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Feasibility Study of Car-Sharing Service in Hangzhou, China

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Feasibility Study of Car-sharing Service in Hangzhou, China

A Major Qualifying Project Report

Submitted to the Faculty of

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

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Abstract

The goal of this project was to prepare an in-depth study of the feasibility of car-sharing service in Hangzhou city to effectively assess the business opportunities and social effects of this alternative of transportation. We analyzed the social, marketing and financial aspects of the feasibility of this business idea through a large survey, interviews and site visits. We also examined the supporting functions to implement future car-sharing service in Hangzhou, including advertising tools, location distribution design, and technologies.

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Chapter 1: Introduction

“In the United States alone, revenue generated by the car-sharing market is expected to experience 44 percent annual growth through 2016 — from just shy of \$200 million in 2009 to almost \$3.3 billion” (Goodison, 2011). Car-sharing is a “business model using modern electronic communication technology and GPS satellite positioning technology to provide a range of car service to the members. Car-sharing Service operators provide vehicles, coordination management of network operations, and are responsible for vehicle maintenance, insurance, parking and other issues; and car-sharing members have the right to use the vehicle only, but not to own” (香港达泰投资咨询有限公司, 2011). It provides people the benefits of using a car without actually owning it and worrying about the responsibilities that comes with it. The growing market and popularity provides opportunity for existing service providers to expand and for new companies to enter the market. In 2009 there were more than one thousand cities in the world where people can use car-sharing services.

Transportation is the life-blood of any economy. And yet, the fast-growing urban centers are faced with increasingly clogged arteries. A country where this kind of problem is escalating is China. Transportation in China has experienced major growth in recent years. One mode of transportation, the highway and road system has gone through a rapid expansion resulting in an increase the use of motor vehicles in China. According to the China’s State Statistical Bureau, China had 5.54 million vehicles on the road in 1990, but this number increased to 90.86 million in 2011, 19.3% from a year earlier. The use of motor vehicles in China is estimated to grow even more as China is one of the fastest growing countries in the world. The increased number of motor vehicles coupled with overpopulation contributes to traffic, transportation issues and air

pollution. A possible way to alleviate these kinds of problems is to implement the idea of car-sharing services in China.

Zipcar, one of the most successful car-sharing services in the USA, was originated in the Boston, Ma in 2000. It provides its customers the opportunity to rent a car for a specific amount of time providing them the benefits of owning a car without owning it. Zipcar currently operates over 8000 vehicles and serves to over 565,000 members worldwide (Zipcar, Inc). This project paper involves the steps and results of the research that our team carried out to help the government of Hangzhou to implement of similar car-sharing service. The reason why the city of Hangzhou is a good candidate for hosting China's first established car-sharing service is that it is sister cities with Boston and share several characteristic with the city of Boston.

Car-sharing service has become a widely used alternative for automobile drivers in the U.S. and Europe. It benefits individuals and institutions by lowering their transportation costs and helps society reduce the number of vehicles on the road, in the parking area, energy consumption and emission of carbon dioxide. While car-sharing services like Zipcar are thriving in American and European cities, they are not yet available in China. As our goal for this project we will answer the following questions.

- Can car-sharing business be equally successful in Hangzhou as in Boston?
- Can it be part of the solution for the increasingly worsening traffic conditions and air pollution of big cities in China?
- What roles can the government play in the development of this new transportation model?
- What opportunities will this business offer to investors and entrepreneurs?

In the end we are planning to provide governments and businesses an in-depth study of the feasibility of car-sharing service in Hangzhou city so that they can effectively assess the business opportunities and social effects of this alternative of transportation.

Chapter 2: Literature Review

2.1 Collaborative Consumption

“Collaborative Consumption describes the rapid explosion in swapping, sharing, bartering, trading and renting being reinvented through the latest technologies”. Several markets, where collaborative consumption is common, are: Transportation (cars, bikes), apparel (clothing, accessories), food, living spaces, household appliances, money (social lending, virtual currencies) workspaces, travel, accommodation, space (storage, parking, spare rooms). (Rachel Botsman, 2010)

Rachel Botsman and Roo Rogers classify collaborative consumption in to three types of systems: product service systems, redistribution markets and collaborative lifestyles. In redistribution markets, used goods are moved from somewhere they are not needed to somewhere they are. Used items can be sold or redistributed; resulting in a more sustainable world. In collaborative lifestyles people who share similar needs and interests share fewer tangible assets such as time, money and space. Product service systems enable companies to offer products as services instead of selling them. This provides the benefits of a product without actually having the customer own the product.

A system of collaborative consumption is based on used or pre-owned goods being passed on from someone who does not want them to someone who does want them. This is another alternative to the more common “reduce, reuse, recycle” methods of dealing with waste. Preventing waste; therefore helping the environment is one of the main benefits of collaborative consumption.

Another benefit of collaborative consumption gives people the benefits of ownership with reduced personal burden and cost. For example renting a product would save someone the initial cost of actually buying the product. Companies, as well as individuals, shape the way they fulfill their needs taking collaborative consumption into account. A very widespread example of collaborative consumption is car-sharing services.

2.2 Car-sharing Service

A car rental agency is a company that rents motor vehicles for short periods of time for a fee. These kinds of agencies often serve people who do not have access to their own cars. For example, tourists who are from out of town or people whose cars need to be repaired. Car-sharing, similar to car rental, allows people to rent cars by the hour. They attract people who occasionally use cars and people who would like to have access to different type of cars than they use day-to-day. Car-sharing services have unique characteristics which separate them from regular car rental services.

Different than car rental companies, car-sharing services provide unit pricing that includes fuel and insurance. While renting a car from a car rental company, the customer pays for the gas they use. They usually receive the car with a full tank and required to return the car the same way. Also if the customer wants insurance on the car they are required to pay extra fees. With car-sharing services, on the other hand, the gas and insurance money are included in the hourly fee of the car. The customer receives a “gas card” from the service provider and can purchase gas with that card.

Another essential element of car-sharing services that distinguish them from car rental is the unattended access to the vehicle at the start and end of the trip. Unattended access is

provided with a mechanical lockbox mounted near the vehicle or on the vehicle. This makes it very convenient for the customer to share a car. At car rentals, the customer needs to talk to a company representative about the terms of agreement before renting the car. This step is done online with cars sharing services. These are the characteristics that make car-sharing services distinct from car rentals.

2.3 Air Pollution and Environmental Impact of Cars

“Air pollution is the addition of harmful chemicals to the Earth’s atmosphere”

(Houghton Mifflin Company, 2005). It is one of the most pressing global issues due to its rapid influence on increasing human diseases. According to the World Health Organization in 2008, air pollution was estimated to have caused approximately two million premature deaths worldwide.

There are several man made activities that contribute to air pollution. Industrial and utility activities such as coal-burning power plants, car engines and trash incinerators are the major sources of air pollution created by human-induced activities (The Encyclopedia of Earth, 2008). These activities produce chemicals that have severe impacts on the environment.

Most common pollutants produced as a result of these activities are ground level ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead (U.S. Environmental Protection Agency, 2011). Each individual pollutant has different effects on the environment and the human health. Ground level ozone, also known as summertime air pollution, forms smog which is harmful when concentrated in the air. As the primary constituent of smog, it can scar the lung tissue causing bronchitis, emphysema, and asthma. Particulate matter can contain materials ranging from acids, organic chemicals, metals, soil, and dust particles. According to the American Lung Association, exposure to particulate air pollution can cause asthma attacks and harm individuals with sensitive airways. The emission of carbon monoxide mainly comes from motor vehicles. Carbon monoxide reduces the amount of oxygen carried by the blood and cause diseases related to lack of oxygen in different body parts (U.S. Environmental Protection Agency, 2011). Nitrogen oxides (NO_x) come from emissions from

cars, trucks and buses, and power plants. Exposure to NO_x may cause adverse respiratory effects including airway inflammation and increase respiratory symptoms, such as asthma. Sulfur dioxide is majorly produced by power plants and industrial facilities which affect human respiratory system causing respiratory effects such as bronchoconstriction and asthma. Lead, an indoor pollutant, affects humans working in contaminated workforces, especially in manufacturing plants. “Lead may cause a range of health effects, from behavioral problems and learning disabilities, to seizures and death (U.S. Environmental Protection Agency, 2011).”

Even though standards are set by the National Resources Defense Council (NRDC) to prevent thousands of cases of respiratory and heart diseases, air pollution is still part of our everyday lives. Studies show that traffic-related air pollutants increase respiratory and cardiovascular mortality. Emission from motor vehicles’ engines release nitric oxide, nitrogen dioxide and carbon monoxide gases, pollutants which contribute to air pollution and provoke several respiratory symptoms.

Large cities, especially ones with high automobile traffic, have a high amount of nitrogen oxides emitted into the atmosphere which can be significant in many ways. “Overall, 80 percent or more of nitric oxide emissions worldwide are generated by human activities, and in many regions the result is increased smog and acid rain” (Vitousek, 2007). Acid rain is produced from high levels of nitric and sulfuric acid in the atmosphere and is considered an environmental problem (U.S. Environmental Protection Agency, 2011)

Acid rain is not the only result of air pollution, global warming is another very pressing concern that can be aggravated by air pollution. Global warming has become a severe environmental issue around the world. The pollutants emitted by vehicles such as nitrogen

dioxide and carbon dioxide contribute to the greenhouse effect. The greenhouse effect is a naturally occurring process that aids in heating the Earth's surface and atmosphere. The atmospheric gases like carbon dioxide absorb the heat from the sunlight and keep the Earth surface warm. An increase in the concentration of these gases can cause the temperature of the Earth to increase causing global warming. Therefore emissions from motor vehicles in high concentrations have an impact on global warming.

With the rise of air pollution worldwide, China has made its way to the top of the list of countries that have the worst air pollution. According to the World Bank, 16 of the world's 20 cities with the worst air are in China. In the foreseeable future China's air pollution does not seem to be getting better. "The air pollution death figure is expected to rise to 380,000 in 2010 and 550,000 in 2020." (Hays, 2011)

2.4 Air Pollution in China

A basic requirement of human health is clean air; therefore organizations such as the World Health Organization, set air quality guidance in order to reduce impacts of air pollution. The air quality guidelines are "expert evaluation of current scientific evidence (Global Health Organization, 2006)." The information included in the guidelines is related to the four common air pollutants: particulate matter (PM), ozone (O₃), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂). There are two types of standards: primary and secondary. Primary standards main goal is to protect the living individuals against adverse health effects. Secondary standards protect against welfare effects, including damages to buildings and vegetation. Pollutants also have standards for long-term and short-term average times which are set to protect chronic health effects (U.S. Environmental Protection Agency, 2011).

The air we breathe in the world today is not as clean as we think it may be. Fine particle matter ($PM_{2.5}$) is the problematic particles which pass the body's normal defenses and penetrate into the lungs causing premature deaths. Figure 1, displays the severity of air pollution in the world as the map shows the global view of health-sapping air pollution particles. The map shows the average $PM_{2.5}$ results until 2006, and levels of $PM_{2.5}$ are very high from Northern Africa to Eastern Asia. It can be clearly seen that China has high volumes of air pollution across the country.

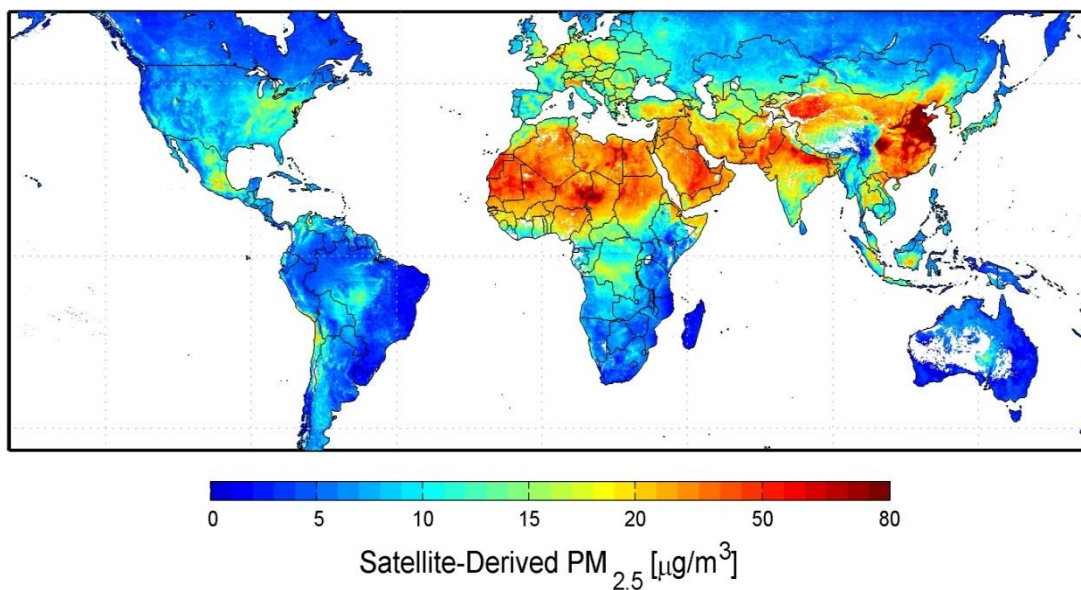


Figure 1: Global satellite-derived map of $PM_{2.5}$ averaged over 2001-2006. (Donkelaar, 2010)

China's growth has several negative impacts on the environment. Land degradation, bad water quality, severe air pollution and declining natural forest cover are some of the consequences of China's rapid growth. These environmental issues are undermining the sustainability of long-term growth and as a result threaten the health of future generations.

