CASE STUDY

CARSHARING IN HANGZHOU, CHINA

A Focus Group Study

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Executive Summary

China is experiencing rapid motorization at an unprecedented rate. Carsharing began in China in 2009. As of June 2014, there are five active carsharing operators running about 1,000 vehicles in total in Beijing, Shenzhen, Shanghai, Hangzhou, Wuhan, and Changsha. However, little information exists concerning carsharing’s market potential, operation model, or its social and environmental impacts in Chinese cities.

This report presents a focus group study on an existing two-way carsharing model in Hangzhou, China conducted in October 2012. We invited 48 young working professionals to the focus group, including 12 existing carsharing members and 36 non-members between the ages of 20 and 40. The focus group explored market interest, service requirements, barriers and opportunities, and potential impacts of the two-way carsharing model from the demand side of the market. This report describes the methodology as well as the initial findings.

CONTENTS

Executive Summary 1
Introduction 3
Methodology 6
Key Findings 11
Conclusion 22
Appendix 1 24
References 25

A Product of The WRI Ross Center for Sustainable Cities
Our key findings include:

**Significant market interest among young working professionals in Hangzhou:**

- 34 out of 36 non-member participants showed interest in trying the service; 48% of participants would use carsharing at least three times a month; non-car owners and people with lower median incomes were likely to use the service more frequently than others.

- There was significant interest in using carsharing for leisure trips, and some interest in occasional business trips and weekend hometown visits; interest in shopping trips seemed to be limited.

**Carsharing’s barriers and opportunities from the users’ perspectives:**

- Aspirations for vehicle ownership might be a barrier, as one-third of participants recognized the status value of personal cars.

- Vehicle travel restrictions and limited parking spaces might create more opportunities for carsharing in Hangzhou, as they both increase the cost of owning a personal vehicle.

- Interest in carsharing is positively associated with the level of service of public transportation.

**Users’ suggestions for carsharing program design:**

- Situate carsharing stations within a 10-minute walk from places of residence or employment, and integrate the stations with community parking programs and/or other transportation infrastructure such as bus stops and bikesharing stations.

- Offer a diverse fleet of vehicles. Carsharing fleets with economical and/or electric vehicles were acceptable to most participants due to their affordable price and low gasoline costs. There was also a noticeable interest in luxury cars.

- Participants considered current pricing structures that combine an hourly rental rate and distance-based gasoline fee to be reasonable, though some participants were very price-sensitive, especially to the distance-based fee.

- Most participants wanted carsharing to operate like one-way station-based bikesharing programs in the city.

**Foreseeable positive impacts on household vehicle holding**

- 23 out of 48 participants would consider delaying or forgoing their vehicle purchase plans if carsharing services were conveniently available in their neighborhoods.

- Among the 16 people who regarded cars as a symbol of social status, 8 would delay or forgo their car purchase plans due to the availability of carsharing program.

This case study is an early attempt to understand market interest, users’ service requirements, and the social and environmental impacts of carsharing in a typical second-tier Chinese city. The results may serve as a basis for future research in this rapidly-evolving field, especially with regard to social and environmental impacts, operational model modification, and relevant governmental policies.

This publication comprises one part of the “Carsharing in Emerging Economies” research project. The other forthcoming publications include a global report and a focus group case study in Bangalore, India.
1. INTRODUCTION

Carsharing is a membership-based, self-service car rental system with a network of stations and vehicles, for which members pay by the time or distance they use the vehicle (Millard-Ball 2005). As of October 2012, more than 1.8 million members around the world were using this service via a network of over 45,000 shared vehicles (Shaheen 2013). In well-established markets (Europe and North America), carsharing has shown positive impacts in reducing vehicle kilometers traveled (VKT), mitigating greenhouse gas emissions (GHGs), delaying or replacing car ownership, and increasing people’s access to auto mobility. There are several carsharing models in operation today: a two-way model, in which users pick up and drop off a vehicle at the same station; a one-way station-based model, in which users can drop off the vehicle at a different designated carsharing station; a free-floating system, which allows user to access and return the vehicles freely within a defined zone of a city, with no fixed positioning of cars and others like peer-to-peer carsharing.

Carsharing is more established in Europe and North America, and was barely available in China before 2010. However, it has gradually emerged along with the country’s rapid motorization. As of February 2013, the total number of motorized vehicles in China hit 120 million (Ministry of Public Security PRC 2013). The annual growth rate of vehicle sales between 2005 and 2010 was as high as 24.5% (China Statistical Yearbook 2006-2011). Against this background, the country’s first carsharing operation began in Beijing in 2009. In October 2012 when we conducted the focus group, there were two carsharing operators (CSOs) running a total of 39 vehicles in Hangzhou and Beijing. As of June 2014, China’s carsharing network has grown to a total of about 1,000 vehicles, with five active CSOs operating in Beijing, Hangzhou, Wuhan, Shenzhen, and Changsha.

Despite the rapid growth, little knowledge exists of carsharing’s workability and impact in Chinese cities. This focus group study aims to fill the gap.

This focus group is part of EMBARQ’s “Carsharing in Emerging Economies” project, which explores the feasibility and sustainability of carsharing in developing countries. The research project is structured in three phases: literature reviews to understand the status quo, expert interviews with CSOs and mobility experts to gather information from the supply side of the market, and focus groups to look into the demand side. Hangzhou was selected as one of the two cities in which to conduct a focus group, because it is a second-tier Chinese city with an active carsharing service (called EVnet). In addition, the city has the world’s second-largest bikesharing program, with 65,000 public bikes in 2012. When the research was conducted, both CSOs in China operated two-way systems, so this focus group centered on the two-way carsharing model. The literature reviews and expert interviews from earlier phases of this project informed the hypotheses and research questions. Young working professionals were selected as the targeted community, as they were considered to be the early adopters of carsharing.

The purpose of this focus group study is to understand the demand side of the carsharing market in Hangzhou, China. Our key research questions include:

- What is the market interest for carsharing in Hangzhou?
- What do users see as the barriers and opportunities for carsharing in Hangzhou?
- From the users’ perspectives, how should carsharing services be designed?
- What might be the social and environmental impacts of increased carsharing?

The report is structured in four sections. The first section describes the research questions and introduces the status quo of carsharing in China and the city of Hangzhou specifically. The second section describes the methodology, including target community, hypotheses, organization of focus group meetings, and analytical methodology. The third section presents the key findings and analysis of the focus group. The paper concludes with a discussion of the prospects for carsharing in China.
Carsharing in China

From the first CSO founded in Beijing in 2009, to two CSOs in operation in 2012, and to five active CSOs in 2014, China’s carsharing industry has been evolving with an increasing speed. As of June 2014, five active carsharing operators—Eduo Auto, EVnet (later renamed Chenfenxiang), Weigongjiao (same as Kandi Technologies), E-car (or Beijing EV Partnership), and car2share—have offered a network of nearly one thousand vehicles across five Chinese cities. Among them, Eduo Auto and EVnet are the more established CSOs. Weigongjiao and E-car use pure electric vehicles in their programs, with some governmental support. Car2share is a pilot program established by a global carsharing network. Overall, the carsharing industry is small in China now, but may grow rapidly in the future.

- **Eduo Auto** is the oldest carsharing operator in China, starting in Beijing in 2009. For the first three years it operated with only seven cars, due to Beijing’s vehicle license quota system. In 2013, Eduo Auto expanded to two other Chinese cities, Wuhan, Hubei, and Changsha, Hunan. According to the company, it now has more than 200 vehicles and serves over 20,000 registrants.

