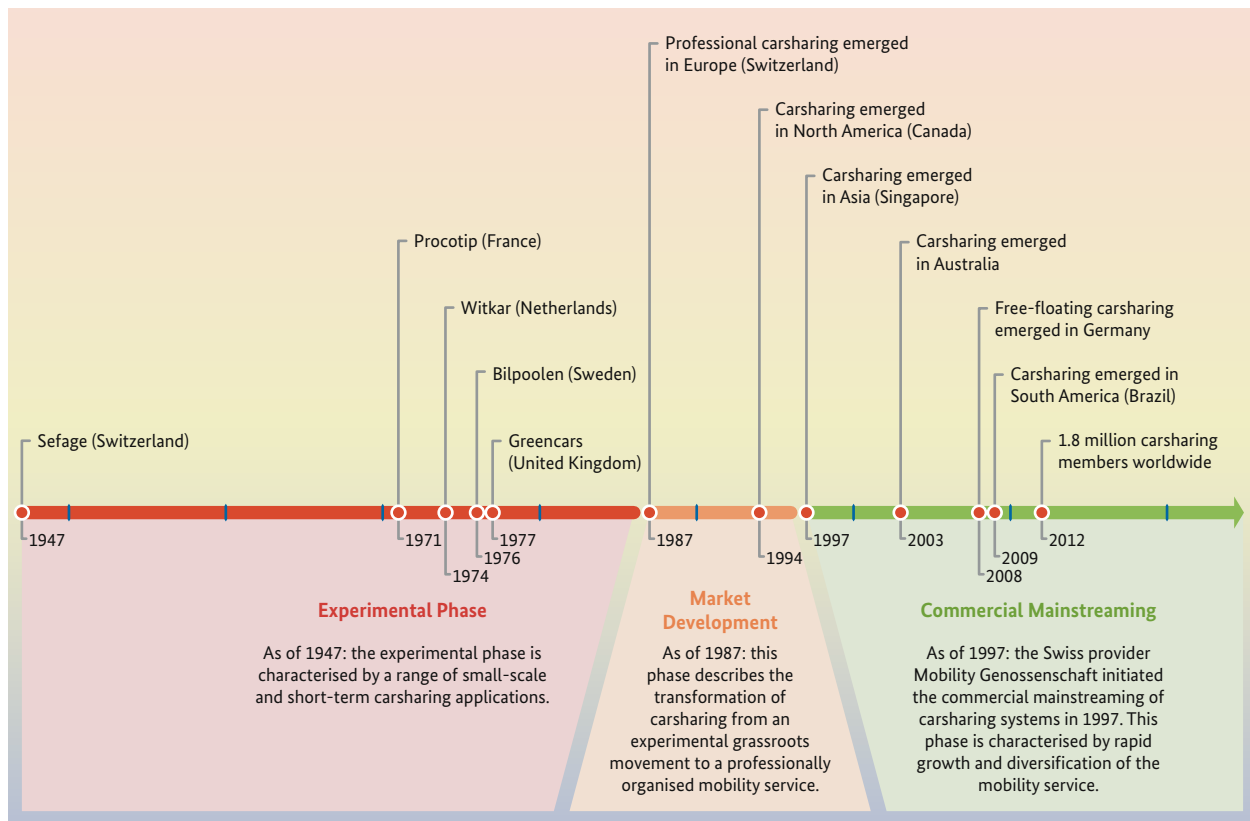


Figure 13: Carsharing development stages.

Source: Own figure

Testimonial Lewis Chen

Question:

“Singapore is one of the few countries in Asia with successful large-scale carsharing systems. What are the major reasons for this positive development in Singapore compared to other Asian countries?”

Testimonial:

“Singapore is the first country to start carsharing services in Asia and the objective is to complement the public transport system in Singapore and also to serve as a social equalizer. Since the beginning, the focus has always been to develop a sustainable business model. Although the operating environment can be challenging



due to high cost of purchasing the vehicle, i.e. higher business risk, so far the existing long time carsharing operators (Car Club and WhizzCar) are commercially viable without much subsidy from the government.”

Name: Lewis Chen
Position: President
Company: Car-Sharing Association Singapore
Website: <http://www.carsharing.org.sg>

3.2 Carsharing in Europe – A Brief Overview

Companies from Germany and Switzerland played a key role for the overall development of carsharing by fostering its transition from a grassroots community movement to a commercial mobility service. Soon after the first professional providers established their schemes during the late 1980s, carsharing gained growing importance as an additional component of public transport. Based on an average annualised membership growth of 20% since 2006, nearly 700 000 registered customers are currently sharing more than 20 000 vehicles across Europe (Cohen and Shaheen 2012). With a share of more than 75% of all European members, the predominant carsharing markets are located in Germany, Switzerland, the United Kingdom and the Netherlands (Website Momo).

Both as a result of the successful diffusion of carsharing in Europe and in order to support the future development of the mobility service, the inner-European project “More Options for Energy Efficient Mobility through Car-Sharing” (momo) has been carried out between 2008

and 2011. Supported with funds from the European Union (EU), 13 organisations from eight European countries implemented the project. In the framework of the project, the International Association of Public Transport (UITP) cooperated with municipalities, research institutes and carsharing providers to achieve the following key objectives:

- Awareness raising of carsharing;
- Service improvement of existing carsharing systems;
- Establishment of carsharing in unexploited areas;
- Enhancement of the energy efficiency of carsharing systems;
- Acquisition of new cooperation partners for carsharing providers.

Figure 14 shows a comparison between the carsharing membership of the participating countries before and after the implementation of momo. Most notable, the United Kingdom could more than double its carsharing members during the life span of the EU-project (Bundesverband CarSharing e.V. 2010).

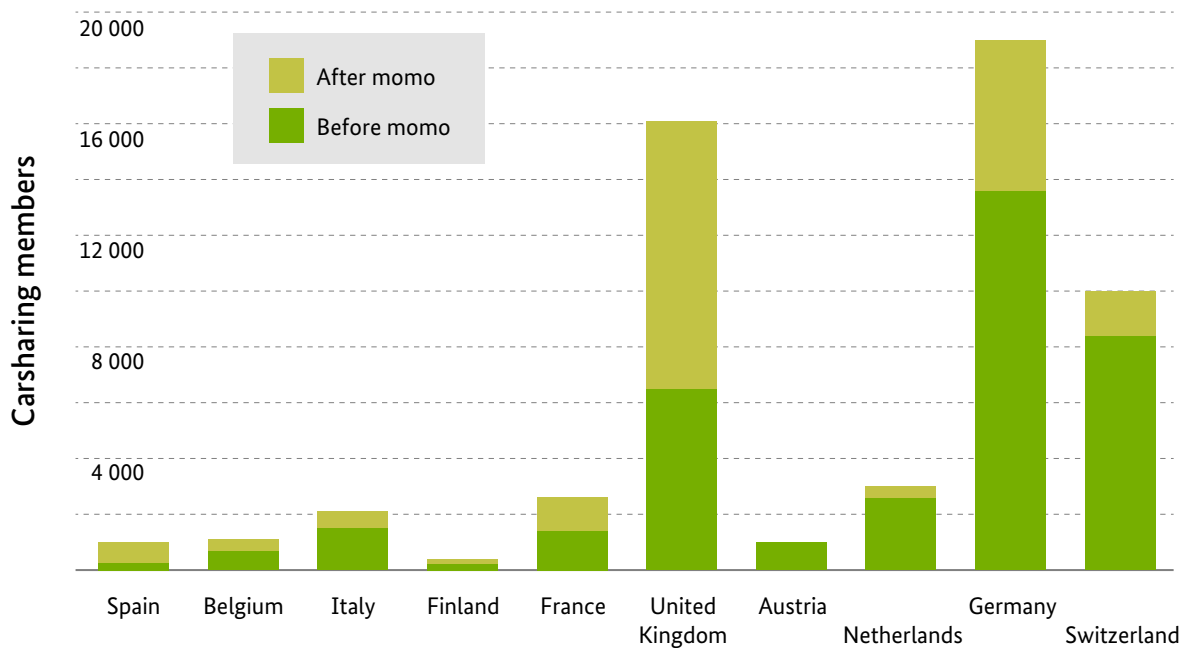


Figure 14: Carsharing membership in Europe before and after the EU-project momo. Source: Website momo

After more than two decades of extensive carsharing development, the mobility service consolidated its importance as an alternative to private car ownership in various European metropolitan regions. Accompanied by an increasing body of scientific research, the successful development of carsharing did not only generate a higher business potential for the providers, it also put a stronger emphasis on its efficiency to contribute to sustainable urban transport systems.

3.3 Key Success Factors and Good Practices

Long-standing carsharing activities in mature markets helped to identify relevant stakeholders that substantially influence the potential of this mobility service. In this context, synergies between carsharing and public transport as well as the importance of policy support from local authorities have to be highlighted as most beneficial for the development of this mobility service. The following section provides a deeper insight into both of these key success factors based on European good practice examples.

3.3.1 Public Transport Integration

Considering its role within an urban transport system, carsharing is not conceived to be a first choice or mono-modal transport mode. Due to its functionality and pricing, carsharing members usually organise their daily mobility needs by public and non-motorised transport, whereas carsharing is mainly used to cover the occasional demand of a private vehicle. In this way, carsharing closes the gap between public and individual transport, enhances the range of inter- and multi-modal mobility patterns and supports its members to develop and obtain a sustainable mobility behaviour. In short, the integration of carsharing into a well-developed public transport network decreases the dependency on a private vehicle and raises the potential for success of carsharing services (Bundesverband CarSharing e.V. 2010).

Across Europe, a variety of carsharing providers recognise the importance of strong public transport systems related to the overall success of carsharing services. Consequently, companies, such as Flinkster in Germany or Mobility in Switzerland, designed their systems as an integrated service based on cooperation agreements with public transport companies. According to the experience from existing partnerships between carsharing operators and public transport companies, the following section provides an overview of effective measures to generate benefits on both sides.

❖ Inter- and Multi-modal Linkage

In order to visibly integrate carsharing as a complementary part of public transport and to facilitate inter- and multi-modal mobility patterns, carsharing stations need to be set up closely to public transport stops and interchanges. In this context, public transport companies can significantly support the development and success of carsharing by providing access to demand-oriented parking spaces on their private properties. Integrated information, for instance carsharing stations highlighted on public transport maps, helps customers to clearly identify carsharing as a complementary part of public transport and simplifies the rational selection between different transport modes (Bundesverband CarSharing e.V. 2010).

