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CARSHARING

*A Vehicle for Sustainable Mobility
in Emerging Markets?*



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FOREWORD

Cities have the potential to become powerful engines of social and environmental progress, lifting hundreds of millions of people out of poverty and ensuring the sustainability of our planet. But rapid urbanization also poses substantial challenges. Poorly planned, sprawling cities can threaten quality of life, worsen pollution and public health, and undermine efforts to sustain economic growth. Perhaps no trend accelerates these challenges more than rapid motorization—advancing personal mobility, but threatening virtually every measure of sustainability, from road safety to climate stability.

Carsharing can provide a powerful mobility alternative for emerging markets, where the pace of urbanization and motorization is highest. The carsharing concept is simple: individuals gain the benefits of car use without the costs and responsibilities of ownership. Carsharing can increase mobility and access, even while reducing vehicle-kilometers traveled and negative environmental impacts of driving.

While well established in developed countries, carsharing is nascent in emerging markets. The potential of carsharing here could be very large, but little is known about its markets, viability, or social and environmental impacts.

WRI seeks to fill this knowledge gap. We have completed the first comprehensive study of carsharing in emerging markets. To develop an initial understanding of the feasibility of carsharing in these cities, we reviewed existing literature and interviewed mobility experts and carsharing operators. Focus groups with targeted communities in Hangzhou, China and Bangalore, India revealed perceptions of carsharing. And a global scan of the industry inventoried carsharing operations in emerging markets over time.

The carsharing industry in emerging markets is expanding quickly. In the past year, carsharing was introduced in 19 cities. This year nearly 898,000 members will share more than 9,200 vehicles across 41 cities in emerging markets.

Carsharing has the potential to increase carless households' mobility and access to goods, services, and opportunities and, in some markets, it might even delay the decision to purchase a car. If carsharing takes root in emerging markets before car ownership becomes ubiquitous, households might opt to share a car instead of owning one. Their need for occasional auto use will be satisfied while they primarily rely on walking, biking, and public transit for day-to-day mobility. In this way, carsharing could be an effective element of a sustainable transportation system in emerging markets.

However, the success of carsharing in emerging markets faces serious obstacles. Many people in the growing middle class aspire to own a car, while cities are plagued by acute congestion and lack of available or adequately regulated parking. And cities are increasingly imposing restrictions and economic disincentives on the purchase and use of vehicles, including shared vehicles, to address growing congestion, pollution, and accidents.

Despite these obstacles, recent growth of carsharing in India and China has far outpaced their predecessors in established markets of the United States and Europe. This suggests that there are carsharing markets ripe for development if stakeholders can minimize barriers.

Sustainable cities are fundamentally dependent on sustainable transportation. Innovative businesses, governments, and academics could use WRI's findings to further support and cultivate carsharing, ensuring it becomes an important part of urban transport systems in rapidly urbanizing emerging markets.



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EXECUTIVE SUMMARY

Modern carsharing has experienced rapid growth since it was introduced in Switzerland in 1987 (Millard-Ball et al. 2005). Today, over 4.8 million members share more than 104,000 vehicles worldwide (Shaheen 2015). With large corporations entering the industry during the last decade, the scale and variety of carsharing programs/services have grown exponentially.¹ Despite global growth of the industry, only a small number of carsharing services operate in emerging markets.² About 78 percent of the world's urban population lives in Africa, Asia, and Latin America and the Caribbean, but these regions accounted for only 20 percent of global carsharing membership in 2014 (UN 2015; Shaheen 2015). Because of the limited history of carsharing in less developed countries, little is known about this transport mode's business viability or social and environmental impacts.

Carsharing might catalyze auto driving in countries with very low car ownership, by lowering the barrier to access; or it might decrease future auto driving by providing an effective alternative to car ownership before motorization has run its course.

This research develops an initial understanding of the feasibility of carsharing as a sustainable mobility option in emerging markets.³ The research develops this understanding through literature reviews; interviews with mobility experts and carsharing operators (CSOs); longitudinal industry scans of where carsharing is active in emerging markets; and focus-group discussions with targeted communities in Hangzhou, China and Bangalore, India. This research seeks to gain initial insights into the following questions:

1. What is the **current status** of the industry in emerging markets?
2. What are the main **barriers to and opportunities** for implementation?
3. What are the **potential markets**?
4. How should **carsharing systems be designed** in these markets?
5. What might be the **societal and environmental impacts**?

By developing preliminary insights about these important aspects of carsharing, WRI aims to inform academics, entrepreneurs, operators, and, to a lesser extent, policymakers, about the perceptions, opportunities, challenges, and potential impact of carsharing in emerging markets.

Key research findings yield initial insights that include:

- The **carsharing industry in emerging markets is small but expanding quickly in 2015**, with at least 22 start-ups operating more than 9,200 vehicles in Brazil, China, India, Malaysia, Mexico, South Africa, and Turkey, serving nearly 898,000 members.⁴ These figures are up dramatically from mid-2014, when the authors estimated 141,200 mem-

bers sharing more than 3,400 vehicles. Recent start-ups show rapid growth, faster than their predecessors in established markets, suggesting the existence of a ready market if operational barriers can be tackled.

- Carsharing has the **potential to increase mobility and access to goods, services, and opportunities for carless households**, (Shaheen and Cohen 2007; Cervero 2003, 2007; Lane 2005). It also has the potential to delay or replace car purchase plans in Hangzhou and to a lesser extent in Bangalore. In the focus groups conducted by WRI in October 2012, about 48 percent of participants in Hangzhou said they would consider delaying or forgoing car purchase plans if carsharing were conveniently available. In Bangalore, the level was around 30 percent. The authors hypothesize that carsharing might increase auto driving when first introduced, because predominantly carless households gain affordable access to cars; but decrease auto driving in the long term because a significant portion of members stay with the service and delay or eliminate car purchase plans.
- The **target demographic in emerging markets seems to be similar to demographics in mature markets: well-educated, mostly carless, middle-income, young to middle-aged, urban residents**. However, differences in market interest between Hangzhou (high interest) and Bangalore (medium interest) suggest that market readiness varies widely, possibly in relation to income and the availability of attractive transport alternatives such as chauffeur-driven cars, motorized two-wheelers, auto-rickshaws, and taxis.
- **Carsharing as a form of shared mobility faces major barriers** in some emerging markets—such as aspiration to personal car ownership; severe road congestion and associated driving stresses; insufficient complementary walk, bike, and transit systems; easily available, affordable labor to act as personal chauffeurs (India); potential competition from well-established informal

and intermediate public transport modes like auto-rickshaws and taxis;⁵ limited available and adequately regulated on-street parking; vehicle registration or use restrictions that limit expansion (China); and immature financial systems to facilitate cashless payment (China). However, some barriers also can be considered opportunities, and vice versa. For example, while limited parking may hinder operations, it also could spur demand. Similarly, the aspiration to drive might favor carsharing as an intermediate solution. And a strong bike sharing system might compete on a trip-by-trip basis but complement carsharing in a mostly car-free lifestyle. Still, barriers clearly are very significant. They can be tackled over time, by entrepreneurs and governments, but they could hinder growth of carsharing in the near term.

- **Affordability could be an important design objective** for carsharing services in emerging markets, where cost is already the main barrier to car ownership, and price sensitivity seems generally high. Local innovation and modifications to models already operat-

ing in emerging markets might also be keys to the success of carsharing programs. In focus groups, prospective members express interest in one-way service, vehicles with drivers, convenient locations, and a variety of car models, though the transferability of these observations remains unclear.

WRI's research provides initial findings regarding the feasibility and impact of carsharing in emerging markets, though many uncertainties remain. Limitations of the study include a light methodology that only scratched the surface of these important issues, and uncertain transferability from Hangzhou and Bangalore. In addition, the relative absence of carsharing (and research on carsharing) in emerging markets limits the extent to which observations can be interpreted and extrapolated. That said, this study provides important early findings on the current industry, barriers, and service features; and suggests significant potential for carsharing in emerging markets. The results could help inform more in-depth research, operational approaches, and public policy.





SECTION I

INTRODUCTION

Carsharing is a membership-based, self-service, short-term car-access system with a network of vehicles for which members pay by time and/or distance (Millard-Ball et al. 2005).

There are several variations of carsharing operation models today:

- **ROUND-TRIP/TWO-WAY SERVICE**, in which users pick up and drop off a vehicle at the same station. A variation of the round-trip model is Peer-to-Peer carsharing (P2P) where the vehicles are owned by private individuals, equipped with telematics, and rented via an on-line website/app. A variation is the free-floating round-trip service, in which users can return the vehicle to a zone rather than to a particular station. However, the focus groups in this research focus more on the classic round-trip station-based model.
- **ONE-WAY SERVICE**, in which users can drop off the vehicle at a different designated carsharing station. Parking may be free-floating, whereby the driver can park the vehicle anywhere within a designated zone of the city; or station-based, such as parking garages or electric-vehicle charging docks.

These two models serve very different types of trips, although with some overlap, and can have very different impacts and benefits for cities. Whereas

the mobility and societal impacts of round-trip services are well understood in mature markets, the literature provides limited anecdotal evidence of the impacts of one-way carsharing services.

Carsharing has become popular in North America, Europe, and Australia over the past three decades (Shaheen and Cohen 2012; Millard-Ball 2005). In these established markets, carsharing provides members with a convenient option to access auto mobility without the hassle of owning a car, and fills the gap between public transportation and personal cars. However, in emerging markets where rapid urbanization and motorization are underway, this mobility option has been introduced only sporadically. Asia, Africa, Latin America and the Caribbean are currently home to over 78 percent of the world's urban population, yet accounted for just 20 percent of global carsharing members in 2014 (UN 2015; Shaheen 2015). Is there a market for carsharing in less developed countries? Which services are already operating? What are the policy, operational, and transport barriers to scaling up?

The authors offer two possible, but competing, scenarios regarding the impact of carsharing on mobility habits in emerging markets:

1. **LEAPFROG SCENARIO:** Carsharing could help slow the rate of increase in personal motorization and lead to a more balanced, sustainable transport system. Experience in established markets would be magnified in cities where large-scale carsharing is introduced early, before car ownership reaches anywhere near western levels. Carsharing could help cities “leapfrog” car ownership—satisfying the occasional demand for auto mobility, while supporting frequent walking, biking, and transit use, provided that a reasonable level of transit and multi-modal travel is available in the city.
2. **STEPPING-STONE SCENARIO:** Carsharing could accelerate motorization, and spur demand for permanent car ownership, by reducing the barriers to accessing a car, and by spurring interest in driving. Indeed, evidence from established markets suggests that zero-car households increase vehicle-kilometers traveled—an effect offset by households that shed cars and drive less (Lane 2005; Millard-Ball et al. 2005). In less developed countries,



carless households comprise the vast majority of the market and might form the core market that ends up driving more than before.

This research explores carsharing in emerging markets and begins by examining two major trends: growth of carsharing, and the simultaneous growth of cities and motorized travel in emerging markets.

Carsharing Worldwide

Modern carsharing programs began in Switzerland in 1987, and in Germany in 1988, and the concept grew rapidly through the 1990s (Millard-Ball et al. 2005). Social entrepreneurs introduced carsharing to the United States, Canada, and Japan in the 1990s; by the mid-2000s, the mode had gained widespread popularity in Europe and North America. As of October 2014, there were about 4.8 million members sharing nearly 104,000 vehicles in organized carsharing systems (Shaheen 2015). Exponential growth is forecast to continue, driven by new markets, continued service innovations, and substantial new capital entering the industry. Frost & Sullivan (2010) project that global carsharing systems will see membership soar to 20 million by 2020. More recently, new service models like one-way trips, instant access (no advanced reservations), and peer-to-peer sharing (owners sharing their own vehicles) promise more convenient, affordable, and flexible forms of shared mobility.

Despite global growth of the industry, only a small number of carsharing services are operating in less developed countries. As of mid-2015, 22 carsharing operators (CSOs) are in business in 41 cities in seven emerging markets—Brazil, China, India, Malaysia, Mexico, South Africa, and Turkey.⁶ Consequently, there is very limited knowledge and understanding about the business viability, market potential, or social and environmental impacts of carsharing in emerging markets.

Motorization Challenges in Emerging Markets

Between 2010 and 2030, less developed countries alone are expected to build more new city area than has been built by all of humanity throughout recorded history (World Bank 2010). China and India, leading the trend, will add at least 600

million new urban residents (Dobbs 2010). Motorization accompanies urbanization, reflecting the rise in household incomes. By 2030, annual light-duty vehicle sales in China, India, and Brazil are expected to nearly double those in the United States and Europe combined (Sehgal 2011), advancing personal mobility, but challenging virtually every measure of transport sustainability from road safety to climate stability.

In established markets, carsharing, in concert with strong walk, bike, and transit options, has been shown to replace the need for car ownership; increase the use of walking, biking, and public transit; and shift driving toward cleaner cars (Cervero 2003; Lane 2005; Millard-Ball et al. 2005; Cervero et al. 2007; Shaheen and Cohen 2007; Shaheen and Martin 2010; Martin et al. 2010; Martin and Shaheen 2011). In Switzerland, a nationwide carsharing study showed a 72 percent reduction in vehicle-kilometers traveled (VKT) among former car owners, with large increases in bicycling and transit use, and only modest increases in driving among carless households (Muheim 2006). Similarly, ten impact studies in North America (Canada and United States) showed an average VKT reduction of 44 percent among users (Shaheen, Cohen, and Chung 2009). Each North American shared vehicle also displaced 9 to 13 privately-owned vehicles (Martin, Shaheen, and Lidicker 2010), yielding substantial cost savings.⁷

However, the transferability of these results to less developed countries is largely unknown, and differences in transport systems and car ownership rates suggest that impacts in less developed countries might be quite different. When modern carsharing first appeared in Europe and North America, complementary public transport systems were fairly advanced, and car ownership levels had already passed their peak growth period. For example, vehicle ownership in the United States stood at about 690 per 1,000 people when the first carsharing system was launched in 1998 (Millard-Ball and Schipper 2010). In contrast, most emerging markets still remain at fairly early stages of motorization: vehicle ownership in China in 2010 was only 58 per 1,000 people, for example (Wang et al. 2012). Also, the public transport infrastructure in cities of emerging markets is often highly inadequate. Furthermore, two-wheelers and affordable

taxis and auto-rickshaws satisfy a large portion of daily mobility needs in countries like India (Pai et al. 2014). As a result, much uncertainty exists regarding the potential market and mobility impact of carsharing in less developed countries.

Research Aims

The goal of this research is to provide initial insights into the feasibility and societal impact of carsharing in emerging markets, and to provide a base of knowledge for future work in this field. The research aims to develop educated hypotheses to address the following five questions:

1. What is the **current status** of the carsharing industry in emerging markets?
2. What are the various **barriers** to implementation?
3. What are the **potential markets**?
4. How should **carsharing systems be designed**?
5. What are the **societal and environmental impacts**?

By developing preliminary insights into these important aspects of carsharing, WRI aims to

inform policymakers, academics, entrepreneurs, and operators about the perceptions, opportunities, and challenges regarding carsharing in emerging markets, and how and whether carsharing should be incorporated into sustainable urban mobility plans.

To develop educated hypotheses, the authors conducted literature reviews; global expert interviews regarding carsharing in a wide range of emerging markets; and focus groups with existing/potential carsharing users in Hangzhou, China and Bangalore, India. The expert interviews and focus groups were conducted in summer and fall of 2012 respectively. However, the scan of the global carsharing industry was updated several times including in summer and winter of 2013, summer 2014, and spring 2015 (see Figure 1). To the best of the authors' knowledge, this is the first attempt to explore the feasibility and impact of carsharing in such a wide range of emerging markets, and the first to document the growth of carsharing over time in emerging markets.

This report is structured as follows: Section 2 provides an overview of the research methodology. The subsequent five sections present key findings for each of the research questions, as described below. Finally, the report concludes with a discussion on the potential opportunities of carsharing in emerging markets and need for further research.