- Another established carsharing operator (CSO) is **EVnet (also called China Car Clubs, or Chenfenxiang)**, which started operation in 2010 in Hangzhou. According to the company, by April 2014, the company had set up 47 stations in Hangzhou with more than 9,915 members. EVnet is the operator that we collaborated with in this study and its operational model will be discussed in more detail in the next section.

- **E-car, or Beijing EV partnership** is a government-supported carsharing system operating domestic-made pure-electric vehicles only. It was founded in May 2013 with the endorsement of Beijing Municipal Science and Technology Commission. Operating about 300 pure-electric vehicles today in two locations in Beijing, this CSO aims to increase its fleet size to 3,000 by 2014 (Roland Berger 2014).

- **Weigongjiao** (or Kandi Technologies), founded in 2013, operates about 300 pure electric vehicles in four stations in Hangzhou (Roland Berger 2014). The system creatively combines vertical vehicle parking garages (like vending machines) with electric vehicle charging infrastructure. The company expected to increase its fleet to 100,000 in Hangzhou within the next four years (Forbes 2013). This number is more than double the total worldwide carsharing fleet in 2012. However, users of Weigongjiao need to sign a contract before each rental period, thus it might not be considered a pure self-service carsharing scheme, but more or less a hybrid between car rental and carsharing.

- In Shenzhen, Guangdong, Daimler launched a **car2share** pilot program in February 2014 with 30 Smart Fortwo vehicles. Currently, the cars are available exclusively for staff of Tencent, one of the biggest IT companies in China. Car2share is the first exclusive corporate carsharing program in China (Li 2014).

In the past few years (especially after our focus group was conducted in 2012), more players entered the carsharing market in China. The players have grown from domestic start-ups to include municipal governments, as well as foreign and domestic vehicle manufactures. According to recent market research by Roland Berger, China’s total carsharing fleet is expected to triple in next year. There is an urgent need to understand the social and environmental impacts of this service as well as how to fit this service into our urban life.
Hangzhou

Hangzhou is the capital of Zhejiang Province, located 180 km west of Shanghai. The population of Hangzhou is 8.7 million. The GDP per capita exceeded 12,300 USD in 2011 (similar to levels in Beijing and Shanghai). Like other large cities in China, Hangzhou has experienced rapid economic growth, urbanization, and motorization over the past decade. The annual GDP growth rate has exceeded 10% on average between 2002 and 2012 (Statistics Bureau of Hangzhou 2012). Motorization also accelerated rapidly. In 2000, the number of motorized vehicles was 0.396 million (Hangzhou Urban Planning Institute 2006). By the end of 2011, the number of motor vehicles hit 2.14 million (Statistics Bureau of Hangzhou 2012). In 2009, non-motorized modes still dominated, as biking and walking altogether accounted for 66.6% of modal split; automobile and public transportation represented 13.7% and 19.7%, respectively (Chen et al 2010).³

Hangzhou has installed a fairly good public transportation system. The city runs the world’s second-largest bikesharing system with 65,000 bikes and over 2,000 stations. It operates 7,200 buses, covering 524 routes, including a 100-km BRT system (Statistics Bureau of Hangzhou 2012, Hangzhou Urban Planning Institute 2006). Hangzhou’s first metro line opened in November 2012, running 48 km from north to south. The city has an ambitious plan for public transit expansion. It aims to build 10 metro lines and 10 BRT lines by 2020, and the metro system will increase to 13 lines and 375 km by 2050 (Hangzhou Urban Planning Institute 2006). Hangzhou faces an acute parking shortage: currently the parking-spot-to-vehicle ratio is less than 0.5. The city needs to build at least 600,000 parking spaces across its neighborhoods to accommodate its current personal vehicle fleet (Zhejiang Online 2014). Currently many cars are parked illegally due to poor enforcement. This number does not include parking spaces to accommodate new growth.

In addition to public transportation facilities in Hangzhou, there is also an active carsharing operator in the city — EVnet. As of October 2012 (when the focus group was conducted), there were 2,000 members and 32 vehicles (including 2 plug-in hybrid electric vehicles) in EVnet’s network.

<table>
<thead>
<tr>
<th>Carsharing operator</th>
<th>Year established</th>
<th>Cities in operation</th>
<th>Operation model</th>
<th>Number of members</th>
<th>Fleet size</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eduo Auto¹</td>
<td>2009</td>
<td>Beijing, Wuhan, Changshan</td>
<td>Two-way</td>
<td>20,000+</td>
<td>200+</td>
<td><a href="http://www.eduoauto.com/">http://www.eduoauto.com/</a></td>
</tr>
<tr>
<td>EVnet/Chenfenxiang²</td>
<td>2010</td>
<td>Hangzhou</td>
<td>Two-way</td>
<td>9,915</td>
<td>138</td>
<td><a href="http://www.ccclubs.com/">http://www.ccclubs.com/</a></td>
</tr>
<tr>
<td>Weigongjia³</td>
<td>2013</td>
<td>Hangzhou</td>
<td>Station-based one-way</td>
<td>N/A</td>
<td>300</td>
<td><a href="http://www.weigongjiao.net/">http://www.weigongjiao.net/</a></td>
</tr>
<tr>
<td>E-car, or Beijing EV partnership⁴</td>
<td>2013</td>
<td>Beijing</td>
<td>Two-way</td>
<td>N/A</td>
<td>300</td>
<td>N/A</td>
</tr>
<tr>
<td>Car2share⁵</td>
<td>2014</td>
<td>Shenzhen, Guangdong</td>
<td>Two-way</td>
<td>N/A</td>
<td>30</td>
<td><a href="http://www.car2share.com.cn/">http://www.car2share.com.cn/</a></td>
</tr>
</tbody>
</table>

Sources:
¹ Liu, Wenjie, e-mail message to author, December 9, 2013.
² Liu, Yi’an, e-mail message to author, April 3, 2014
³ Roland Berger 2014
⁴ Roland Berger 2014
⁵ Li 2014
2. METHODOLOGY

This section describes the design of hypotheses, the organization of focus groups, the analytical methodology, and research limitations.

2.1 Literature review

Due to the nascence of carsharing as an industry and business concept in emerging economies, there are limited studies before 2012. Shaheen et al. (2010) tested the carsharing concept in Beijing in 2006 by surveying 840 people and found a noticeable interest in carsharing—25% of participants were highly interested in the service (Shaheen and Martin 2010). Wang et al. (2012) looked into carsharing’s potential in Shanghai. His survey (N=271) found that those interested were more likely to be younger, more educated, have longer commutes, and own fewer cars than those not interested in carsharing. Jung et al. (2011) surveyed international and domestic carsharing cases to explore operation models in China. Their team proposed a compound-based carsharing model that integrated housing development with carsharing services. Another draft technical report by Worcester Polytechnic Institute and Hangzhou Dianzi University investigated the feasibility and businesses of carsharing in Hangzhou. Their study identified a strong market interest, with 70% of participants interested in carsharing. It also analyzed factors for success such as technology, market, and location, and provided recommendations on the operations in Hangzhou (Aragon 2011, Worcester Polytechnic Institute 2012).