❖ Combined Ticketing and Pricing

Another possibility to intensify the linkage of carsharing and public transport is the combination of user tariffs and tickets. In general, holders of a monthly or annual season ticket can pay an additional charge to gain access to carsharing services at a reduced rate. Combined ticketing schemes, often labelled as “mobility packages”, help to cut the total costs of mobility and provide seamless usage of carsharing and public transport (Bundesverband CarSharing e.V. 2010).

❖ Joint Marketing

Joint marketing campaigns raise the visibility and awareness of combined mobility services and help to share expenses as well as potential customers. Especially small-scale and financially weak carsharing providers profit from the existing advertising channels of public transport companies (e.g. customer newspapers, e-mail newsletters and postings in buses, trains and stations) (Bundesverband CarSharing e.V. 2010).

Altogether, the cooperation between carsharing and public transport companies generates a significant synergy potential that helps to attract new and to retain existing customers on both sides. In particular, carsharing companies profit by providing greater mobility to their members and by strengthening the independency of private car ownership. One of the good practices on the combination of carsharing and public transport is represented by Flinkster, a German carsharing service established by a public transport operator itself.

Good Practice: Flinkster

With Flinkster (previously known as DB Carsharing), the German railway company Deutsche Bahn AG launched its own carsharing scheme in 2001. As one of the leading station-based carsharing systems in Germany, Flinkster provides 2 800 cars in 140 German cities for about 215 000 members. In addition to the conventional Flinkster fleet, Deutsche Bahn launched the electric carsharing scheme e-Flinkster in 2010 (Deutsche Bahn 2013).

One of the key success factors of Flinkster is the direct linkage to the public transport network. Most of the

carsharing stations are located nearby railway stations and airports in order to facilitate a connection of long- and short-distance transport as well as to enhance the options of inter- and multi-modal mobility patterns. Together with Call-a-Bike, a nationwide available bikesharing system from Deutsche Bahn, Flinkster members can easily choose and switch between different sustainable transport modes.

Another success factor of Flinkster is the interoperability with other mobility services. Holders of a “BahnCard25 mobil plus”, an annual membership card for the mobility services

from Deutsche Bahn, can use Flinkster, Call-a-Bike and public transport. In this way, one membership card provides access to a broad range of different transport modes, facilitating seamless sustainable mobility (Website Deutsche Bahn).



Figure 15: Flinkster connects carsharing with public transport.

Source: Website e-GAP

3.3.2 Public Carsharing Support

Since the positive impact of carsharing on traffic and environment is widely recognised across Europe, more and more local authorities are supporting the mobility service to tackle the consequences of intensive car use and ownership in urban areas. Thus, carsharing is gaining importance as a transport demand management tool, which is used to diversify the overall mix of transport options as well as to reduce private car ownership and VKT.

The growth potential of carsharing systems largely depends on the availability of customer-oriented parking spaces, which can be used to set up carsharing stations. Especially visible on-street parking spaces in areas with a high level of parking pressure can raise the awareness of the mobility service and significantly influence its success. In this context, local authorities play a key role as they are able to provide access to high quality public parking space to carsharing companies (Cohen *et al.*, 2010). While the designation of carsharing stations is usually not regulated by national law, various European countries have granted local authorities the necessary legal scope to autonomously decide, if public space will be provided to carsharing companies (Bundesverband CarSharing e.V. 2010).

In Europe, governmental support for carsharing is not only limited to the provision of public parking space. Local authorities of cities, such as Bremen, London or Paris, adopted comprehensive development strategies by providing monetary as well as non-monetary incentives to support carsharing providers and to enhance the availability of carsharing services. Exemplary incentives reach from funding and tax reliefs up to awareness rising and road traffic privileges (for instance parking free of charge or the exemption from congestion charges and city toll) (Bundesverband CarSharing e.V. 2010).

The following good practice example gives a brief overview of Autolib', a Paris based carsharing scheme, which receives strong support from the local government.



Figure 16: A carsharing station on public parking spaces in Bremen, Germany.

Source: Michael Glotz-Richter

Good Practice: Autolib'

Based on a tendering from the city government of Paris, the French carsharing provider Autolib' launched one of the world's first large-scale E-carsharing schemes in December 2011. As of October 2012, 37 000 members signed up with the company that currently offers 2 012 electric vehicles at 857 stations with 4 358 parking spaces and charging pillars. Autolib' plans to expand the system successively to 3 000 vehicles, 1 150 stations and 6 000 parking spaces with charging pillar across the city. The carsharing fleet exclusively consists of battery electric vehicles, so-called Bluecars, which are produced by Bolloré, a French investment and industrial holding group and the company behind the brand Autolib'. A major difference to conventional station-based carsharing schemes is the possibility to rent and return the electric vehicles at different stations. In fact, even though Autolib' is a station-based carsharing

system, it enables its members to make one-way trips between different stations (Website Autolib' 1).

The rapid diffusion of Autolib' is mainly driven by the strong (proactive) support of the local government, which is committed to the development of carsharing due to the negative impacts of increasing private car ownership in Paris. Therefore, Autolib' received extensive financial support from the city government (EUR 35 million) as well as the city districts (up to EUR 50 000 per carsharing station). With regard to the limited parking space in the city core of Paris, the local government additionally provides public parking spaces to set up carsharing stations – an essential requirement for the feasibility of large-scale carsharing schemes (Website Metropolitics).

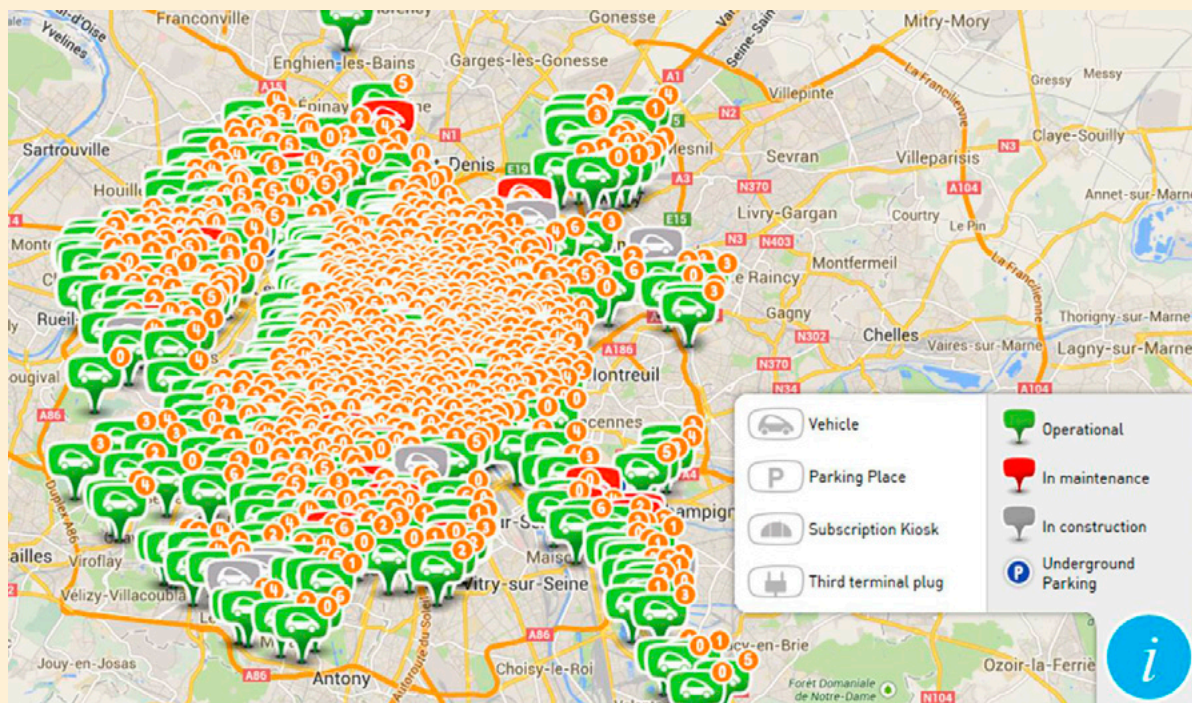


Figure 17: Autolib' station network in Paris, France.

Source: Website SocieteAutolib' 2

Testimonial Joachim Kolling

Question:

“DriveNow is one of the most successful providers of free-floating carsharing worldwide. Since its launch in 2011, the carsharing scheme could attract more than 290 000 members in six different cities. Based on your experience, what are the main reasons for this tremendous success?”

Testimonial:

“DriveNow has the potential to scale the car sharing business for the benefit of its shareholders and cities alike. DriveNow is as flexible and easy to use as a privately owned car and is even better. DriveNow offers access to a variety of different premium cars from BMW and MINI, which are efficient and appropriate in different use cases and they are fun to drive. The cars are available where our customers are and customers can book them spontaneously on the street or via an app or the web. Furthermore, customers do not need to go to dedicated stations or plan the return of the car. Within the business area they drop the car off



when and where they like, which makes DriveNow a relevant Mobility concept in combination with public transport, walk and bike. Attractive car sharing is a necessary precondition for substituting car ownership and emissions. The sufficient conditions come from attractive public transit and regulations without distortions between transport modes.”

Name: Dr Joachim Kolling
Position: Head of Car Sharing at Mobility Services
Company: BMW Group
Website: <http://www.BMW-i.com>

4. Carsharing in China

For the first time in China, carsharing could be publicly experienced on a broader scale during the World Expo 2010 in Shanghai. According to the exhibition's motto „Better City, Better Life“, the carsharing strategy of the Free Hanseatic City of Bremen (Germany) has been displayed from May 1st to October 31st 2010 as one of the international good practices on sustainable urban development. Bremen and the German station-based carsharing provider Cambio jointly presented the functionality and beneficial impacts of carsharing services, which received great interest from the Chinese news agency Xinhua and the state owned TV Channel China Central Television (CCTV). One of the outcomes of the exhibition was a nationwide broadcasted TV feature on carsharing services (Glotz-Richter 2010).

Only a few months after the World Expo 2010, the carsharing operator China Car Clubs (formerly known as EVnet) introduced its service in Hangzhou, the capital city of Zhejiang Province. The station-based system offers about 140 carsharing vehicles (Smart Fortwo mhd, MG3 and Buick Excelle), located at more than 80 stations throughout the city. The cheapest rates start at 13.7 RMB per hour and 0.89 RMB per kilometre (MG 3). Table 2 gives a detailed overview of the provider's tariff structure (Website China Car Clubs).