Air pollution is the cause for hundreds of thousands of deaths each year (New York Times, 2007). China has the highest annual incidence of premature death triggered by air

pollution (United Press International, 2011). According to the Ministry of Health, in 2007 pollution made cancer China's leading cause of death. Figure 2 shows the number of deaths in 2000 due to urban air pollution (World Resources Institute, 2007). Worldwide, air pollution causes approximately 800,000 million premature deaths each year. 25% of these deaths are seen in East Asia, with China having more than 200 million deaths.

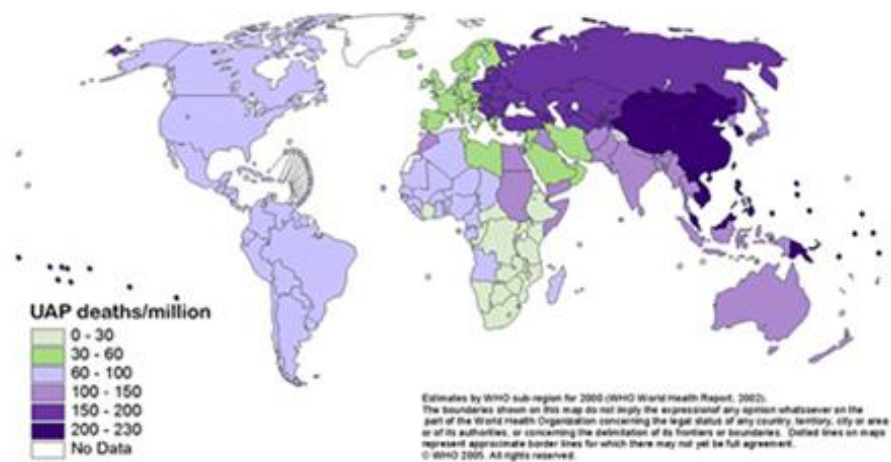


Figure 2: Deaths from Urban Air Pollution (UAP) in 2000 (World Resources Institute, 2007)

According to the World Health Organization, 90% of urban air pollution is caused by fossil fuels burned by motor vehicles. Today, sulfur dioxide and nitrogen oxide are the major two pollutants responsible for China's environmental issues (The World Bank, 2007). The increase in industrial-based sulfur dioxide emissions has degraded air quality in the country. In 2003, almost three-quarters of China's cities had sulfur dioxide below the U.S. annual average standard ($60 \mu\text{g}/\text{m}^3$). In 2005, China discharged 25.49 million tons of sulfur dioxide creating about 50% of these cities violating at least one air quality standards (Xinhua News Agency, 2006). Figure 3 shows the total sulfur dioxide emissions worldwide, making China the largest

producer of sulfur dioxide. Over half of China's sulfur dioxide emissions come from electric utilities, but motor vehicles have become another growing source.

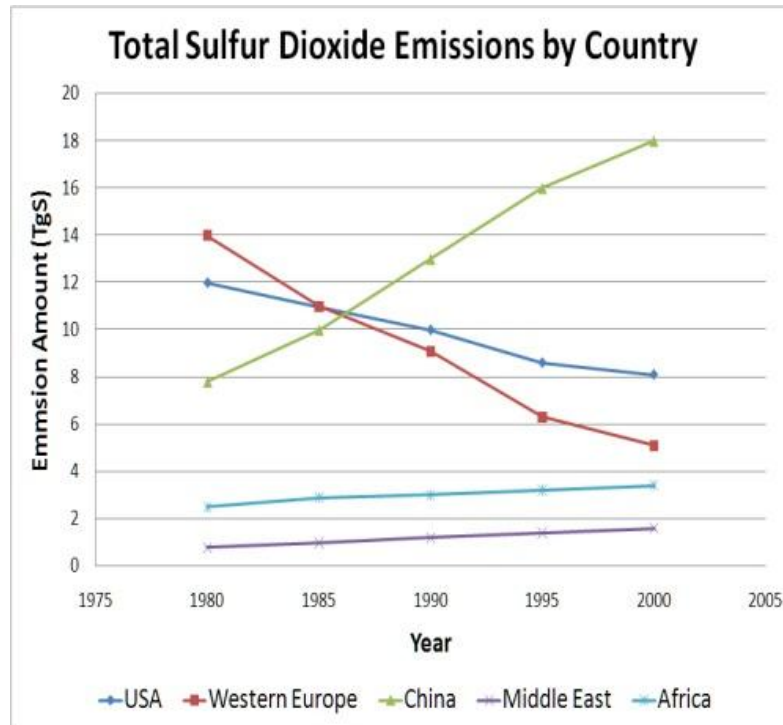


Figure 3: Total Sulfur Dioxide Emission by Country (Paster, 2007)

The ambient air pollution levels in China's major cities (The World Bank, 2007) show that northern cities are more vulnerable to particulate pollution than cities in the south of China. Three northern cities, "Linfen, Lanzhou and Urumqi—made the top 10 list of cities in the world with the worst air pollution by the Blacksmith Institute." (Hays, 2011) China's northern cities due to industrial activities as well as their geographic and meteorological conditions make the cities to be more vulnerable to particulate pollution. Nitrogen oxide is emitted in the exhaust fumes when vehicle engines operate at high temperatures. (Espere, 2008) In cold weather conditions, pollution is trapped near the ground and motor vehicles run less efficient

and also require more combustion for space heating. This is another reason why northern cities are easily polluted than the southern area of China.

Nitrogen oxide is released by power plants, heavy industrial activities and motor vehicles. “China’s emissions of nitrogen oxide have increased 3.8 percent a year for 25 years (Hays, 2011).” Figure 4 shows the total nitrogen oxide emissions in China, allocated in different economic sectors and fuels. The pink color shows transportation which includes the emission in all the country until 2000; transportation is the third largest source in the country. The nitrogen oxide emissions from this graph were mainly concentrated in the eastern and central provinces, accounting for over 80% of the totals (Tian, 2003).

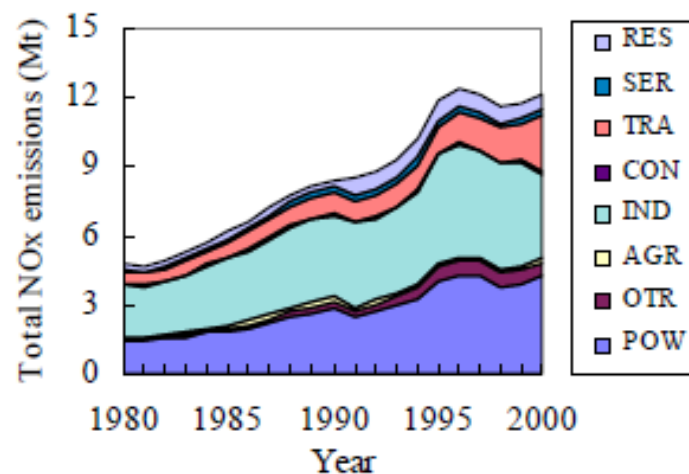


Figure 4: China's Total NOx emissions by sectors, 1980~2000 (The World Bank, 2007)

A direct consequence of air pollution from sulfur dioxide and nitrogen oxide is acid rain; this is a serious problem in China. Figure 5 shows the distribution of acid rain in the country from 2001 until 2005 (The World Bank, 2007). As seen in these maps, the problem remains serious in the south and southeastern portion of China. The maps also show that the main areas affected are gradually moving from southwest to southeast. 38% of Chinese cities are affected

by acid rain where Beijing and Shanghai are the two most affected cities. In cities, the major causes of acid rain are the rapidly growing number of cars, and the increasing consumption of coal. In recent years coal consumption has accounted for about 70% of total energy consumption (China Statistical Yearbook, 2004). The increase of crude oil consumption is due to the rapid expansion of motor vehicles in many cities in China. “The drastic rise in the number of vehicles and rapid development of industries in cities has led to worsening air quality in China (Tang, 2004)”.

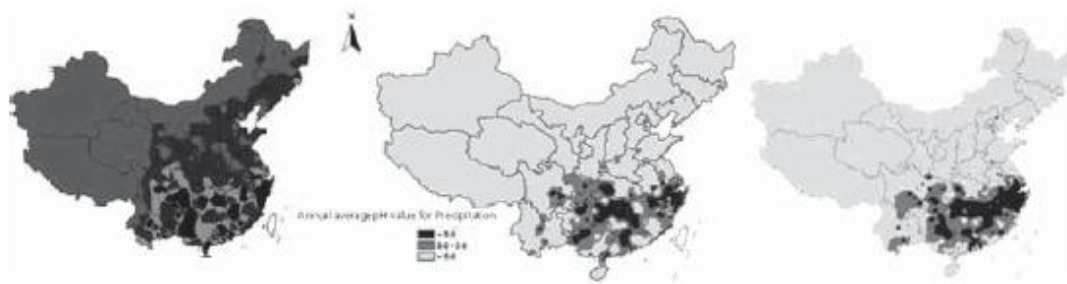


Figure 5: Distribution of Acid Rain in China, 2001, 2003, and 2005

Vehicle pollution has increased dramatically in China according to the Chinese Ministry of Environmental Protection (MEP) in 2010. In cities across China, exhaust fumes from vehicles have become the major source of air pollution. In 2009, the total vehicle emissions across China were 51.433 million tons, of which 5.833 million tons were nitrogen oxide. 25.4% of the automobiles meet Grade III National Vehicle Emission Standard and only about 17% of all vehicles are below any standards. Automobiles contribute to over 70% of China’s carbon oxide and more than 90% of nitrogen oxide (Clean Biz , 2010).

China is the country that suffers the most from air pollution in the world. Amongst the many reasons of air pollution there are few that people can take action against. One of these is the overuse of motor vehicles. As mentioned before motor vehicles are an important contributor of air pollution in China. The quality of air we breathe can be improved by the choices we make every day. If we can take strides in our everyday lives to prevent harmful emissions, we can help create a healthier world.

Chapter 3: Car-sharing Services in the US and China

3.1 Zipcar in Boston and Beyond

Car- Sharing has been around since the late 1940s, but it was not until the European car-sharing services and Zipcar got established that it has become noticed. We can learn from the early days of car-sharing to help us analyze why it came about and what use it has in today's world. But as we look deeper into what the car-sharing service really has to offer we will notice more characteristics it has such as providing convenience, cost savings, and environmental impacts in society. As we look at the past and beyond on what car-sharing has to offer, we notice that it brings us much more than we expected.

3.1.1 History of Car-sharing Services

The development of the car-sharing industry has become a more predominant matter in society today than has in its beginning years. With rising fuel costs and a strapped economy the demand for a car-sharing service is more than ever. With innovators in the industry such as Zipcar, many people are second guessing the way they travel. The concept of car-sharing has been around for a while, but it took an economic downturn and a well-developed car-sharing service to get it noticed. To help understand how car-sharing got its name to fame, we need to understand where it started.

Car-sharing took its first real steps in the early 1990s even though smaller undeveloped types of car-sharing programs tried to spurt earlier but never turned the corner. The first structured car-sharing programs include Statt auto in Germany, Green Wheels in the Netherlands, and Zipcar in Boston which would help carve a new face in the car-sharing industry. By introducing this new market to the world, car-sharing Companies helped bridge the

gap between people not owning a car and convenience of being able to use one at the fraction of owning one (Rachel Botsman, 2010).

3.1.2 History of Zipcar

The car-sharing industry has really taken off in the past 15 years and has been driven by the lack of affordable and convenient car rental agencies in congested cities. One of the premier names that pop up in the car-sharing industry is Zipcar. Zipcar was founded in 2000 by Antje Danielson and Robin Chase who are residents in Cambridge Massachusetts. Their vision was to create a car-sharing company that provided major cities the ability to provide wheels when you want them. In 2000, the first “Zipcars” hit the streets of Boston. Soon after that Washington D.C. and New York City followed suit. Soon after launching the program, Zipcar became a hit in these major cities and as of today they are made available in over 50 major cities and over 100 universities nationwide. (Zipcar, Inc)

Zipcar funding is made available through venture capitalist firm Benchmark capital. They provide Zipcar with \$10 million in funding and gave them the ability to expand their service worldwide. In 2010, Zipcar bought out Streetcar which is a London based car-sharing service. With this addition, Zipcar currently operates over 8,000 vehicles and serves to over 565,000 members worldwide. As it keeps expanding Zipcar has shown it has become a reliable form of transportation and stands by its slogan “Wheels when you want them.” (Zipcar, 2011)

3.1.3 Zipcar and Competitors

Zipcar offers an easy and unique service compared to its competition. They offer easy affordable enrollment fees and competitive daily driving charges. If you are a Zipcar member you first have to reserve a vehicle within your local area online or by telephone for a specified

date and time. Once you have a schedule appointment you then go to the Zipcar parking area and use your membership card to unlock your car. All “Zipcars” use RFID incorporated into membership cards to open the cars via GPS system. Once in the car you must return it to the same location at the time your reservation ends or late fees will be added. The GPS monitoring system in the car lets Zipcar track their cars and know where a car is at all times. This helps Zipcar attend to accidents, assess late fees, and know the status of their cars at all times. The cars come equipped with a gas card to fill up, 180 miles per reservation \$.45 per mile over, and insurance. By offering these amenities in their service Zipcar continues to be a leader in car-sharing services. (Zipcar, 2011)

Even though Zipcar is one of the top companies that offer a car-sharing service, it does have to compete with a few other services. These companies include Co-Operative Auto Network (CAN), Philly Car Share, and U Car Share. (Goodison, 2011) All of these companies have a developed business model and require memberships in order to use the service. All of these competitors are located in the regions where Zipcar operates which include the continental US and parts of Canada. Even though Zipcar seems to control a high percentage of the car-sharing industry, they still have to compete against these other companies that take away possible members to the Zipcar.