The literature review shows most studies above are concept exploration. They are mainly stated preference surveys based on a hypothetical carsharing model that had not been implemented yet. Our focus group study is different in three ways. First, it is based on an existing carsharing model, which allows us to touch some real issues related to current carsharing operations in China. Second, compared to surveys, the method of focus group allowed us to capture participants’ detailed thoughts in a conversational way, thus generating richer details for later analysis. Third, we solicited feedback from both potential and existing users. The results thus contain revealed preferences of current members and their user experiences as very early adopters. In summary, this focus group study is carefully designed to fill several knowledge gaps in this field.

2.2 Hypotheses

A series of hypotheses around the four key research questions was developed based on the literature reviews and expert interviews. The literature review informed initial hypotheses on users (Q2, Q3), trip types (Q4), barriers and opportunities (Q8), social and environmental impact (Q9), and the relationship between carsharing and public transit (Q7). We conducted 26 interviews with experts in 11 countries—including 9 CSOs in six countries, 11 mobility experts, and 6 stakeholders such as technology providers and operators of other shared modes. Most of these CSOs were the oldest carsharing systems in their region. The hypotheses were refined and new ones (Q1, Q5, Q6) were added based on experts’ suggestions. For example, we learned from Zazcar in Brazil that car-owning participants’ were motivated to start using carsharing due to the cost-savings, while access to auto mobility attracted non-car owners. Experts also suggested that high status value was associated with the cars they use in developing countries, so people might want to use high-end vehicles. At the end, we identified the following hypotheses to test, which are all linked to the four key research questions at the introduction.

- **Market interest** (What is the market interest for carsharing in Hangzhou?)

  Q1. The main reason for car owners to use carsharing services is “cost-saving.” “Access to auto mobility” is a key factor to attract non-car owners;

  Q2. People with better environmental awareness would be more inclined to use carsharing services;

  Q3. The early adopters of carsharing in the developing world are likely to be young and well-educated individuals;

  Q4. Carsharing will mostly be used for occasional shopping and leisure trips, business trips and weekend trips.
• **Design of the carsharing model** (From the users’ perspectives, how should carsharing services be designed?)

Q5. People might favor trendy and luxury vehicles due to status of cars;

Q6. Additional features might be needed to respond to local context, but users might not be willing to pay extra;

Q7. Carsharing is more likely to thrive in neighborhoods with good public transit systems.

• **Barriers and opportunities** (What do users see as the barriers and opportunities for carsharing in Hangzhou?)

Q8. The barriers to entering the carsharing service include “aspiration for car ownership and usage,” “lack of familiarity with the car sharing concept,” “lack of driving experience,” “limited access to personal credit/credit cards,” and “price sensitivity.”

• **Social and environmental impacts** (What might be the social and environmental impacts?)

Q9. Carsharing might have positive social and environmental impacts in terms of replacing or delaying private car purchases and reducing vehicle-kilometers traveled (VKT) and fuel consumption.

Detailed questions were designed to test these hypotheses. The detailed questions can be found in Appendix 1: Focus Group Program.

2.3 **Focus group design**

This section describes the target community, specifications for the two-way carsharing model we used in the focus group, and the organization of focus group meetings.

2.3.1 **Target community**

Suggested by expert interviews, the early adopters of carsharing are probably young, well-educated people with median income level (Shaheen and Martin 2010, Wang et al. 2012). Therefore, we chose young working professionals as the target community in Hangzhou. The detailed criteria include:

• **Age:** 20 to 40 years old;

• **Residence:** Hangzhou residents (people who have lived in Hangzhou for at least three years);

• **Education:** Well-educated (junior college or above);

• **Income:** Full time job with medium-level income, i.e. the annual income between RMB 60,000 to RMB 500,000 per household (roughly $9,800 to $82,000 USD in 2012) or RMB 30,000 to RMB 250,000 per person (roughly $4,900 to $41,000 USD);

• **Driving skills:** Possess a driver’s license or plan to get a driver’s license in the next three years.

We also considered the following factors to ensure the diversity of participants:

• **Household car ownership:** Car owners are people who own cars themselves or people who live at least four days a week with a car-owning family member;

• **Vehicle access:** This is a sub-categorization for car owners. The primary vehicle owners who can access the vehicle at any time are defined as having “regular access,” while family members who could occasionally use the vehicle are regarded as having “irregular access.”

• **Carsharing membership:** In order to gather some insights from the earliest adopters in China, EMBARQ invited 12 young working professional EVnet members to the focus group.

Table 2 lists the profiles of the Hangzhou focus group participants.
This study uses two-way carsharing as the model to test (Figure 1). To tap into the local context, we referred to EVnet’s pricing structure and membership scheme when participants asked for operation and design details in the focus group.

### Focus group organization

**Reaching out to participants**

We first selected non-member participants through random phone interviews via the help of a local market research company. All non-carsharing members were phone screened to ensure they met the focus group criteria. Our selection also ensured the diversity of participants in terms of gender, vehicle ownership and age. To reach out to carsharing member participants, we contacted EVnet and asked them to send email invitations to its members. Interested carsharing members were phone screened before being invited to the focus group to ensure they were qualified young working professionals in our targeted community. In the end, we successfully invited 36 non-members and 12 carsharing members to join this study. We also recorded all participants’ socio-economic and demographic characteristics during the phone-screening phase.

**Test and formal focus group meetings**

To test questions for the focus group meeting, we first conducted a test focus group with a mixed group of three car owners and three non-car owners. The success of the test focus group led us to include its results in the final analysis, as the questions between test and final did not change. As vehicle ownership is considered to be a determining factor in carsharing usage, two types of formal focus group meetings were convened: car-owner focus groups and non-car-owner focus groups. Three meetings of each type of focus group took place, with seven participants (two existing carsharing members and five non-members) in each meeting.

The focus group meetings started with a discussion of participants’ current travel patterns, followed by a presentation on a two-way carsharing service. Then detailed discussion on users’ perceptions of the service, their service requirements, and potential behavioral changes ensued. Appendix 1 documents the detailed process.

### Table 2: Hangzhou Focus Group Participants

(including participants from six formal focus group meetings and one test focus group meeting)

<table>
<thead>
<tr>
<th>Type of participants</th>
<th>Number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household car ownership</strong></td>
<td></td>
</tr>
<tr>
<td>Car owners</td>
<td>24</td>
</tr>
<tr>
<td>• Regular access</td>
<td>15</td>
</tr>
<tr>
<td>• Limited access</td>
<td>9</td>
</tr>
<tr>
<td>Non-car owners</td>
<td>24</td>
</tr>
<tr>
<td><strong>Carsharing Membership</strong></td>
<td></td>
</tr>
<tr>
<td>Members</td>
<td>12</td>
</tr>
<tr>
<td>Non-members</td>
<td>36</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>21</td>
</tr>
<tr>
<td>Male</td>
<td>27</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
</tr>
<tr>
<td>Unmarried</td>
<td>16</td>
</tr>
<tr>
<td>Married with no child</td>
<td>6</td>
</tr>
<tr>
<td>Married with one child</td>
<td>26</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>Aged 20-29</td>
<td>26</td>
</tr>
<tr>
<td>Aged 30-40</td>
<td>22</td>
</tr>
<tr>
<td><strong>Education Level</strong></td>
<td></td>
</tr>
<tr>
<td>Junior college degrees</td>
<td>28</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>15</td>
</tr>
<tr>
<td>Master degree</td>
<td>5</td>
</tr>
<tr>
<td><strong>Income Level (RMB/person/month)</strong></td>
<td></td>
</tr>
<tr>
<td>Level 1: 2,501-5,000</td>
<td>13</td>
</tr>
<tr>
<td>Level 2: 5,001-8,000</td>
<td>17</td>
</tr>
<tr>
<td>Level 3: 8,001-11,000</td>
<td>6</td>
</tr>
<tr>
<td>Level 4: 11,001-13,000</td>
<td>6</td>
</tr>
<tr>
<td>Level 5: 13,001-18,000</td>
<td>4</td>
</tr>
<tr>
<td>Level 6: 18,001-23,000</td>
<td>2</td>
</tr>
</tbody>
</table>
**Figure 1** Carsharing Model in Focus Group Study