Table 2: Tariff Structure China Car Clubs

Vehicle	Tariff	Price [RMB]	Price per km [RMB/km]
MG 3	09:00 – 17:00	13.7/hour	0.89
	17:00 – 09:00	20/hour	
	Daily rent	148/day	
Buick Excelle	09:00 – 17:00	16.7/hour	0.99
	17:00 – 09:00	23/hour	
	Daily rent	168/day	
Smart Fortwo mhd	09:00 – 17:00	19.7/hour	0.67
	17:00 – 09:00	24/hour	
	Daily rent	198/day	

Source: Website China Car Clubs

According to China Car Clubs, more than 6 000 members signed up with the carsharing provider as of August 2013. The carsharing stations are mainly located at private parking spaces in underground car parks close to the Central Business District and the Zhejiang University. Based on the permission of the local government that endorses the expansion of the mobility service in Hangzhou, China Car Clubs could set up additional carsharing stations on public on-street parking spaces (Lai Xiaoming 2012).

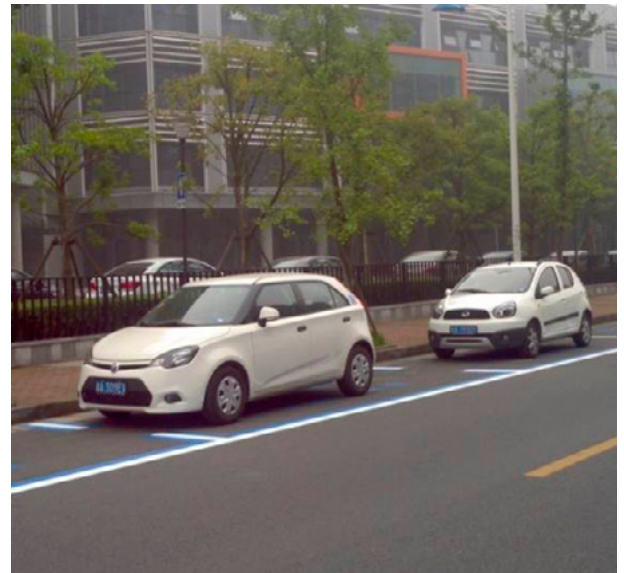


Figure 18: China Car Clubs on-street carsharing station.

Source: Lai Xiaoming 2012

EduoAuto, another station-based carsharing provider, emerged in China's capital Beijing. While EduoAuto already started its operation on a small-scale basis in 2009 (ten vehicles at five stations), the provider could substantially expand the carsharing scheme as of May 2013 by cooperating with domestic car rental companies and car manufacturers. Today, EduoAuto offers 400 cars at more than 100 stations in ten Chinese cities (Beijing, Changsha, Chengdu, Guangzhou, Nanjing, Qingdao, Shanghai, Tianjin, Wuhan and Xi'an). With smartphone based vehicle access, stand-alone key management and a range of comprehensive user tariffs (e.g. for private, student or corporate users) EduoAuto operates its carsharing scheme

on the same level as sophisticated European and North American providers (Liu Wenjie 2014).

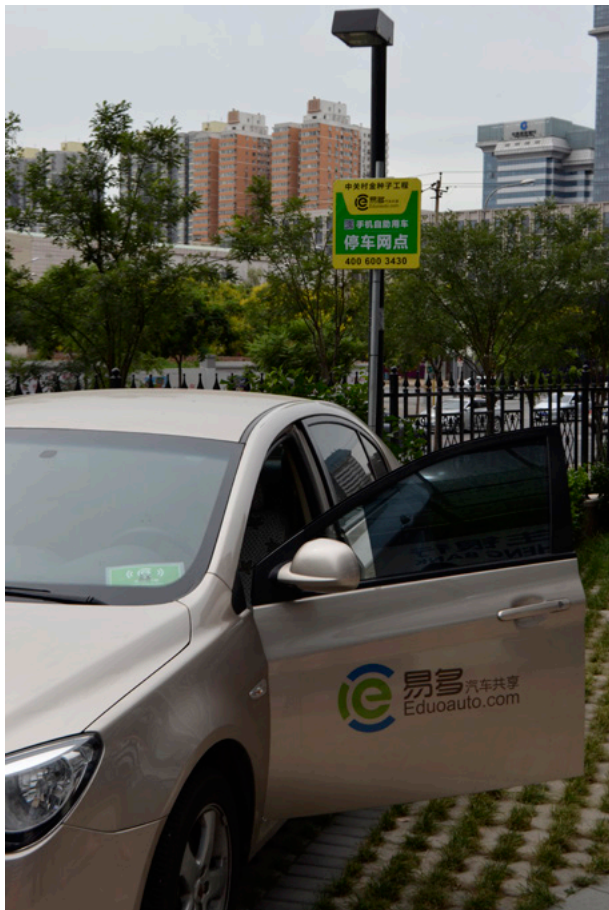


Figure 19: EduoAuto carsharing station in Beijing.
Source: Own figure

In summer 2013, Zhejiang Kandi Electric Vehicles, a joint venture of Zhejiang Geely Holding Group and Kandi Technologies Group, introduced a fully electric carsharing/short-term car rental system in Hangzhou. Since the operator requires the conclusion of a rental contract prior to each rental period, “Wei Gong Jiao” (Chinese for “Mini Public Bus”) has to be classified as a hybrid concept between station-based carsharing and short-term car rental. The operator exclusively offers a fleet of battery electric vehicles parked and charged in automated tower stations (see Figure 21). The electric vehicles are two-passenger cars with a range of approximately 120 km per

charging cycle. While charging a battery takes up to eight hours, users have the option to swap the battery at one of the tower stations. The tariff consists of an hourly fee (20 RMB/hour) as well as a distance fee (0.8 RMB/km; 25 kilometres free of charge). Wei Gong Jiao announced to finish 50 stations (each holding up to 30 cars) in 2014 and to bring the system to other cities, such as Shanghai or Hainan (Website Wei Gong Jiao).



Figure 20: Wei Gong Jiao tower station in Hangzhou.
Source: Own figure

One of the latest Chinese carsharing schemes was introduced by Daimler AG. The German car manufacturer expanded its station-based corporate carsharing pilot project car2share (initially introduced in Hamburg, Germany) to Guangdong’s capital city Shenzhen in December 2013. During the initial pilot phase, car2share offers 30 Smart mhd, which can be exclusively accessed by employees of the Chinese IT company Tencent. After registration via corporate e-mail account, Tencent employees

(about 10 000 employees) are eligible to use the cars for business as well as private trips. Car2share charges by the hour and distance (starting from 33 RMB/hour and 0.65 RMB/km), but offers additional overnight and weekend tariffs. The payment can be made via Wechat Pay, a mobile payment service integrated in Tencent's popular mobile messaging service Wechat. While the corporate carsharing scheme started with two stations in Shenzhen, car2share recently opened up a third station at a Tencent facility in Guangzhou (Li Fangfang 2014). Figure 21 shows one of the car2share stations in Shenzhen.



Figure 21: Car2share corporate carsharing station in Shenzhen.

Source: Car2share China 2014

Testimonial Tony Lai

Question:

“China Car Clubs is one of the leading carsharing providers in China. How do you rate the importance of governmental support for carsharing and which kind of support did you receive in order to set up your carsharing system?”

Testimonial:

“As a new business model in China, carsharing is dependant on appropriate policy support from local authorities. A variety of supportive measures, for instance in terms of marketing, financing and parking, can stimulate the carsharing market during both the early start-up stage as well as the ongoing day-to-day business. Governmental support becomes even more important, if carsharing is operated with electric vehicles. Financial subsidies, tax incentives, preferential parking and other new energy vehicle policies will directly affect the feasibility and operability of electric carsharing services.

Regarding our carsharing system China Car Clubs, the promotion of carsharing at the local government is part of our overall development strategy. Even though we

currently do not receive as much support as we wish and need, we are highly confident that especially our future plan to integrate electric vehicles in the carsharing fleet will help to generate a higher level of awareness and support from the government.”



Name: Tony Lai
Position: General Manager
Company: Hangzhou Cherry Intelligence Company Ltd.
Website: <http://www.ccclubs.com>

4.1 Challenges and Opportunities for Carsharing in China

In contrast to European and North American countries, where carsharing is often considered as a “complementary component” of public transport, Chinese carsharing activities are still in an exploratory stage. The availability and utilisation is low and the impacts on urban transport and environment are barely quantifiable. As carsharing services could be part of an overall strategy to mitigate air pollution, traffic volume and space consumption in major Chinese cities, the following sections aims to identify challenges and opportunities for the further development of this mobility service in China.

4.1.1 Mobility Indicators

Since carsharing has evolved to meet the occasional need of a private car, it is meant to complement the public and non-motorised transport modes instead of replacing them. Carsharing cannot be considered as a primary or first choice transport mode, as its functionality and price structure are not intended for high frequent regular trips, such as daily commuting. For this reason, the success of the mobility service largely depends on individuals commuting by non-car modes and using carsharing for non-commute travel.

Based on this characteristic, carsharing is generally more attractive in areas with an overall low automobile dependency, a transportation mix with a high share of sustainable transport modes as well as a high level of irregular and infrequent trips. Thus,

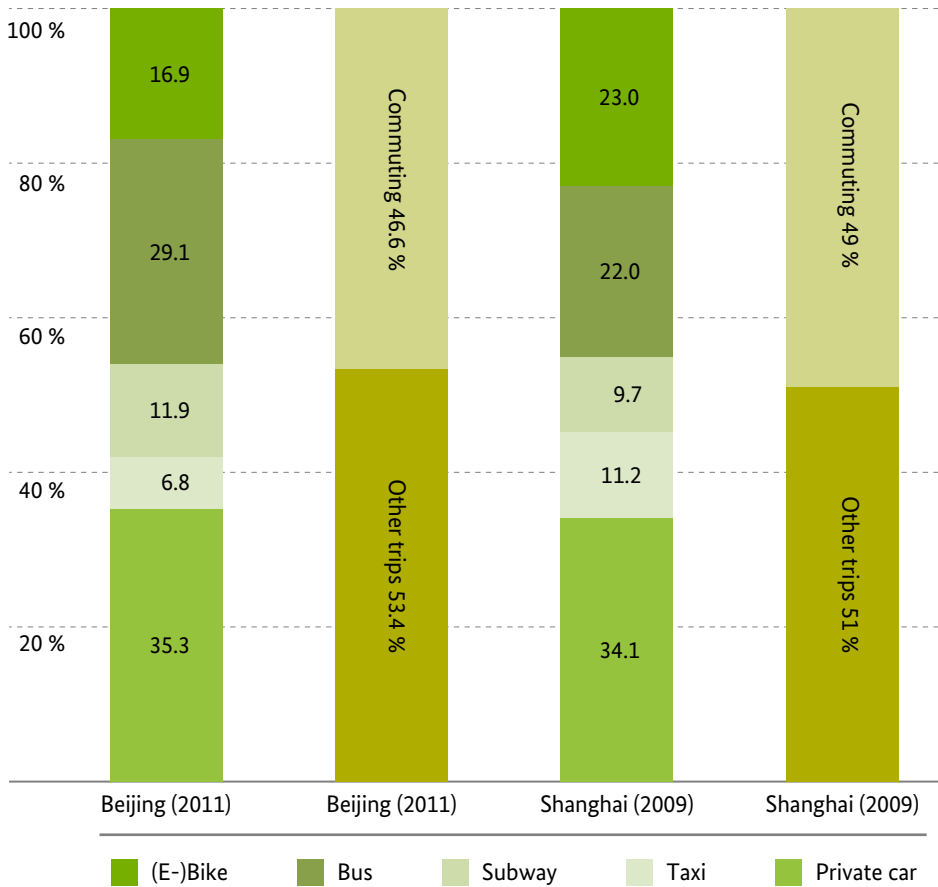


Figure 22: Modal share and purpose of trips in Beijing and Shanghai.
 Source: BTRC 2011; SCCTPI 2010; Website Xinhua

the modal share and purpose of trips within urban areas can be used to make a first estimation on the potential of car-sharing. Figure 22 shows both of these mobility indicators by taking the example of Beijing and Shanghai.