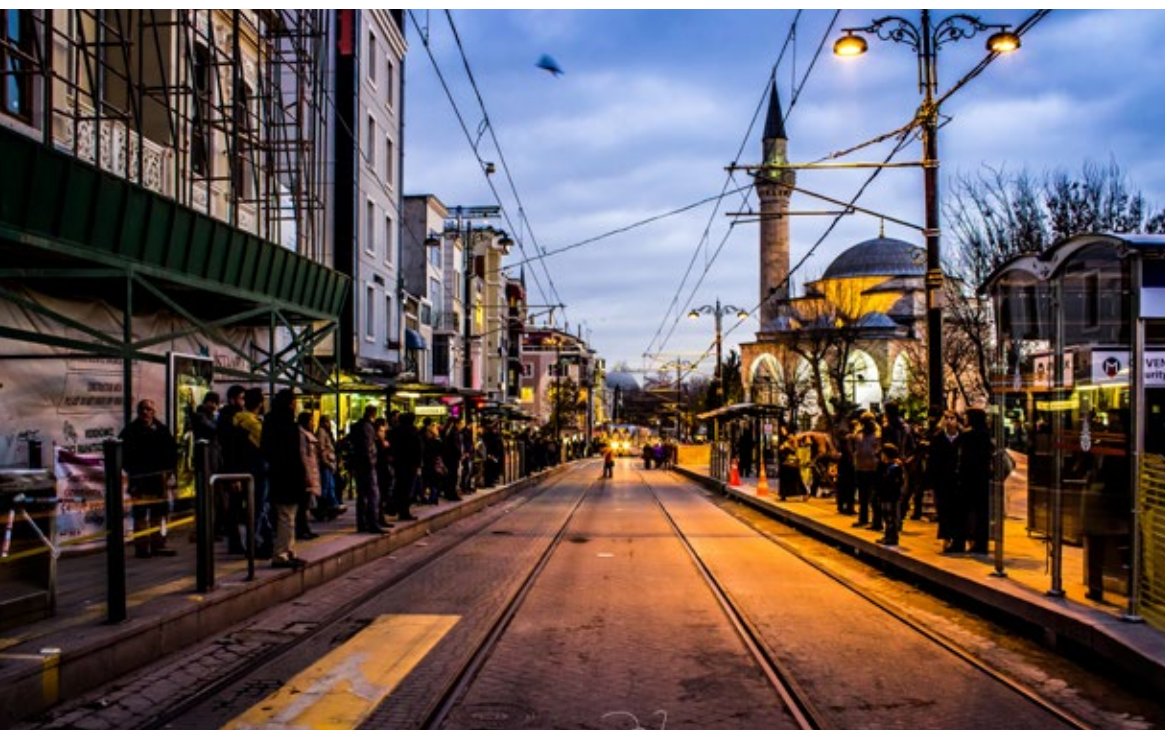
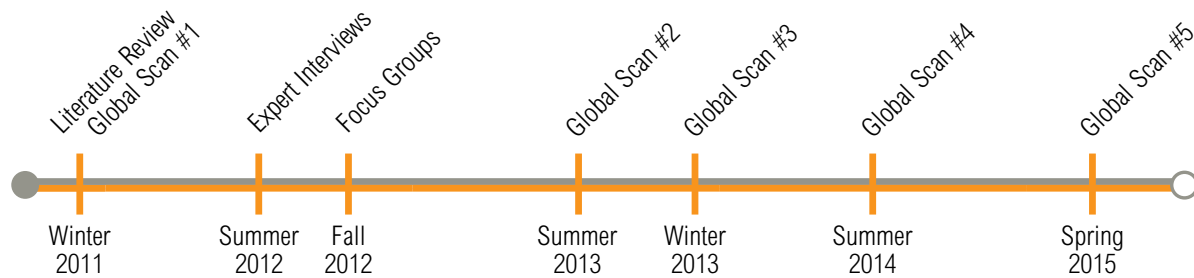


Figure 1 | **Research Timeline**



- Section 3, “Current Status,” presents an overview of existing carsharing operators in less developed countries.
- Section 4, “Social and Environmental Impacts,” summarizes initial findings about potential mobility impacts of carsharing based on focus groups and expert interviews.
- Section 5, “Barriers and Opportunities,” summarizes potential obstacles to the round-trip carsharing business model in emerging markets under the following four categories: potential users, transportation infrastructure, governance (regulatory and policy challenges), and business.
- Section 6, “Potential Markets,” presents current user and trip types in countries including Brazil, China, India, Mexico and Turkey. It also explores the market potential in target communities in Hangzhou and Bangalore, based on findings from focus groups.
- Section 7, “Operational Models,” explores the design requirements of carsharing systems in emerging markets. It highlights some innovative operational solutions adopted by CSOs in these markets in response to specific barriers. It also presents specific requirements from the demand side that might influence the design of systems in Hangzhou and Bangalore.





SECTION II

METHODOLOGY

Each part of the research was designed to inform the next, and to address some key questions more deeply than others (see Figure 2). This project started with literature reviews to assess existing knowledge about the feasibility and impact of carsharing in emerging markets. Then the researchers collected insights from interviews with mobility experts and carsharing operators in multiple countries, which led to the development of the research hypotheses. The researchers then “ground tested” some of the hypotheses and assertions through focus groups with potential or existing carsharing members in Hangzhou, China and Bangalore, India.

As shown in Figure 2, views from mobility experts (either derived from literature reviews or through interviews) helped refine the research hypotheses for all questions. Interviews with current carsharing operators helped to inform supply-side findings about operational barriers. Focus groups with existing or potential users explored market demand and mobility impacts. The researchers analyzed the information and data qualitatively and quantitatively to generate some initial answers to the five research questions.

Literature Review

The literature reveals extensive research on carsharing in the established markets of Europe and North America but only a modest volume focused on emerging markets. Evidence from the literature is cited throughout this research and also summarized here. Shaheen and Martin (2010) conducted an intercept survey on perceptions of carsharing in Beijing and found significant interest. Wang (2010) conducted surveys in Shanghai that suggested that early adopters would likely be young and well-educated, as in established markets. Regarding the social and environmental impact, Zazcar in Brazil conducted a customer survey in 2012 and found potential positive impacts of their service (Zazcar 2012). However, the literature

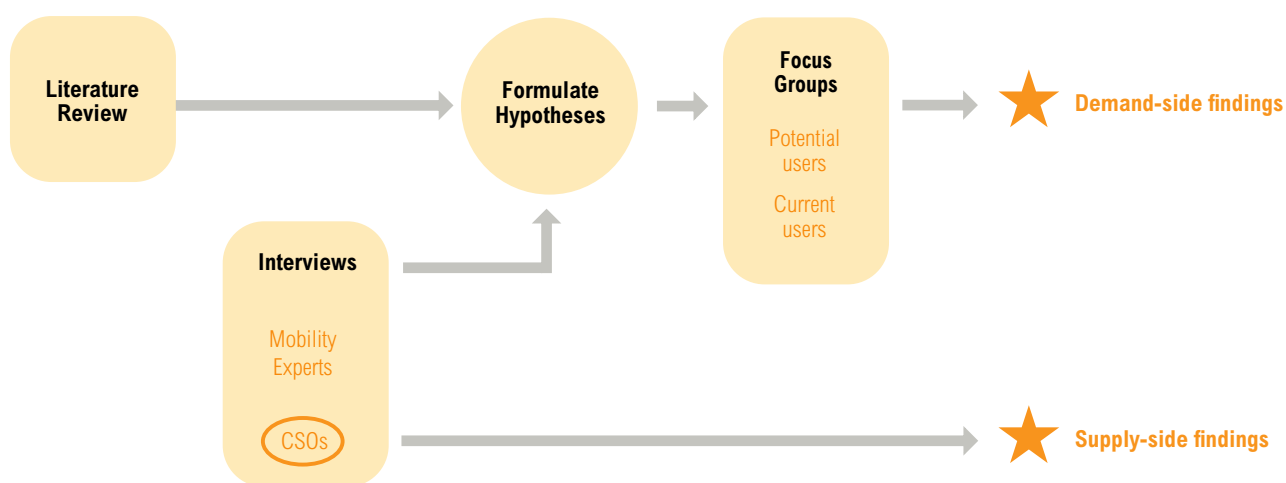
review as a whole revealed a significant knowledge gap (Shaheen and Martin 2010, Wang 2012), especially regarding the current status, operational performance, and impact of carsharing in emerging markets.

Expert Interviews

The researchers reached out to 45 experts and conducted 26 interviews with participants in 11 countries; they included nine CSOs, 11 mobility experts or academics, and six other stakeholders such as technology providers and operators of other shared modes. The researchers tried to ensure a diversity of geographic perspectives, by including experts from established markets as well as from emerging markets where carsharing was already operating or would operate soon. The CSO interviewees included one from Brazil, two from China, one from Europe, two from India, two from Mexico, and one from Turkey.⁸ Most of these CSOs were the earliest carsharing start-ups in their region.

The expert interviews further developed the authors' understanding of carsharing in several emerging markets, informed focus group city selection, and helped refine a set of hypotheses and research questions for the focus groups.

Figure 2 | **Formulation of Supply-side and Demand-side Findings**



Focus Groups

The researchers selected China and India as focus-group countries because they are (1) the most populous emerging-market countries and (2) at different positions on their motorization, urbanization, and development trajectories. Hangzhou, China and Bangalore, India were chosen as the two focus-group cities because researchers and experts believed they might present promising markets for carsharing, and therefore could more likely reveal user preferences. Both urban areas are fast-growing, medium-sized cities with rising income and major traffic issues, for which carsharing might offer an alternative to growing car ownership. Hangzhou also supports the world's largest bike sharing system, with over 60,000 public bicycles (MetroBike 2014), and is home to Chefenxiang (formerly EVnet), one of the first carsharing services in China, with over 1,000 carsharing members at the time of the focus groups. Meanwhile, Bangalore is home to a burgeoning information-technology industry with a well-educated work force, and a brand new carsharing service called Zoom which launched in February 2013, a few months after we conducted the focus groups there.

Since this was possibly first-of-its-kind research on carsharing perceptions in these cities, it remains unclear to what extent the findings from these cities are applicable to other cities, especially those that vary in demographics and travel demand and patterns.

The questions posed to focus-group participants explored their likelihood of using the service, price sensitivity, service requirements like stations and fleet type, and possible behavioral and car-ownership change. The focus groups were designed to target likely early adopters of carsharing, as suggested by previous research (Shaheen and Martin 2010, Wang 2010).

In Hangzhou, focus-group participants were relatively young (aged 20 to 40), well-educated (junior college or above), middle-income working professionals (US \$413 to US \$3,802/month). Seven focus-group meetings were scheduled⁹ with 48 participants. The groups included 24 car owners, 24 non-car owners and, within these groups, 12 members of Chefenxiang (EVnet), Hangzhou's CSO at the time.



Because Hangzhou had an existing carsharing service at the time and Bangalore did not, and considering the unique social and mobility characteristics of Bangalore, the composition of focus groups in Bangalore was somewhat different. Researchers studied two target communities of potential car-sharing users:

- **WORKING PROFESSIONALS** who are the primary breadwinners in a household and would have primary access to the household's automobile if one existed
- **SECONDARY HOUSEHOLD MEMBERS** who know how to drive and might need a vehicle occasionally but who might not have primary access to a household vehicle¹⁰

Forty-four individuals participated in nine focus-group meetings in Bangalore. This included a mix of working professionals and secondary household members with varying car access and ownership rates.¹¹

BOX 1 | PROFILE OF HANGZHOU, CHINA



GEOGRAPHY: capital of Zhejiang Province, located 180 km west of Shanghai.

POPULATION: 8.7 million.

GDP PER CAPITA: exceeded US \$12,300 in 2011 (similar to the level of Beijing and Shanghai).

ECONOMIC GROWTH: Like other large cities in China, Hangzhou has experienced rapid economic growth, urbanization, and motorization over the last decade. The annual GDP growth rate exceeded 10 percent on average between 2002 and 2012 (Statistics Bureau of Hangzhou 2012).

MOTORIZATION: In 2000, the number of motorized vehicles was 396,000 (Hangzhou Urban Planning Institute 2006). By the end of 2011, the number of motor vehicles had risen to 2.14 million.

MODE-SHARE: In 2009, non-motorized modes still dominated modal split. Biking and walking together accounted for 66.6 percent of all trips, while automobile and public transport represented 13.7 percent and 19.7 percent respectively (Banister and Liu 2013).

PUBLIC TRANSPORT SYSTEM: Hangzhou has installed a fairly good public transport system. The city runs the world's second largest bike sharing system with 65,000 bikes and over 2000 stations. It operates 7,200 buses, covering 524 routes, including a 100-km BRT system (Statistics Bureau of Hangzhou 2012). Hangzhou's first metro line opened in Nov 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 is facing an acute parking shortage: currently the parking space 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 (Zjol 2014). This does not include parking spaces for new growth.

CARSHARING: As of early 2015 there are three active carsharing operators in Hangzhou—YiDianzc, Chefexiang, and Weigongjiao (Kandi).

BOX 2 | PROFILE OF BANGALORE, INDIA



GEOGRAPHY: Bangalore is the capital of the state of Karnataka, located in the southern part of India. Its land area is 800 sq km.

POPULATION: approximately 8.5 million in 2011, it is the third largest city in India. Bangalore is also one of the fastest growing cities with a decadal growth rate of 65.2 percent between 2001 and 2011 (Balachandra and Sudhakara 2013).

GDP PER CAPITA: The per capita GDP in Bangalore was US \$3,963 in 2012 (Verma 2013). Bangalore is commonly referred to as the “Silicon Valley of India” because of the concentration of IT jobs in the city.

ECONOMIC GROWTH: Bangalore’s per capita GDP grew 5.5% between 2000 and 2014 (Parilla et al. 2014). Over the years, increasing employment and educational opportunities in Bangalore have attracted a significant number of people from outside the city, affecting the structure of the city and, as a result, its transportation demand and mobility patterns. One glaring characteristic of this emerging

mobility system is the huge “mobility divide” between rich and poor in terms of the conditions and available opportunities for transport.

MOTORIZATION: The total vehicle population in Bangalore as of August 2013 was 4,779,000, of which two-wheelers comprised the large majority at 3,286,892 (Rajkotia and Chanchani 2012). Close to 900 motorized vehicles are registered in Bangalore every day, mostly two-wheelers, a trend that is fast becoming a matter of concern among not only planners and policymakers but also the citizens of the city (Balachandra and Sudhakara 2013). In fact, Bangalore has the highest share of motorized two-wheelers when compared to the rest of the five metro cities in India, namely Delhi, Mumbai, Chennai, Kolkata, and Hyderabad. In the absence of any policy to regulate ownership and utilization of personal vehicles, Bangalore has suffered from increased pollution, congestion, and road crashes.

MODE SHARE: The share of trips in Bangalore was observed to be 4.5 percent bicycle, 4.6 percent auto-

rickshaw, 5.5 percent private car, 21.4 percent motorcycle, 30 percent bus, and 34 percent walking (Prabhu and Pai 2012).

PUBLIC TRANSPORT SYSTEM: Bangalore has a more extensive network of public bus transport than most Indian cities, but the service coverage still falls short of the need of the growing population. Bus services are operated by Bangalore Metropolitan Transport Corporation (BMTCL). With a mixed fleet of 5,593 buses of various makes and capacities operated by BMTCL, about four million passengers a day are carried on 2,307 routes (EMBARQ India 2010). The city’s first metro line opened on 20th October 2011 and runs along a 6.7 km corridor.

CARSHARING: At the time of this research, Bangalore was an untested market for carsharing services. More recently (February 2013), a new carsharing system called ZoomCar was launched in Bangalore and has subsequently expanded to other Indian cities.

Figure 3 | Classic Round-Trip Carsharing Mode Presented to Hangzhou and Bangalore Focus Groups

HOW TO BECOME A MEMBER

- possess a driver's license
- own a credit card or debit card to pay online
- fill out the application form

USAGE FEE

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



Since classic round-trip service (rather than one-way or peer-to-peer) is the most widely adopted carsharing business model, the focus groups introduced the round-trip carsharing model as the standard example for a carsharing service (see Figure 3).

Limitations of the Research

There are several important limitations of this research that may restrict the transferability of its results:

- **METHODOLOGY:** The research methods of expert interviews, literature reviews, and targeted focus groups provide just enough insight to form well-educated hypotheses to guide future research. They by no means approach the sophistication of an in-depth or comprehensive feasibility study.

- **GEOGRAPHIC COVERAGE:** The relative absence of carsharing in most emerging markets, and of research on this topic, limits the extent to which observations can be interpreted and transferred. Also the research focuses mostly on upper, middle-income, emerging markets of Brazil, China, India, Malaysia, Mexico, South Africa, and Turkey. Many differences may exist between these countries and with other future emerging markets.

- **GENERALIZABILITY FROM HANGZHOU AND BANGALORE:** Focus group results from these two cities may provide the strongest insights for cities that are similar in terms of their demographics, culture, economic structure, urban form, and transport. But, in general, results cannot be transferred to all cities in emerging markets; even in China and India, markets vary among cities.