**How to become a member**
- possesses a driver’s license
- owns a credit card or debit card to pay online
- fills out the application form

**Usage fee**
- membership fee 0-150 yuan/year
- hourly rental fee 19-27 yuan/hour
- gasoline-related distance charge 0.2-0.9 yuan/km
- no insurance fee

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**Carsharing in Hangzhou**

EVnet was the second CSO in China. It was founded in 2010 and was still in its pilot period when we conducted the focus group. As of Oct 2012, EVnet was operating 32 compact vehicles of four types: Smart Fortwo mhd, Geely Panda, Shangqi MG 3, and BYD F3DM (Figure 2). All the cars are gasoline-based except for two plug-in hybrid electric vehicles (PHEV - BYD F3DM). The 32 vehicles are situated in 12 stations within the central business district, technology parks, universities and residential areas.

*Source: Authors*

*Note: Membership is free for regular members; however, there is also an option for anyone who meets the member requirements to be a VIP member. VIP members are charged 150 yuan/year, but enjoy a 5% discount for their usage.*
EVnet offered free membership. The trip charge was a combination of hourly rate and distance-based gasoline fees. The hourly rate ranged from 19 to 27 yuan/hour (about $3.10 to $4.40/hour USD), and the daily rate ranged from 128 to 198 yuan/day (about $21 to $32/day USD), depending on the type of vehicle. The distance-based gasoline charge also varied by vehicle type. For example, the low-consumption vehicle PHEV cost only 0.2 yuan/kilometer (about $0.03/kilometer USD), whereas gasoline-based vehicles cost 0.9 yuan/kilometer (about $0.15/kilometer USD). In addition, EVnet offered two special packages. The 5-hour package allowed five hours of use with a rate of only 45-60 yuan (about $7.40 to $9.80 USD) plus the distance charges. The overnight package was valid from 5:00 p.m. until 9:00 a.m., and cost only 40 to 55 yuan (about $6.50 to $9.00 USD) plus the distance charges.

**Figure 2** Carsharing Model in Focus Group Study

1. 
2. 
3. 
4.
2.4 Data analysis

We translated the results of the focus groups, based on the video records and meeting transcripts, into an excel document, where we linked the socio-economic characteristics of each participant with their answers to each question. All these data were analyzed qualitatively and quantitatively to draw deeper insights.

2.5 Research limitations

- **Target group sample:** The focus groups included a small sample of a target population with certain demographics in Hangzhou. Other types of participants, such as college students, might also be potential carsharing users, but they were not included in this study.

- **Focus group methodology:** Another limitation derives from the methodology of focus groups. It is not a rigorous statistical methodology and the results are more qualitative than quantitative. As we found, opinions in the focus group converged sometimes as people may have been affected by others’ ideas in group conversation.

- **Transferability of the results:** Because of the unique geographic, transportation, and demographic characteristics of Hangzhou, the numeric results cannot be directly transferred to other Chinese cities.

3. KEY FINDINGS

This section describes the key findings from the focus groups in the following aspects: market interest, barriers and opportunities, service requirements, and social and environmental impacts.

3.1 Market interest

3.1.1 Strong market interest in carsharing

The focus groups revealed strong interest in trying carsharing. Thirty-four of 36 non-member participants expressed interest in trying out carsharing. Participants cited “convenience,” “cost-saving,” and “access without ownership” as the three most attractive features of a carsharing service (Table 3). Other motivations, such as trying out different types of vehicles or using rental cars to test driving skills, were sporadically mentioned. Environmental benefits were rarely mentioned.

<table>
<thead>
<tr>
<th>Appealing factors of carsharing</th>
<th>Number of mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>By car owners</td>
</tr>
<tr>
<td>Convenience</td>
<td>8</td>
</tr>
<tr>
<td>Cost-saving</td>
<td>4</td>
</tr>
<tr>
<td>Vehicle access without ownership</td>
<td>0</td>
</tr>
<tr>
<td>Flexible/hourly</td>
<td>0</td>
</tr>
<tr>
<td>Opportunity to try different vehicles</td>
<td>3</td>
</tr>
<tr>
<td>Backup option when personal car is unavailable or restricted</td>
<td>4</td>
</tr>
<tr>
<td>Membership model</td>
<td>0</td>
</tr>
</tbody>
</table>

The demand for carsharing trips might be large, as we asked participants to estimate/reveal their usage frequency under the assumption that carsharing service is conveniently available. Based on their stated or revealed usage frequency, we categorized the participants into four groups:

- **Non-users** were disinterested in this service;
- **Light users** would use this service occasionally but less than twice a month;
- **Moderate users** would use this service about twice a month;
- **Heavy users** would use this service at least 3 times a month.

As shown in Table 4, 23 participants might be heavy users of carsharing services. This suggests strong market interest in carsharing among young professionals in Hangzhou.6
3.1.2 Carsharing users

Current carsharing members were younger and better educated than non-members, and had a high average usage rate. Five member participants had master’s degrees, while none of the non-members did. Members were also younger; the average age of members was 26.8, while participants’ average age was 29.1. Current members revealed higher usage frequency than non-members’ estimations. The share of heavy users among members (10/12) is much higher than the stated preference for heavy usage among non-members (13/36). However, our focus group only touches a very small sample group. These characteristics might be caused by sample bias, due to EVnet’s strategy of recruiting the earliest adopters.

Figure 3 Usage Frequency and Carsharing Membership of Anticipated and Existing Users

Table 4 Estimated Carsharing Usage by User Type in Hangzhou

<table>
<thead>
<tr>
<th>User type</th>
<th>Non-users</th>
<th>Light users</th>
<th>Moderate users</th>
<th>Heavy users</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car owners (COs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carsharing members</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Carsharing non-members</td>
<td>2</td>
<td>11</td>
<td>5</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td>Total of COs</td>
<td>2</td>
<td>11</td>
<td>6</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>Non-car owners (NCOs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carsharing members</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Carsharing non-members</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Total of NCOs</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>12</td>
<td>11</td>
<td>23</td>
<td>48</td>
</tr>
</tbody>
</table>

Note: Includes anticipated and existing users.
3.1.3 Usage level in relation to user characteristics

Participants’ current or estimated levels of carsharing usage were associated with car ownership, personal income, and personal travel budget.

Carsharing usage in relation to car ownership

Non-car owners show stronger interest in using this service than car owners. Seventy-five percent of non-car owners might be heavy users, while only 21% of car-owning participants might use carsharing more than three times a month (Figure 4). Here, if we further break down by membership, a similar relationship exists among member and non-member communities (see Figure 3).