Despite the large stock of private cars in Beijing and Shanghai, public and non-motorised transport modes are still dominating the transportation mix in both cities. In addition, the majority of trips are made for non-commute purposes, such as shopping, leisure and private matters. Although this example is not representative for all Chinese megacities, the data indicates a trend towards

densely populated urban areas as an adequate environment for the implementation of carsharing in China.

The latest five-year plan (2011-2015), the roadmap for the social and economic development of China issued by the state council, as well as the National-Level Transit Metropolis Programme, a public transport pilot project in selected Chinese cities initiated by the Chinese Ministry of Transport (MoT), support the previous assumption by

prioritising China’s urban public transport development (MoT 2013). The Chinese government provides extensive monetary and non-monetary support to strengthen public and non-motorised transport and to reduce the growing demand for private vehicles in urban areas. One of the major goals is to increase the share of eco-modes in the transportation mix to at least 60 % in cities with more than ten million citizens and 40 % in cities with more

Table 3: Public Transport Development Objectives and Key Indicators Set by MoT

Development Objectives	Key Indicators
Improved level of service	<ul style="list-style-type: none"> ■ 90 % of built-up areas provide a bus stop within every 500 meters ■ Transfer time less than 5 minutes within the principal city ■ Loading factor not greater than 90 % for buses during peak hours ■ Most vehicles, stations and facilities meet requirements of disabled residents ■ 5 % of the bus fleet consist of clean energy vehicles ■ Average energy consumption decreases by 10 % or more compared to 2010 ■ 80 % of public transport users are satisfied
Improved public transport infrastructure	<ul style="list-style-type: none"> ■ Off-street bus bays for all expanded and new roads ■ Bus stops in residential areas with 20 000 residents or more ■ Advanced dispatch system and intelligent bus monitoring system ■ 30 % of arterials and important intersections equipped with bus priority signals
Improved level of safety	<ul style="list-style-type: none"> ■ Bus-involved traffic accidents have a fatality rate less than 45 persons/1 000 buses ■ Public transport system security and emergency programs in place
Improved management efficiency	<ul style="list-style-type: none"> ■ Centralisation of responsibilities on the municipal level (one public transport entity per city) ■ Systematic public transport planning ■ Complete administrative regulations and technical standards ■ 80 % or more customers use public transport smart cards ■ Average income of public transport workers is comparable or higher than the income of local workers
Stronger support from local governments	<ul style="list-style-type: none"> ■ Public transport accounts for 45 % of all trips in cities with rail rapid transit and 40 % in cities without rail rapid transit ■ 3 km transit routes per square kilometres in built-up areas ■ 15 or more buses per 10 000 residents ■ Bus routes in all populous towns ■ 85 % of city-countryside routes served by a regular bus within 20 km of the principal city

Source: MoT 2013

than three million citizens (Minch and Shi 2012). Besides large investments in the public transport infrastructure, a range of push-and-pull policies, implemented to shift mobility patterns from motorised individual transport towards alternative transport options, were introduced in megacities, such as Beijing, Shanghai, Guangzhou and Xi'an. Disincentives for private car use and ownership, for instance the limitation of number plates and the introduction of driving ban days, are not only supporting the governmental aim to strengthen public transport, but also raising the demand for innovative mobility services and comprehensive alternatives to private vehicles (Feng *et al.*, 2010).

Table 3 gives a more detailed overview of public transport development objectives on the national level set by the Chinese Ministry of Transport.

4.1.2 Policy Framework

As a consequence of missing large-scale carsharing schemes and demonstration projects, which prove the viability and positive impacts of carsharing, political awareness and endorsement to support this mobility service in China is still low. Even though first approaches to mitigate private car ownership already exist, the implementation of carsharing systems requires more specific and comprehensive policy support, such as the provision of public space to establish designated carsharing stations. In this context, one of the opportunities to politically prioritise carsharing, especially in terms of policy support, could be its potential to integrate electric vehicles in sustainable urban transport. Therefore, this section outlines the correlation between the Chinese ambitious goals on electro-mobility as well as the potential of carsharing as a driving force for electro-mobility.

In order to evolve into a leading market for New Energy Vehicles (NEV), the Chinese government aims to increase the sales volume of Battery Electric Vehicles (BEV), Plug-In-Hybrid Electric Vehicles (PHEV) and Fuel-Cell Electric Vehicles (FCEV) to 500 000 until 2015 and five million until 2020. One of the major efforts to approach this target was jointly initiated by the Ministry of Finance (MoF), the Ministry of Science

and Technology (MoST), the Ministry of Industry and Information Technology (MIIT) and the National Development and Reform Commission (NDRC) of the People's Republic of China in 2009. The 'Tens of Cities, Thousands of Vehicles Program' was introduced to integrate more than 150 000 NEV in the public fleets of 25 selected cities within a timeframe of three years (MoST 2010)^[2]. Besides subsidies of up to 120 000 RMB for the purchase of a NEV, other incentives, for instance the exemption from license limitations in cities with vehicle restrictions, aim to attain the targets set by the Chinese government (World Bank 2011). However, the efforts to accelerate the market entry of electric vehicles could yet not bring the estimated success. By the end of 2012 only 27 432 new energy vehicles were acquired, which causes a considerable discrepancy between the aims and the status quo of China's electro-mobility sector (Website Research and Markets). Considering the high total cost of car ownership, insufficient charging infrastructure and vehicle related limitations in terms of range and charging time as major barriers to the acceptance of electro-mobility, its technology adoption requires new and innovative solutions, such as the integration of electric vehicles in sustainable urban transport concepts.

Sophisticated European and North American e-carsharing schemes already demonstrate the feasibility and synergy potential of electric vehicles and carsharing services. By offering electric cars without the necessity to purchase the vehicles, carsharing is a promising concept to facilitate low-cost access to electric-mobility. In addition, carsharing is often used for short trips in urban and suburban areas, which decreases the implications on the mobility service due to limited range and charging time. For this reason, even though e-carsharing increases the level of financial and operational challenges for carsharing providers, it could multiply the environmental benefits of the

^[2] While the first phase (2009–2012) of the "10 city, 1 000 vehicles" program included 25 Chinese NEV pilot cities, the responsible ministries approved 23 additional cities as well as five city clusters to be pilots for a second round of NEV promotion at the beginning of November 2013. Since February 2014, another eight cities and four city clusters are included in the second batch of pilot cities.

mobility service and contribute to the overall acceptance and diffusion of electro-mobility (Knie *et al.*, 2012).

Particularly in view of the ongoing NEV development strategy in China, the government could profit by supporting the implementation of e-carsharing systems in different ways. On the one hand, e-carsharing is a promising approach to spur the diffusion of electric vehicles and to contribute to the government's ambitious goals on electro-mobility. On the other hand, electro-mobility alone will not solve the traffic related issues caused by

intensive private car ownership. Innovative mobility solutions, such as carsharing, are necessary to slow down the high demand of private vehicles and to decrease car ownership within Chinese megacities and metropolitan regions. With regard to these characteristics, the integration of electric vehicles in carsharing services could be a promising opportunity to draw political attention to carsharing in general as well as to generate the necessary endorsement and policy support from governmental authorities.

Testimonial Rainer Becker

Question:

“Although electric vehicles are often criticised for their high purchase price, limited range and long charging time, car2go offers fully electric carsharing fleets in Europe and the USA. Why does it make sense to integrate electric vehicles in carsharing systems?”

Testimonial:

“Electric vehicles and an urban mobility programme like car2go are a perfect fit: there are positive environmental effects of zero-emission-driving in dense urban areas; Citizens are getting familiar with electric-mobility for a moderate price. Still car2go is committed to sustainably, and thus economically, use electric vehicles in its fleets. With the cost structure of running EV's generally higher than for an ICE fleet, there will have to be measures to balance this to enable further large scale EV roll outs.

With the smart fortwo electric drive and its range of 140 kilometres we are using the perfect electric car for inner-city districts and common driving distances. With an average range between 5 and 15 kilometres most car2go rentals with an electric smart can be finished on

a regular parking spot without re-plugging the car2go to a recharging station. Only when the battery level is lower than 30 %, we ask our customers to terminate their rental at a recharging point. For this favour we provide an incentive. Most ca2go vehicles are re-plugged

before they reach a very low state-of-charge and they must not be re-charged to a full level before they could be rented again, so charging times are not an issue for the normal service.”



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Website: <http://www.car2go.com>,
<http://www.moovel.com>

4.1.3 Public Awareness and Acceptance

Due to the presently insufficient availability of sophisticated carsharing services, first empirical studies unveil a low level of public awareness as one of the consequential challenges for the development of carsharing in China. For this reason, in new markets, such as China, education and promotion of carsharing are crucial key criteria to raise the public awareness and acceptance of this mobility service.

In 2006, Martin and Shaheen conducted one of the first empiric studies on carsharing in Beijing. The scope of the study contained 840 respondents, who answered questions on their average mobility behaviour as well as specific questions on carsharing systems. To ensure a common understanding of carsharing, basic information about the mobility service was provided to the respondents before answering the questionnaire. Even though the results of the study show an incipient stage of interest in carsharing (26.4% of the respondents confirmed their interest), the average level of awareness aggregates to not

more than 10%. However, those who confirmed their interest in the mobility service are primary using public- and non-motorised transport modes to meet their daily mobility needs, indicating a promising condition in terms of carsharing acceptance (Martin und Shaheen 2010a). Figure 23 shows the overall choice of transport modes linked to the interest in carsharing stated by the respondents in Beijing (multiple answers were allowed).