- **PERSPECTIVE AND SAMPLING:** The perspective of regulators and policymakers in emerging markets is not explored directly. Also the focus groups comprise only a small portion of the markets, and just one or two types of potential users. The presence of carsharing members in our focus groups also underscored their particular sub-market in our study. The research did not attempt to create an unbiased sample. Results may be more applicable to similar segments of the market, and to other cities of very similar size, urban form, transport systems, and economic development levels.
- **COMPARABILITY BETWEEN HANGZHOU AND BANGALORE CASE STUDIES' RESULTS:** Researchers selected different sets of target communities in Hangzhou and Bangalore due to their unique social and mobility systems and the different maturity of carsharing. Thus the results in these two cities may not always be comparable.

Focus group results from Bangalore and Hangzhou may provide the strongest insights for cities that are similar in terms of their demographics, culture, economic structure, urban form, and transport.





SECTION III

CURRENT STATUS OF CARSHARING IN EMERGING MARKETS

This section provides an overview of the current status of carsharing in less developed countries based on literature reviews and expert interviews. It summarizes the variety of operational and business models in use. While the research scans less developed countries broadly, carsharing is found to exist in a subset of lower-to-middle-income, emerging markets.

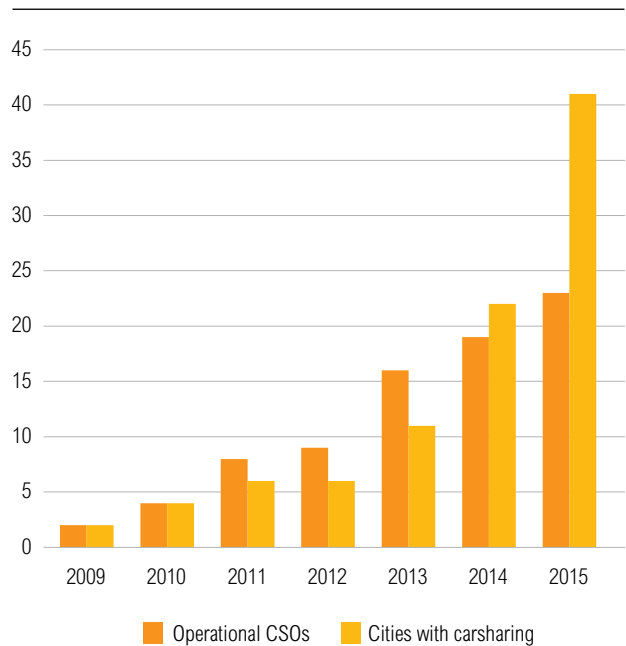
Global Carsharing Scan

Carsharing is a recent phenomenon in emerging markets, only taking root within the last five years. As of mid-2015, 22 carsharing operators exist in 41 cities in seven emerging countries—Brazil, China, India, Malaysia, Mexico, South Africa, and Turkey.¹² See Table 1 and Figure 5.

Carsharing in emerging markets has grown and changed quickly, even in the few years since WRI began this research. Since 2012, there has been some consolidation of CSOs as well as some growth. Seventeen new CSOs were introduced and four were canceled (or put on hold, or acquired), bringing the total number of operational CSOs from 9 in 2012 to 22 in mid-2015; two additional CSOs are planned for late 2015 and 2016. The number of cities in emerging countries with at least one operational CSO has risen steadily from six in 2012 to 41 in mid-2015 (see Figure 4). Expansion to two new cities is planned by late 2015, and to a third in 2016.

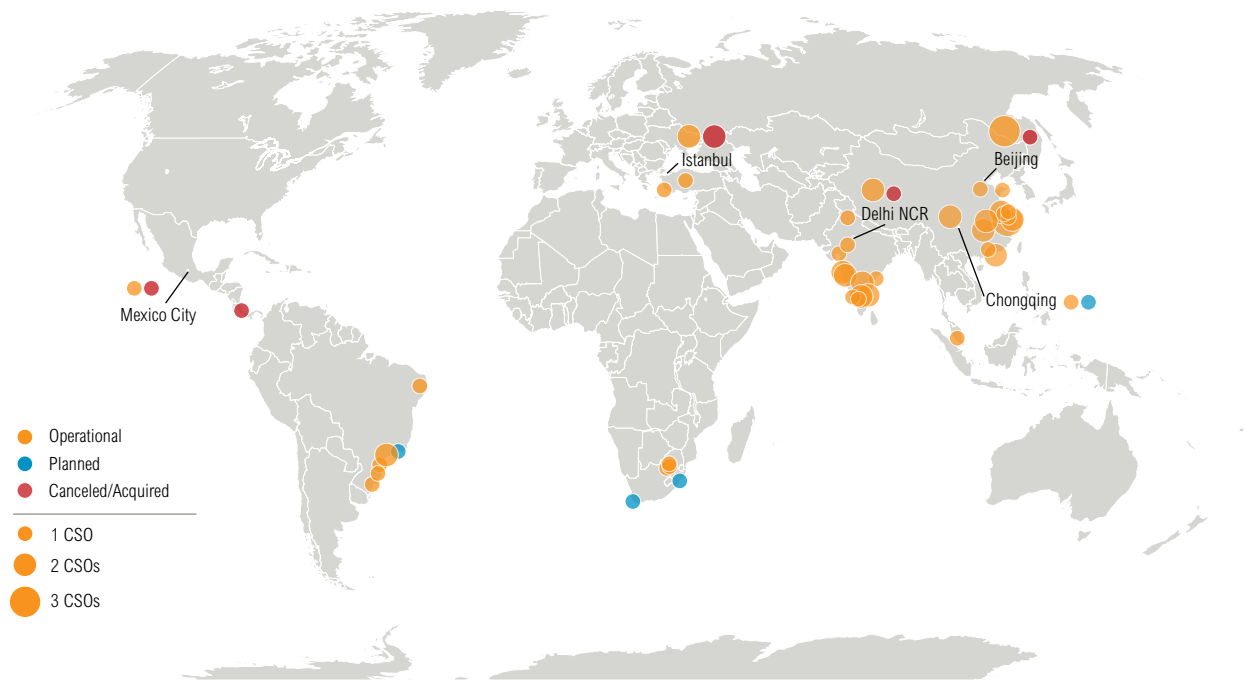
The size of the individual CSOs has also significantly expanded in recent years. In 2012, the nine CSOs operated a combined fleet of about 260 vehicles and served about 4,460 members. By mid-

Figure 4 | Growth of Carsharing Operators in Emerging Markets



2015, the 22 CSOs had nearly 898,000 members sharing more than 9,200 vehicles, a remarkable expansion in four years (see Figure 6).

Figure 5 | Map of Carsharing in Emerging Markets (2015)



Status by Country

Brazil was the first emerging market country to introduce carsharing. Founded in 2009, São Paulo’s Zazcar was the first carsharing system in South America. In August 2012, Zazcar operated 60 vehicles serving around 1,100 members; membership had grown to over 3,000 members by early 2015.¹³ After many years with only one CSO, Brazil has experienced a recent expansion in the industry. Since 2013, five new CSOs have launched at least pilot operations in five different Brazilian cities. Plans are also being developed for a CSO to launch in Rio de Janeiro in 2016.

In 2010, Sigo launched four stations in San José, **Costa Rica** with four vehicles. It grew to a fleet of 23 before closing in April 2014.

Mexico’s carsharing systems emerged in mid-2012 in Mexico City. Carrot launched with three vehicles, grew to a fleet of 20 within its first two months (Jung 2014b) and had 60 cars with over 3,000 members by January 2014.¹⁴ Ubicar launched in August 2012 with 25 vehicles and was acquired by Carrot later that year. In contrast to pilots in other emerging markets, carsharing in Mexico benefitted

from early local government support. For example, Mexico City officials partnered with Carrot to co-launch the service at a public event, implicitly endorsing the service.

Four CSOs have launched in Istanbul, **Turkey** since 2010: Atlagit, Mobicar, Mobilizm, and YOYO. Reaching a peak of two cars and 55 members, Atlagit was cancelled in 2013 after about three years of operation. Between 2011 and 2014, Mobilizm grew to a fleet of 60 vehicles serving about 4,000 members (Daily Sabah 2014), but by early 2015 operations were put on hold indefinitely (Mobilizm 2015). At its peak in 2014, Mobicar had 41 cars and about 3,500 members but by early 2015 had scaled back operations to only 10 vehicles.¹⁵ The fourth and most recent Turkish CSO, YOYO, was launched in Istanbul in 2012 with 15 vehicles and has continued to grow since. They expanded to Ankara and Bodrum in 2014 and by early 2015 had 112 vehicles and more than 14,000 members. The YOYO fleet also includes scooters.

The research identified ten CSOs in **China**, and an eleventh is scheduled to launch in late 2015. As of early 2015, these CSOs were operating nearly 6,500 vehicles in 15 Chinese cities (see Table 1).

Figure 6 | Growth of Carsharing Members and Fleet in Emerging Markets

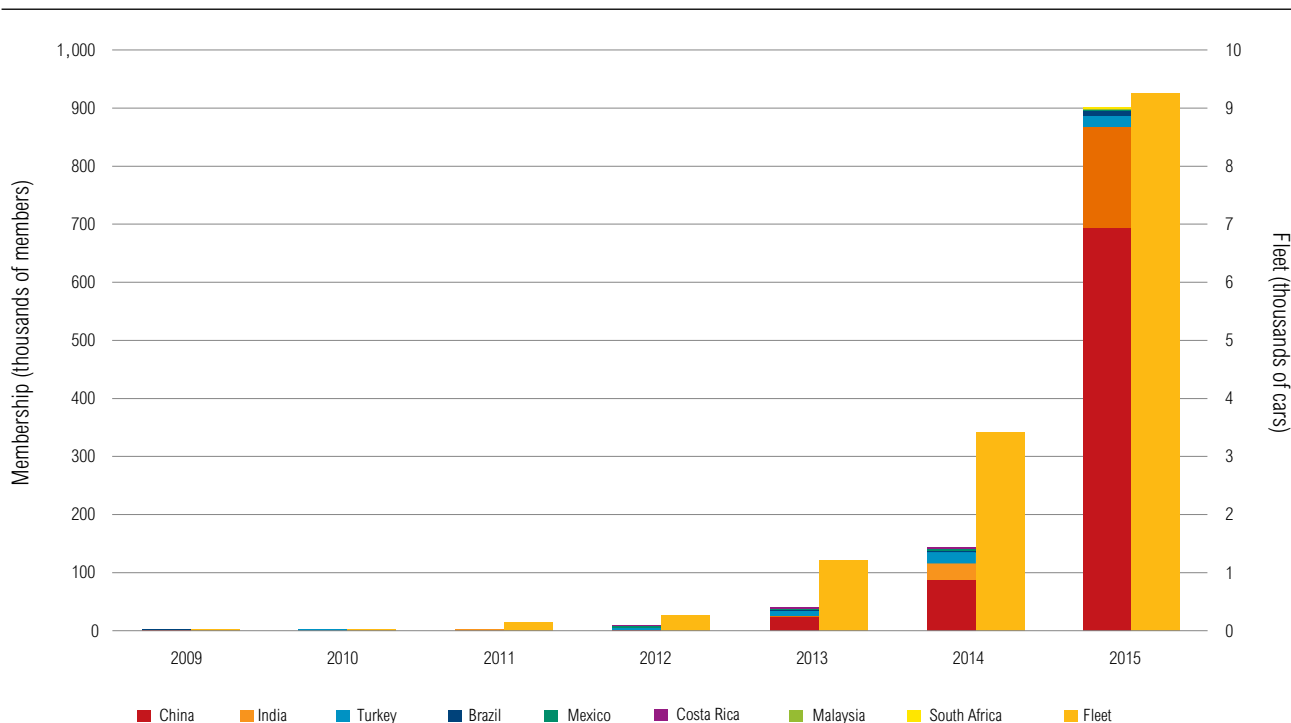


Figure 7 | Longitudinal Growth of Carsharing in Emerging Markets

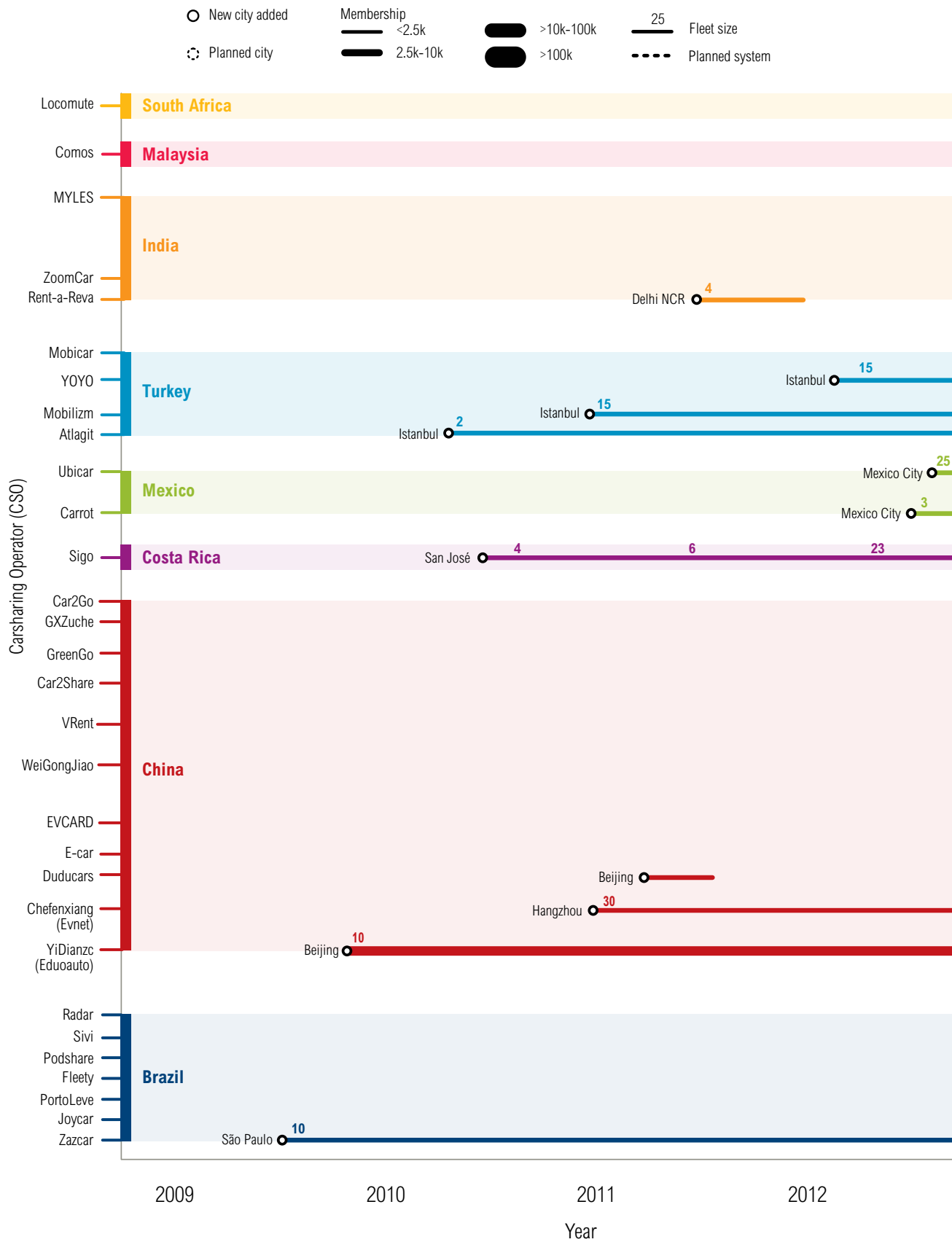


Figure 7 | Longitudinal Growth of Carsharing in Emerging Markets (continued)