The CAN or Co-Operative Auto Network based in Vancouver, Canada was first established in 1997 under the company’s director Tracy Axelsson. The company originally started off with 16 members and 2 cars when it started up in 1997. Now the company has climbed to having over 2000 members and 113 vehicles. Even though this may seem small compared to Zipcar, CAN only serves in the area of Vancouver in which Zipcar also serves. The

membership fee for CAN is \$50 annual fee plus the user gets to choose driving plans for a certain amount each month for use of the service. Driving plans are based upon usage and CAN also charges a fee for kilometers traveled on top of an hourly charge based on the driving plan chosen. Even though CAN is not one of Zipcars biggest competitors, they compete of the same playing field as Zipcar. (Goldman, 2008)

Another competitor of Zipcar that is stationed in Philadelphia, Pa called Philly Car Share is a unique company that pushes its car-sharing services towards universities and colleges in neighborhood Pennsylvania areas. The company founded by both Tanya Seaman and Clayton Lane in 2002 focused on bringing a car-sharing service to local universities in order to get college students a way to travel around town. Starting with only 13 environmentally friendly vehicles, Philly Car Share took off booming. In 2008 it partners with the University of PA to launch the largest university car-sharing program by deploying 40 vehicles around campus. Currently they have expanded to many other area colleges and have made its services available in Delaware. The rates depend on the car and are anywhere from \$4-8 hr/\$40-60 day and includes gas, insurance, and 210 free miles a day. The access is 24/7 and can be accessed online. They have over 35000 members today and are a true competitor to Zipcar when it comes to car-sharing around universities. (Goldman, 2008)

One of the last main competitors to Zipcar called U Car Share is a car-sharing service that is a division under the worldwide known U-Haul international. U haul, which is widely known for storage and truck rentals, established a car-sharing division in 2007 in 26 U-Haul centers nationwide. They run in major locations around the US including Boston, Washington D.C., Chicago, and many more cities that have U-haul centers. Unlike all the other competitors

which have a variety of vehicles, U Share only has PT Cruiser in its fleet. The rates include an annual \$50 fee along with \$10/hr or \$65 day which includes gas, insurance, and 125 miles. Although the other competitors seem to have better offerings in their plans, U-haul has a great reputation worldwide and makes most of its profits in car-sharing by focusing its services more towards businesses than individuals. With its wide array of U-haul centers, it is one of Zipcars biggest competitors with its versatility of being a nationwide service. (Goldman, 2008)

Having a wide array of competition, Zipcar needs to always be one step ahead of the game in order to maintain its dominance in the car-sharing industry. Each of its competitors offer something different in their services which makes possible Zipcar members choose another service. For example, Philly Car Share focuses around local universities for its business while CAN focuses its customers in only one region. With all of its competitors it just gets tougher for Zipcar to keep one step ahead.

3.1.4 Zipcar and Customers

Zipcar scores high on Business to Customer (B2C) loyalty drivers by focusing on shared values, differentiate aggressively, and engage to their customers (Mull, 2011). The values that Zipcar puts great emphasis on are environmental and financial values. Both of this values are part of Zipcar's mission: "providing a great timesaving service that frees up space in our cities and puts more money in consumers' wallets (Zipcar, 2011)." Values such as these are not strong for car ownership. Zipcar stand out their believes for its values in their marketing materials and plays an active role in helping consumers implement this values. "Differentiate aggressively" is the way a brand inspires the most loyalty differentiated from their competitors. Technically, Zipcar is a car rental company but they rent only by the hour, instead of by the day. Zipcar's

stations are located within customer's neighborhood, not in airports or train stations. The brand is more complex than just renting a car. Another way Zipcar obtains loyalty from its customers is by engaging to them and "rope" consumers into the brand. "Zipster," created by Zipcar, is the name given to one who uses Zipcar (Zipcar, 2011). Zipcar offers "Zipster" events as well as discounts at area retailers and restaurants.

3.1.5 Zipcar and Government

In April 2007, Zipcar received the Green Business Award by The City of Boston and Mayor Thomas M. Menino (City of Boston, 2011). This award recognizes businesses that are committed to promoting a sustainable vision for Boston. The sustainable vision and performance is related to the environmental practices, in this case the promotion of alternative transit.

"The City of Boston has partnered with local company Zipcar to promote car-sharing in an effort to reduce congestion and promote sustainable transportation alternatives (City of Boston, 2011)." This community involvement shows that the government is aware of its traffic congestion and wants to solve this problem by facilitating carpooling. By partnership with car-sharing companies, Boston City Government wants to ensure that its residents live within one-fourth of a mile of a shared car by 2020 (City of Boston, 2011). The Boston Transportation Department requires developers and parking facility owners to work with car-sharing companies. This communication will determine whether their facilities can be sites for car shared cars. If the city ensures that users can easily access shared cars locations, then potentially it will be reducing vehicle miles traveled. Boston residents will access cars when needed; therefore the city will be implementing an expansion method (Green Boston, 2010).

Today, Boston City Government is using its contracting authority in order to increase the number of car-sharing opportunities in different areas. A request for proposal (RFP) was issued in November 2011 from car-sharing providers, this included: (a) Reserve approximately 19 vehicles at two different locations for City Government employees during working hours, but available to general public at other times, (b) 20 vehicles located in areas outside of downtown, possibly located in municipal parking lots (City of Boston, 2011).

3.2 Car-sharing in China

Through our research online we found out that the closest resemblance to car-sharing in China is eHi Auto Services Co. Ltd. Therefore we analyzed the history, operations, and marketing.

eHi Auto Services Co. Ltd, founded in 2006, is a leading car rental service provider in China for both corporate and individual clients. The company offers both self-drive and chauffeur-drive service nationwide, including Hong Kong, Macao and Taiwan. Head-quartered in Shanghai, they provide services in more than 50 cities in China and own 7,000 of vehicles. (一嗨租车, 2011). Their mission is "To Share, Create an Environmentally Friendly look, Promote Energy Savings, and create a Greener Society". In 2010, eHi had become the first company in China to offer a car-sharing service. Branded as eHi Fast Car, it provides users to experience the car-sharing system since they have to be self-service stations. This system has won the recognition from inside and outside of the car rental service industry.

Building on their industry-leading proprietary IT platform, eHi has won the trust from their customers with their professional, efficient and reliable services. Some of the company's attractive characteristics are their fashionable vehicle selection, flexible pricing, and convenient

booking system. This has made many local guides and residents become their customers for their car rental needs. eHi's client range covers all sectors including companies involved with energy, education, media, finance, manufacturing and more (一嗨租车, 2011). Today, the majority of the Fortune 500 companies that have operations in China have chosen eHi as their preferred service provider for car rental service.

eHi provides customers with a wide range of services to fit the need of its different customers. For individual service, eHi provides different deals including: vehicle delivery service, special price, self-driving, free vehicle inspection, and weekly or monthly rental. The individual service allows the customer to choose different insurance, payment and booking methods. On the other hand, for the company service eHi offers a long-term rental service and allows the company to design the service depending on their needs. Their corporate service includes an enterprise shuttle, commercial car rental, and more type of vehicles depending on the customer demand.

There are two types of individual service, one for car-renting and the other for car-sharing. Car-renting allows customers to return the rent vehicle to different locations, this is known as self-drive service. This process doesn't limit the customer to use the service in one area since customers can pick up the car and return it in a different city. eHi offers its customers 30 different models of cars for them to rent and has 300 eHi offices in more than 50 cities. (百度百科, 2011) When car-renting, eHi offers the customer two options: self-drive or chauffeur drive. eHi chauffeur drive service is only for VIP customers, and a professional chauffeur drives the customer in a limousine to his/her destination. eHi car-renting service also provides vehicle delivery, which involves an eHi's staff to deliver the car to a designated location. This method is

very convenient for the customers to avoid trouble finding the store. Car-sharing service, known as eHi Fast Car, allows customers to drive a car for a short period of time. This service can be done by online booking, and it provides the service to its customers all year after they acquire a membership. eHi Fast Car service is available in all main central district in Beijing & Shanghai.

Corporate services have three methods to offer. Enterprise shuttle is driving service used by private companies, as well as shopping malls or supermarkets customers. Companies can use this service to transport their staff. This service may also be useful for the stores such as malls or supermarkets. Offering this service for customers will make its convenient for shopping. It will increase their customers because they can directly get on the shuttle for free after shopping. The commercial car rental provides an experienced driver, who provides the customer with knowledge about the city, suburban routes, main attractions, and restaurant information. This service facilitates customer traveling experience. The designed service method provides various types of vehicles, according to business needs to develop the car programs. The customer can create a unique service only for their company.

3.3 Why Hangzhou for this Project

The Urban Planning of 2001-2020

City Properties

Hangzhou is the capital of Zhejiang Province and the center of economy, culture, science and education. The city aims to be a historical, cultural, and tourist city.

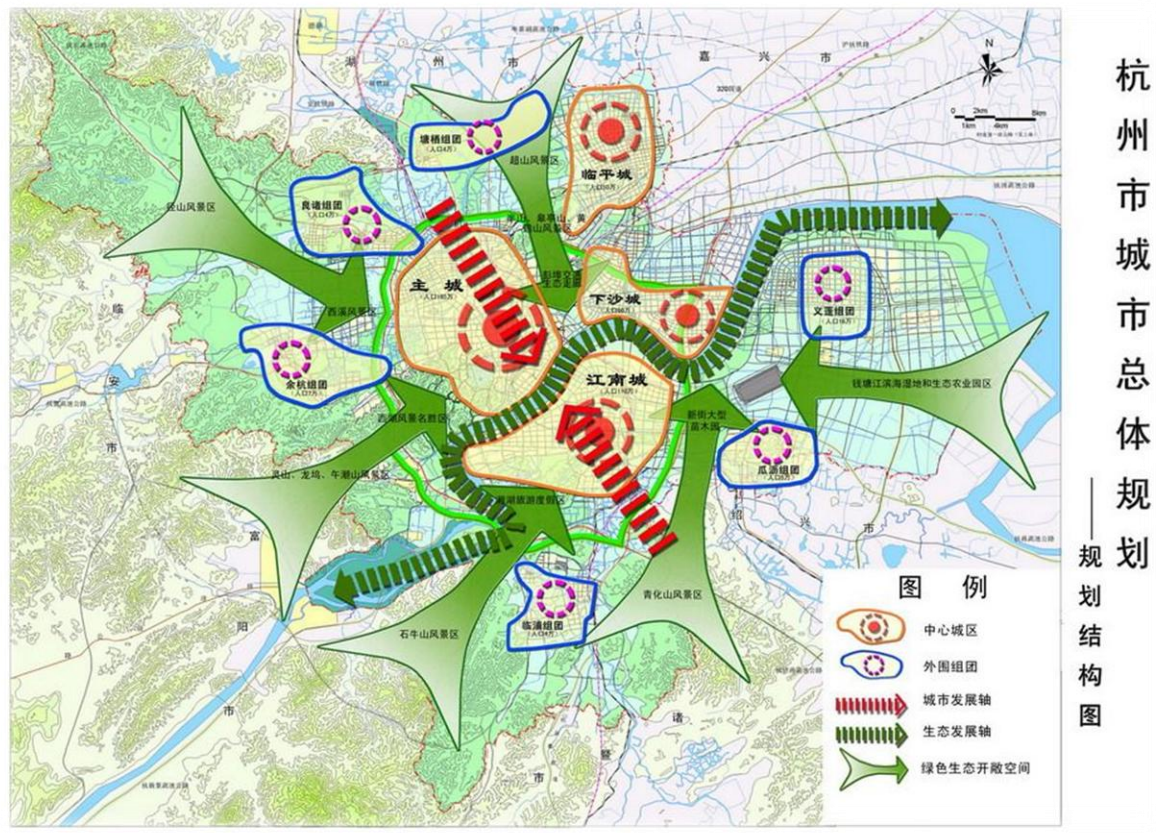
Development Goals

After 20 years of efforts, the main economic and social development indicators will be close to the level of developed countries. Further develop the effect of Hangzhou links to Shanghai as the leading major urban centers in the Yangtze River Delta region and the leading role of radiation in the province political, economic, culture, science and education. Also strength, scientific, and technological innovation is at the center of the city's comprehensive services. Soon Hangzhou will have economic prosperity, social harmony, developed ecological environment and become a city with local characteristics as well as the modern characters.