To gain further knowledge on the demand of carsharing in China, Martin and Shaheen conducted another survey 2011 in Shanghai. The researchers received 271 responses from 4 000 conveyed questionnaires, which included a common definition of station-based carsharing. Compared to the survey conducted in Beijing, the respondents showed a higher interest in the mobility service. 53% of all respondents confirmed their interest in carsharing, most of them are frequent users of eco-modes (Martin *et al.*, 2011a). Similar to the outcome of empiric studies conducted in Europe, carsharing interest rises with education level and declines with higher age and household income. According to Figure 24, respondents, who are

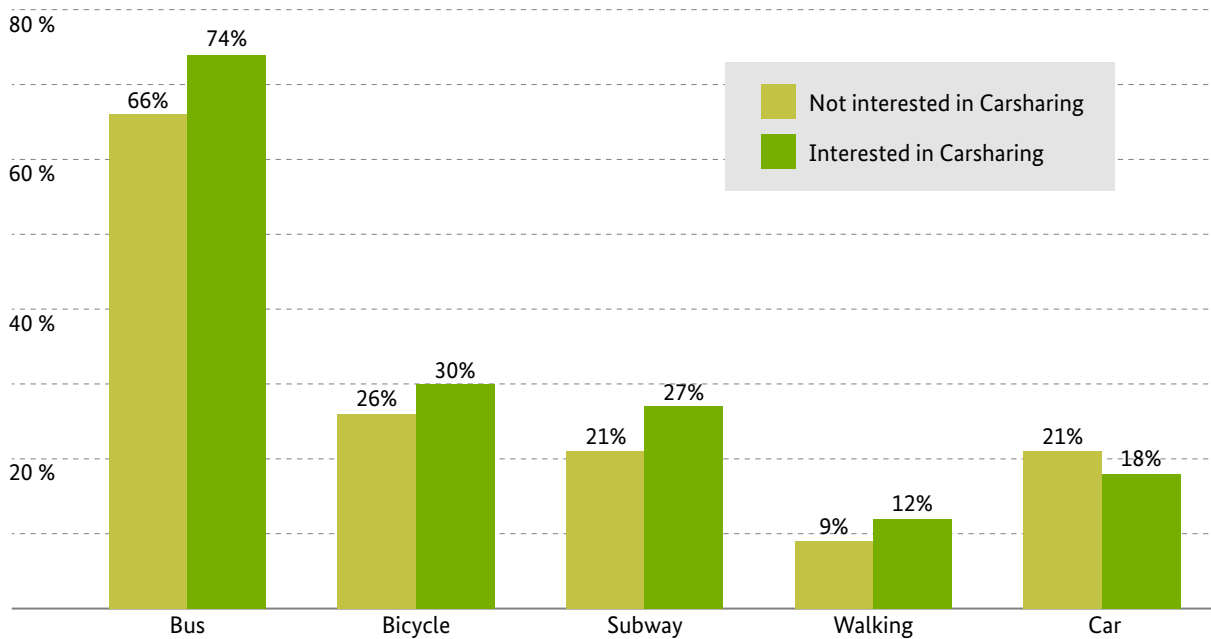


Figure 23: The correlation between choice of transport mode and carsharing interest in Beijing.

Source: Martin und Shaheen 2010a.

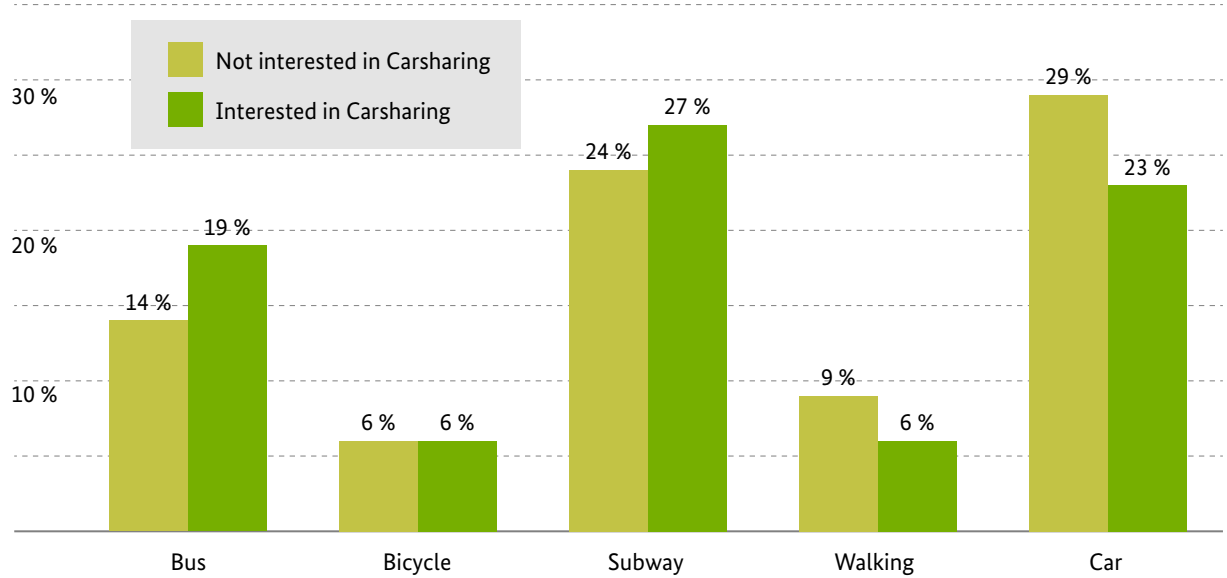


Figure 24: The correlation between choice of transport mode and carsharing interest in Shanghai.

Source: Martin *et al.*, 2011a

not interested in the mobility service are primarily using a car to meet their mobility needs.

Considering China’s landscape of urban transport, the acceptance of carsharing cannot only be affected by missing or insufficient awareness, but also by the availability of competitive mobility services. Particularly taxi transport can be considered as a potential competitor to (free-floating) carsharing, as it meets similar mobility needs by offering on-demand, short-term and pay-per-use access. While taxi services rarely exceed a share of 1% within the transportation mix of European and North American

cities, Chinese carsharing providers have to face the taxi as a more utilised component of urban transport. Mainly driven by inexpensive pricing and high availability, taxi mode shares of megacities, such as Beijing or Shanghai, can range from six to 12% (Martin *et al.*, 2011b). Nevertheless, the competitiveness of carsharing and taxi transport cannot be generalised, as it depends on specific use cases and individual mobility needs (especially in terms of the ratio of driving and parking). Therefore, carsharing companies can still complement the range of different transport modes without heavily affecting the taxi industry and vice versa.

Testimonial Liu Wenjie

Question:

“Insufficient public awareness and knowledge on the impacts of carsharing are major challenges for the development of this mobility service in China. How do these and other challenges impact on your business and what would be necessary to overcome them?”

Testimonial:

Regarding the current social environment, carsharing will certainly be one of the options to tackle China’s traffic problems. As car ownership is continuously increasing, it might even be the only possible way. According to our experience as carsharing operator, for most people it is quite easy to accept and adopt the business model of carsharing. Still, there are people who cannot or do not want to use smart devices and prefer the traditional way of car rental. We do not see the necessity to force them to understand the idea behind carsharing as we are convinced that they will understand the philosophy of our service once they have made their own experiences with it.

At present EduoAuto carsharing is facing two major challenges. The first challenge is parking. In Beijing, parking costs account for a large proportion of operating

costs. Moreover, parking demand is high and the availability of parking is limited. For this reason, we hope to receive support from relevant governmental departments in terms of the provision of exclusive parking lots for carsharing in public areas. The second

challenge is related to the variety of vehicle types included in the carsharing fleet. Only one or a few different cars cannot meet the demand of an average user. Therefore, related governmental authorities could help to establish and foster cooperation between automobile manufactures and EduoAuto.



Name: Liu Wenjie
Position: CEO
Company: EduoAuto
Website: <http://www.eduoauto.com>

4.2 Options for Governmental Authorities to Support Carsharing

According to the experience of mature carsharing markets, one of the key success factors to accelerate the development of carsharing is the endorsement and support from governmental authorities. In China, where the level of carsharing services is still low, a proactive thinking and acting of governmental authorities could help to create an environment in which the mobility service can flourish. For this reason, the following section outlines adequate monetary and non-monetary options for governmental authorities to support carsharing.

4.2.1 Monetary Incentives

Since the establishment of carsharing systems is tied to high financial investments, monetary support for both the initial and operational stage is a substantial measure to decrease the business risk for companies and to stimulate the carsharing market. Especially startup companies often depend on direct financing aid or tax reliefs until they reach a critical mass of customers. Depending on the availability of carsharing services, additional (indirect) monetary support can be granted, if governmental authorities supplement or substitute own corporate fleets by carsharing. The adoption of carsharing could not only help to increase the utilisation during business hours, but also provide a certain degree of planning security to the providers by guaranteeing a stable source of monthly

revenue. Moreover, governmental authorities could reduce the expenses for business travel, improve their own fleet management and encourage other companies to shift their mobility behaviour towards carsharing usage (Lytton and Poston 2012).

However, regarding the low level of carsharing providers in China, a more fundamental approach of monetary support could generate a larger impact on the development of the carsharing market. Government-funded pilot projects, for instance organised as state-run programs or public-private-partnerships, could be a potential strategy to accelerate the process towards the market maturity of carsharing in China (Le Vine and Scott 2012). As the development of bikesharing in China already demonstrated, pilot projects initiated by the public sector are an effective measure to raise public as well as political awareness and to spur the diffusion of mobility services. The implementation of Public Bicycle, a successful large-scale bikesharing system in Hangzhou, did not only help to gain experience in the field of mobility services, it also proved the viability of this application and encouraged other Chinese megacities to implement bikesharing (Martin *et al.*, 2011b). With regard to the development process of bikesharing systems in China, government funded carsharing pilot projects could generate a similar spillover.

4.2.2 Non-monetary Incentives

Especially on a local level, governmental authorities are responsible for various externalities, which facilitate the establishment of carsharing services. In this context, non-monetary support from local authorities is playing a key role for carsharing by setting the relevant policy framework. Effective non-monetary governmental support can be offered in terms of:

- Integrated Transport Planning;
- Parking Policies;
- Private Vehicle Disincentives;
- Carsharing Vehicle Incentives;
- Political and Public Awareness-raising.

Hangzhou Public Bicycle

The city of Hangzhou launched China's first bike-sharing system in May 2008. Under the guidance of the local authorities, Hangzhou Public Bicycle offers 60 000 bikes on more than 2 000 stations in eight city districts. Due to the successful implementation and the positive impact on the transport sector, other cities followed and bikesharing spread quickly across China. Today, more than 19 Chinese cities are offering bikesharing as a complementary non-motorised component of public transport (Martin *et al.*, 2011a).