Non-car owners are mostly interested in using the vehicles on weekends, whereas most car owners expressed that they may use the service occasionally when their own vehicles are not available. Note that some car owners anticipated being heavy carsharing users too. Of those, four out of five do not have primary access to their household vehicle or need to equally share a vehicle with other household members, so they would need to use the carsharing vehicles more often than other car owners.

Carsharing usage in relation to income level

Income level is inversely correlated with carsharing usage. The majority of potential heavy users earned less than RMB 13,000 per month. People with higher income tended to own a personal vehicle and estimated that they would not use carsharing as often. As shown in Figure 5, most people with higher income are light users.

---

**Figure 4** Usage Frequency and Car Ownership of Anticipated and Existing Users

<table>
<thead>
<tr>
<th>Car Ownership Status</th>
<th>User Category</th>
<th>N</th>
<th>% of Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Car Owners (N=24)</td>
<td>Non-Users</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Light Users</td>
<td>5</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Moderate Users</td>
<td>18</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Heavy Users</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Car Owners (N=24)</td>
<td>Non-Users</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Light Users</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Moderate Users</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Heavy Users</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**Figure 5** Usage Frequency and Income Distribution of Anticipated and Existing Users

<table>
<thead>
<tr>
<th>Monthly Income (RMB/Month)</th>
<th>User Category</th>
<th>N</th>
<th>% of Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>18,001-23,000 (N=2)</td>
<td>Non-Users</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Light Users</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Moderate Users</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>13,001-18,000 (N=4)</td>
<td>Non-Users</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Light Users</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Moderate Users</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>11,001-13,000 (N=6)</td>
<td>Non-Users</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Light Users</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Moderate Users</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8,001-11,000 (N=6)</td>
<td>Non-Users</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Light Users</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Moderate Users</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>5,001-8,000 (N=17)</td>
<td>Non-Users</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Light Users</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Moderate Users</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>2,501-5,000 (N=13)</td>
<td>Non-Users</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Light Users</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Moderate Users</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>
Carsharing usage in relation to transportation budget

Potential users’ interest in carsharing is also inversely correlated to their transportation budgets (monetary cost including buses, taxi fees, and private car maintenance and gasoline expenditure). Shown in Figure 6, heavy users’ monthly travel expenses averaged less than RMB 700 per month (about $115 USD per month). Their maximum transport budget—i.e. the maximum amount of money that they were willing to pay to improve their mobility—averaged RMB 1,319 per month (about $215 USD per month), less than the average monthly travel expense of light users (Figure 6). The heavy users’ limited transport budgets might be one reason that they were interested in carsharing, for their travel budget seemed to allow them to use carsharing services for some occasions, but was still not enough to afford the expense of owning a personal vehicle.

Figure 6 Travel Expenses and Maximum Personal Travel Budget of Anticipated and Existing Users

Non-car owners could be the major consumers for carsharing services, since the majority of car owners relied on personal cars in most trips.

3.1.4 Carsharing trips

The travel patterns of non-car owners and existing carshare members indicate that carsharing might be widely used for weekend leisure trips and occasional leisure (infrequent leisure trips on weekdays or holidays) and business trips, and to a lesser extent, shopping trips.

Non-car owners are the major consumers for carsharing services, since the majority of car owners relied on personal cars in most trips (Table 5). Table 6 summarizes non-car owners’ travel modes by trip type. For leisure activity, more than half non-car owners found ways to access cars; they either rented a car or borrowed cars from families and friends. In rapidly-developing Chinese cities, access to auto mobility becomes increasingly important for leisure outings, especially for families with children. The conversations in our focus group suggested that non-car owners have strong aspirations for car usage for leisure purposes. Existing carsharing members most often used carsharing service for leisure trips over the weekend or at night.
Our focus group also found that interest in EVnet’s overnight package was relatively strong among young people aged 20 to 30. Existing members would use the package if they had more than one stop at night, as doing so would cost less than traveling by taxi (see Table 7).

According to the focus group, carsharing may also be used for business trips, but to a lesser extent. Several non-car owners who need to travel within the city indicated interest in using this service for business trips in the future. Likewise, as two participants pointed out, carsharing could also serve people who visit Hangzhou for business or travel purposes.

3.1.5 Competing modes

Taxis and rental cars were revealed as the competing modes to carsharing in Hangzhou. We identified the competing modes as those that participants most often compared to during mode-choice discussions. For occasional trips, focus group participants often considered the expenses of using carsharing or hiring a taxi, while for daily trips, they referred to the price of car-rental services. Members suggested they would use carsharing instead of taxis for long or linked trips. Several participants found carsharing more attractive than car rental because the price of carsharing in Hangzhou is fixed while car rental’s daily fees spike on holidays when travelers need them the most.
To test whether participants would welcome carsharing as part of urban transportation in their daily lives, we asked participants to rank the following infrastructure they wanted to see built or improved in their neighborhoods based on their priorities. The infrastructure options were metro, bus, public bikes/bike lanes, carsharing, parking lots, side-walks, and highway entrances.

Carsharing ranked as the third-most desirable neighborhood service overall, after metro and bus, before public bikes, and at a similar level to parking lots, side-walks, and highway entrances.

The result seems to be consistent with the current maturity of Hangzhou’s transport systems, which have a relatively good public bike program, but under-developed rapid transit and bus systems, and face problems of acute under-supply of parking. The result also seems consistent with current car ownership patterns and the strong interest that non-car owners revealed for carsharing in earlier discussions. Non-car owners ranked carsharing at a similar priority as metro or bus, whereas car owners ranked carsharing well behind public transit (Figure 7).

### Table 7 Carsharing, Car Rental, and Taxi Price Comparison in Hangzhou

<table>
<thead>
<tr>
<th>Pricing structure</th>
<th>Carsharing</th>
<th>Taxi</th>
<th>Car Rental</th>
</tr>
</thead>
<tbody>
<tr>
<td>10km-trip</td>
<td>RMB 25-37 (1 hour)</td>
<td>RMB 30 + waiting cost</td>
<td>-</td>
</tr>
<tr>
<td>20km-trip</td>
<td>RMB 29-45 (1 hour)</td>
<td>RMB 45-73 (2 hours)</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>RMB 50-78 (5 hour-package)</td>
<td>RMB 60 + waiting cost</td>
<td>-</td>
</tr>
<tr>
<td>Daily rental</td>
<td>RMB 130-200 + gasoline fee</td>
<td>-</td>
<td>RMB 150-600 + gasoline fee</td>
</tr>
</tbody>
</table>

Note: Data collected in Hangzhou from EVnet in October 2012.

### 3.1.6 Interest in carsharing in relation to other public transportation modes

To test whether participants would welcome carsharing as part of urban transportation in their daily lives, we asked participants to rank the following infrastructure they wanted to see built or improved in their neighborhoods based on their priorities. The infrastructure options were metro, bus, public bikes/bike lanes, carsharing, parking lots, side-walks, and highway entrances.

Carsharing ranked as the third-most desirable neighborhood service overall, after metro and bus, before public bikes, and at a similar level to parking lots, which are significantly under-supplied in Hangzhou. This indicates that most participants were willing to have carsharing as an option next to other public transit services in their neighborhoods.