City Scale and Land use scale

As for 2020, the permanent population should be under 9.3 million, the urban household population under 8.2 million. And the urban land sites will reach to 400 square kilometers.

Layout Structure (City Planning Board, 2011).The city will be then expand to the east, while tourism to the west.



Chapter 4: Methodology

The goal of this project was to prepare an in depth feasibility study of launching a car-sharing service in Hangzhou. Furthermore, we were asked to analyze four aspects; social, marketing, technological and financial; of launching such a service. We achieved these goals by analyzing the infrastructure of the city Hangzhou, similar existing services within the city and successful car-sharing services around the world. We employed a number of methods to accomplish these goals and objectives including data collection from surveys and interviews, cross analysis between taxi, private cars and car-sharing, location analysis and feasibility study. The flowchart below shows the entire process that we went through to achieve our goals.

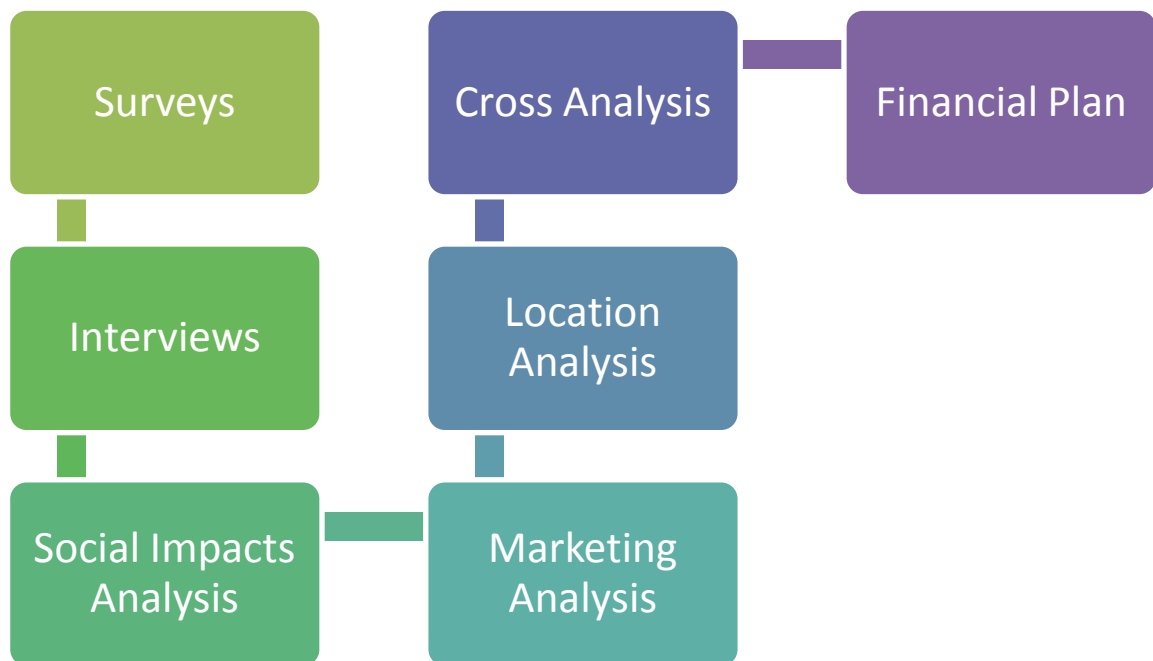


Figure 7: Methodology Flow Chart

One of the methods that we used to gather information was conducting surveys. We decided that it would be helpful for our project and our sponsors if we identified some characteristics of the population in Hangzhou. We prepared a survey that would help us

understand the opinion of potential customers towards car-sharing. The survey we used can be found in Appendix A. We asked questions on the background of the customer as well as their opinions about the service. We surveyed people at tourist attractions, supermarkets and busy streets. This way we aimed to get a mixture of the population in Hangzhou. These surveys helped us to decide whether implementing such a service in Hangzhou would be successful or not. It also helped us to come up with a price scheme for the service. The overall data that we obtained from the surveys helped us better analyze the feasibility of car-sharing in Hangzhou.

Our group also conducted several interviews to gather information. We conducted our first interview with chief engineer Jianhua Yao and Dr. Lv from the City Planning Department of Hangzhou. This interview helped us understand the infrastructure of Hangzhou better and allowed us to obtain reliable data about the city. We have also learned the role that the government played in launching the bike sharing service in Hangzhou. We got insights on how we should approach the government when we introduce car-sharing service to them. We were also able to discuss some of the difficulties to implement a car-sharing service in Hangzhou and the obstacles that our team needed to overcome.

Another interview we had was with Zhao LiYuan, one of our sponsors, who is the head of a company called Omnipay. Omnipay is a company that produces the software that is used for the bike sharing service in Hangzhou. Bike sharing service is a successful and profitable service in Hangzhou with characteristics resembling a car-sharing service. Our team thought it would be useful if we analyzed the social, marketing, technical and financial aspects of this service. From our interview with Zhao LiYuan we acquired useful information on how the system works. We were also able to obtain information on the financial and technological

details on bike sharing service. This interview allowed us to compare the bike sharing service and potential car-sharing service in Hangzhou.

Our team also conducted an interview with an electric car manufacturer, Zotye, in Hangzhou. The Chinese government is trying to promote electric cars in China. Our team thought that utilizing electric cars in the car-sharing service would interest the government into investing in a car-sharing service. A car-sharing service could be a good way to advertise electric cars in Hangzhou. Utilizing electric cars would also help the lower harmful emissions into the air. The interview with Zotye gave us insight about the technological and financial aspects of electric cars. This information helped us decide whether to utilize electric cars in the car-sharing service.

With the information we gathered through our surveys, interviews and research we prepared analysis on the social and marketing aspects of implementing a car-sharing service in Hangzhou. In analyzing the social aspects we took into consideration the impacts electric cars, traffic, and environmental issues that would arise due to implementing a car-sharing service. We felt that these three issues would be the most important aspects in implementing the service. We also looked into the marketability of the service in the Hangzhou area by creating possible marketing plans as well as what would be the best way to market this new service to the people of Hangzhou. By focusing on the social and marketing aspects of the car-sharing service, we created a better outlook of how car-sharing would work in Hangzhou.

Next, our team performed a location analysis. We have taken into consideration several factors such as population density, low vehicle ownership, mixed land uses and proximity to transit areas that would make a location suitable for a car-sharing station. This allowed us to

come up with the locations that would attract more people. We made several recommendations on the plausible locations for the first year of the car-sharing in Hangzhou.

Our research showed us that the main competitors of car-sharing in Hangzhou are private cars and taxi. Cost saving is one of the most important motivation for members to join a car-sharing service. Therefore we did a comparison between the yearly cost of owning a private car and car-sharing service. We also compared the cost of car-sharing to taxis. Through these comparisons we found out scenarios where car-sharing is cheaper or more expensive. This allowed us to make recommendations to better compete with private cars and taxis.

We used all the previously mentioned techniques to help us gather information to prepare a realistic and accurate financial analysis. We came up with acceptable prices for variable and fixed costs. We also estimated the number of customers and utilization of the cars according to the past performance of other car-sharing services. We then prepared a price scheme using the information we obtained from our surveys and interviews. With this information we were able to prepare a financial analysis. This analysis showed us whether launching a car-sharing service in Hangzhou is profitable or not.

By fulfilling our objectives and goals, we successfully provided an in depth feasibility study for our sponsors. Furthermore, we provided useful recommendations for further research on the subject. We hope our findings will allow our sponsors to take wise steps in launching a car-sharing service in Hangzhou.

Chapter 5: Results and Findings

5.1 Surveys

To help gather data for the feasibility of car -sharing we thought it would be necessary to create a survey to help with the car-sharing analysis in Hangzhou. The survey was done by using a random sampling method by picking out people on the street in the many popular parts of Hangzhou. These places in Hangzhou included: West Lake, Wumart, Hangzhou Tower, Hubing Square, Wushan Square, Wensan Road, Huanglong Gym, Yigao Digital Square, Citizen Centre, and Qingchun Road. We thought it was necessary to have a survey in our study in order to find key information about how people reacted about car-sharing and whether they would accept it. Also the survey served as a baseline in our financial analysis in order to get a reasonable per hour charge and also was used to find out information for marketing car-sharing. As you will see we were able to analyze questions we asked in order to find valuable information about the social, marketing, financial, and location parts in our study.

By the end of the survey we were able to get a total of 414 surveys from a wide variety of people and got a starting basis to see what people think about car-sharing. In Appendix A, you can see a sample of the exact survey that was given. We asked ten multiple choice questions in order to make the survey compact and effective to get a high a response rate. Below are the data charts of our results and the exact numbers of the results can be found in the excel spreadsheet in Appendix B.

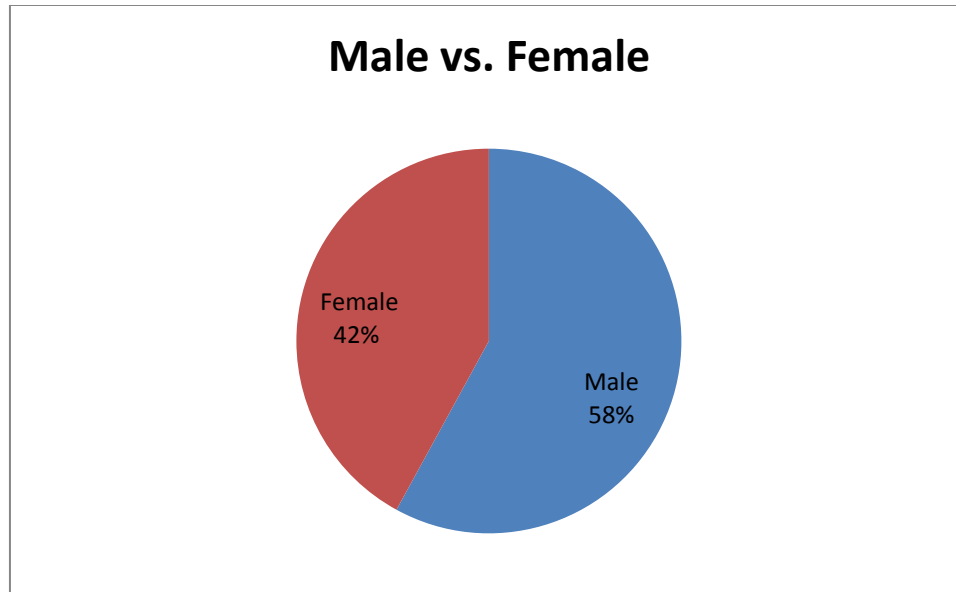


Figure 8: Survey Results Question 1

In the first question in our survey we thought it would be important to ask the audience whether they were male or female. We did this so we could keep track of who we ask so we could get as close to an even mix from both genders. Also the question served as a baseline in other questions to help us evaluate if any questions favor males over females or vice versa. In the end of our survey we used information like this to help us find similarities and differences between gender and the car-sharing relevant questions we asked.

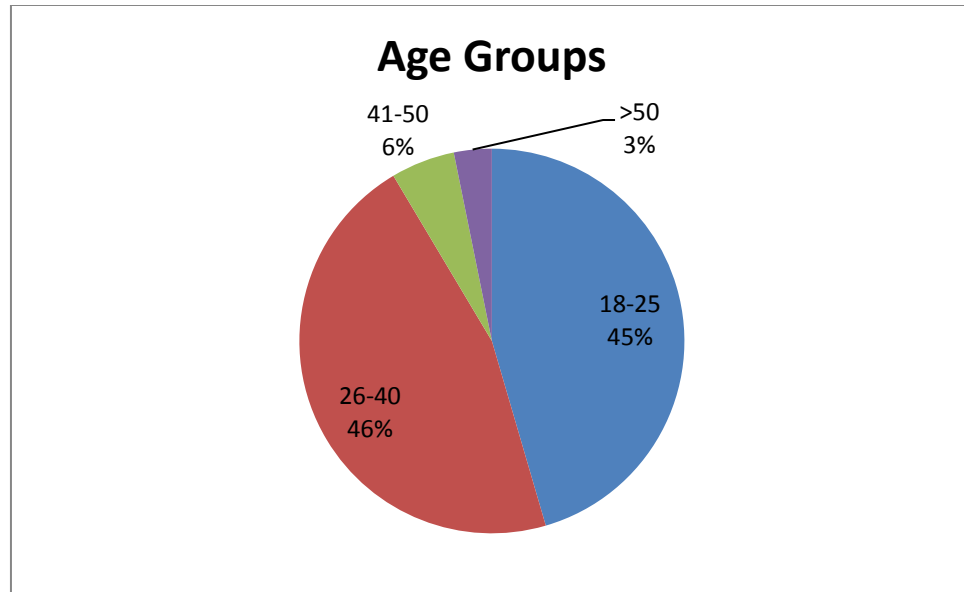


Figure 9: Survey Results Question 2

The second question of our survey focused on analyzing the age groups of the people we asked. We wanted to gain this information to help us find the possible age groups of the potential car-sharing users. We thought this information could be helpful in order to help find the marketability of the service and analyzing information with the other questions we asked. As you can see in the figure above our general population ranged from 18-40 which would most likely be the people we would target the service towards.