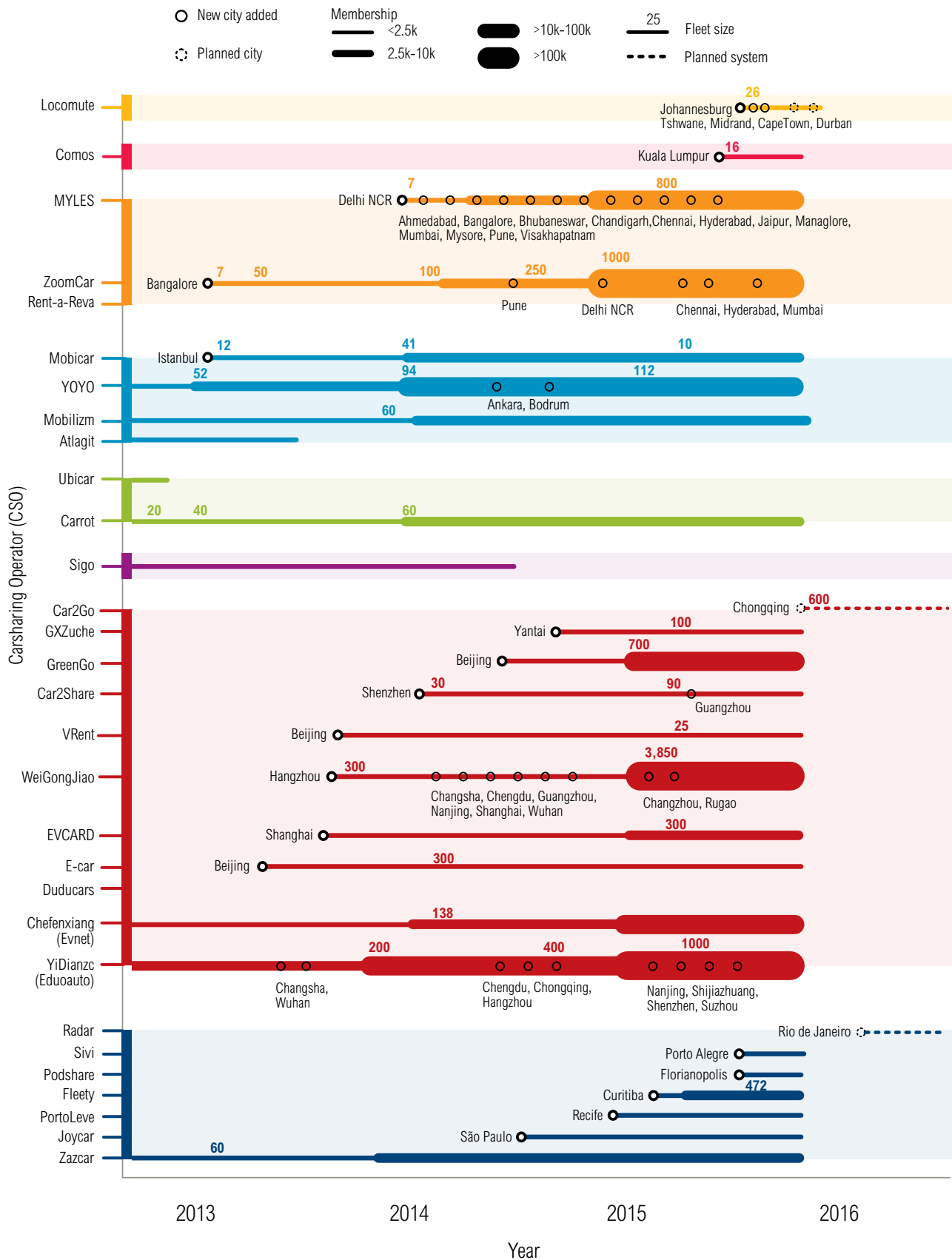


Table 1 | Illustrative Status of Carsharing Operators in Emerging Markets

SYSTEM NAME	CITY (1ST, SUBSEQUENT)	COUNTRY	BUSINESS MODEL	START DATE (1ST CITY)	FLEET SIZE (MAX)	MEMBERS (MAX)	STATUS	WEBSITE
Zazcar ^a	São Paulo	Brazil	Roundtrip	2009	60	3,200+	Operational	www.zazcar.com.br
JoyCar	São Paulo	Brazil	Roundtrip	2014	/	/	Operational	www.joycar.com.br
PortoLeve	Recife	Brazil	Roundtrip	2014	/	/	Operational	www.portoleve.org
Fleety	Curitiba	Brazil	Peer-to-Peer	2015	472 ^b	5,505 ^b	Operational	fleety.com.br
Podshare	Florianopolis	Brazil	/	2015	/	/	Pilot	www.podshare.com.br
Sivi	Porto Alegre	Brazil	/	2015	/	/	Pilot	www.mvmtechnologies.com.br/
Radar ^c	Rio de Janeiro	Brazil	/	2016	/	/	Planned	/
YiDianzc (EduoAuto)	Beijing Changsha Chengdu Chongqing Hangzhou Nanjing Shenzhen Shijiazhuang Suzhou Wuhan	China	Roundtrip	2009	1,000 ^d	278,419 ^d	Operational	www.yidianzc.com
Chefenxiang (EVnet) ^e	Hangzhou	China	Roundtrip	2011	138	9,915	Operational	www.ccclubs.com
Duducars	Beijing	China	/	2011	/	/	Canceled (2011)	www.duducars.com
E-car (Beijing EV Partnership)	Beijing	China	Roundtrip	2013	300 ^f	/	Operational	www.evbeijing.cn/
EVCARD ^d	Shanghai	China	Roundtrip	2013	300	3,000	Operational	www.evcardchina.com

/ = indicates an unknown figure

Table 1 | Illustrative Status of Carsharing Operators in Emerging Markets (continued)

SYSTEM NAME	CITY (1ST, SUBSEQUENT)	COUNTRY	BUSINESS MODEL	START DATE (1ST CITY)	FLEET SIZE (MAX)	MEMBERS (MAX)	STATUS	WEBSITE
Wei Gong Jiao, (Kandi)	Hangzhou Changsha Changzhou Chengdu Guangzhou Nanjing, Rugao Shanghai Wuhan	China	One-way	2013	3,850 ^g	385,000 ^h	Operational	www.kandivehicle.com
VRent ^d	Beijing	China	Roundtrip; Corporate	2013	25	/	Pilot	www.vrent.cn
Car2Share	Shenzhen, Guangzhou	China	Roundtrip; Corporate	2014	90d	/	Operational	www.car2share.com.cn
Green Go ^d	Beijing	China	Roundtrip	2014	700	15,000	Operational	www.green-go.cn
GX Zuched	Yantai	China	Roundtrip	2014	100	2,000	Operational	www.gx-zuche.com
Car2go	Chongqing	China	One-way	2015	600	/	Planned	www.car2go.cn
Sigo	San José	Costa Rica	Roundtrip	2010	23	/	Canceled (2014)	
Rent-a-Rev ^a	Gurgaon	India	Roundtrip	2011	4	357	Canceled (2011)	www.uthaanngo.org
ZoomCar ⁱ	Bangalore Chennai Delhi NCR Hyderabad Mumbai Pune	India	Roundtrip	2013	1,000	100,000	Operational	www.zoomcar.in
MYLES	Delhi NCR Ahmedabad Bangalore Bhubaneswar Chandigarh Chennai Hyderabad Jaipur Mangalore Mumbai Mysore Pune Visakhapatnam	India	Roundtrip	2013	1,000 ^j	75,000 ^k	Operational	www.mylescars.com

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Table 1 | Illustrative Status of Carsharing Operators in Emerging Markets (continued)

SYSTEM NAME	CITY (1ST, SUBSEQUENT)	COUNTRY	BUSINESS MODEL	START DATE (1ST CITY)	FLEET SIZE (MAX)	MEMBERS (MAX)	STATUS	WEBSITE
Comos ^l	Kuala Lumpur	Malaysia	Roundtrip	2015	16	/	Operational	www.comos.com.my
Carrot ^m	Mexico City	Mexico	Roundtrip & One-way	2012	60	3,000	Operational	www.carrot.mx
Ubicar	Mexico City	Mexico	Roundtrip	2012	25	/	Purchased by Carrot in 2012	
Locomute ⁿ	City of Tshwane, Johannesburg, Midrand; Cape Town & Durban planned	South Africa	Roundtrip	2015	26	/	Operational	locomute.co.za
Atlagit ^a	Istanbul	Turkey	Roundtrip	2010	2	55	Canceled in 2013	
Mobilizm	Istanbul	Turkey	Roundtrip	2011	60 ^q	4,000 ^q	Canceled in 2015	www.mobilizm.com
YOYO ^r	Istanbul Ankara Bodrum	Turkey	Roundtrip	2012	112	14,100	Operational	www.driveyoyo.com
Mobicar	Istanbul	Turkey	Roundtrip	2013	41 (10 currently) ^p	3,500 ^q	Operational	www.mobicar.com.tr

/ = indicates an unknown figure

Notes:

- a. Barroso, Felipe. Interview by Heshuang Zeng. Email. Washington D.C., December 5th, 2013.
- b. Shahan 2015.
- c. Auto Rental News 2015.
- d. Jung 2015.
- e. Liu, Yi'an, CTO of Chefenxiang, email message to author, April 3, 2014.
- f. Roland Berger 2014,
- g. Conservative estimate assuming 9,850 total fleet (Kandi 2014) with 6,000 used for long term rentals (Geekcar 2015) leaving 3,850 for carsharing.
- h. Estimated using ZoomCar's Spring 2015 vehicle to member ratio of 0.010.
- i. Moran, Greg. Co-founder ZoomCar. Email message to Aileen Carrigan. March 11, 2015.
- j. www.mylescars.com
- k. Estimated using Myles Spring 2015 vehicle to member ratio of 0.013 (Franchise India 2015; Business Line 2015).
- l. Lee 2015.
- m. Solórzano, Diego. 2014. Interview by Heshuang Zeng, Tape recording, Washington, D.C., Jan 18, 2014.
- n. Uzebu 2015.
- o. Mushin Guler. Interview by Heshuang Zeng.
- p. Öztürk, Erben. Co-founder Mobicar. Email message to Aileen Carrigan. March 23, 2015.
- q. Daily Sabah 2014.
- r. Cavusoglu, Berkman. Email message to Aileen Carrigan. April 7, 2015.
- s. Carrot offers limited one-way service in Santa Fe, Mexico.

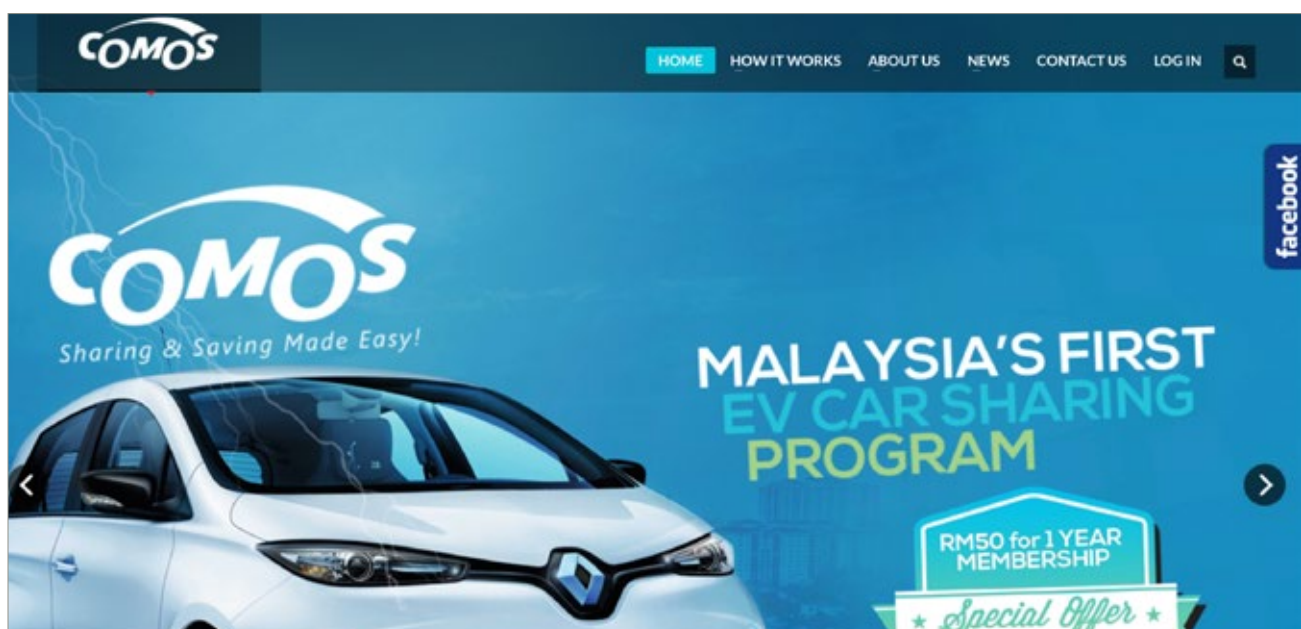
When the focus groups were conducted in October 2012, only two CSOs were in operation in China: EduoAuto (later changed name to YiDianzc) and EVnet (later changed name to Chefenxiang). YiDianzc had seven vehicles in Beijing while Chefenxiang operated over 30 in Hangzhou.^{16,17} By December 2013, YiDianzc had grown quickly to 200 vehicles serving 20,000 registered users in three Chinese cities¹⁸ and added 200 more vehicles by 2014 (Jung 2014). As of early 2015, YiDianzc operates 1,000 vehicles in ten Chinese cities serving a remarkable 278,000 members. The growth rate of Chefenxiang was also quite fast; by April 2014, they had grown to 138 vehicles with 47 stations serving 9,915 members.¹⁹

Kandi, an all-terrain vehicle manufacturer, launched an all-electric vehicle sharing service, Wei Gong Jiao, in Hangzhou in September 2013. The service shares an estimated 3,850 vehicles between 385,000 members across nine Chinese cities.²⁰ It has a contract to deploy 20,000 electric cars in Hangzhou, and aspirations to scale up the system to 100,000 shared vehicles operating from 750 stations by 2017 (Forbes 2013), a scale that, if achieved, would roughly double the entire world's carsharing fleet, in one city. Green Go launched in Beijing in 2014 and has expanded quickly. The service's 15,000 members currently share 700 vehicles. In 2014, Car2Share launched a pilot in

Shenzhen, accessible to employees of a local IT company. German automaker Daimler AG also plans to launch a public version of its North American and European carsharing service, Car2Go, in Chongqing by the end of 2015 (Yingzi 2015).

After a tentative start, carsharing is beginning to show significant growth in **India**. In 2011, a small carsharing pilot with four electric vehicles was tested in the suburbs of Delhi by a local NGO in partnership with a car manufacturer, under a project called Rent-a-Reva. However, the project was abandoned after the partnership ended prematurely. ZoomCar, a new semi-carsharing service, was launched in Bangalore with seven vehicles in February 2013, shortly after WRI completed the focus groups. ZoomCar operates similarly to Zipcar. However, unlike typical carsharing services for which members need to pick up and drop off the cars at the stations themselves, ZoomCar has staff in each station to issue the vehicles to customers, collect customer signatures, refuel the vehicle, and provide assistance to users. ZoomCar has witnessed exponential growth in Bangalore since its launch. By mid-2014, ZoomCar had 250 cars in 35 locations across Bangalore, serving approximately 10,000 registered members, and had started operations in Pune, a tier-two metropolitan city in the state of Maharashtra.²¹

Figure 8 | **Comos, Malaysia's First Carsharing Operator**



Source: <http://www.comos.com.my>. Accessed on October 29, 2015.