The result seems to be consistent with the current maturity of Hangzhou’s transport systems, which have a relatively good public bike program, but under-developed rapid transit and bus systems, and face problems of acute under-supply of parking. The result also seems consistent with current car ownership patterns and the strong interest that non-car owners revealed for carsharing in earlier discussions. Non-car owners ranked carsharing at a similar priority as metro or bus, whereas car owners ranked carsharing well behind public transit (Figure 7).
3.2 Carsharing barriers and opportunities

This section summarizes barriers and opportunities to carsharing from users’, perspectives. The barriers and opportunities include aspirations for vehicle usage and ownership, parking shortages, quality of public transportation, and vehicle travel restrictions.

3.2.1 Aspirations for vehicle usage and ownership

We found strong interest among participants in gaining access to auto mobility. This interest seems to provide good opportunities for carsharing business. At the same time, we found strong aspirations for vehicle ownership, which might be a barrier to carsharing. In Hangzhou, all non-car owners in the focus groups were planning to buy a car in the future, and 50% had short-term car purchase plans (within two years). Twenty-nine percent of car owners already owned two vehicles, and another 29% planned to purchase a second vehicle in the short term. Note there was a strong link between car ownership and driving in Hangzhou. As shown in Tables 5 and 6, car owners relied on their cars for most trips, while non-car owners used a variety of modes including public transportation, walking, biking, and also carsharing or car rental for different types of trips. Thus, increasing vehicle ownership might reduce the market potential for carsharing.

3.2.2 High cost of parking

Limited parking spaces and high parking costs in Hangzhou would help boost the appeal of carsharing. At least two potentially heavy carshare users suggested that carsharing was appealing partly due to the savings on parking, as they found the current on-street parking fee in Hangzhou city to be high. One car owner spent RMB 800 (about $130 USD) per month and several other car owners needed to pay monthly parking fees for permit parking in their communities (usually gated communities). One car owner could not buy a second car because there was insufficient parking in the neighborhood.

High parking costs were cited in the focus groups to be one reason that some car owners took buses for leisure trips. The cost of on-street parking in downtown Hangzhou is higher than in most other Chinese cities. In the West Lake scenic area, the parking rate on weekdays was RMB 12/hour (about $2/hour), while on weekends, it was RMB 25-35/hour (about $4.00 to $5.70 per hour).

3.2.3 Public transportation

In well-established markets, carsharing seems to complement public transit. Our focus group in Hangzhou confirmed the complementary relationship. Some focus group participants reported that the delay in public transit construction induced their purchase of a new private car. The service level of public transit also seemed to affect the market potential for carsharing, with better transit encouraging more carsharing.

In Hangzhou, the majority of participants, even the car owners, were still willing to take public transit or bikes to work if doing so was convenient. However, insufficient transit service in the new urban areas led people to buy personal vehicles and drive to work. Five car owners mentioned that the poor public transit near their place of employment or residence was an important factor behind their vehicle purchase. One participant bought an apartment near the metro station, but he had to buy a car for commuting because the metro construction was delayed for a long time.

Why do people want to own cars in Hangzhou?

The utility of personal mobility is the most frequently-mentioned reason for car ownership. Seven car owners indicated that they chose to own a car for work, as they either needed to commute long distances to work or drive from place to place for work. Three people mentioned family as the key consideration—they bought cars either to accommodate their child or to make long-distance hometown visits. The status value of private cars seemed to encourage a noticeable number of participants to be interested in purchasing private cars. One-third of participants recognized the status of cars or felt peer pressure to own a vehicle.
A challenge facing Hangzhou is whether the development of public transit can keep pace to preserve the current public transportation mode share. If so, carsharing would likely be used by more people as a complement to public transit.

3.2.4 Vehicle travel restrictions

At the time of the focus groups, Hangzhou was implementing vehicle travel control policies based on the last digit of vehicle license plates, to keep one-fifth of vehicles off the street during peak hours on weekdays. Although shared vehicles were not exempt from this travel restriction, this policy seemed to provide a good opportunity for carsharing. Three car owners mentioned that they would use carsharing services on their vehicles’ travel restriction days. One car-owning EVnet member already used the service on travel restriction days.

Traffic congestion will likely be a lasting challenge for Hangzhou, and several participants expected that vehicle license control systems like those in Beijing or Shanghai might be introduced to Hangzhou in the very near future. Actually, in March 2014, Hangzhou became the sixth Chinese city to operate vehicle quota restrictions. In this case, carsharing seems to be an increasingly important option even for vehicle owners in Hangzhou.

3.3 Service requirements

This part describes carsharing service requirements, including station arrangements and fleet type, pricing structure, and technology.

3.3.1 Station and fleet

Stations

Hangzhou’s carsharing stations were situated in technology parks, universities, the central business district, and in some residential areas. Participants in the focus group found those locations satisfying, but they suggested that EVnet’s network of twelve stations (the number at the time) was too small. Participants would like to see a denser network consisting of more carsharing stations in the city.

The preferred carsharing station location was within walking distance to employment and/or place of residence. Participants indicated their maximum acceptable walking/biking time to carsharing stations averaged about 11 to 12 minutes. As shown in Figure 8, non-car owners were willing to walk further, consistent with their desire for car access. Participants warned that when carsharing stations are too far away, the service becomes significantly less attractive. They would choose to take the bus or wait for taxi. Participants also suggested integrating carsharing services with bikesharing stations, bus stations or community parking programs.
Vehicle Types
In terms of vehicle types, a majority of participants found compact and economical vehicles acceptable and preferable due to their low cost (Table 8). This was consistent with the types of vehicles owned by participants. About 75% of car owners owned a compact vehicle (Table 9). Two female participants wanted “small” cars because they were easy to park.

In terms of other types of vehicles, seven people mentioned that they would like to use “bigger and better” cars for comfort and status reasons. One member who is tall complained about the small and uncomfortable interior of the current fleet. In addition, driving a good car is believed to help build up one’s social status, so some people suggest offering better cars. However, the idea of “big and luxury” cars in Hangzhou is not necessarily consistent with other countries’ concepts of big and luxurious cars. For instance, one participant referred to the Mazda 6 as an ideal “bigger and better” vehicle.

In addition, eight participants would like to have a large variety of vehicles catering to the needs of different trips. They hoped carsharing could offer different vehicle models— not only economical cars, but also more luxury cars for business trips, light vans for trips with friends or family, or small trucks for moving.

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Compact vehicles</th>
<th>Mini cars or two-seaters (which is “easy to park”)</th>
<th>Larger/ luxury vehicles (e.g. Mazda 6)</th>
<th>New models</th>
<th>A variety of vehicles (including light vans and trucks)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of responses</td>
<td>16</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>8</td>
<td>36</td>
</tr>
</tbody>
</table>

Note: Not all participants answered this question, so the number of responses is not equal to the number of participants.
3.3.2 Pricing

In Hangzhou, the majority of participants found EVnet’s current pricing structure, combining an hourly rate and distance-based gasoline fee, to be reasonable. About 22% indicated that the current price was the maximum amount that they could afford. Another 25% indicated that although the hourly or daily rate was affordable, the distance charge was high. Carsharing members in Hangzhou expressed that they would choose vehicles with particular rates (gasoline and hourly rate combination) based on the type of trip. For example, if they planned to travel a long distance in a short duration, they would rent a gasoline-efficient but high-hourly-rate vehicle. However, if they needed a car over a longer duration for a short-distance trip, they would choose a low-hourly-rate vehicle, even if its distance-based gasoline rate was higher. Participants also suggested variations to EVnet’s existing price model including:

- Changing the service from an hourly basis to a half-hour basis to increase flexibility;
- Starting with a minimum of two-hours with a lower hourly rate, since almost all users rent the car for more than two hours;
- Instead of charging a relatively high distance rates, require users to pay to refill the gasoline;
- Decreasing the unit distance price as the kilometers traveled increases, since gasoline consumption is usually much lower for highway driving.