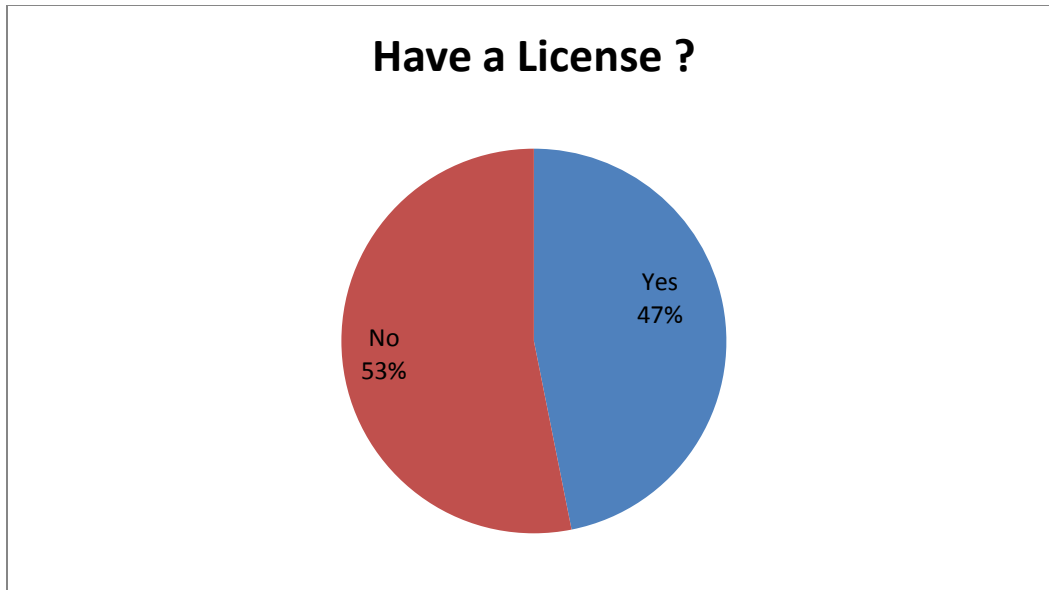


Figure 10: Survey Results Question 3

In question three of the survey we thought it would be necessary to ask individuals if they possessed a driver's license. We thought this information was a very important aspect of our study because it would tell us whether car-sharing would influence people getting a license and to help us estimate how much of the population possess a driver's license. This question could be used in many ways to help us analyze more of the questions that we asked in the survey. Being able to cross analyze questions helped us create an effective survey to get the most data out of the least questions.

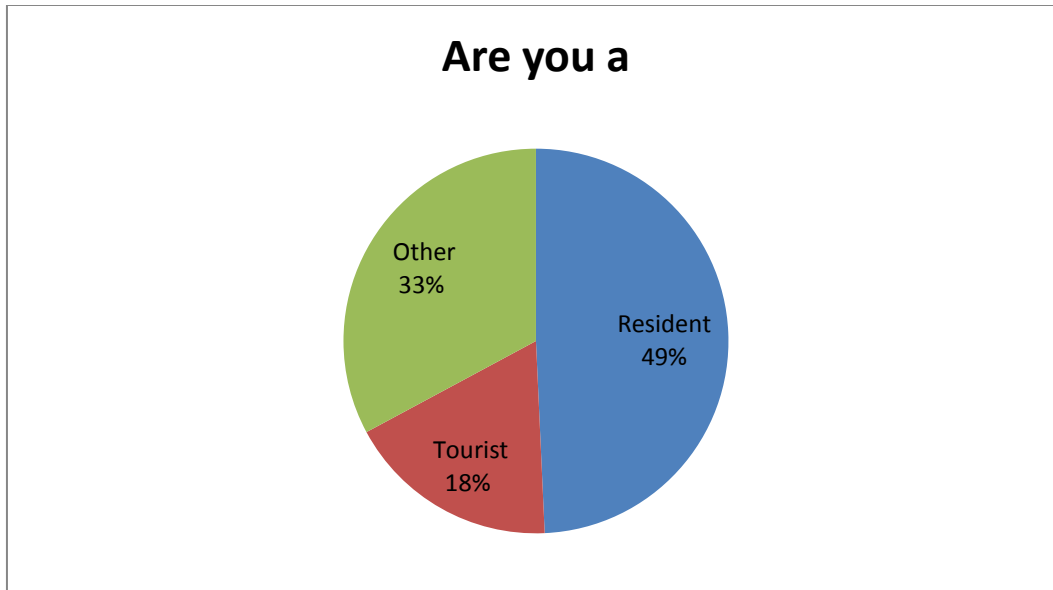


Figure 11: Survey Results Question 4

In question four we asked the individuals if they were a tourist, resident, or other (told them to specify). This information was critical for us to see the scope of people we were getting in our study. We wanted to get a variety, but wanted to get specifically the opinions of residents in Hangzhou. Getting opinions of the people who would be a part of the potential car-sharing service would be valid information for us because their opinions would be the ones that the government would be interested in. This information also showed us whether resident or other people would be more interested in the service. Knowing what kinds of people would use the system is crucial in the final analysis. From the survey results, we had almost 50% resident response rate which gave us a great input on how local people think about having such a service available.

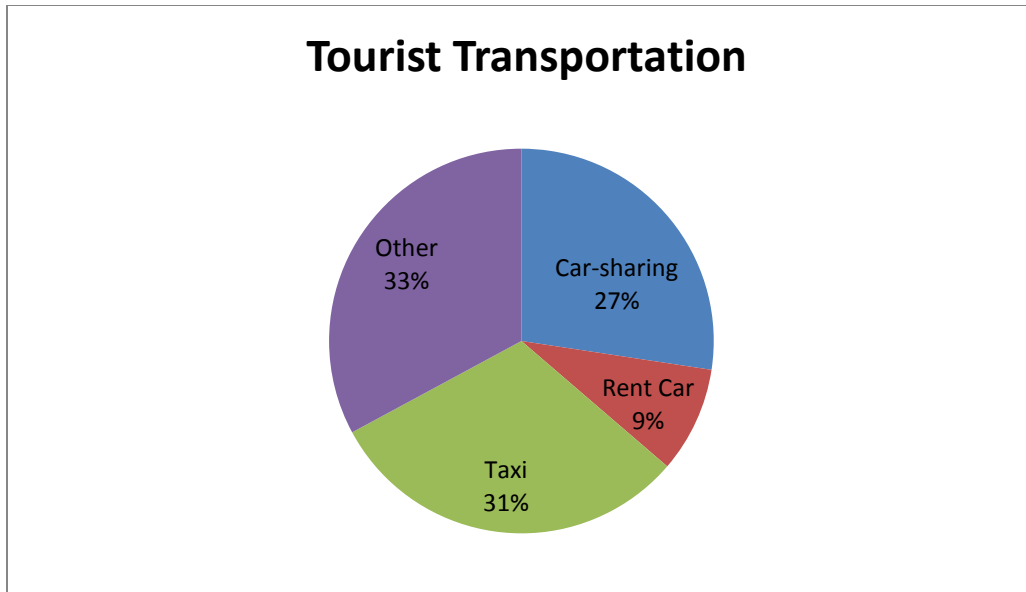


Figure 12: Survey Results Question 5

The fifth question in our survey asked if you are a tourist, what mode of transportation you use. This question helped us get an idea of what kinds of transportation tourists are using and whether they would use car-sharing if it was available. The importance of this question was to see what modes of transportation tourists are attracted to and whether they would change to car-sharing. This question helped us analyze the traffic in Hangzhou by seeing what transportation modes become more affected by tourism. The information in this question proved to be helpful in analyzing the transportation habits of tourists coming to Hangzhou. We put a car-sharing option in the question to see if people would use the service if it was an available mode of transportation.

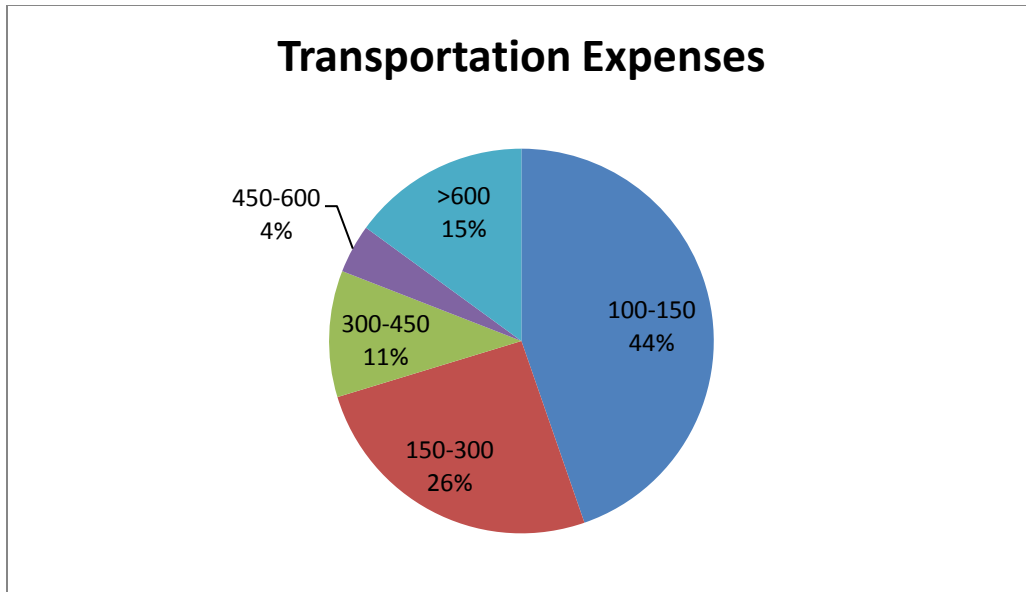


Figure 13: Survey Results Question 6

In question six of our survey we asked what are your estimated monthly transportation costs. This figure was important to help us assess a possible charge for the car-sharing service and give us an idea of how much people spend in their traveling costs monthly. Based on the feedback we received, most people would likely use low cost modes of transportation that have a flat rate (i.e. buses) or free modes of transportation (i.e. owning a bicycle).

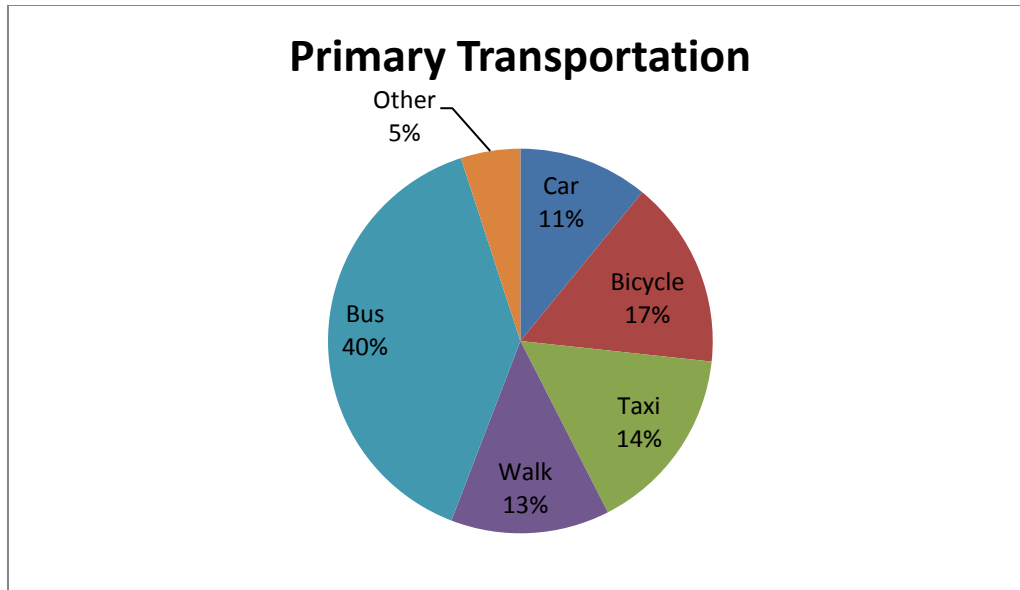


Figure 14: Survey Results Question 7

In question seven of the survey, we wanted to ask the individual what is their primary source of transportation they use on a daily basis. This information was useful in our traffic analysis to see which modes of transportation were being used the most. Knowing this information gave us a target model to argue that car-sharing could free up usage on these types of transportation and create better traffic conditions. Looking at the feedback we received in our survey, many people choose the bus as a primary mode of transportation.