The service expanded to the Delhi National Capital Region (Delhi NCR) at the end of 2014 and has since continued to grow rapidly. As of early 2015, the company had over 100,000 members and 1,000 vehicles,²² and had expanded to Chennai, Hyderabad and Mumbai.²³ India has recently seen the growth of a second CSO. In late 2013, car rental company Carzonrent launched the “self drive” carsharing brand MYLES in Delhi NCR. With a fleet of 1,000 cars, the service currently offers hourly carsharing in 13 cities.²⁴ MYLES’ membership is estimated to be 75,000.²⁵

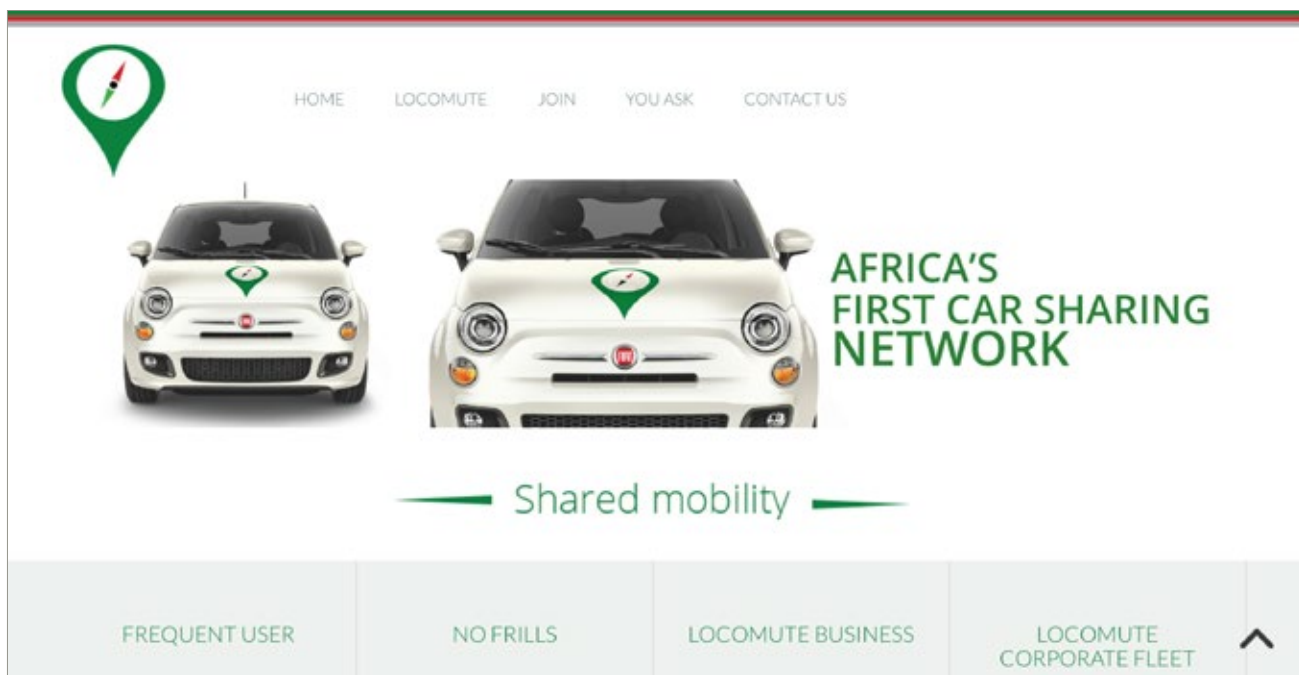
In May 2015, Cohesive Mobility Solution, an electric car company, launched the electric carsharing service Comos Carsharing in Kuala Lumpur, Malaysia (see Figure 8). Through a partnership with the local transit agency, Comos offers 16 electric Renault Zoes available at 10 stations, including five of the city’s light rail stations (Lee 2015; Comos 2015).

Africa’s first carsharing operator, Locomute, launched in South Africa in June 2015 (see Figure 9). They currently serve three cities—Johannesburg, Midrand, and City of Tshwane Metropolitan Municipality—with 26 vehicles. Locomute has announced plans to expand to Cape Town and Durban by late 2015.

Operational and Business Model Trends

Almost all CSOs in middle-income countries operate classic round-trip services. Kandi, in Hangzhou, is the only fully one-way system operating in emerging economy nations. Carrot started piloting a very limited station-based, one-way service in late 2013 between the main fleet area and a shopping/business area 10-15 miles away. The operation was not considered successful, according to the CEO.²⁶ Fleety, in Curitiba, is the only peer-to-peer CSO we identified in emerging markets.

Figure 9 | Locomute, Africa’s First Carsharing Company



Source: <https://www.locomute.co.za>. Accessed September 16, 2015

Both mobility experts and CSOs suggested that round-trip carsharing is the most feasible model to implement during initial years of operation in less developed countries, because one-way systems are more complex to operate and require larger fleet sizes to ensure adequate availability.

Several carsharing operators noted that they were considering one-way systems for the future, but they were concerned about logistical costs. Studies have shown that fleet redistribution in one-way systems can constitute up to 40 percent of total operating costs.²⁷

BOX 3 | THE RISE OF RELATED MODES IN EMERGING MARKETS: RIDESHARING, CAR RENTAL, SHARED TAXI, AND CAR HAILING PLATFORMS

In **Brazil**, the largest employer-based ridesharing company, called Caronetas, has over 1,000 participating corporate clients and more than 800,000 employee-members, as of 2014 (Nigro 2014). Caronetas provides an online platform that allows users to share a ride with co-workers. Passengers compensate drivers for the cost of fuel and car usage through an online credit system, while participating companies have the option of branding themselves as green enterprises on the ridesharing website. According to expert interviews, most customers use ridesharing to replace private vehicle trips. Caronetas is therefore expected to reduce vehicle emissions.

In **China**, while the potential for carsharing has not yet been fully explored, chauffeured car rental, self-drive car rental, and other vehicle-sharing services are growing quickly. The total size of the car-for-hire market in China was estimated to be US\$3 billion in 2010 and the chauffeured car rental and self-drive car rental contributed shares of 17 percent and 11 percent respectively (Motorlink 2012). The largest car rental company in China, Shenzhou Zuche, had over 50,000 vehicles in 2013 and its annual growth rate from 2009 to 2013 was over 200 percent (Bloomberg 2013). Another car rental giant, eHi Car Service, with a fleet of 18,000 vehicles in 90 cities, launched its public offering in November 2014.

New modes like shared taxi and ridesharing have also emerged in China. For example, Shanghai's Dazhong offers shared taxi services in which users can make reservations online and share the ride with strangers (Wang 2012).

Meanwhile, the taxi industry in China is undergoing major changes brought on by the increasing popularity of taxi-hailing applications on mobile devices. One of the most popular taxi applications, Kuaide dache, has reached 500,000 users in over 10 cities, connecting over 60,000 taxis and serving more than 20,000 daily trips (Li et al. 2014). However, their operational models and user characteristics have yet to be studied.

In **India**, the organized car rental market has close to 20 players and is dominated by chauffeur-driven models. While the self-drive car rental market share in India remains significantly smaller than the chauffeur-driven model, it is growing yearly and in 2011 accounted for up to five per cent of the total car rental business in India (Bhatia, 2011). CarzonRent is a dominant organized player in the car rental space with an aggregate fleet size of 8,000 cars all over India, and self-drive service available in 20 cities (CarzonRent 2014). In the past six to seven years, India has seen an upsurge of demand-responsive taxi services like Ola, Mega-Cabs, Meru, TaxiForSure, Uber, etc. However, it is

also reported that the unorganized taxi market share is close to 90 percent of the total taxi market share (Utkarsh 2014).

In **Mexico**, related or similar vehicle-sharing modes have emerged, including new ridesharing services (aventones) and an on-demand taxi service (cabify). Both recently became available in Mexico City.

Finally, Uber and similar "peer-to-peer (P2P) taxi" services are organizing community drivers to add their personal vehicles to the supply of taxis. These "transportation network companies" (TNCs) promise riders easier, more secure, and more reliable access to taxi services. With substantial venture capital backing, TNCs have become available in over 280 cities in 50 countries worldwide, including in emerging countries like Brazil, China, India, Mexico, South Africa, and Turkey. Uber boasts tens of thousands of monthly riders since the service launched in Istanbul in mid-2014. In India, ZoomCar says it does not view Uber as a competitor, but as a different kind of service provider. In fact, together ZoomCar and Uber in Bangalore launched a "Ride Smart Bangalore Campaign" where the central message was, "use Zoom to self-drive, and Uber to taxi". However, the full impact of TNCs on mobility is not yet well understood, in any country.

All CSOs that were interviewed had received their initial capital investment from local private investors or through self-funding. In terms of profitability, CSO interviewees suggested that carsharing systems will need time to achieve a self-sustaining business model, which is consistent with the experience of CSOs in established markets.²⁸

Government recognition and support of carsharing varies significantly among emerging markets.²⁹ In Hangzhou, Chefenxiang was able to secure ten free on-street parking spaces by positioning carsharing as a way to introduce electric and fuel-efficient vehicles, a priority of the Chinese central government. Likewise, Kandi, which manufactures its vehicles, benefitted from a government subsidy for electric

cars. In Bangalore, the level of government involvement was limited to the allocation of a fleet service license to ZoomCar. Even this “support” proved to be a laborious process, because the operator was required to have a fleet of 50 vehicles before it could apply for a fleet permit, and had to partner with an existing taxi operator in the interim. Mexico City’s municipal government publicly recognizes carsharing. According to one operator, the city’s mayor participated in the CSO launch ceremony, which helped CSOs to receive extensive media attention that built credibility and helped expand membership quickly. Meanwhile, the authors are unaware of any central government in emerging markets that formally recognizes carsharing in public policy.

Table 2 | **Defining Characteristics of Existing Car Rental Modes**

CATEGORY	DRIVER	WHO OWNS VEHICLE?	RESERVATION	SHARE RIDE WITH STRANGERS?	SERVICE CHARGE
Round-trip carsharing	Customer	CSO	Required; Online/ phone	✗	By hour or hour + distance
Peer-to-peer carsharing (two-way)	Customer	Individual	Required; Online	✗	By hour
One-way carsharing	Customer	CSO	On demand	✗	By minute
Rideshare (carpool)	Owner	Individual	Required; Online	✓	By distance
Taxi^a	Driver /Owner	Fleet management company / individual	On demand; some via booking	✗	By time and distance
Car rental	Customer	Fleet management company	Required; Online/ phone / in person	✗	By day and distance
Chauffeured car rental	Driver	Fleet management company	Required; Online/ phone / in person	✗	By time & distance
Shared taxi	Driver	Fleet management company	On demand	✓	By time and distance

Notes:

a. Taxis include transportation network companies (TNCs) such as Uber and other peer-to-peer taxi companies.

Emergence of Other Related Transport Modes

While carsharing is growing quickly in some emerging markets, related modes have been around longer and are growing even more rapidly in some regions (see Box 3). Some of these related modes, like ridesharing, taxi,³⁰ and self-drive car rental, can also be found in developed countries, but others have arisen from the unique urban context of emerging markets, including shared taxis in China, large-scale ridesharing networks in Brazil, and chauffeured car rental in China and India. To be clear, these modes are not defined as “carsharing,” and they often service very different travel markets. However, given that early carsharing operators are

still exploring the ideal business model, some of the related modes could be combined with carsharing, or could provide inspiration for their business innovation.

The characteristics of all these different modes are summarized in Table 2. Understanding these related modes is critical for CSOs and important to the success of a local carsharing industry. However, this research focuses consciously on the feasibility of classic, self-access, self-drive carsharing models as defined earlier.

Table 2 | **Defining Characteristics of Existing Car Rental Modes (continued)**

CATEGORY	TYPICAL TRIP DURATION	VEHICLE ACCESS	STATIONS?	MEMBERSHIP MODEL	COUNTRIES
Round-trip carsharing	Hours	ID card/ lockbox key	✓	✓	EU, US, Canada, India
Peer-to-peer carsharing (two-way)	Hours	Key exchange	✓	✓	EU, US
One-way carsharing	Minutes	ID card	varies	✓	EU, US
Rideshare (carpool)	Minutes/ Hours	Through driver	✗	✓	EU, US, Brazil, South Africa
Taxi^a	Minutes	Through driver	✗	✗	All
Car rental	Days	Key pick-up	✓	✗	EU, US, emerging in China
Chauffeured car rental	Days	Through Driver	✗	✗	China, India
Shared taxi	Minutes/ Hours	Through Driver	✗	✗	China, India

Notes:

a. Taxis include transportation network companies (TNCs) such as Uber and other peer-to-peer taxi companies.



SECTION IV

SOCIAL AND ENVIRONMENTAL IMPACT

There is a growing body of research on carsharing impacts (albeit of inconsistent quality)³¹ that consistently reports overall positive impacts of carsharing. Social and environmental benefits of carsharing may come in the form of improved access to urban amenities and opportunities, reduced vehicle-travel distance, reduced emissions, and reduced cost of car ownership and transportation.

While the literature provides ample evidence of social and environmental benefits of carsharing in mature markets (Shaheen and Cohen 2007), little published evidence exists about less developed countries. A survey of potential carsharing users in Beijing revealed that, if carsharing were available, 31 percent of participants would cancel or postpone plans to purchase a new car (Yoon 2014). Only one CSO, Zazcar in São Paulo, has published results of customer surveys to demonstrate the positive social and environmental impact of their service. Carrot in Mexico City also conducted an internal customer survey, which suggested positive impacts among early adopters by delaying private car purchases. However, most other CSOs highlighted that it was too early to draw any conclusions about the impacts of the service. And previous research by Cervero (2003, 2007) on the San Francisco Bay Area's City CarShare suggests that early surveys might not capture the full dynamics of mobility impacts. In addition, impacts might vary greatly depending on the operational model (for example, one-way versus round-trip) and fleet size. The literature does not yet explore these potential differences in much depth.

In Hangzhou and Bangalore, focus groups were designed to understand the potential behavioral changes resulting from carsharing, particularly regarding future car purchase and use. This section summarizes initial findings about potential social and environmental impacts based on the focus groups, expert interviews, and early user surveys.

Increased Access to Auto Mobility and Access to Goods and Services

Results of focus groups in Bangalore and Hangzhou suggest that carsharing would increase non-car-owners' access to auto mobility and therefore possibly increase access to jobs, education, shopping, and leisure. Non-car-owning participants in Hangzhou and Bangalore showed a strong desire to gain access to cars for infrequent trips related to leisure, shopping, and healthcare. This increased mobility seemed to be the most certain of all impacts that were tested, because it reflected focus-group participants' currently preferred reasons to increase their car use, rather than assertions about future preferences.

Reduced or Delayed Car Ownership

Car ownership is closely associated with car usage, and reducing car ownership could help mitigate vehicle-kilometers traveled, and the associated negative externalities. In Hangzhou and Bangalore, the authors found strong aspiration to vehicle ownership. For example, in Hangzhou all non-car owners in the focus groups expected to buy a car in the future, and 50 percent had a short-term car-purchase plan (within the next two years). Twenty-nine percent of car owners already owned two vehicles, and another 29 percent planned to purchase a second vehicle in the short term.

However, evidence from Hangzhou, Bangalore, and São Paulo suggests a potential for carsharing to reduce vehicle ownership in some markets of less developed countries.³²

In Hangzhou, focus-group participants' interest in reducing their future car ownership seemed evident. Twenty-three out of 48 participants indicated that they might delay or forgo their vehicle-purchase plans if there were a convenient carsharing network. Among the 24 non-car owners, half indicated that the service might prompt them to delay their car purchase plan, and another three said they would give up their car purchase plan if the service were very convenient. Among car owners, although none of them would sell their first vehicles, six indicated that they might delay the second car purchase plan, and two said they would consider replacing their second vehicle with carsharing, if the service was convenient (see Table 3).

One interesting finding in Hangzhou is that, among 16 people who regard the car as a symbol of social status, eight said a convenient carsharing service would likely encourage them to delay or replace their car purchase plan. This result suggested that the cultural desire for car ownership might not be so closely linked to actually owning a car, if a practical alternative is effectively marketed. Zipcar has demonstrated the possibility of marketing carsharing as a desirable lifestyle choice and not as a "second choice" option (Hirsch 2012).

Bangalore focus-group participants showed much less willingness to reduce their future car ownership, though the idea of carsharing still had some impact. As in Hangzhou, car ownership in Banga-

lore was highlighted as an aspiration and status symbol. Even so, 29 percent of working professionals (eight participants) and 31 percent of secondary household members (six participants) said they would consider delaying the purchase of the first car. Almost all car owners said that they might forego a second or third vehicle purchase. Existing car owners were not likely to give up using their personal vehicles in favor of carsharing; however a couple of respondents said they would like to try the service before forming an opinion. The inclination to forego or delay car purchases was clearly weaker in Bangalore than in Hangzhou.

Finally, in a 2012 survey of members in São Paulo, Zazcar found that 24 percent had sold their cars after using the carsharing service, and 73 percent thought less about purchasing a car after using the system (Zazcar 2012). The 24 percent figure is somewhat lower than results found in developed economies of Europe and North America, where roughly one-third of users report having sold a car in association with carsharing. Nevertheless as Zazcar scales up its membership, the positive benefits from reduced car ownership will increase as well.

If one considers the results from Hangzhou, Bangalore, and São Paulo comparable, the pattern may suggest a correlation between development index, market interest, and mobility impact. Bangalore, where interest and likely mobility impact were found to be lower, also has significantly lower consumption capacity than Hangzhou or São Paulo. Although focus group members in Bangalore included IT professionals, income levels in the city as a whole are much lower than in Hangzhou or São Paulo, and the complementary walk, bike, and transit networks in Bangalore are less developed. Due largely to lower labor rates, Bangalore also offers ubiquitous and very affordable rickshaw services, two-wheelers, and chauffeured cars that could compete directly with carsharing for short-distance trips.

The authors infer that the ability of carsharing to replace car ownership might be greater in markets where development of pedestrian, bicycle, and public transport infrastructure is more mature, and where incomes are higher. This hypothesis requires further research.