3.3.3 Technology

Existing carsharing users were quite satisfied and comfortable with the technology that EVnet utilized. Carsharing members could reserve a car online or by phone. However, participants also suggested some technological solutions that could improve the service:

- Special station design or vehicle technologies (e.g. black boxes on rental cars, or station cameras installed at the corner of each parking lot) to identify timing of accidents and related responsible members;
- A carsharing mobile application.
3.3.4 Service modification

Focus group participants also suggested new service features that they wanted to see. We found a strong interest in one-way station-based services. Almost all participants would like carsharing to operate like the current bikesharing system. However, most participants indicated they were unwilling to pay too much extra for one-way service (see Table 10).

Participants suggested the following ways to cover the additional cost of one-way service:

- Add a premium to cover the redistribution cost based on the distance travelled (e.g., if the car is within 10 km of the originated station, it costs 5 yuan etc.);
- Increase the annual membership for one-way users.

Carsharing members also suggested that a station-based one-way system should allow people to reserve a parking space at their destination station when making a reservation.

3.4 Social and environmental impacts

Carsharing demonstrates positive impacts in well-established markets, including increasing access to automobiles, reducing the number of household vehicles, and reducing greenhouse gas (GHG) emissions (Cervero 2003; Lane 2005; Cervero et al. 2007; Shaheen and Cohen 2007; Elliot and Shaheen 2010; Shaheen and Elliot 2010; Elliot et al. 2010).

Due to the short operation time of carsharing in Hangzhou (EVnet was still in the pilot period when we did the focus group), it was too early to draw definitive conclusions on the impact of carsharing in China. However, investigation of participants’ attitude regarding car ownership indicated that carsharing might have positive impacts on delaying or reducing car purchases.

3.4.1 Impact on increasing non-car owners’ access to auto mobility

Based on the focus group meetings, we found that a well-structured carsharing network could greatly increase people’s access to auto mobility. This benefit was widely recognized by non-car owning participants and existing carsharing members.

3.4.2 Impact of carsharing on car purchase plans in Hangzhou

Car usage is associated with car ownership. Experiences in established markets indicate that reducing vehicle ownership might encourage more sustainable lifestyles and reduce people’s dependence on cars. Towards the end of the focus group sessions, we asked participants whether carsharing would influence their vehicle purchase plans. Twelve out of 24 non-car owners said they might delay their car purchase plans, and another three would give up car purchase plans if carsharing services were very convenient. Among car owners, although none would sell their current vehicles, six indicated that they might delay vehicle purchase plans for a second car, and two would consider giving up their second vehicle (Table 11).

Table 10 Acceptable Price Increase for One-Way Station-Based Service

<table>
<thead>
<tr>
<th>Acceptable price increase over that of two-way</th>
<th>Less than 10%</th>
<th>20-30%</th>
<th>10%</th>
<th>100%</th>
<th>Total responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of responses</td>
<td>64%</td>
<td>24%</td>
<td>8%</td>
<td>4%</td>
<td>25</td>
</tr>
</tbody>
</table>

Note: Not all participants answered this question, so the number of responses is not equal to the number of participants.
Existing carsharing members were found to be more willing to forgo or delay their car purchase plans. Ten out of 12 members suggested they have delayed or would delay car purchases due to carsharing.

Another interesting finding is that among 16 people who regarded the car as a symbol of social status, eight would be willing to delay or replace their car purchase plan. This indicates that the desire to own a car might not be as strong as it first seems; participants could make choices more pragmatically if a convenient, affordable carsharing system is available.

### 3.4.3 Low consumption vehicles

Our focus group revealed carsharing to be a good way to introduce electric cars or hybrid cars to the public. However, the real impact on lifecycle GHG emissions is uncertain since 79% of electricity in China is generated from coal-fired power plants (WCA 2014).

### 4. CONCLUSION

The focus groups explored existing and potential users’ perceptions of an established two-way carsharing model in Hangzhou, China. Our key findings offer some initial insights on carsharing’s market potential, operational models, and social and environmental impacts in Hangzhou, which might inform the development of the carsharing industry in China. The focus group methodology used in this study might also help other researchers gather and analyze potential users’ opinions toward an innovative mobility service.

The focus group found significant interest among young working professionals in the current carsharing model in Hangzhou. The barriers and opportunities included aspirations for car usage, lack of parking, vehicle restrictions, and quality of public transportation. Most focus group participants found the current carsharing operational model (based on EVnet’s model) reasonable, though many of them preferred a station-based one-way model. Focus group participants also suggested that carsharing would replace or delay private vehicle purchases. Therefore, positive impacts on VKT, GHG emissions, air pollution, and other environmental indicators might be foreseeable.

As we build new knowledge in this field, additional questions are raised and need to be further explored. For example, what is carsharing’s impact on VKT in China? How should the government guide this innovative service? How should private operators position their service in current urban mobility systems in Chinese cities? How might foreign players customize carsharing offerings to the Chinese market? As several players have entered the industry and become increasingly active since our study, existing services must be tracked closely to better design operation models and relevant public policies.

Moving forward, carsharing could be used as a way to introduce electric vehicles, which some CSOs in Hangzhou or Beijing are trying to achieve today. However, the real benefit of carsharing lies in its promotion of higher-quality non-car-owning lifestyles, in which carsharing complements good public transit and non-motorized transportation, and makes cities more livable and accessible places. Therefore, research on the impact of carsharing on people’s travel behaviors in Chinese cities is especially needed. We hope our case study can serve as a start. After all, what carsharing can bring to cities is a more convenient, environmentally-friendly travel option to improve city life without the hassle of owning a car.

<table>
<thead>
<tr>
<th>Total responses</th>
<th>Forgo or give up first vehicle</th>
<th>Delay first vehicle</th>
<th>Delay second vehicle</th>
<th>Forgo second vehicle</th>
<th>Make no changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car Owners</td>
<td>24</td>
<td>0</td>
<td>6 (3)</td>
<td>2</td>
<td>16 (2)</td>
</tr>
<tr>
<td>Non-Car Owners</td>
<td>24</td>
<td>3</td>
<td>12 (7)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Note: All participants answered this. The number in the parentheses () indicates current carsharing members.*

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### Table 11: The Impact of Carsharing on Car Purchase Plans
Testing results of the hypotheses

✓ Indicates the hypotheses are true
✘ Indicate the hypotheses are false
● Inclusive

Market Interest (What is the market interest for carsharing in Hangzhou?)

1. The main reason for car owners to use carsharing services is “cost-saving.” “Access to auto mobility” is a key factor to attract non-car owners.
   **Mostly True**
   - Overall, convenience was cited at double the rate of cost-saving.
   - Most non-car owners—found it “convenient” and others stated access to a car without ownership.
   - For car owners, cost-saving was one reason, but most saw it as one more option for auto mobility when personal vehicles were unavailable.

2. People with better environmental awareness would be more inclined to use carsharing services;
   **False**
   - Environmental considerations were rarely mentioned.