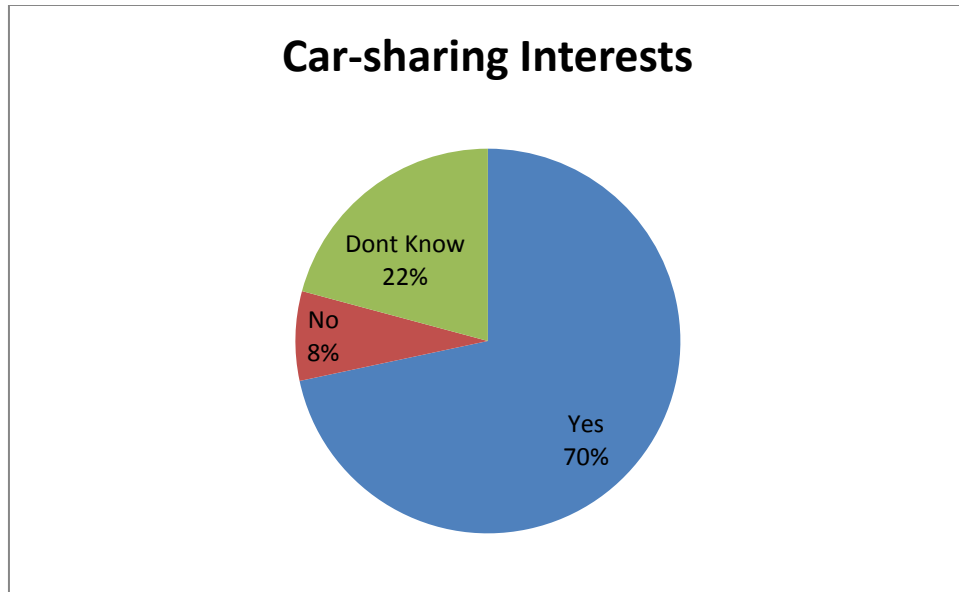


Figure 15: Survey Results Question 8

In question eight we wanted to ask individuals if they would be interested in car-sharing if it became available. This information helped us get an idea of whether people would be willing to try or be an everyday user of the service. Knowing if people are interested or not in the idea, was the first step we needed to take to see if the service would work in Hangzhou.

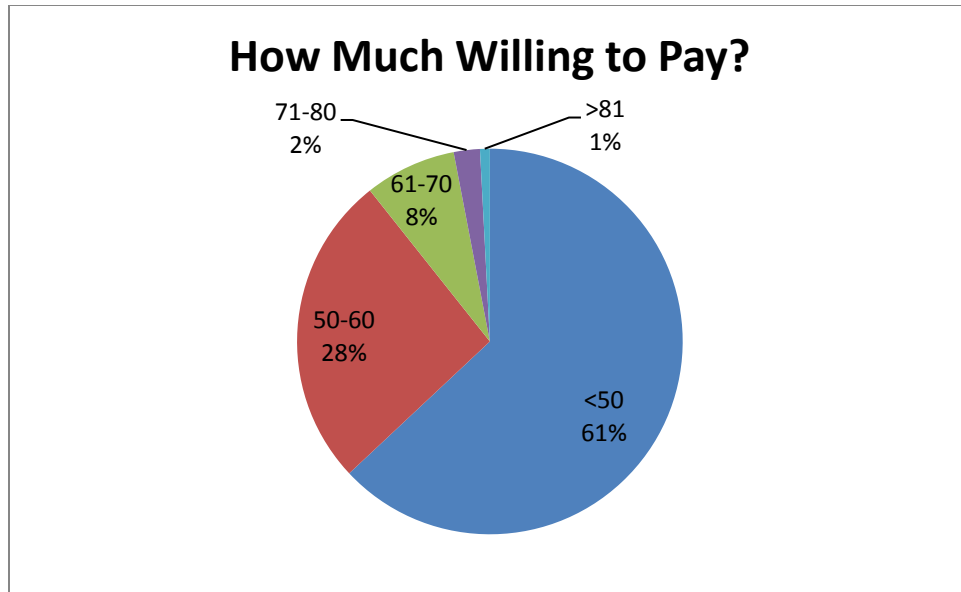


Figure 16: Survey Results Question 9

Question nine asked individuals how much per hour charge they would be willing to pay for a car-sharing service. The information gathered from this question was crucial in helping develop an accurate per hour charge figure in our financial analysis. Knowing how much people are willing to pay per hour is our most sensitive figure in our analysis and is the most important number if the service wants to reach profitability quickly. Based on this information we found that less than 50 Yuan was an accurate figure to start with.

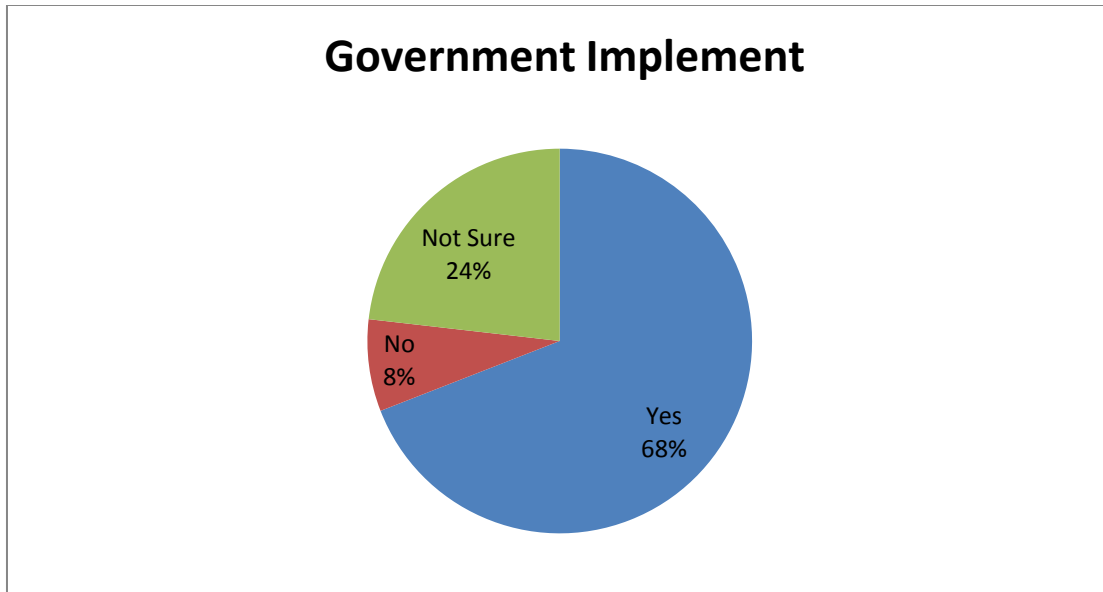


Figure 17: Survey Results Question 10

In our last question we asked people whether they thought it would be a good idea for the government to implement such a service. From the data we were able to get people's opinions on why or why not they thought the government might put such a service into the city. This question was used to gather opinions of people on how they thought about the government and the car-sharing system in general.

Overall the survey provided us with a substantial amount of information we used throughout the study. It provided us with an in-depth analysis of the pricing for the car-sharing service and also served as a reference to help us find the target customers for the service. In section 5.4.2 it talks about how we used the survey data to analyze our target market. The questions we asked also helped us break down the results into more specific areas. For example, we were able to analyze people who were residents, who had a driver's license, and were interested in car sharing. This kind of sub-analysis was very helpful in quantifying our

results. Overall the surveys went very well despite having a small sample size of only 414 surveys and provided us with beneficial data.

5.2 Interviews and Site Visits

Omnipay Interview on Bicycle Sharing

The bicycle-sharing system provides on-street bicycle rentals available to be shared by individuals who do not own a bicycle. This concept increases the number of bicycle usage in urban environment and removes some disadvantages that user have with other mobility services. Bicycle sharing has been implemented in many countries, in Europe and North America, and its purpose was to encourage individuals the use of nonpolluting transportation. In addition, the bicycle sharing offers a form of mobility for those who lack the resources to transport. Due to the collaborative consumption of this transportation form, greenhouse gas and air pollution are potentially reducing.

Before implementing the bicycle-sharing project in Hangzhou, the government and city planner had to gather different information to make decision. The city's infrastructure should provide road space for the bicycle in order for people to travel, the stations location need to be located in high transited areas, there needs to be a high population willing to use and afford the service.

Hangzhou tourism activity is high. The daily average of visitors in downtown is 878,800 and in 2020 it's approximated to be about 1,635,500 visitors during tourism season. The city's infrastructure facilitates transportation for this population and it is ideal for bicycle-sharing service since the roads provide space for bicycle users. Currently, 84% of the roads in Hangzhou

are divided into automobile lanes and bicycle lanes by physical barriers, 10.5% by painted lines, and 5.5% are not divided. The roads are also in good condition which is important when driving bicycles.

On May 1, 2008 61 service stations with 2500 bicycles in total were put into operation. There were 31 permanent service stations and 30 mobile stations. These stations were located only in scenic areas in Hangzhou such as West Lake, Lake District and WuShan Square. The station location areas were selected due to their business activities, tourism and leisure, their large flow of people daily, their high foreign workers concentration, and the short distance travel demand. The lack of parking space and the limited small cars' travel was another factor that influenced in determining the station's location.

The bicycle-sharing company set different fees depending on the amount of time the user uses the bicycle. Table 1 shows the prices for bicycle usage in Hangzhou. The prices are the same for all locations. Today, 60% of the users go beyond 120 minutes of bicycle usage. In scenic areas, up to 90% of the users use more than 60 minutes and to be more precise, in Lake District and WuShan Square 70% of the users use the bicycle-sharing for more than 60 minutes. 88.9% of total rentals come from scenic areas since the 15 most popular service centers are located there.

Minutes	Price
0-60	Free
60-120	¥1
120-180	¥2
>180	¥3/hr

Figure 18: Prices for bicycle usage in Hangzhou

After selecting the station location, the location needs to be approved by 30-50 departments. This process is usually followed to legal and securities responsibilities by the government. Then the company needs to buy the property from the owner of the local area and construct the station. The owner needs to buy the property from Public Transportation Group for a cost of approximately ¥35,000. The construction cost is approximately ¥150,000 for each station and it includes 20 standard bicycles, electricity, terminal, multimedia screen, and the station.

One bicycle-sharing station offers three types of advertising space. Figure 20, shows one station and its three types of advertisement. Type 1 accounts for 50% of the advertisement and this type are selected by the government. Companies buy advertising space to the owner, in this case to the government, in order to promote their product or service. Type 2 is the advertisement on the bicycles, one part is found in the front set and the other between the top tube, the down tube, and the seat stay. Type 3 is the multimedia screen advertising found at the terminal. The right to advertise on bicycles and the terminal can be sold to a private

company for ¥23,000,000 each year. This revenue from 2,000 stations belongs to the government.

There are three types of technologies involved in the bicycle-sharing system: RFID cards, software, and multimedia terminal. RFID cards are provided to the bicycle-sharing company by OmniPay. The bicycle user will use the RFID card in two ways. First, the owner of the card will deposit money to the card in a terminal. A minimum of ¥200 is required by the company for the security deposit. This is the first information that the chip needs to transfer to the remote computer in order for the system to activate. Then, the same RFID card will unlock the bicycle from the station. The remote computer uses software that manages and analyzes how often people use the system. This software is also used to identify problems at the moment of renting. The government pays approximately ¥580,000 each year for the software to OmniPay. Today, the government gives ¥30,000 to OmniPay for maintenance of their software. The multimedia terminal is added to the station in the construction and is where the customer can access information to/from the card.

The government started this project with an initial investment of ¥400 million in May 2008. With this money they were able to start with 28 stations. Due to the revenue obtained from 5,000,000 cards, the government break-even point was 6 months after the initial deposit. In 2.5 years, the bicycle-sharing company accomplished 2,000 stations with at least 20 bicycles in each station. Today, they have 500,000 transactions a month from all IC cards, which informs that the business is profitable.

Other Cities with Bicycle Sharing

	Beijing	Shanghai	Guangzhou	Hangzhou
Size(squ.km)	16808	6340.5	7434.40	16596
Population	19,612,368	23,019,100	10,334,500	8,700,000
Density (pop. Per squ.km)	1167	3630	1390	524
City character	Political/Cultural /Economical	Economica l/Financial	Economical	Economical /Leisure
Government Support	Y	Y	Y	Y
Initial Investment	Small	Small	Small	Huge
Price	High	High	High	Cheap
Successful	N	N	N	Y

Figure 19: Bicycle Sharing in other Cities

The bicycle sharing system has shown to be very effective in some cities. But it is highly sensitive to the way it is priced. First, the prices in the three other cities are 5 Yuan in 1 hour and 20 Yuan for 24 hours. But no matter how long the rent is, the customers all have to hand in 400 Yuan as deposit. Second, Restrict development of bicycle rental market. Not only the high deposit, but also the inconvenience for returning the rental deposit. Usually, the rental bike must be returned to the same point where you get the bike to take back the deposit. And only VIP card customers can return the bike in different locations. At last, set too little Bicycle locations to meet demand.

On the other hand, Hangzhou is a special city, the government is very interested in create a new model of transport, like water bus, public bicycle, electric cars and so on. The Hangzhou government gives 5 billion start-up funds for the implementation of public bicycles that to provide public bicycle a material basis.

The car-sharing has been promoted successfully in America and UK, and has a good impact on environment and the traffic, as well as it is a new mode of transportation, the government will be interested in it.