Table 3 | Predicted Impact of Carsharing on Car Purchase Plans in Hangzhou

	FOCUS GROUP PARTICIPANTS	# RESPONDENTS INDICATING A CONVENIENT CARSHARING SYSTEM WOULD ENCOURAGE THEM TO:			
		REPLACE 1 ST VEHICLE	DELAY 1 ST VEHICLE PURCHASE	REPLACE 2 ND VEHICLE	DELAY 2 ND VEHICLE PURCHASE
Car Owners	24	0	-	2	6 (3)
Non-Car-Owners	24	3	12 (7)	-	-
TOTAL	48	3	12	2	6
% of total	100%	6%	25%	4%	12.5%

Note: The number in parentheses indicates # of carsharing members
 Source: Seven focus groups conducted in Hangzhou, China in October 2012.

Impacts on VKT of Carsharing Members

Would carsharing in less developed countries increase or decrease auto driving? This research provides initial insight into this important question. The authors hypothesize that the short-term impact could be an increase in auto driving, as non-car-owners quickly gain affordable access to a car; but that the long-term impact could be a decrease in VKT, as many of these members decide to stay with the carsharing service rather than acquire a car. Evidence from both this research and previous studies provides some initial support for this hypothesis, which requires further study.

Several factors suggest that carsharing might increase auto driving in emerging markets where car ownership rates are very low. Focus groups clearly indicate participants' strong desire for increased auto mobility, and suggest that in Hangzhou and Bangalore carsharing would accelerate affordable access to cars. Similarly, research from established carsharing markets suggests that previously carless households tend to increase their auto driving, albeit to modest levels (Lane 2005).

However, the ability of carsharing to slow the growth in car ownership rates (discussed earlier) could reduce auto driving. In established carsharing markets, reduced vehicle ownership is associated with less auto driving and higher use of walk, bike, and transit modes (Lane 2005, Klinevicius et al. 2014, Muheim 2006, Martin et al. 2010). Initial evidence from São Paulo is consistent: Zazcar's 2012 member survey revealed that 51 percent of respondents said they walked and biked more after joining the service.

Based on the evidence, the authors hypothesize that carless households would increase their auto driving in the short term, after joining a carsharing service, but drive less in the long term as they delay purchasing a car. The duration of delay in car purchase, whether it is permanent, and the magnitude of driving reduction, all would be important to research further. Likewise, so would the potential short-term increase in driving: a large proportion of carless households joining the service would suggest more driving in the near term. Further research in emerging markets is needed to

Figure 10 | **Mobicar's website touts environmental benefits of carsharing**

The screenshot shows the Mobicar website's homepage. At the top left is the Mobicar logo with the tagline "Öde kullandığın kadar". To the right are navigation links: "Bana Göre Mi?", "Nasıl Çalışır?", "Fiyatlandırma", and "Rezervasyon". Further right are buttons for "Üye Ol" and "Giriş Yap". The main content area features a car icon with a green leaf, the headline "Doğaya katkısı olan yeşil yakalı araçlar!", and a sub-headline: "Her bir araç paylaşım aracı trafikten 15 araç geri çekiyor, yeni nesil araçlarımız daha çevreci egzoz emisyonuna sahip." The footer contains copyright information "© 2013 Mobicar. Tüm Hakları Saklıdır.", social media icons for Twitter, Facebook, and LinkedIn, the KOSGEB logo, and a list of links: "HAKKIMIZDA", "ARAÇ KİRALAMA SÖZLEŞMESİ", "GİZLİLİK SÖZLEŞMESİ", "ÖN BİLGİLENDİRME FORMU", "S.S.S.", and "İLETİŞİM". An "Available on the App Store" badge is also present.

Source: www.mobicar.com.tr. Accessed on March 22, 2015

fully explore this important and hard-to-measure impact, by tracking the behaviors of carsharing members and their mobility behavior in practice.

However, some barriers also can be considered opportunities. For example, limited parking might hinder the carsharing operator but also increase demand for the service. Strong aspiration to car-ownership and use might discourage the lifestyle choice of living mostly car-free, but also increase demand for carsharing as an intermediate solution. A weak public transit system could have similar effects. Conversely, bike sharing might complement carsharing to encourage a low-car lifestyle, but compete on a trip-by-trip basis. Where such complexities arise, the authors attempt to portray the more prominent effect—as perceived by potential users, described by experts in our interviews, or evidenced from the literature.

Table 4 summarizes barriers and opportunities in emerging markets; italics indicate that the barrier or opportunity is also found in mature markets.

The following sections detail the most prevalent barriers, as determined through expert interviews and focus groups.

The authors hypothesize that carless households would increase their auto driving in the short term, after joining a carsharing service, but drive less in the long term as they delay purchasing a car.



DELHI BHAVAN LODGE

HOTEL

CHANDRA

VIHAR

NEW RES
CBHS
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BAR

MOKSH
Swarna
Champa
MOKSH AGARBATTI

Galaxy Home
Appliances

TRAFFIC POLICE BANGALORE
FOUR WHEEL
TWO WHEEL



ಬಾಲಾಜಿ ಸ್ವೀಟ್ಸ್
BALAJI SW



SECTION V

BARRIERS AND OPPORTUNITIES

This section summarizes key barriers and opportunities in the round-trip carsharing business model. Four categories are identified: **potential users, transportation infrastructure, government, and business.** In general, the carsharing industry faces some universal challenges in emerging markets, such as potential users' unfamiliarity with the shared vehicle concept, limited parking, acute traffic congestion, aspiration to car ownership, and prevalence of alternatives such as rickshaws, taxis, and motorized two-wheelers. In addition, emerging markets pose a number of diverse, location-specific barriers to carsharing.

Potential Users

ASPIRATION TO CAR OWNERSHIP AND USAGE: In emerging markets, where personal mobility is rapidly increasing, mostly because of motorization, the aspiration for car ownership and usage can be both a large barrier and an opportunity. People might prefer owning a vehicle to sharing, or they might view carsharing as a sufficient substitute for ownership. Strong aspiration to own a personal car was found in both the Hangzhou and Bangalore focus groups, largely because of the social status conferred by vehicle ownership.

UNFAMILIARITY WITH CARSHARING: The public’s lack of familiarity with the carsharing concept is a key barrier for local CSOs. Carsharing is a recent innovation in emerging markets, and it can take time for people to understand and use the self-service model. However, the rising popularity of bike sharing in China might present an opportunity to reduce the carsharing learning curve, as the population becomes familiar with the shared vehicle

concept. All focus-group participants in Hangzhou were familiar with the city’s popular bike sharing program and they quickly grasped the concept of roundtrip carsharing when presenters analogized it to the city’s bike sharing program.

TECHNOLOGICAL BARRIERS: Interestingly, several other hypothesized barriers did not seem to dampen market interest. For existing carsharing members, limited access to a credit card, smart phone, or internet service was not seen as a barrier.³³

Transportation Infrastructure

LIMITED PARKING: Limited opportunities for the carsharing company to access reserved on-street parking is considered by experts to be one of the biggest barriers to carsharing in both developed and emerging markets. This is especially true in countries like India, where parking regulations of any kind are often non-existent. On the other hand, limited parking infrastructure and high parking prices in residential neighborhoods or at attractions can

Table 4 | **Barriers to and Opportunities of Carsharing in Emerging Markets**

CATEGORY	BARRIERS	OPPORTUNITIES
Potential Users	<ul style="list-style-type: none"> Strong desire for car ownership and usage Limited driving experience <i>Unfamiliarity with carsharing service</i> <i>Price sensitivity</i> 	<ul style="list-style-type: none"> Desire for car access <i>Familiarity with bike sharing (China)</i>
Transportation Infrastructure	<ul style="list-style-type: none"> Road congestion Insufficient public transport, cycling infrastructure to provide alternatives to car use for short trips <i>Limited parking for carsharing (on street or public garages)</i> 	<ul style="list-style-type: none"> Public transport system improvements <i>Poor taxi and rental car options (China)</i> <i>Low rate of car ownership</i> <i>Limited or expensive parking for private vehicles</i>
Governance	<ul style="list-style-type: none"> Lack of procedures for checking driving record Lack of personal credit system <i>Public agencies unfamiliar with carsharing</i> <i>Vehicle restriction policies</i> 	<ul style="list-style-type: none"> Air pollution concerns Vehicle restriction policies (even carsharing is not exempted) Clean vehicle promotions High cost of private car ownership
Business	<ul style="list-style-type: none"> <i>High capital investment</i> Limited access to capital Difficult to reach a certain level of operational scale Potential competition from intermediate public transportation modes like rickshaws and taxis and personal two-wheelers. 	<ul style="list-style-type: none"> Low labor cost

Note: The italicized words are the barriers that also exist in more developed countries.
 Source: Developed by the authors based on literature review, interviews, and focus groups.

make carsharing a more favorable option compared to owning a car. In both Hangzhou and Bangalore, the number of personal vehicles far exceeds the number of legal parking spaces in the city, prompting drivers to park on sidewalks, in alleyways, and in illegal spaces on the margins of roadways. Parking controls might also be missing or insufficient to address such practices. In Hangzhou focus groups, two participants considered savings on parking as an attractive feature of carsharing. But, in Bangalore, focus-group participants did not cite saving on parking as a key motivator, possibly because parking is even less regulated and priced in Bangalore than in Hangzhou.

PUBLIC TRANSIT: Carsharing is a complement to public transit, with each mode serving a portion of an individual's local and regional transport needs. Consequently, the market for carsharing might be limited in cities without good public transit, because people might be more inclined to own personal vehicles or to make use of semi-formal transit like auto-rickshaws. In Hangzhou, the delayed development of public transit had encouraged many focus-group participants—who live along the planned public transit corridors—to purchase private vehicles. Once the car is owned, the participants said they were more likely to drive a private car for most of their travel. Conversely, continuous improvements to public transit can create an opportunity for carsharing to prosper. Four participants in Hangzhou, including two car owners, said they would prefer to take transit instead of driving if high-quality transit were available.

TRAFFIC CONGESTION: The rapid increase in the number of cars and limited expansion of road infrastructure in some emerging markets can lead to chronic traffic congestion, making driving even a shared car unpleasant. Furthermore, in São Paulo, Zazcar indicates that acute congestion makes it difficult for carsharing customers to predict when they can return the cars, challenging the traditional carsharing reservation model.³⁴ CSOs can implement operational strategies, such as multiple vehicles at a location, to minimize the impact of late vehicle returns on other users.



Government

PUBLIC POLICIES UNSUPPORTIVE OF CARSHARING:

Government recognition and support can be critical for carsharing to take root and become successful. Local governments in established markets sometimes provide on-street parking, administrative support, funding, membership, and credibility and marketing (Millard-Ball et al. 2005). The absence of government support can limit carsharing market potential. Governments in emerging markets typically have not acknowledged or formally defined carsharing—either because the service is so new, or because the social and environmental impacts are not clear enough to inform public policy. Mobility experts interviewed during this research also stated that carsharing was unlikely to get any support in the near future in India. With limited public funds and critically underdeveloped public transportation infrastructure, prioritizing carsharing systems over the development of public transport seemed hard to justify.

LACK OF PERSONAL CREDIT AND DRIVING RECORD

SYSTEMS: In established markets, personal credit and a clean driving record are vital criteria in membership screening but use of credit is limited in many emerging markets. In China and India, the

BOX 4 | COMPETING MODES WITH CARSHARING IN HANGZHOU AND BANGALORE

The Hangzhou focus groups revealed taxis and rental cars as the transport modes that compete with carsharing in Hangzhou. These were the modes with which participants most often compared carsharing during mode-choice discussions. For occasional trips, focus-group participants often considered the fare difference between carsharing and taxis, while for daily trips they referred to the price of car rental services. Members suggested that 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 rentals' daily fees spike on holidays when travelers need them the most.

In Bangalore's focus group (conducted before ZoomCar launched), most participants viewed auto-rickshaws as the competing mode.

The literature from established markets also suggests that carsharing can draw trips away from taxis. Lane (2005) observed that, in Philadelphia, carsharing members increased their use of walk, bike, and transit modes but decreased their use of taxis.

However, conversations with ZoomCar after its Bangalore launch revealed a more nuanced relationship. According to ZoomCar, people used carsharing largely for long distance, out-of-town trips—which were both cost-effective and convenient to undertake using carsharing as opposed to two-wheelers, auto-rickshaws, or even taxis (see more discussion on this in the section on Trip Types). This dynamic might also occur in response to ZoomCar's business model, with distantly spaced vehicles and rates that encourage car-rental-style, overnight trips. ZoomCar viewed similarly priced day-cabs or weekend taxi rentals as more competitive, as opposed to rickshaws or two-wheelers, whose trips are typically shorter in length and duration (Back 2014). In addition, some experts also questioned the idea that carsharing would compete with two-wheelers. According to ZoomCar, access to its distantly spaced stations occurs most frequently on two-wheelers, followed by auto-rickshaws. Also, two-wheelers can offer an important alternative to car ownership (Pai et al. 2014). Thus carsharing and two-wheelers may be complementary in some people's lives (Back 2014).

share of non-cash payments was 55 percent and 32 percent in 2012, much lower than in developed nations (MasterCard 2013). In addition, the lack of electronic driving records in emerging markets was mentioned as a key barrier by Latin American technology providers and by two Chinese CSOs that had developed their own screening technology.

VEHICLE RESTRICTION POLICIES: As a response to congestion and air pollution problems associated with rapid motorization, emerging markets such as China,³⁵ Brazil, and Mexico have implemented vehicle ownership and/or usage restrictions in some cities—suggesting both barriers and opportunities for carsharing. So far, India has not experimented with any kind of vehicle restriction policies although, according to expert interviewees, several big Indian cities have considered levying a congestion charge.

Vehicle restrictions could make carsharing an attractive alternative to a household's first or second car. For example, when we conducted the focus group, Hangzhou was implementing vehicle-travel control policies³⁶ to keep one-fifth of vehicles off the street during peak hours on weekdays. Although carsharing vehicles were not exempted, some of the Chefenxiang members participating in the focus groups did mention that they used carsharing services when their private cars were restricted.

Conversely, when vehicle registration and usage restrictions apply to carsharing fleets, they limit CSOs' productivity and financial feasibility. Vehicle registration laws in emerging markets do not clearly categorize shared cars. Thus, carsharing fleets tend to fall under the purview of general vehicle restrictions. For instance, at the time of its interview, YiDianzc (EduoAuto) had been able to operate just seven vehicles for two years because of Beijing's restrictions on vehicle purchases.³⁷ Likewise, individual carsharing vehicles are usually not exempted from vehicle usage restrictions.

Business

Establishing a financially sustainable business model can take time, because operators must address many unknowns, and the service model from established markets might not transfer directly to emerging markets. Challenges include the cost of capital, potential competition from other entrenched and relatively affordable modes (see Box 4),³⁸ and the cost of vehicles and technology.³⁹ Because carsharing is quite new in many countries, it can be hard for CSOs to attract investors. Brazilian experts, when interviewed, reported that vehicles and carsharing technology can be more costly. In addition, because of the high capital investment, it takes time for CSOs to reach operational scale. As a result, when the service is just starting out with only a few station locations, potential customers in a large city are often unable to find a station within easy walking distance.

Though labor costs are lower in emerging markets, the research did not find very strong evidence of CSOs taking advantage of this difference. All carsharing services except for ZoomCar provided automated technology, rather than using more labor-intensive vehicle access and billing solutions.

Summary

The research reveals several significant barriers to carsharing in emerging markets that are not so prevalent in established markets. These range from vehicle registration quotas, acute traffic congestion, and limited transit systems, to lack of government awareness, and limited capital. These barriers will hinder the growth of carsharing, and they may account for some of the reasons why so few of the world's carsharing members are found in cities in emerging markets. Asia, Africa, and Latin America and the Caribbean are currently home to over 78 percent of the world's urban population, but they accounted for just 20 percent of global carsharing members in 2014 (UN 2015; Shaheen 2015). That said, because these barriers effectively raise the cost of entering a market, entrepreneurs who establish a successful model could gain a significant first-mover advantage, particularly if they have adequate capital to offer large-scale service and good relations with local governments. As early innovators test service models and markets, educate governments, and tackle operational barriers, the feasibility of carsharing might continue to improve.





SECTION VI

POTENTIAL MARKETS

This section describes current carsharing user and trip types in countries including Brazil, China, India, Mexico, and Turkey based on the research team's expert interviews with CSOs. It also explores the market potential in target communities in Hangzhou and Bangalore, based on findings from the focus groups. Comparisons to established markets are made throughout the section.

Users

According to the experience of existing carshare operators and the views of some experts, the early adopters of carsharing in emerging markets are very likely **young, well-educated and middle-income carless households** (see Table 5)⁴⁰—very similar to the demographic profile of members in established markets (Lane 2005, Millard-Ball et al. 2005). Intercept surveys conducted in Shanghai also provide evidence to support this view (Wang 2010). These individuals are considered generally more willing to try out new services (Shaheen et al. 2010, Wang et al. 2011). They also show strong aspirations to obtain access to auto mobility for occasional trips and weekend trips for leisure or shopping. Conversely, a survey of potential users in Beijing found older people more likely to use carsharing (Yoon 2014).