Figure 25: Hangzhou Public Bicycle.

Source: Website ITDP China Bicycle Parking and Sharing Project

Integrated Transport Planning

An integrated transport planning strategy with carsharing as the automobile component of a sustainable urban transport network is a key success factor to spur the development and diffusion of carsharing services. The integration of carsharing in public transport can enhance the citizen's mobility, obviate the need of a private vehicle, and facilitate a rational choice of the most efficient

transport modes. Since the public transport sector is often strongly linked to governmental institutions, local authorities are in charge to encourage the cooperation between carsharing and public transport as well as to enforce the functional and technical connection of both modes.

Good Practice

The Brussels public transport operator “Société des Transports Intercommunaux de Bruxelles” (STIB) and the carsharing company cambio Brussels exemplify the synergy potential between public transport and carsharing. In order to enhance multi- and inter-modal transport in Brussels (Belgium), STIB supports the development of Cambio Brussels by facilitating the

integration of carsharing in public transport stations. In addition, STIB includes carsharing in the public transport maps as well as in its commercial marketing and advertising strategy (Loose 2009).

More information on the cooperation between Cambio and STIB can be found at <https://www.stib-mivb.be/cambio.html?l=fr>.



Figure 26: Cambio carsharing included in a STIB advertisement.

Source: Website Changemakers

Parking Policies

One of the most effective non-monetary incentives can be granted by authorising carsharing stations on public space. The provision of highly visible public on-street parking facilities in key locations, such as dense mixed-use urban areas with convenient access to public and non-motorised transport, decreases the expenses for carsharing operators and improves the inter- and multi-modal

transport integration of the mobility service. As a result, more potential customers can be attracted and larger impacts on urban transport and environment can be evoked. Adequate parking policies should not only regulate the provision of public parking space, but also include enforcement mechanisms to prevent non-carsharing vehicles from parking on carsharing stations. This is particularly important in areas, which are characterised by high parking demand (Cohen *et al.*, 2008).

Good Practice

The Free Hanseatic City of Bremen (Germany) facilitates the installation of carsharing stations on public ground by renting out public parking spaces to local carsharing providers that meet specific criteria set by the city government. In addition, the city introduced a unified design of the carsharing stations to increase their visibility and recognition value. As the first city worldwide,

Bremen determined these and other comprehensive carsharing support measures based on a comprehensive carsharing action plan (Glötz-Richter 2012).

The Action Plan “Carsharing for Bremen” can be downloaded at: http://www.mobilpunkt-bremen.de/data/files/110/aktionsplan_carsharing.pdf (only in German).



Figure 27: Carsharing integrated in a residential parking area in Bremen.

Source: Michael Glötz-Richter, Bremen

Private Vehicle Disincentives

While parking is an essential topic in terms of non-monetary carsharing support, the introduction of push-and-pull strategies is an additional option to accelerate the diffusion of the mobility service. Carsharing will be most likely successful in an environment with a high level of private vehicle disincentives and easy accessible alternative modes of transportation. Thus, restrictions and regulations of private vehicles, for instance fuel-consumption-based vehicle fees and vehicle licensing limitations, are measures to decrease the attractiveness of private vehicles and to encourage people to adopt a lifestyle that does not build on car ownership (Bundesverband CarSharing e.V. 2010). In order to generate a greater benefit for carsharing based on individual transport disincentives, the understanding of policy makers to exempt carsharing companies is crucial.

Carsharing Vehicle Incentives

In addition to individual transport disincentives, local authorities can introduce privileges for drivers of carsharing vehicles. The exclusion from congestion charging and the provision of designated parking spaces for carsharing vehicles are exemplary measures to improve the usability of carsharing in congested areas and to incentivise the adoption of the mobility service. (Bundesverband CarSharing e.V. 2010). As already mentioned before, the exemption of the carsharing systems from private vehicle disincentives can be a further possibility to provide privileges for users of the mobility service.

Nevertheless, an incentivisation of carsharing based on road transport privileges should not pose a challenge to other public transport modes. In this context, the permission of additional vehicles on bus lanes, for instance carsharing or electric vehicles, is often a controversial topic among transport planners and city officials.

Good Practice

Due to persistent air pollution above European standards, the city of Paris (France) imposed a partial car ban in March 2014. While cars with even-numbered license plates were banned from the city centre, Autolib's electric carsharing vehicles could be used without any restrictions. Moreover, the city granted free of charge access to carsharing, bikesharing and public transport (Website New York Times).

More information on the Paris based carsharing provider Autolib' is available at: <http://www.autolib.eu/en>.



Figure 28: Autolib' E-carsharing Station in Paris, France.

Source: Dominik Schmid, 2013

Good Practice

Based on the “Iniziativa Car Sharing” (ICS), Italy provides extensive support for carsharing services, which includes legally approved incentives for drivers of carsharing vehicles. Exemplary incentives are free of charge access to low emission zones and free parking in city centres (Bundesverband CarSharing e.V. 2010).

More information on the Italian Carsharing Initiative can be found at: <http://www.icscarsharing.it/main/english/ics-car-sharing-initiative>.

Table 4: Carsharing Members, Vehicles and Stations in Italian Cities Supported by ICS (June 2014)

Cities	Members	Vehicles	Stations
Bologna	1 159	39	28
Brescia	120	6	5
Firenze	613	16	16
Genova/Savona	2 339	55	45
Milano	6 530	137	75
Padova	143	11	11
Palermo	857	43	31
Parma	372	10	10
Roma	3 313	115	78
Torino	2 420	121	76
Venezia	4 018	44	18
Total	21 884	597	393

Source: Website ICS – Iniziativa Car Sharing

Political and Public Awareness-raising

As the political as well as public awareness of carsharing is still low in China, awareness-raising is an essential component of non-monetary carsharing support. Especially on a political level, relevant ministries of the central governments should provide comprehensive information to local authorities, such as mayors and planners, in order to generate awareness of the functionality, impacts and benefits of carsharing services. Based on this

Good Practice

Together with the central transport coordination agency Transport for London (TfL), London’s city government introduced a Car Clubs Strategy to support local car clubs (carsharing is considered as car clubs in England) to reach market readiness. Based on workshops, public events, flyers, etc. local authorities actively promote the concept of carsharing and its benefits for individual users, transport and environment (Bundesverband CarSharing e.V. 2010).

London’s Car Clubs Strategy can be downloaded at <http://www.tfl.gov.uk/cdn/static/cms/documents/tfl-car-club-strategy.pdf>.



Figure 29: A designated parking space for car club vehicles in London, UK (operator-independent).

Source: Armin Wagner, 2014

knowledge, local authorities can assess the city-specific value of carsharing and promote the development of the mobility service in their transport planning departments as well as among the public. On a customer based level, governmental-supported marketing campaigns, media events, advertisement on public space and other measures with a high publicity potential cannot only increase the public awareness, but also contribute to the general acceptance of carsharing schemes (Bundesverband Car-Sharing e.V. 2010).

Testimonial Wang Hao

Question:

“Governmental support on a national as well as local level is one of the main reasons for the positive development of carsharing in Europe. How could the government try to promote this new mobility service in China?”

Testimonial:

“As a new type of transport mode, carsharing plays a prominent role in relieving urban traffic congestion, reducing energy consumption and environment pollution as well as effectively enhancing the attraction of public transport. China is in an important phase of rapid urbanisation and carsharing can provide a complementary solution to solve the urban traffic problem. Therefore, the government should intensify propulsion to promote carsharing from three aspects.

First is to include carsharing in urban planning. A reasonable distribution of parking space is one of the key success factors of carsharing. The government should consider carsharing as an important mobility service in terms of urban development planning, and designate parking space for carsharing in the planning of airport, railway station, metro station, and new communities.

Secondly, carsharing should be promoted by complementary policy instruments. The introduction of complementary policies, for instance in terms of on-street parking, park and ride and central area parking

restrictions, as well as the introduction of generous policies for carsharing cars to cultivate carsharing development are crucial.



Thirdly, governmental efforts to promote carsharing and carsharing related benefits can shift the mobility behaviour of urban residents towards carsharing and public transport. The government should endorse low carbon travel and make more people understand and participate in carsharing.”

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Institute: Research Institute of Highway, Ministry of Transport of the People’s Republic of China
Website: <http://www.rioh.cn>

4.3 Compound Carsharing – A Promising Option to Jump-start Carsharing in China?

Since the previously outlined challenges for carsharing in China are mainly caused by external factors, the integration of this mobility service in micro residential districts, often referred to as compounds, could be a promising short-term solution to foster the Chinese carsharing development. More than 90% of the Chinese urban population lives in densely populated semi-private accessible compounds, which usually provide underground car parks for residents (Website Goethe-Institut). Based on the cooperation with real estate developers and property owners of compounds, carsharing providers would be able to gain access to private parking facilities and to offer the mobility service exclusively to residents. In this way, compounds provide an appropriate environment for the implementation of small-scale station-based carsharing systems, which can be successively expanded according to the acceptance and demand of the residents. The business risk for providers of the mobility service is low and the above-mentioned challenges for carsharing in China can be mitigated in different ways.

On the one hand, compound carsharing minimises the relevance of political endorsement and support, as the cooperation with the real estate industry facilitates access to private parking areas and decreases the dependency on public space to set up carsharing stations. Except for regulations and restrictions on motorised individual transport imposed in major Chinese cities, compound carsharing facilitates the implementation of this mobility service with little involvement of governmental authorities. On the other hand, the exclusive provision of carsharing to residents of compounds enables carsharing operators to address a defined group of potential customers. Consequently, target-group-specific marketing activities can be realised and costs as well as effort required due to the problem of insufficient public awareness can be reduced to a minimum level.

After all, compound carsharing is not only an option to implement a feasible business model and to spur the overall carsharing development in China, it can also help to generate a unique selling-point for real estate companies

by offering an additional comprehensive mobility solution to tenants. Especially in densely populated metropolitan areas, where it is inconvenient to own a private vehicle, carsharing can unleash its potential as a complementary part of public transport and encourage a lifestyle that does not build on car ownership. Together with the increasing level of disincentives for private vehicles, the provision of compound carsharing as a viable alternative to private car ownership could significantly influence the personal choice of residence and attract new or retain existing tenants. In this regard, real estate developers are able to generate synergies with the carsharing industry by embracing the mobility service as a marketing-tool, which contributes to the value and attractiveness of real estate properties.