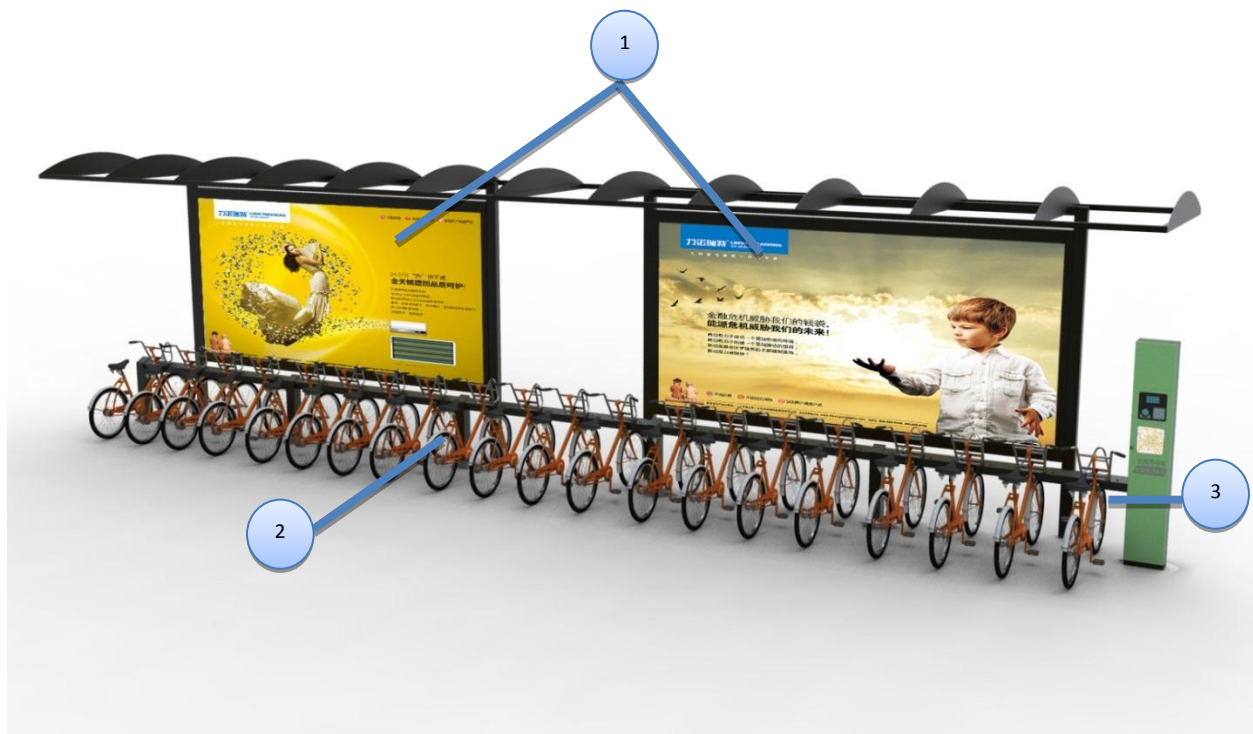


Figure 20: Bicycle Sharing Station

Hangzhou Urban Planning Bureau

The following information was provided to us in the interview with the Hangzhou City Planning and Design Bureau.

Geography

Hangzhou is located in northern Zhejiang province, eastern China, at the southern end of the Grand Canal of China, on the plain of the mid-lower reaches of the Yangtze River. As a core city of the Yangtze River Delta, its position on the Hangzhou Bay 180 kilometers southwest of Shanghai gives it economic power, and moreover. The prefecture-level region of Hangzhou extends west to the border with the hilly-country Anhui Province, and east to the flat-land near Hangzhou Bay. The city center is built around the eastern and northern sides of the West Lake, just north of the Qiantang River.



Figure 21: Map of China (City Planning Board, 2011)

Administrative division

Hangzhou is the capital and largest city of Zhejiang Province in Eastern China. Governed as a sub-provincial city, and as of 2010, its entire administrative division or prefecture had a registered population of 8.7 million people. The Urban agglomeration of the Hangzhou metropolitan area has a resident population of 6.242 million as of 2010, of which 4.36 million are permanent residents. Hangzhou Region or prefecture-level city contains the Hangzhou metropolitan area (eight districts), 3 metropolitan counties, and 2 ordinary counties. The central six urban districts occupy 682 km² and have 1,910,000 people. The two suburban districts occupy 2,642 km² and have 1,950,000 people.

It has direct jurisdiction over 8 districts, 3 county-level cities and 2 counties (See figure below)


Map	Subdivision	Hanzi	Area	Population (approx.)
	Hangzhou City Proper			
	■ Gongshu-qu	拱墅区	87.49 km ²	551,900
	■ Xiacheng-qu	下城区	31.46 km ²	526,100
	■ Shangcheng-qu	上城区	18.30 km ²	344,600
	■ Jianggan-qu	江干区	210.22 km ²	998,800
	■ Xihu-qu	西湖区	308.70 km ²	820,000
	■ Binjiang-qu	滨江区	72.02 km ²	319,000
	Hangzhou Suburban and Rural			
	■ Yuhang-qu	余杭区	1,223.56 km ²	1,170,300
	■ Xiaoshan-qu	萧山区	1,420.00 km ²	1,511,300
	■ Lin'an-shi	临安市	3,126.80 km ²	566,700
	■ Fuyang-shi	富阳市	1,831.20 km ²	717,700
	■ Jiande-shi	建德市	2,321.00 km ²	430,800
	■ Tonglu-xian	桐庐县	1,825.00 km ²	406,400
	■ Chun'an-xian	淳安县	4,427.00 km ²	336,800

Figure 22: Districts of Hangzhou

Tourism

Hangzhou is renowned for its historic relics and natural beauty. It is often known as one of the most beautiful cities in China, also ranking as one of the most scenic cities. Although Hangzhou has been through many recent urban developments, it still retains its historical and cultural heritage. Today, tourism remains an important factor for Hangzhou's economy. One of Hangzhou's most popular sights is the West Lake, a UNESCO World Heritage Site. The West Lake Cultural Landscape covers an area of 33 km² and includes some of Hangzhou's most notable historic and scenic places. Adjacent to the lake is a scenic area includes historical pagodas, cultural sites, as well as the natural beauty of the lake and hills. There are two causeways across the lake.

Economy

Hangzhou's economy has rapidly developed since its reconstruction in 1992. It is an industrial city with many diverse sectors such as light industry, agriculture, textile, it is also considered as an important manufacturing base and logistics hub for coastal China.

In 2001, the GDP of the whole city amounts to RMB 156.8 billion which ranks the second among all of the provincial capitals except for Guangzhou. The city has more than tripled GDP in the last eight years, with GDP increasing from RMB ¥156.8 billion in 2001 to RMB ¥594.582 billion in 2010 and GDP per capita increasing from USD 3,025 to USD 10,103.

The city also has developed many new industries since; they include medicine, information technology, heavy equipment, automotive components, household electrical appliances, electronics, telecommunication, fine chemicals, chemical fiber and food processing.

Transportation

Airport

Hangzhou is served by the Hangzhou Xiaoshan International Airport, which provides direct service to many international destinations such as Germany, Thailand, Australia, Japan, Korea, Malaysia, India, Vietnam, Ethiopia, Singapore, and the Netherlands. Regional routes reach Hong Kong, Taiwan and Macau. It has an extensive domestic route network within the PRC and is consistently ranked top 10 in passenger traffic among Chinese airports. Hangzhou Xiaoshan International Airport has two terminals, namely Terminal A and Terminal B. The smaller Terminal A serves all international and regional flights while the bigger Terminal B solely handles domestic traffic. The airport is located just outside the city in the Xiaoshan District with direct bus service linking the airport with Downtown Hangzhou. The ambitious expansion project will see the addition of a second runway and a third terminal which will dramatically increase capacity of the fast-growing airport that serves as a secondary hub of Air China. A new elevated airport express highway is under construction on top of the existing highway between the airport and downtown Hangzhou. The second phase of Hangzhou Metro Line 1 has a planned extension to the airport.

Railway

Hangzhou sits on the intersecting point of some of the busiest rail corridors in China. The city's main station is Hangzhou Railway Station (colloquially the "City Station"). There are frequent departures for Shanghai with approximately 20-minute headways from 6:00 to 21:00. Non-stop CRH high speed service between Hangzhou and Shanghai takes 45 minutes and leaves every hour (excluding a few early morning/late night departures) from both directions. While

other CRH high speed trains that stop at one or more stations along the route complete the trip in 59 to 75 minutes. Most other major cities in China can also be reached by direct train service from Hangzhou. The Hangzhou East Railway Station (colloquially "East Station"), is closed for renovation until late 2011. Once completed, it will become one of the biggest rail traffic hubs in China consisting of 15 platforms that will house the High Speed CRH service to and from Shanghai, Nanjing, Changsha, Ningbo, and beyond. The subway station beneath the rail complex building is a stop along the Hangzhou Metro Line 1.

Direct trains link Hangzhou with more than 20 cities, including 4 daily services to Beijing (1650 km), more than 45 daily services to Shanghai (200 km) and it reaches as far as Ürümqi. The Shanghai–Hangzhou High-Speed Railway serviced inaugurated on October 26, 2010. The service is operated by the CRH 380A and CRH 380BL train sets which travel at a maximum speed of 350 km/h, shortening the duration of the 202 km trip to only 45 minutes.

The construction of the Shanghai-Hangzhou Maglev Train Line has been debated for several years. On 18 August 2008 Beijing Authorities gave the project the go-ahead to start construction in 2010. Transrapid has been contracted to construct the line. However, as of 2011 construction has not yet started.

Highway

Central, north, south and west long-distance bus stations offer frequent coach service to nearby cities/towns within Zhejiang province, as well as surrounding provinces. And as of 2010, the government had totally invested ¥99.99 billion to build 15,266 km highway, including 502 km expressway to service 1,832,500 Motor vehicles, as well as 942,400 private cars.

City Buses

Hangzhou has an efficient public transportation network, consisting of a modern fleet of regular diesel bus, trolley bus, hybrid diesel-electric bus and taxi. Hangzhou is known for its extensive Bus Rapid Transit network expanding from downtown to many suburban areas through dedicated bus lanes on some of the busiest streets in the city. As of 2010, there were 548 bus routes and among this 15 were new, and the total length of bus routes is 87.6 km. 7,120 buses run across the roads to service 350,000 passengers per day and 12.8 billion for one year.

Taxi

Taxis are also a very popular form of transportation in the city of Hangzhou. With its line of the newest Hyundai Sonatas and Volkswagen Passats, and tight regulations, the city's taxi service is rated amongst the best in the country. According to the public information of Hangzhou government, there are 65 taxi companies and more than 10,215 taxis by June, 2011. In early 2011, also 30 electric taxis were deployed in Hangzhou. 15 were Zoyte Langyues and the other 15 were Haima Freemas, however in April, one Zoyte Langye caught fire and all of the electric taxis were taken off the roads later that day. Despite this electric vehicle scare, the city still intends to have a fleet of 200 electric taxis by the end of 2011.

Subway

The Hangzhou Metro is currently under construction. It is expected to have 13 lines with total distance of 480 km upon completion. Phase I, which consists of Line 1, the southern segment of Line 2 and part of the Line 4 that links Line 1 and 2. The first subway line is expected to enter into service by October 1, 2012.

5.3 Social Impacts of Car-sharing in Hangzhou

5.3.1 Environmental Concerns

The implementing of a car-sharing service in a city brings up many questions about costs, efficiency, and risks of car-sharing. But one of top concerns on people's minds these days is how it will affect the environment. Yes, you can argue that car-sharing puts more cars on the road which makes more air pollution. But the question people should ask themselves with implementing a car-sharing service is how many cars it takes off the road. According to Zipcar, every Zipcar that is on the road replaces fifteen privately owned cars. In other words, this takes away roughly thirty-five tons of carbon dioxide emissions a year and 42,150,000 grams of other harmful greenhouse gases (Rui, 2010). For most people, taking fifteen cars off the road on top of eliminating tons of harmful emissions into the atmosphere per one shared car is a good trade off than owning a private car.

Every vehicle on the road impacts the environment differently depending on numerous factors including engine size, design, fuel type, etc. In Zipcar's design of their car-sharing system, they tried to incorporate cars based on what people would use them for. They have compact cars for the everyday users, light duty trucks for construction workers, luxury vehicles for people looking to impress, and SUVs for families. Each of these cars emit pollutants differently and Zipcar tried to pick cars in accordance with the emission factors they create in order to put the greenest and most environmentally safe vehicles on the road. The figure below shows the top eight cars Zipcar uses in their fleet and the CO₂ emissions grams per mile each vehicle gives off.

Cars	Est. CO2 emitted (Gram per Mile)
Toyota Prius	<188
Honda Civic Hybrid	188-233
Mini Cooper	280-325
Smart Car Coupe	234-279
Volvo S80	372-417
BMW 3 series	372-418
Toyota Tacoma	464-509
Honda CRV	372-417

Figure 23: Zipcar Car Emissions (U.S. Environmental Protection Agency, 2011)

Having a car-sharing service that strives to put the environment as a priority shows the company's dedication to help the world become a cleaner place. Not just adding the most fuel efficient cars on the road but also electric vehicles will get environmentalists thinking car-sharing is the way of the future. As a potential business the car-sharing service will need to emphasize if they can get a minimum of 10% of a city's population to adopt car-sharing as a mode of transportation. They can help save billions of gallons of gas and oil every year, eliminate tons of greenhouse gases, and save money compared to private car ownership. According to Zipcar, every member saves roughly \$500 USD per month by car-sharing over private car ownership. On top of that people tend to drive less, creating less harmful emissions entering the atmosphere every year. Appendix D talks about the differences of the costs of car ownership versus sharing. This information gives an idea of cost savings and how many vehicles are being taken off the roads. Not only is car-sharing going to impact the future of the environment, it will soon be the future of how we do things with the oil crisis amongst us (Zipcar, Inc).