The one significant difference from established markets is users’ motivation for using a carsharing service. Focus-group participants generally emphasized affordability and convenience but rarely mentioned environmental considerations. Users in Philadelphia emphasized convenience over affordability (Lane 2005) and North American users highlighted environmental considerations as an important motivator (Millard-Ball et al. 2005). Affordability therefore appears to be a stronger motivator in emerging markets than in established ones.

In the focus groups in Hangzhou and Bangalore, **non-car owners** showed greater interest than car owners in sharing vehicles. These findings are consistent with Chufenxiang membership composition in Hangzhou today, where non-car owners account for more than 80 percent of members. However, that does not hold in all emerging markets. For example, according to Zazcar in Brazil, the number of car owning and non-car owning members is similar.

In terms of gender, the research did not find a significant difference between the number of male and female members in China or Brazil; however, in India, according to ZoomCar, 90 percent of its current users are male. In comparison, a North American membership survey observed that females comprised 55 percent of users (Millard-Ball 2005). In terms of income and occupation, current CSOs

Table 5 | **Typical Characteristic of Potential Individual Users**

USER CHARACTERISTIC	COMMON VIEW FROM EXPERT INTERVIEWS AND FOCUS GROUPS
Age	Young (18–40 years)
Education	Well-educated (junior college or above)
Income	Middle to upper-middle class
Car ownership	Non-car owners will be interested in obtaining access without car ownership. Existing car owners might be interested in replacing a second vehicle.
Occupation	Younger working professionals
Motivation	Affordability, convenience. Environmental benefits are not a powerful motivator of membership.

Source: authors, based on mobility expert interviews and focus groups.

indicated that most of their customers are middle-income working professionals, of various occupations. Some experts were of the opinion that IT professionals are probably the early users in India because they are more open to new technology. CSOs in China predicted a potential market of early adopters among university students, as they obtain their first driver’s licenses.

Market Interest in Hangzhou

Hangzhou’s focus groups convened 48 young, working, middle-income professionals of whom 12 (25 percent) were carsharing members. Of the 36 non-carsharing members, 34 (94 percent) were interested in trying the service. Of all participants, 48 percent indicated they might use or are using carsharing at least three times a month. Participants cited “convenience,” “cost-saving,” and

“access without ownership” as the top three attractive features of carsharing services, while environmental reasons were rarely mentioned. In terms of convenience, participants expressed a strong desire to avoid parking hassles, avoid the trouble of maintaining a car, and find a way to meet their travel needs in a comfortable manner. Regarding incomes, potential high users were mostly non-car-owners with incomes lower than RMB 12000/month (about US \$1800/month). People with higher income were more likely to own a car and expressed less interest in using a carsharing service. Comparing members and non-members, members were relatively younger and better educated than non-members on average—similar to the target market predicted by expert interviews.

Market Interest in Bangalore

Of the 44 individuals who participated in Bangalore’s focus groups, 27 were working professionals and 14 were housewives/work-from-home/stay-at-home individuals. Among participants, approximately 60 percent of working professionals and 50 percent of secondary household members indicated that they would be interested in using carsharing services. Cost-effectiveness, convenience, and easy access were the motivational factors most often cited by all participants; environmental reasons again were rarely mentioned. In terms of age, the greatest interest in carsharing was expressed by individuals in the 26–35-year-old age group; nearly all of them were well-educated (Bachelor’s or Master’s Degree). In terms of group type, non-car owning working professionals expressed the greatest interest in carsharing. Shopping, leisure, and airport trips were cited as most likely reasons for carsharing. These trip types were later validated during discussions with ZoomCar regarding its user base.

Trip Types

According to interviews with carsharing operators, their cars are used mostly for infrequent round-trip non-work purposes by individuals, such as weekend trips, occasional leisure and shopping, and, to a lesser extent, for business.

In Bangalore, the focus groups suggested mostly shopping, airport, and leisure trips (which included



long distance and weekend trips). ZoomCar in Bangalore admitted that at present the market for carsharing in Indian cities is young adults in need of a vehicle for out-of-city trips, day trips or trips to the airports, each of which is typically at least three or more hours long. The service also indicated that 70 percent of its trips were actually over 10 hours long and only 30 percent were restricted to intra-city. This differs significantly from the typical market and business model of classic carsharing companies in established markets, where three to four hours is a typical average trip length.⁴¹

Similarly, Hangzhou’s focus groups indicated higher demand for weekend hometown visits to nearby cities and lower demand for shopping trips.



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SECTION VII

OPERATIONAL MODELS

This section explores the design of carsharing systems in emerging markets. It highlights some innovative operational solutions adopted by existing CSOs in emerging markets in response to specific barriers. It also presents specific user (demand-side) requirements that might influence the design of systems in Hangzhou and Bangalore.

Stations

Most CSOs located their stations in dense, usually mixed-use and middle-income urban areas with public transport access—as do carsharing operators in established markets. The number of cars per station varied from one to ten, depending on availability of parking and the business strategy. Several CSOs in Brazil, China, India, and Mexico partnered with real estate developers or property managers in gated communities, commercial buildings, technology parks, universities, hotels, and restaurants. This was a strategy to secure parking in convenient locations, because the operators did not benefit from government support in the form of privileged allocation of parking spaces for carsharing.

In terms of station planning, some CSOs started creating a network of carsharing stations in certain neighborhoods. In Mexico City, Carrot arranged 18 stations in five neighborhoods clustered on average every 600 meters to enable users to walk to the next station if the first one was vacant. Zoom, on the other hand, located larger pools of vehicles in more

dispersed locations, with users often traveling beyond easy walking distance to the stations, via rickshaws or two-wheelers. All CSOs would prefer on-street parking to make their service more visible and accessible, but it was often hard to obtain. Participants in the Hangzhou and Bangalore focus groups preferred carsharing stations to be located within easy walking distance of work and/or residences.

Fleet

The fleet size of CSOs in emerging markets ranges from only a few vehicles to 3,850 (see Table 1). The majority of shared vehicles in Brazil, China, and Mexico are compact vehicles. Few CSOs provide or plan to provide luxury cars, with the exception of YOYO carsharing in Istanbul, which operates luxury vehicles, and ZoomCar in India, which provides compact, sedan, and SUV models, including some luxury and electric cars. Chefenxiang, the Hangzhou carsharing operator, includes hybrid vehicles in its fleet and is considering adding electric vehicles in the future because of the government's subsidy to EVs.

Figure 11 | Chefenxiang (EVnet) station locations in Hangzhou



Source: www.coclubs.com. Accessed March 22, 2015

Table 6 | Pricing Structure of Selected Carsharing Operators (2015)

CARSHARING OPERATORS	NAME OF PLAN	APPLICATION FEE (US\$)	MEMBERSHIP FEE (US\$/YEAR)	TRIP CHARGE	
				HOURLY RATE (US\$/HOUR)	DISTANCE RATE (US\$/KM)
Zazcar São Paulo, Brazil	Occasional	16.63	0	4.30–16.40	0.24 for first 100 km then 0.13
	Frequent	0	200	3.30–11.30	0.24 for first 100 km then 0.13
	Your Car	0	400	2.30–9.30	0.24 for first 100 km then 0.13
Chefenxiang Hangzhou, China	Regular	0	0	2.21–3.87	0.04–0.13
Carrot Mexico City, Mexico	Casual User	0	20.10	5.36–8.04	0.20–0.34
	Frequent User	0	80.40	3.35–6.03	0.20–0.34
YOYO Turkey	—	0	26.52	0.38–9.60	0.06–0.38
ZoomCar India	—	0	0	0.30–5.62	0.02–0.26

Sources: Zazcar: <http://zazcar.com.br/index.php/precos>, Chefenxiang: <http://www.ccclubs.com/productsandprice.aspx>, Carrot: <http://www.carrot.mx/site/costos.php>, YOYO: <http://www.driveyoyo.com>, ZoomCar: <http://www.zoomcar.in> in 2015 US\$ exchange rates via www.xe.com accessed April 7, 2015.

A wide variety of desires was expressed by focus-group participants. Considering the small pool of participants, their views may or may not represent the broader market.

In Hangzhou:

- More than half of focus-group participants found economical compact vehicles acceptable.
- A majority of participants preferred to have a variety of vehicles to choose from, as well as the option of luxury vehicles for special occasions.

- Most participants were open to using low-consumption vehicles, mostly because of a lower distance-based gasoline charge, not because of environmental considerations.

In Bangalore:

- Car-owning males preferred luxury cars and SUVs (BMW, Mercedes, and Toyota), particularly for dates or special events; while non-car owning males were happy with any compact car for regular use (Maruti, Hyundai, Tata, etc.).
- Secondary household members generally did not favor a specific make or model of car.

Response to Congestion

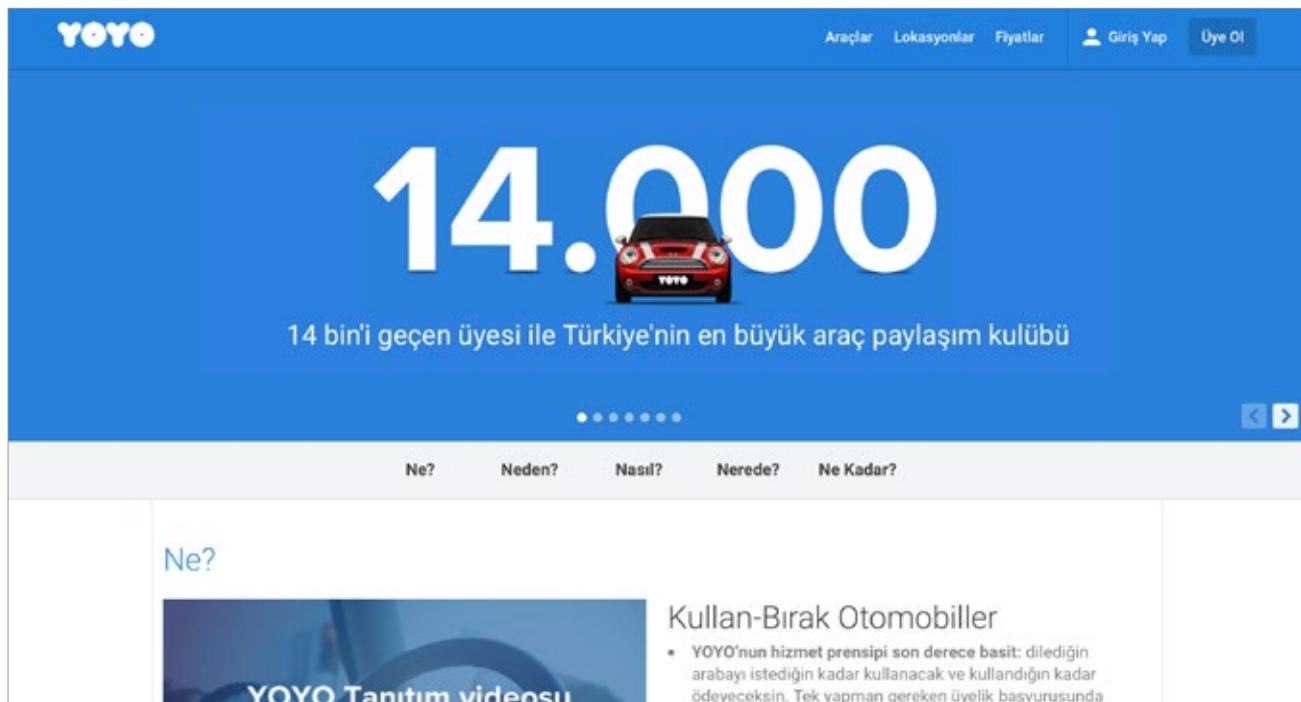
In response to unpredictability of vehicle returns caused by congestion, CSOs in Brazil and China increased their operational flexibility to attract customers. In São Paulo, where travelers often suffer from severe traffic congestion, Zazcar developed relatively flexible policies on late vehicle returns. Early returns now result in credit for the unused hours in Zazcar—thus users can pad their reservation in case of delay, and then shorten to the actual return time without paying for the unused hours. Also Zazcar charges only twice the regular hourly rate with no other penalty. Hangzhou's Chefenxiang adopted a similar solution of a low penalty for late returns.⁴²

Membership and Pricing Strategies

Most CSOs charge very low or even free application fees and very low annual membership fees (see Table 6), which are potentially attractive to people unfamiliar with the new service. PhillyCarShare in Philadelphia began waiving all up-front and membership fees in 2006, which helped explain its meteoric rise in membership to over 50,000 users in one mid-sized city. Another analogy is that Zipcar routinely offers free or heavily subsidized applications in university campuses in the United States. This has been a successful strategy to attract their target market—students often become regular Zipcar users when they leave the university.

CSOs in Brazil and Mexico developed different plans for various users. Frequent users who were willing to pay regular monthly fees could spend less on their individual trips, while infrequent users could pay more per trip without the membership fee. Other CSOs use the same pricing scheme for all types of users.

Figure 12 | YOYO membership reaches 14,000



Source: www.driveyoyo.com. Accessed March 29, 2015

Most CSOs charge by time and distance, starting from the first hour and kilometer. However, ZoomCar in India has a minimum billing of four hours, which means all bookings of one to four hours are billed at four hours.

In terms of trip charge, CSOs in Brazil, China, Mexico, and Turkey all use a model that combines the hourly usage rate and a distance-based charge. As one CSO pointed out, charging only per hour might not be profitable because cars can travel 100 miles within two hours, resulting in very high fuel costs. On the other hand, charging only by distance might not be profitable either, because a car could sit idle for extended periods, and chronic congestion could reduce distance traveled per day.

In Hangzhou, more than half of participants find the current price of Chefenxiang acceptable, though several participants suggested the distance-based gasoline charge was too high.

Operational and Payment Technology

Implementing technology solutions in emerging markets still faces some obstacles, but also some opportunities. Credit card authorization and online payment processing can be less mature. For example, to enable online payments, small businesses in some countries need to obtain credit preauthorization from every individual bank. However, e-payment systems, which may be even more suitable for carsharing businesses, are growing very fast. Examples include Ali Pay (similar to PayPal), social media accounts (for example, Wechat), or mobile app accounts (for example, Didi Dache). Thus, there is potential for less developed countries to “leapfrog” established markets in terms of payment methods.

Operational technology—including on-vehicle computers and back-end reservation, billing, fuel, and fleet management systems—seems to be a common design feature among CSOs in emerging markets, despite their lower labor costs. In Mexico, Brazil, and Turkey, CSOs usually hire technology providers from more developed nations to develop customized solutions in their countries, often resulting

in higher costs. In China, both of the early CSOs, Chefenxiang and YiDianzc, developed their own operational technology, including fleet management, smart-card access, gasoline-payment system, travel-distance monitoring, client-service systems, and smartphone applications. In-car telematics, which provide the member with unattended access to the vehicle and trip data to the CSO, is another important carsharing technology that is developing rapidly, with lower cost solutions appearing every month. As noted previously, for telematics requiring a cellular network, coverage in most emerging economy nations appears sufficiently reliable. On the other hand, ZoomCar staffs its stations, which tend to include many vehicles, with attendants.

Electric Vehicles (EVs)

Mobility experts interviewed for this study suggested that carsharing could be a good way for the government to introduce electric or hybrid vehicles to the public and encourage broader uptake, by exposing a large number of auto travelers to these newer technologies.

While there was limited interest in electric vehicles from the Bangalore focus group, ZoomCar in India now offers electric vehicles and a 10 percent discount for anyone who owns an electric vehicle and

There is potential for less developed countries to "leapfrog" established markets in terms of payment methods.

opts to rent a ZoomCar vehicle for long-distance trips (Back 2014). In addition, Kandi, Carrot, YOYO, and Comos offer electric vehicles, and Chefenxiang in Hangzhou is moving forward with incorporating electric vehicles into its fleet.

The alacrity with which operators in emerging markets are incorporating electric vehicles into their fleets contrasts with established markets, where e-vehicles have experienced mixed success. This can be attributed to the cost and implementation challenges of charging infrastructure and the additional downtime experienced by vehicles while they recharge.

The environmental impact of using electric vehicles rather than internal combustion vehicles in carsharing systems is context-specific and depends largely on the local source of electricity. For example, 79 percent of electricity in China and 69 percent in India is generated from coal-fired power plants (WCA 2012). The environmental impact of adding EVs to the electricity grid in these specific cities needs to be analyzed further.