Thinking about further possibilities to implement the concept of compound carsharing, business and particularly mixed-use properties would be suitable locations for an on-site adaption of the mobility-service. While carsharing usage of private customers generally concentrates in the evening and on the weekend, business customers are potential daytime users. Thus, a mix of private and business customers can lead to a higher and more balanced utilisation of the vehicles and raise the profitability of the mobility service. In addition, business properties can improve their competitiveness as business locations by offering a complementary cost-saving mobility solution for corporate fleets.

Altogether, compound carsharing could be a promising option to avoid major challenges for the implementation of carsharing systems in China and to provide a first feasible basis for the further development of this mobility service. A carsharing scheme designed as a compound integrated application could evoke the niche potential of carsharing to fill existing gaps between traditional transit and private vehicles and therefore relief residents from the dependency of private car ownership. Together with cooperation partners from the real estate industry, carsharing providers could unfold synergies by providing an environmental friendly mobility solution for residential, business or mixed-use compounds. As a positive side effect, this approach could support the overall diffusion of carsharing in China and raise the political as well as public awareness of this mobility service.

Testimonial Felix Somerville-Scharf

Question:

“Compound carsharing could be a possible option to set up a carsharing scheme in China, which is less dependent on the support of local authorities. How do you rate the chances of success of such a carsharing scheme?”

Testimonial:

“Although parking space in compounds is often rare and primary reserved for residential usage, the previously defined compound scheme could be a promising approach to set up carsharing in China with a great synergy potential for participating companies.

By offering an eco-friendly mobility solution on-site, real estate companies could not only add a unique selling point to their properties, but also optimise the living conditions for residents as well as the utilisation



of parking facilities. Depending on the residential structure of the compounds, carsharing operators could gain access to a high density of private affluent customers and therefore provide target-group-specific mobility on demand.”

Name: Felix Somerville-Scharf

Position: Head of New Mobility

Company: Volkswagen New Mobility Services

Website: <http://www.vwnms.com.cn>

5. Conclusion

Due to the rapid pace of motorisation, rising car ownership turned from an economic driving force into a major concern across Chinese megacities and metropolitan regions. The increasing vehicle population poses a risk to the sustainable development of transport and environment, and exacerbates the pressure on political decision-makers to ensure urban livability. Since various cities across China have already reached saturation point with respect to private car ownership, comprehensive demand-oriented solutions are necessary to react to the ongoing urban mass motorisation. In this context, the promotion of innovative mobility services, such as carsharing, could be a promising approach to decelerate the high demand of private vehicles and to ease the tense situation of China's urban transport sector.

Despite its capability to impact on private car ownership as well as to shift mobility patterns towards public and non-motorised transport modes, Chinese carsharing activities are still in an initial phase. Up to today, most efforts to establish the mobility service remained small-scale or could not succeed in the market. Although relevant mobility indicators, such as the choice of transport modes and the purpose of trips, point towards a promising environment for the implementation of this mobility service in Chinese megacities, inadequate political conditions as well as insufficient public awareness are major challenges for the expansion of the carsharing market in China.

While restrictions and regulations of motorised individual transport are first governmental measures to increase the demand of alternatives to private car ownership in various Chinese megacities, the political endorsement to actively support this mobility service is still low and appropriate strategies to promote carsharing schemes are missing. However, governmental support strategies are often a key success factor for carsharing, as the feasibility of this mobility service is strongly dependent on a broad range of externalities regulated by the administrative sector. For this reason, especially non-monetary policy support, such as public parking spaces dedicated to carsharing, could be an option for governmental authorities to support the establishment of sophisticated carsharing systems with a positive impact on urban transport and environment.

But the current legal and political framework does not only implicate challenges for the development of carsharing services in China. As the Chinese government struggles to accomplish its high level goals on electro-mobility, e-carsharing offers the potential to gather momentum for the whole industry. While the high purchase price, limited range and long charging time affect the diffusion of electric vehicles especially among private consumers, innovative strategies and different use patterns of electric vehicles are necessary to commercialise this new technology. The integration of electric vehicles in carsharing systems facilitates a substantial compensation of the above-mentioned constraints by providing a rental-based, professionally managed and easy accessible consumer platform for electro-mobility. Thus, being one of the most promising concepts with the potential to encourage the acceptance and usage of electric vehicles, carsharing could benefit by gaining political attention as a climate-friendly electro-mobility solution.

To jump-start the Chinese carsharing market, an integrated concept – carsharing linked to micro residential districts – could be a first promising approach to overcome a wide range of challenging factors and to establish a first feasible carsharing application on a short-term basis. Similar to the evolution of bikesharing in China, the implementation of a successful carsharing system, which is accepted on a political as well as public level, could lead to the emergence of spin-off effects and contribute to the overall development of carsharing. If eventually embraced by governmental planning, this mobility service may not only develop on a more stable and promising basis, it could also be implemented as a countermeasure to the high demand of private car ownership in urban areas as well as a compelling force for the acceptance and diffusion of electro-mobility.

6. A Practitioner's Contribution

What a City Government Can Do – The Example of the City of Bremen (Germany)

Written by Michael Glotz-Richter [*]

The Free Hanseatic City of Bremen (population 550 000) is a traditional harbour city in the North of Germany. The municipality is quite ambitious in the field of sustainable transport and quality of life. Bremen has received several awards for its transport strategies and pro-active integration of carsharing.

Carsharing started in Bremen in 1990 as a club with three cars and 28 users. The city currently has three operators (all station-based). The largest operator, cambio, has more than 9 000 customers (May 2014) and a fleet of about 200 cars at 60 stations in the city. All of the local providers operate as private market-based businesses.

eight “treasures” are listed here and described below in more detail:

1. Embedding in an overall transport and urban development strategy;
2. On-street carsharing stations;
3. Integration into neighbourhood parking management;
4. Integration in new urban developments;
5. Integration with public transport;
6. Using carsharing to make fleet management more efficient;
7. Quality standards/certification;
8. Public relations and awareness raising.

The Eight Treasures for the Successful Implementation of Carsharing – Eight Fields of Municipal Support by the City of Bremen (Germany)

It is possible to identify eight concrete measures that the City of Bremen has undertaken in its efforts to fully exploit the potential of carsharing within the city. These

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Figure 30: 2013 European Sustainable Energy Award.

© M. Glotz-Richter, Bremen



Figure 31: Guangzhou Award for Urban Innovation.

© M. Glotz-Richter, Bremen

6.1 Embedding Carsharing in an Overall Transport and Urban Development Strategy

Bremen is continually improving its public transport network and promoting cycling and it has a strategic objective of reducing the number of cars on its streets. Carsharing is not a stand-alone measure but is embedded into the city's urban development and transport strategies. Today, cycling accounts for more than 25% of all trips of Bremen's citizens, and the city has a goal of 30% by 2020. The city's goals and strategies are intended to allow as many people as possible to make their daily trips by the sustainable modes of walking, cycling and public transport. Carsharing in Bremen is seen as a supplement to the sustainable modes; only together they can be an alternative to the private car.

In addition to the other transport-related strategies, in which carsharing is embedded, Bremen adopted the world's first Carsharing Action Plan in September 2009. This clearly defined the interest of the municipality in carsharing and set a target for its development of at least 20 000 carsharers – equating to approximately 6 000 private cars removed from the streets – by 2020. This would quadruple the use of carsharing in Bremen as compared to 2008.

Currently, the City of Bremen undertakes a revision and update of its strategic transport concept ('Verkehrsentwicklungsplan' – see <http://www.bremen-bewegen.de>). The concept and process fulfils all requirements of a "Sustainable Mobility Plan" (SUMP) and the online tools of the participation process are a leading example of using modern technology for a broad involvement of citizens.



Figure 32: Quality of life and good conditions for business go together in Bremen; The historic city centre is pedestrianised and well connected by tram.

© M. Glotz-Richter, Bremen



Figure 33: Bremen's cycling culture is supported through a growing number of cycle streets.

© M. Glotz-Richter, Bremen

The Internet Forum about the transport strategies (with an electronic map where citizens could put on 'stickers' and other citizens could comment on these proposals) had 35 000 active visitors, 4 200 entries (proposals) and 9 500 written comments.

6.2 On-street Carsharing Stations

To make carsharing attractive, it is necessary to provide carsharing stations close to its customers. In the historic inner city areas with the highest demand and the biggest parking problems, the only option for carsharing stations is in public street space.

Since 2003, the City of Bremen has provided space for carsharing at mobility points (*mobil.punkt*). These stations

are marked by a three metre tall pillar and are placed very visibly in public street space. They include reserved parking for the carsharing cars and bicycle racks. The *mobil.punkt* stations are either close to public transport stops or in the centre of residential neighbourhoods.

The provision of street space for accessible and visible carsharing stations at attractive locations close to the users is one of the key ingredients of successful carsharing implementation.



Figures 34, 35: Bremen: *mobil.punkt* carsharing stations – with pillar and bike racks.

© M. Glotz-Richter, Bremen

6.3 Integration into Neighbourhood Parking Management

Carsharing is part of neighbourhood parking management in Bremen. Being aware that there is not enough street space to accommodate so many cars, Bremen decided that carsharing is a smart, cost-efficient measure to re-organise parking management.

Since 2013, a strategy has been in place to add a number of smaller carsharing stations (*mobil.punktchen*) in very small streets in order to relieve the parking situation there. The design includes extended kerbstone at intersections to reduce the problems of illegal parking. This approach eases the work of waste collectors and fire fighters, whose vehicles were often blocked by parked cars.



Figure 36: Small carsharing station in Bremen (mobil.pünktchen).
© M. Glotz-Richter, Bremen

Mobil-Pünktchen setzt Zeichen

Umgestaltung von Kreuzung in Seitenstraßen des Viertels dient der Rettungssicherheit

VON BETTINA GOSSLER

Rund 8.600 Kunden nutzen in Bremen bereits die Möglichkeit des Car-Sharings. Die meisten von ihnen leben im Viertel und haben jetzt das erste „Mobilpünktchen“ der Stadt in ihrer unmittelbaren Nähe.

STENTOR Ein „Mobilpünktchen“ ist die kleinste Version einer Car-Sharing-Station. „An dieser Stelle sind zwei bis drei Wagen stationiert“, erklärte Kerstin Hornigshausen, Geschäftsführerin des Anbieters „Cambio“, vor der Einweihung des Standortes an der Ecke Schmidtstraße/Hollerstraße. Ein solcher trage nicht nur zu einer „nachhaltigen Mobilität“ bei, wie Verkehrssenator Joachim Lohse (Grüne) sich ausdrückte. Er habe ganz nebenbei auch andere Vorteile. Davon sprach „Viertelbürgermeister“ Robert Rücking: „Wir haben hier das Problem eines unendlich überparkten Quartiers und hoffen, aufgrund von Car-Sharing, dass



Für Rettungswagen und Müllabfuhr ist es wichtig, die Kurvenbereiche passieren zu können. An der Ecke Schmidtstraße/Hollerstraße ist das jetzt wieder möglich. Fotos: Schlie

Figure 37: Media coverage describes the improvement for waste collection vehicles due to carsharing.
© M. Glotz-Richter, Bremen

The Bremen carsharing operator cambio has reached a service level such that every carsharing car equates to removing eleven private cars from the streets. Thus the installation of an ever-growing network of carsharing stations both helps to make carsharing more attractive and also reduces the pressure on limited parking space.