3. The early adopters of carsharing in the developing world are likely to be young and well-educated individuals.
   **Mostly True**
   - Most participants were interested in trying out this service.
   - Participants who were active carsharing members (earliest adopters) were younger and better educated.
   - Median and lower-median income groups were most likely heavy carsharing users.

4. Carsharing will be mostly used for occasional shopping and leisure trips, business trips and weekend trips.
   **Somewhat true**
   - Strong demand for leisure trips.
   - Some interest in usage for occasional business trips.
   - Less demand for shopping trips compared to in the developed world.
   - New demand for trips to visit hometowns.

Design of the carsharing model (from users’ perspectives, how should carsharing services be designed?)

5. People might favor trendy and luxury vehicles due to their status.
   **Mostly False**
   - Most favored compact vehicles due to their low cost.
   - Participants were open to “luxury and big vehicles,” but would not use them often.

6. Additional features might be needed to respond to local context, but users might not be willing to pay extra.
   **Mostly True**
   - Strong interest in station-based one-way service.
   - Half would not pay more than 10% over the cost of two-way service.

7. Carsharing is more likely to thrive in neighborhoods with good public transit systems.
   **True**
   - Travel patterns of carsharing members suggest they used carsharing for leisure and business trips and public transit for commutes.
   - Carsharing was ranked the third-most desirable transportation infrastructure improvement. This comes after metro and bus improvements and before more developed public bike systems.

Barriers and opportunities

8. Barriers inhibiting participation in carsharing services might include “aspiration for car ownership,” “lack of familiarity with car sharing concept,” “lack of driving experience,” “limited access to personal credit/credit cards,” and “price sensitivity.”
   **Somewhat False**
   - One-third of participants recognized the status value of personal cars. However, car ownership aspiration may not be as strong as it seemed to be: half of non-car owners would postpone purchasing a car because of carsharing, and 12.5% of non-car owners might forego future car purchases entirely if carsharing is really convenient.
   - Lack of driving experience or access to credit rarely was stated as a barrier.
   - Lack of familiarity with carsharing services was revealed.
   - Some participants were price-sensitive, but more found the price to be acceptable. From the general usage frequency stated, cost might not be a big barrier.

Social and environmental impacts

9. Carsharing might have positive social and environmental impacts in terms of replacing or delaying private car purchases, reducing VKT, and reducing fuel consumption.
   **Somewhat True**
   - 18 participants might delay and 5 might forgo car purchases.
   - 83.3% of carsharing members had delayed or would delay car purchase plan.
   - Because carsharing is still in its early stages, it is not yet clear what the environmental impact would be in Hangzhou.
APPENDIX 1: FOCUS GROUP PROGRAM

1. Introduction
   • Moderator introduces himself and the format of focus group meeting.
   • Participants make self-introduction (age, occupation).

2. Current Travel Pattern – Q&A
   • How do you travel from place to place in Hangzhou? Please describe by trip type, such as commute, shopping, leisure and business trips.
   • How much do you and your family spend on transportation per month? Are you willing to spend more money on transportation to increase your mobility in the future—what will be the maximum budget?
   • Are you planning to change your travel pattern in the near term? What’s your plan?
   • What does “a personal vehicle” mean to you?
   • Are you satisfied with the current traffic conditions in Hangzhou? Which travel mode do you think is the most convenient in the city?
   • Do you feel the problem of too many vehicles in Hangzhou? Have you ever thought of changing your behavior to reduce the environmental pressure?

3. Introducing Carsharing
   • Moderator introduces “two-way carsharing” to the audience, key word: membership-based, hourly rental, and self-service.
   • Participants ask questions about this new type of service.
   • Moderator defines “carsharing” service.

4. Carsharing Perception – Q&A
   • With that introduction, would you like to try out this service? Which feature of carsharing do you find most attractive?
   • What are potential constraints that prevent you from using this service?

5. Service Requirement – Q&A
   • If you were to use this service, where would you want the stations to be located? How far are you willing to walk or bike to reach a carsharing facility?
   • Would the type of vehicle offered affect your choice to use this service? How? What type of vehicle would you prefer? What variety of vehicles is interesting to you (variety in terms of purpose: small/economy, sedan, utility).
   • Are you interested in electric vehicles or low consumption vehicles? Do you prefer low consumption vehicles to traditional vehicles? Why?
   • What add-on features would you suggest to make the service more usable? (e.g. chauffeur, person to person customer service, pick-up and drop-off services, etc.).
   • The current price for carsharing in Hangzhou is 19-27 yuan per hour with the gas charge of 0.2 to 0.9 yuan/km. Will you be willing to pay this much? How do you want the service to be priced? E.g. by hour or by minute?

6. Usage Potential – Q&A
   • If there is a carsharing station in your neighborhood, how often do you think you will use this service? What activities will you most likely use carsharing for?
   • Will you drive more with carsharing?
   • If you had access to a carsharing facility, would you consider giving up use of your car or car purchase plan? Or would you consider postponing your car purchase plan?
   • Which of these transport infrastructures would you most want to see built or improved in your neighborhood and why? Please rank according to your preference.
   • A. a bus station; B. a bikeshare station/bike-lane improvement; C. a carsharing station; D. a parking garage; E. sidewalks; F. a freeway entrance.
References


Cervero, R. 2003. “City CarShare: First-Year Travel Demand Impacts.” Transportation Research Record: Journal of the Transportation Research Board, No. 1839, 159-166.


Endnotes

1. In China, cities often are categorized as first-tier, second-tier, and third-tier. There is no formal definition of these categories, but there is a common agreement that first-tier cities refer to Beijing, Shanghai, Guangzhou, and Shenzhen, which are more economically developed. The property brokerage company Knight Frank defines a second-tier city as having a population of at least 3 million and a minimum per-capita GDP of US$2,000 or more. Using that definition, there are some 60 cities that qualify as "second tier," including Hangzhou. (McMillan, Andrew Frew. 2011. “The Rise of China’s 2nd and 3rd Tier Cities.” CNBC, February 10, 2011. Accessed at http://www.cnbc.com/id/41420632#.)

2. The vehicle quota system has been implemented in Beijing since January 2013. The system imposes a yearly cap on new vehicle registrations to stem the growth of private vehicles in the city. Those who want to get a new vehicle license plate must participate in a monthly lottery. The winning rate now is 1:99.

3. We also tried to collect data on average commute distance, but the latest public-available data we can attain is from 2000. Therefore we did not include that in this paper.

4. These rates come from EVnet’s website, as of Oct 1, 2012.

5. The number of focus group meetings was decided by saturation principle. Saturation in focus group research refers to the duplication of observation—i.e., no one is saying anything new in subsequent meetings. In most cases in social science research, three or four group meetings with one type of participant are considered sufficient (Krueger and Casey 2000, Gaber and Gaber 2007).

6. These usage patterns reported by our focus group participants might be much higher than the distribution of actual carshare member usage, as they reflect stated preference. People might anticipate higher usage for their future activity.

7. However, there are still some car owners that use non-driving modes for activities like commuting, shopping, or leisure. There are two reasons for this. First, nine car owners in the focus group were not the primary users of their household vehicles, so needed to sometimes take other modes of transportation. Second, even though some car owners were the primary users of household vehicles, they were willing to take sustainable modes like walking or biking if it was convenient or if the weather was nice.

8. A comparative study between the target community and non-target community might be needed in the future to better test this assumption.

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