Marketing and User Education

All CSOs interviewed emphasized that user education is critical to the success of their business. User education usually includes the introduction of the concept of carsharing, and information about how to use it, and the social and environmental benefits of carsharing. Marketing strategies often differentiate carsharing from existing mobility options. Strong marketing and user-education components are found in CSOs in Mexico City, and to a lesser extent in China, Turkey, and India. They include internet, social media, applications, printed flyers and street marketing, and print and television media.

Government Support

A critical enabler for carsharing in less developed countries is local government's supportive policies such as dedicated parking, tax-exempt and low-interest rate grants, which can reduce the operating costs of carsharing. Government support might also lower the cost of carsharing relative to private car ownership, thus helping expand the carsharing market.

Figure 13 | YiDianzc (Eduoauto) website promotes their cell phone application



Source: www.yidianzc.com. Accessed March 22, 2015



- **FREE PARKING.** The interviewed CSOs sought support from municipal governments. In Hangzhou, a CSO has engaged with the city government to help frame this service as a way to introduce the electric and low consumption vehicles that are of great interest to the government. So far, the Hangzhou government has provided 10 free parking spaces for CSOs since 2011. Other CSOs in Latin America appealed to the city government for dedicated carsharing parking.
- **GOVERNMENTAL RECOGNITION.** CSOs also tended to present carsharing as one mobility option under a city's public transport system. According to carsharing start-ups in Mexico City, the government helped promote carsharing as one public transit option through the mayor's participation in the CSO launch ceremony. This recognition and support, according to Mexican carshare operators, has helped them to receive attention in the media and expand quickly.

Additional Service Requirements from Hangzhou and Bangalore

Influenced by the public bike sharing program in Hangzhou, almost all focus-group participants would like carsharing to operate under a one-way station-based model, similar to that used by the current bike-sharing system. However, most participants indicated they were unwilling to pay much extra for one-way service.

In Bangalore, chauffeur service and car-delivery services were the key modifications suggested in the focus groups, partly because of unpleasant driving or walking conditions. Providing staff at stations was suggested, and this was a key modification in ZoomCar's operational model. Cheaply available labor and the population's unfamiliarity with driving make chauffeurs more feasible in India, where many males migrate from rural areas to cities in order to become drivers.



SECTION VIII

CONCLUSION

This research is an attempt to explore the feasibility and impact of carsharing as a sustainable mobility option in cities of less developed countries, with a special focus on emerging markets.

In the introduction, this report proposed two scenarios of behavioral impact: a “Leapfrog” scenario in which carsharing would reduce car ownership and driving; and a “Stepping Stone” scenario in which carsharing would spur more auto driving and encourage higher rates of car ownership. The research finds less evidence for the “Stepping Stone” scenario, particularly because focus-group participants universally expressed already-high interest in car ownership, independent of car-sharing. But the research also suggests that some elements of both scenarios may be true. Some key findings include:

- **Market interest seems strong in Hangzhou** and possibly other cities of emerging markets where car ownership rates remain comparatively low, reasonable transit and cycling alternatives exist, and the middle class is growing. Differences in market interest between Hangzhou (high interest) and Bangalore (medium interest) suggest that **market readiness may vary widely, possibly in relation to incomes and the availability of attractive auto transport**

alternatives such as rickshaws and taxis.

Interestingly, initial results suggest that the target demographic in emerging markets might indeed be similar to that in established markets—well educated, mostly carless, middle-income, young to middle-aged, urban residents who can travel to work without a car. Further market research on carsharing members is needed.

- **Carsharing shows strong potential to delay or replace car purchase plans in Hangzhou and, to a lesser extent, in Bangalore, suggesting that carsharing could lead toward more environmentally sustainable mobility in some emerging markets.** Evidence from this research suggests that carsharing could increase auto driving in the near term as mostly carless households gain easier access to automobiles. But the research also reveals significant potential for lower car-ownership rates in the long term, as members delay or forgo car purchases and some car owners sell or choose not to replace their household’s second vehicle. The research hypothesizes that lower car-ownership rates



This research sketches a picture of the nascent industry of carsharing in emerging markets, and indicates that its potential varies by place, and is shaped by its context.

should translate into less auto driving in the long term. The actual impact on car ownership and especially driving behavior in emerging markets needs further research and pilot testing.

- **Carsharing innovations tailored to specific markets seem worthy of consideration.** This research found examples ranging from flexible return times, to PayPal-supported payment systems, to an emphasis on affordability, to strong interest in one-way service. Because such service features respond to local market and transport conditions, the authors infer that tailoring service designs to particular markets might be more effective than a one-size-fits-all approach.
- The carsharing industry is very small but growing fast in emerging markets. **Carsharing faces significant barriers** such as aspirations to car ownership; acute traffic congestion; insufficient complementary walk, bike, and transit systems; limited on-street parking; and vehicle purchase and use restrictions. These operational and market barriers help to explain why carsharing remains uncommon in less developed countries. That said, recent start-ups show rapid growth, much faster than their predecessors in established markets of the United States and Europe,

suggesting the **possibility of a ready market if operational barriers can be tackled.**

In addition, the authors note that most of the major barriers listed are within governments' purview, and therefore government intervention will be quite important for addressing barriers. The experiences of Carrot in Mexico City and Weigongjiao (Kandi) in Hangzhou provide initial evidence that local government also can be an important partner for promoting the service.

- In terms of service features, **affordability might be an important design objective** for carsharing in less developed countries, where cost is already the main barrier to car ownership, and price sensitivity is generally higher than in established markets. Focus-group participants also express interest in one-way service, vehicles with drivers, convenient locations, and a variety of models, though the extent to which these observations can be extrapolated remains unclear.

Feasibility

This research could not rule out the feasibility of carsharing as a sustainable transport option in some cities in emerging markets. Although no CSO has yet claimed operational profitability in emerging markets, perhaps because most services are very young and still in the growth stage, the market potential is substantial.

On the demand side, focus groups revealed a significant interest in carsharing. Many participants were willing or even eager to try out the service. However, market interest will vary from city to city, as a result of a variety of factors described in this report.

On the supply side, CSOs have demonstrated creativity and a commitment to sustainability in countries like Brazil and China. CSOs have been learning from established markets and trying to apply existing models to the local context, with modifications. Some CSOs have developed their own technologies and introduced new business strategies. Many CSOs see themselves as social entrepreneurs committed to a certain environmental mission, and position their service as complementary to public transit.

Contextual Considerations

The unique barriers and opportunities resulting from public policies and transportation infrastructure, as well as different preferences of potential users (such as the great interest in chauffeur service in India and desire for one-way service in Hangzhou), challenge the transferability of a standardized carsharing business model across all markets. The localized business model is still being tested and modified in cities like Bangalore (round-trip), Mexico City (round-trip with a small one-way experiment), Istanbul (partnerships with developers), and other cities. The feasibility and potential of these modes in the mobility system need future exploration. It is certainly too early to conclude how profitable carsharing could be in emerging markets.

In addition, ongoing rapid motorization and urbanization provide a much more dynamic context for business development in emerging markets. On the one hand, economic growth and urbanization might increase the demand for personal motorized trips for leisure, shopping, and other purposes, creating more opportunities for carsharing; on the other hand, new cities are being built quickly and new transport policies are emerging swiftly. The changing context poses uncertainties and opportunities; if new cities are built keeping cars in mind, there might not be sufficient space for public transit or walking and cycling, or even complementary carsharing, which clearly will threaten the sustainability of the city. This conflicting and dynamic context in urban mobility, city design, transport infrastructure, and governance will require shared mobility operators to modify the business model to be responsive over time, making it challenging for business to take off.

Another issue important to the carsharing industry is the uninformed attitude of key transportation stakeholders. The involvement of government as well as other businesses could significantly impact the dynamics of this nascent industry currently dominated by grassroots entrepreneurs. If the government provides support, such as parking, subsidies, or tax exemption to carsharing start-ups, these small for-profit CSOs could develop more quickly and grow into a big market in a short time, potentially becoming the Zipcar of China, Brazil,

or Mexico. However, if the government chooses to take the lead in this business—a possible scenario in China—private operators might not have an adequate opportunity in the market.

Finally, businesses like car manufacturers or car rental companies might promote carsharing in emerging markets, to facilitate their core businesses. Currently, almost all major car-rental companies, and several car manufacturers, operate carsharing programs in established markets. While these companies are competing for larger market share in the developing world, carsharing could be an attractive way to promote their brands. Additionally, the technology and advanced management systems of carsharing might benefit the traditional car rental business, which is also on the rise in these countries.

Future Research

Moving forward, further research is needed to explore market segmentation, financial sustainability and business models; ex-post impact on members' access, travel activity, and choices; and public policy practice and needs. The role of central and local governments could be addressed more systematically, with a special focus on supportive public policy. In addition, research into the relationship of emerging vehicle and trip-sharing models such as ride-sharing, peer-to-peer, and shared or chauffeured taxis, would expand knowledge about optimal mobility models for emerging markets. Study of actual pilots would be especially helpful to examine real-world behavioral impacts and public policy implications.

This research sketches a picture of the nascent industry of carsharing in emerging markets, and indicates that its potential varies by place, and is shaped by its context. The research improves understanding but also raises more questions. WRI hopes *Carsharing: A Vehicle For Sustainable Mobility In Emerging Markets?* will provide inspiration for forward-looking businesses, governments, and academics, and help them further explore the potential of carsharing in less developed countries.

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ENDNOTES

1. Over the last several years, both traditional car rental companies as well as automakers have entered the carsharing market through acquisition, partnership, and new start-ups. As of fall of 2014, there were five rental companies operating carsharing companies worldwide including Avis, Hertz, and Enterprise (Shaheen and Cohen 2014; Lane 2013). Increasingly, automakers are also moving into the carsharing industry, including many of the leading brands—among them BMW, Daimler, Ford, Nissan, Renault, Toyota, and Volkswagen (Stanley 2013; Briggs 2014).
2. Using the United Nation's classification of economies by per capita gross national income, for the purposes of this research we define "emerging markets" as upper-middle-income countries plus India, which is classified as lower-middle-income (UN 2014).
3. The industry scans conducted by this research did not yet reveal carsharing in low-income countries other than India.
4. These 22 include only CSOs operational in July 2015. Additional CSOs are expected to launch in Chongqing, China by the end of 2015 and in Rio de Janeiro, Brazil in 2016. Sigo operated in San José, Costa Rica until 2014.
5. Uber and similar "peer-to-peer" taxi services are considered taxis. See discussion in Box 3.
6. This figure is based on our global scan of the carsharing industry compiled through extensive desktop research and supplemented with expert interviews. It excludes CSOs planned to launch in Chongqing, China by the end of 2015 and in Rio de Janeiro in 2016, as well as planned expansions of an existing CSO to Cape Town and Durban, South Africa in 2015. See Table 1 for more detail.
7. This is also due to the presence of cycling and transit infrastructure.
8. At the time of the interviews in summer 2012, there were no CSOs in Malaysia or South Africa.
9. The number of focus group meetings was determined according to the saturation principle. Saturation in focus-group research is duplication of observation—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 participants are considered sufficient (Krueger et al. 2000, Gaber and Gaber 2007).
10. In the Bangalore focus groups, secondary household members included family members that either stayed at home or worked from home or were studying. Housewives, college students, young adults, retired parents, and work-from-home family members fell into this category. However, only members up to the age group of 45 were included in the sample.
11. Nine focus group meetings with 27 working professionals and 17 secondary household members were scheduled, and among these participants, roughly half had access to cars while the other half had no or limited access. In the primary group, out of 27 participants, 16 were car owners; however only 13 had access to a car when they needed it. Similarly in the secondary group, though 15 of the 17 participants interviewed owned cars in their households, only seven had access to it. These data suggest a fairly good definition of the two groups with regard to their actual vehicle access when the household owns a car.
12. This figure is based on our global scan of the carsharing industry compiled through extensive desktop research and supplemented with expert interviews. See Table 1 for more detail. A CSO previously operated in Costa Rica in 2014; new CSOs are planned for Chongqing and Rio in 2015 and 2016 respectively. Locomute, a new South African CSO, is planning to expand to two new cities by late 2015.
13. Barroso, Felipe. Interview by Heshuang Zeng. Email. Washington, D.C. December 5, 2013.
14. Solórzano, Diego. 2014. Interview by Heshuang Zeng, Tape recording. Washington, D.C., January 18, 2014.
15. Öztürk, Erben. Co-founder Mobicar. Email message to Aileen Carrigan. March 23, 2015.
16. Liu, Wenjie (CEO of EduoAuto). 2012. Interview by Heshuang Zeng. Tape recording. Washington D.C., July 20, 2012.
17. Lai, Xiaomin (CEO of EVnet/Chefenxiang). 2012. Interview by Heshuang Zeng. Tape recording. Washington D.C., July 28, 2012.
18. Liu, Wenjie (CEO of EduoAuto/YiDianzc). Email message to author, December 9, 2013.
19. Liu, Yi'an (CTO of Chefenxiang). Email message to author, April 3, 2014.
20. The authors estimate the Wei Gong Jiao fleet by subtracting an estimated 6,000 vehicles used for long-term rentals from their total fleet of 9,850 (Kandi 2014; Geekcar 2015). Membership is estimated using ZoomCar's 2015 vehicle-to-member ratio of 0.01.
21. Back, David. Co-Founder and President, ZoomCar, Interviewed by Chhavi Dhingra, Tape recording. Bangalore, September 4, 2014, India.
22. Moran, Greg. Email communication with Aileen Carrigan. March 11, 2015.
23. Moran, Greg. Email communication with Aileen Carrigan. March 11, 2015.
24. www.mylescars.com

25. Estimated by authors using Myles' spring 2015 vehicle-to-member ratio of 0.013 (Franchise India 2015; Business Line 2015).
26. Solórzano, Diego. 2014. Interview by Heshuang Zeng. Tape recording. Washington, D.C., January 18, 2014.
27. Chin, Ryan, 2012, Interview by Heshuang Zeng. Tape recording, Washington, D.C., July 18, 2012.
28. Zipcar has not recorded an annual profit since its founding in 2000 (Lane 2013).
29. This may refer to municipal, state or central government recognition or support depending on the national context.
30. Uber and similar "peer-to-peer (P2P) taxi" services are considered taxis here. They organize community drivers to add their personal vehicles to the supply of taxis creating "transportation network companies" (TNCs) that promise riders easier, more secure, and more reliable access to taxi services. See further discussion in Box 1.
31. The rigor and quality of research on carsharing impacts could be improved. As Millard-Ball et al. (2005) note, many studies are of poor quality, conducted by carsharing operators or advocates with potential bias toward promoting carsharing; study sample sizes are often small; and few long-term longitudinal studies of user behavior have been conducted. Nevertheless the research consistently reports positive net social and environmental benefits of carsharing, while not necessarily agreeing on the magnitude of those benefits.
32. Based on focus group findings and Zazcar's customer survey (Zazcar 2012).
33. As technology providers pointed out during interviews, the 3G networks in China and India are sufficiently reliable. One expert indicated that smartphones might be expensive but they are still attainable for many people. A recent survey among young people between the ages of 15 and 28 in 12 big Chinese cities revealed that 78 percent own a smartphone (China Youthology 2012).
34. Barroso, Felipe. Interview by Heshuang Zeng. Email. Washington D.C., December 5, 2013.
35. Currently, ten cities in China restrict vehicle ownership or use in some way. <http://thecityfix.com/blog/on-the-move-reducing-car-usage-ownership-china-latin-america-developing-economies-heshuang-zeng/>.
36. Vehicles are restricted based on the last digits of the license plates.
37. To stem the rapid growth of personal vehicles, Beijing has capped the number of yearly vehicle registrations since 2011. People need to enter a lottery for a vehicle registration permit. YiDianzc (EduoAuto) had to enter into the same regional lottery system as everyone else, to have a 1-in-50 chance each month of obtaining the license to acquire a car for its carsharing fleet.
38. Namely, competition from auto-rickshaws, two-wheelers, and day-cabs/weekend taxi rentals in Bangalore, and from taxis and car rental services in Hangzhou.
39. Though expert interviews did not highlight insurance, the authors believe that variations in insurance laws and availability might also be a barrier.
40. Other types of users were mentioned, especially small businesses that need occasional car usage. Most interviewed CSOs offered corporate membership services. One small CSO indicated that corporate clients accounted for 70 percent of its trips. According to another CSO, the trip share of small business turned out to be much higher than expected.
41. Author's professional experience and conversations with several operators.
42. Compared to Zipcar, which charges a US\$50 late fee, or about five to eight times the hourly rate.

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