Replacing private cars:

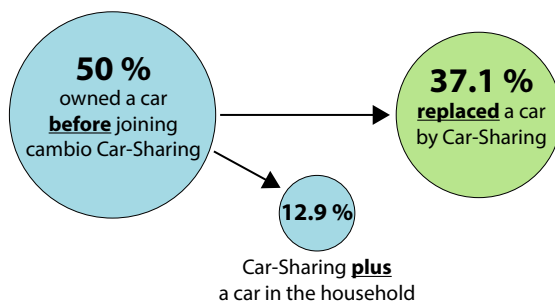


Figure 38: Impacts of carsharing in Bremen.
© M. Glotz-Richter, Bremen

6.4 Integration in New Urban Developments

Most new developments are still built with a great deal of car parking. For new housing or office developments in locations with good public transport and good cycling conditions, it makes sense to reduce the amount of parking and integrate carsharing.

As part of its building regulations, the City of Bremen revised its parking requirements for new developments. The regulations now require a higher standard for bicycle parking, while for car parking the developer has a choice of providing parking or offering mobility management options – including carsharing. It is thus possible to integrate carsharing to reduce the number of parking bays required. Fewer parking spaces mean lower construction costs for new urban developments, meaning more incentives can be offered for the use of walking, cycling and public transport – supplemented by carsharing.

This change in regulations helps to limit the car traffic often generated by new developments. It also offers benefits to the users: they don't have to pay for a parking space but they have access to a range of carsharing vehicles.



Figures 39, 40: Bremen: publicly accessible carsharing station on the estate of a new housing development (2002).

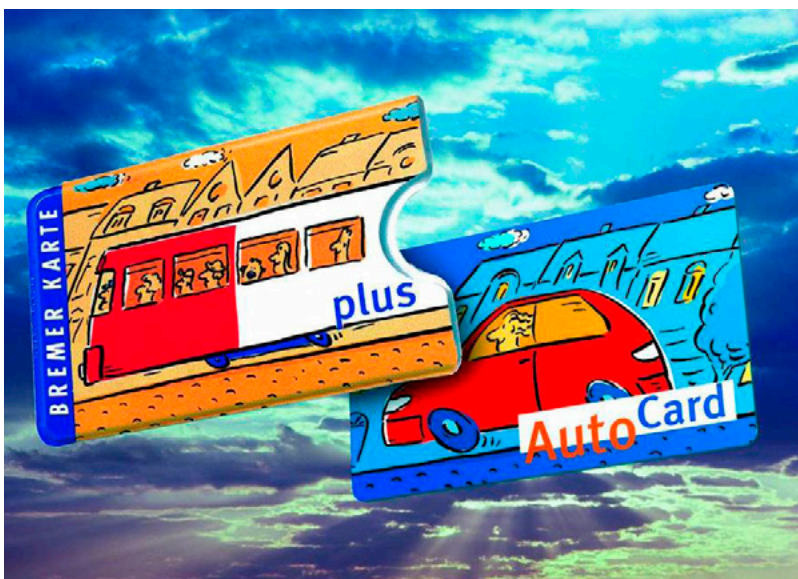
© M. Glotz-Richter, Bremen

6.5 Integration with Public Transport

There is synergy between the public transport and car-sharing. The public transport system covers most daily trips, but a car is still sometimes needed.

A core element of a new mobility culture is the promotion of public transport and cycling – supplemented by

carsharing – as an attractive alternative to car ownership. In Bremen, the collaboration between the public transport operator and the carsharing operator has a long history: the joint public transport season ticket with carsharing access – known as the *Bremer Karte plus AutoCard* – was implemented in June 1998.



Figures 41, 42: Promotion of the Bremer Karte plus AutoCard.

© M. Glotz-Richter, Bremen

The combination of a public transport season ticket with carsharing extends the service of public transport and creates a more solid ridership base for public transport and a less car-dependent lifestyle. There is combined promotional work and the carsharing stations are marked on the maps of the Bremen public transport operator.



Figure 43: Taxi transport integrated in a carsharing station in Bremen.

© M. Glotz-Richter, Bremen



Figure 44: Bremen's public transport map indicates carsharing stations.

© M. Glotz-Richter, Bremen

Taxis are also part of that strategy. The call centre for carsharing is operated by the taxi company over night. The rationale is easy to understand: those who do not own a car are more frequent taxi customers.

6.6 Using Carsharing to Make Fleet Management More Efficient

The City of Bremen uses carsharing to improve the efficiency of its own fleet management. In 2003, the Senator for Environment and Construction started to reduce the department's fleet by using carsharing instead. Since then, the department has – except for a few specialised vehicles – moved completely from its own fleet to carsharing.

Ten years of experience show the advantages: more cars are at the city's disposal to meet peak demand more easily. In addition, the administration mainly uses cars during working hours while private demand is stronger in the evening and on weekends. The needs are complementary making the use of each car more efficient.

A major advantage for an administration or company is that the cars are managed by the carsharing operator. The fixed costs are low and the cost for each journey is completely transparent – An important ingredient for efficient cost management.



Figures 45, 46: 2003 – New fleet management for the Bremen administration – today many companies use carsharing.
© M. Glotz-Richter, Bremen

The City of Bremen also offers workshops together with the Chamber of Commerce to show how companies (especially start-ups) can keep costs low while still maintaining the mobility of their workforce.

6.7 Quality Standards or Certification

Not every carsharing service is leading to similar impacts – especially on car ownership. A good carsharing system should be an alternative to owning a private car. Thus, it must be able to allow not only urban but also regional trips. Family-friendliness is another important aspect.

The City of Bremen requires certain standards to be fulfilled by a carsharing operator if the operator wants to use public street space for stations. Bremen initiated a certification for carsharing providers under the official German “Blue Angel” eco-label. The main requirements for Blue Angel certification are:

- High service quality (24-hour reservation, 24-hour pickup and 24-hour car return);
- A tariff structure based on time and mileage (*i.e.* no free kilometres);
- A tariff structure that encourages short-time use;
- Low emission and low noise vehicles;
- Regular care and maintenance of vehicles.



Figure 47: The official German “Blue Angel” eco-label. The full set of requirements can be found in English at <http://www.blauer-engel.de/en/index.php>.

In Bremen, operators must also present results of annual user surveys about the replacement of private cars. Only when a carsharing operator can demonstrate (through before and after customer surveys on car ownership) how many cars really are replaced, the privilege of street space is provided.

6.8 Public Relations and Awareness Raising

As the general public is still generally not aware of car-sharing, awareness raising is an absolute “must” if a municipality wants to get carsharing started. The city has options such as:

- Mentioning carsharing in regular media reports (e.g. when discussing the issue in political committees);

- Using billboards (especially near to public transport stops and stations);

- Running campaigns.

The City of Bremen has carried out a number of such activities. Currently, a comic person called Udo (a German man’s name, but also an acronym for *Use it. Do not own it!*) shows that he has a better life when using carsharing instead of owning a car – as he has more time, more money and more choices.

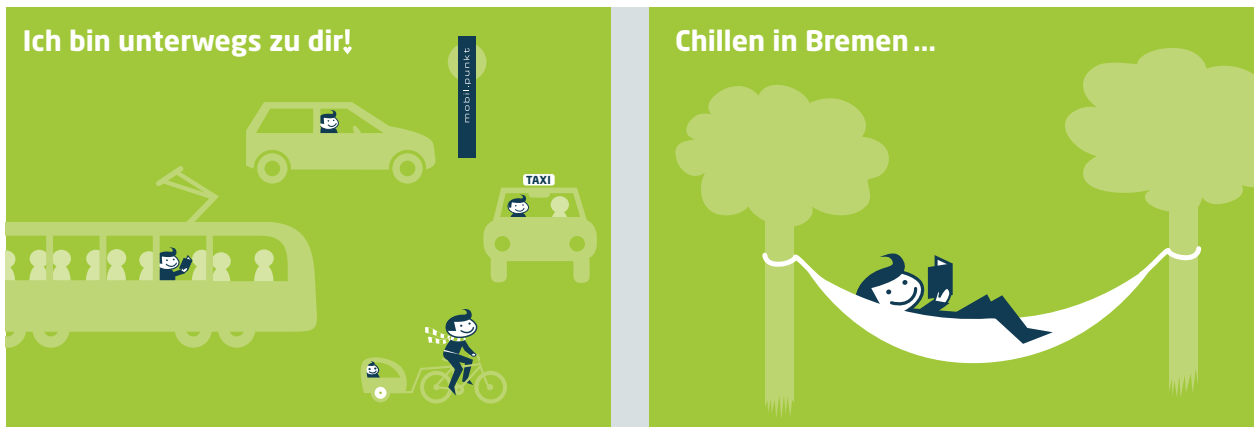


Figure 48 a, b: Udo (an acronym for “Use it do not own it”) in Bremen: using all modes of transport and having more time (as he does not need to take care of a car).

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A tram operated in Bremen during the 2010 world exposition in Shanghai saying in German and Chinese: always the right vehicle (ranging from the bicycle to various carsharing cars to bus and tram).

Figure 49: Reference to the EXPO2010 in Shanghai: Carsharing promotion on a tram: “always the right vehicle” indicating that public transport, cycling and carsharing belong together.

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During the 2010 EXPO (where Bremen presented car-sharing), promotional activities in Bremen used the Chinese characters for carsharing – linking the EXPO in Shanghai with local carsharing development.



Figure 50: Carsharing T-shirt – Bremen promotes carsharing at the 2010 EXPO in Shanghai.

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But the most beloved promotional activity is still a post-card asking simply: “*Would you buy a cow for a glass of milk?*”



Figure 51: Promotional postcard: *Would you buy a cow for a glass of milk?*

© M. Glotz-Richter, Bremen

6.9 Conclusion

Carsharing has huge potential to improve quality of life and traffic conditions in cities. The City of Bremen has been successfully integrating carsharing in its strategies for more than a decade, and is an example for many

other cities in Germany, in Europe and abroad. Every of the “Eight Treasures” of the strategic integration into urban policy making reinforce each other and jointly they develop a high level of synergy.



Figure 52: Michael Glotz-Richter at the EU-China Exhibition on Urban Development 2013 in Beijing, China.

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