5.3.2 Traffic in Hangzhou and Car-sharing's Impact

There are several factors that contribute to the traffic problems in Hangzhou. First of all, West Lake is located in the center of the city, so the tourists increase the burden of downtown traffic, especially on weekends and holidays. Secondly, because there is no purchase limit of private cars, Hangzhou has an increasing number of motor vehicles on the road. Thirdly, the education in the new city is not as good as it is in downtown, so many people send their children to downtown to have a better education. Another important reason is that urban public transport is not so convenient or fast enough to convince people to use it rather than private cars. If the buses are on time, and they drive quickly, there will be more and more people choosing public transportation. So as of now, Hangzhou does not have a sufficient plan to solve these congestion issues.

With car-sharing implementation, many people asked in our surveys: “why should I pay a per hour charge if I’m going to sit in traffic?” Depending on what time of day you use the system and how the overall system is implemented, car-sharing will not add any more impact to the already congested roads. On the other hand, it will help free up the roads by taking off private cars off the road and give people another option of commuting on an everyday basis. If the system is implemented in a way where you can drop the cars off at any car-sharing parking lot, you will be able to park and walk from destination during busy hours or use the every so popular bicycle sharing to get around. The primary goal of car-sharing is to be convenient, cost saving, environmentally friendly, and overall to get people driving less. If the system can’t be implemented in a way to offer this type of service then it shouldn’t be implemented in the first place. Looking at the figure below, it shows Hangzhou City Planning Board’s traffic plan and can give us a base point of where proper locations of implementing the system could take place in

order to minimize the traffic impact of the system. If we can create an implementation plan that favors less traffic, we could see that the car-sharing service will be more useful in areas that are less developed or “newer” areas of the city. According to the City Planning Board’s recommendations, we should implement in “newer” districts to see how the system will work and further educate use on how the overall system works and if traffic will be affected.

Urban Traffic Planning

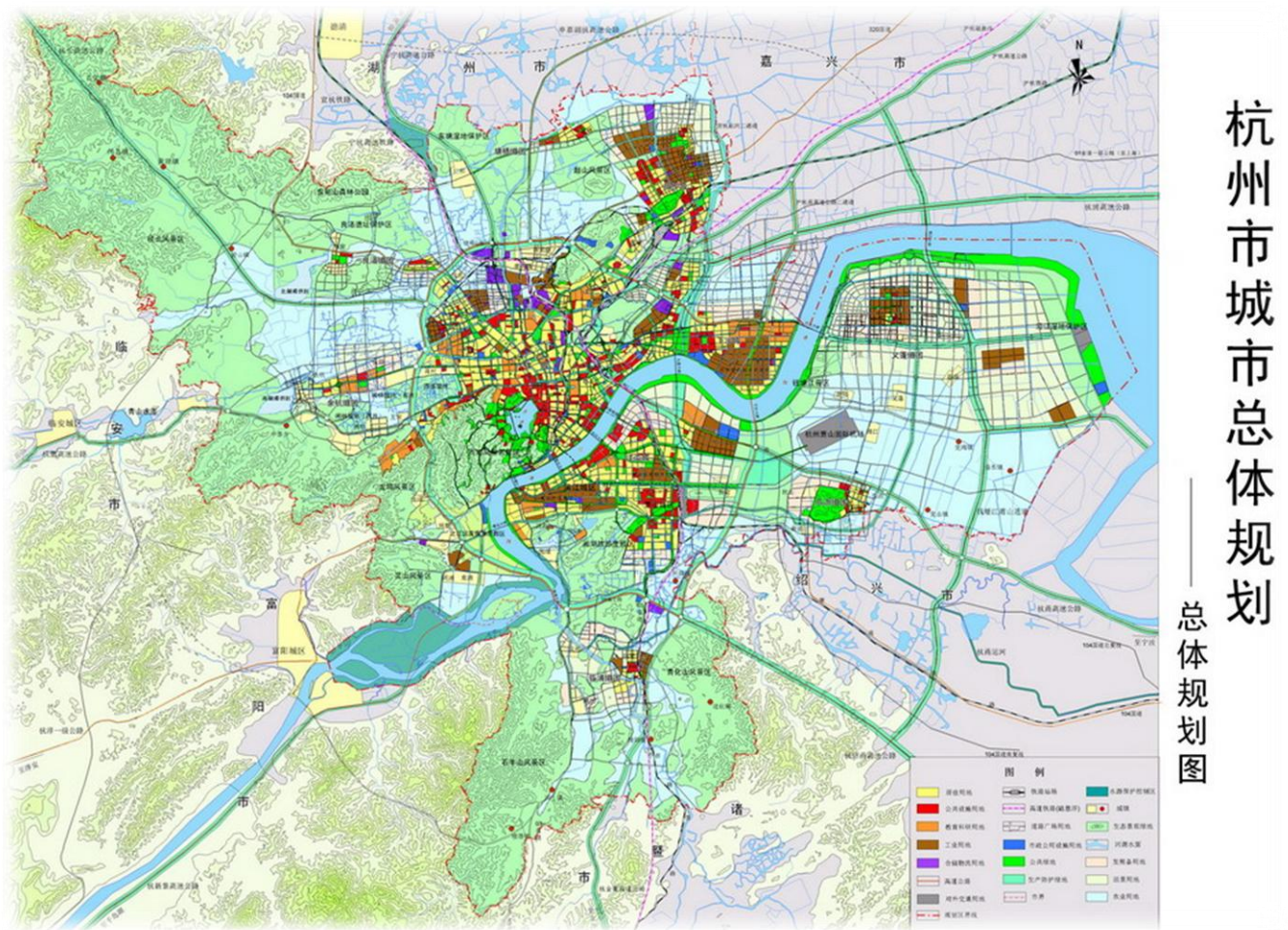


Figure 24: Urban Traffic Planning (City Planning Board, 2011)

ZhongHe Bridge

The ZhongHe Bridge is one of the most dreaded places to be if you are an everyday commuter in Hangzhou. The design has been poorly developed and creates traffic that exceeds the bridge's constraints. The traffic volume of the ZhongHe high level bridge has been elevated twice above the design volume. Now the traffic situation is so bad that the peak traffic goes from 7am to 7pm.

According to the original design, a one-way lane traffic capacity is about 1600-1800 vehicles, two-lane road capacity is 3600 vehicles, while presently the double lane capacity on the bridge has exceeded 3500 vehicles. According to preliminary estimates, the average hourly traffic flow elevated the river close to 50 meters, while the original design is 20 meters. The river bears the elevated section of the overall enormous pressure, as a typical "open-air parking lot."



Figure 25: Zhonghe Bridge (City Planning Board, 2011)

5.3.3 Social Impact of Electric Cars

The Chinese Academy of Social Sciences released in December 2010 the "Asia Pacific Blue Book" that in 2010, China has become the most important export market. Blue Book pointed out that after the World Financial Crisis, the Chinese economy made up its losses in GDP created by Europe and the United States having less of a demand during the crisis. But since the crisis has started, the demand for goods in China has declined in these countries. China's GDP is more than \$4 trillion, ranking second in the world. At the same time, China's domestic economic output has accounted for only 36% of the total economy. This proportion is the lowest among the developed countries in Asia. China's economic development still has a lot of room for growth and development in the future (Rui, 2010).

With China's rising economic output, energy consumption has showed a sharp upward trend. According to the National Bureau of Statistics in March 2011, The Republic of China's 2010 National Economic and Social Economic Development Statistics Report ", China's total annual consumption of coal is 32.5 million tons. This is up 5.9% over the previous year, of which , the national coal consumption increased by 5.3%, the original consumption grew 12.9%, natural gas consumption grew by 18.2%, and the electricity consumption increased by 13.1 %. The National GDP for energy consumption fell 4.01% per 10,000 Yuan. At the same time last year, China has imported 230 million tons of crude oil. This is up 17 % which means it increased by 3 percentage points to more than 55%, which brings China closer to the United States which is the second largest oil importer and consumer. In 2020 China's oil import dependence is expected to exceed 64%, which will increase the domestic energy security and will challenge China's energy consumption structure (China Energy Development Report, 2009).

The automotive industry

Chinese automotive industry has developed quickly, and it has been an important part in a rising Chinese economy. The following chart represents the 1991 - 2009 Automotive Output and the Proportion of the Country's Industrial Production Output in 100,000 million Yuan. This chart helps give us an idea of how many vehicles China is producing and putting on the road over almost a 20 year period. It just goes to show the rapid development of the auto industry and the amount of revenue it has picked up since the early 90s. Knowing this information can help us conclude that there are way too many cars being put on the roads and that we need to find alternative modes of transportation to make our environmental impacts less destructive.

Years	Auto Industry (A)	Automobile Output (Current Prices)					National Industry Output (Current Prices) (B)	A/B %
		Includes :						
		Car	Modified Cars	Motorcycle	Vehicle Engines	Car/Motorcycle Accessories		
1991	704.5	373.5	108.8	48.3	34.2	139.7	28248	2.5
1992	1191.1	671.7	166.9	86.1	59.5	206.9	37066	3.2
1993	1792	977.6	236.7	176.2	105.1	296.4	52692	3.4
1994	2183.1	1166.4	225.6	301.8	116.6	372.7	76909	2.8
1995	2216.5	1133.1	179.8	401.1	104.3	398.2	98520	2.3
1996	2399.1	1197.6	214.1	468	94.2	425.2	99595.4	2.4
1997	2668.7	1347.3	239.2	482.7	87.1	512.4	113733.7	2.4
1998	2787.3	1392.5	272.7	466.4	98.1	557.6	67737.1	4.1
1999	3122.7	1595.6	283.8	526.1	108.5	608.7	72707	4.3
2000	3612.6	1985.8	352.7	549.6	108.8	615.7	85673.7	4.2
2001	4433.2	2524.4	389.1	561.6	99	859.1	95449	4.6
2002	6224.6	3576.8	611	549.4	171	1316.4	110776.5	5.6
2003	8357.2	5274.4	634.8	579	245	1624	142271.2	5.9
2004	9463.2	5762.7	680.1	714.9	291.7	2013.8	201722.2	4.7
2005	10223.3	5640.4	640.3	779.9	508.7	2653.9	251619.5	4.1
2006	13937.5	7429.8	813.2	903.2	623.7	4167.7	316589	4.4
2007	17242	9338.1	33	84.3	840.6	4946.1	386747	4.5
2008	18780.5	10375.4	204.5	130.9	898.5	5171.3	507448	3.7
2009	23437.8	14243.7	469.1	882.6	44.1	5798.3		

Figure 26: Automobile Output (National Bureau of Statistics, 2009)

Note: Since 1998, the country's industrial output value of all state-owned, state-controlled and non-state industrial enterprises above the scale of output, are not comparable with the previous; non-state industrial enterprises above designated size refers to the sales produced of 500 million Yuan of business .

According to the latest statistics from the Ministry of Transportation Bureau, as of June 2011, the country's total motor vehicle ownership is more than 217 million and 72.06 million is private car ownership (Qiyu, 2010). About 11 cities including, Chengdu and Shanghai, have reached over 1,000,000 privately owned cars. The number of passenger cars in the country is about 67.85 million according to the National Bureau of Statistics.

There is no doubt that China's auto industry output for China's economic contribution is immeasurable. But the auto industry's expansion has also brought lots of hidden dangers: The first danger being China's energy consumption structure; making the process of economic development in China for oil consumption increase. By having an increase in oil consumption it further deepens China's dependency on foreign oil. Secondly, it is causing serious environmental pollution. According to the 2009 environmental monitoring report, the National Key Environmental Protection says only 1/3 of the 113 cities that are a part of the National Key Environmental Protection have not reached the standards of air quality. Many cities have a coal-burning and car exhaust mixture characteristics of air quality problems and vehicle exhaust emissions from nitrogen oxides and fine particles, which are directly related to the air pollution problem. Not only are our environmentally cities not meeting air quality standards, they are creating more problems to the people that live in the area.

As the use of electric vehicles increases, related companies will benefit from their use including battery, electric motor, electronic control and other industries. Since the

development of electric vehicles and other equipment, they will provide charging stations and related equipment so that the providers are faced with new opportunities. Any industry with the same business, electric vehicles will also be involved in downstream automotive distributors, service providers, insurance, financial and many other downstream businesses, a new electric car around the whole automobile industry chain will become a new growth opportunities. Meanwhile, the new industry for China will ease the current employment rate. It will help create more job opportunities and help the economy rise.

To the benefit of the social well-beings of a community, electric vehicles will bring in more social benefits. Compared with the traditional car, each electric vehicle will reduce carbon dioxide emissions 52%. The automotive industry's carbon dioxide emissions accounts for about 16% of the total carbon dioxide emissions. By 2020, assuming that electric vehicles account for 10% of car ownership, then electric vehicles will replace the entire automotive industry to reduce carbon dioxide emissions by 9%. The automotive industry will then reduce carbon dioxide emissions in the country by 1.5%. From the life-cycle perspective, the assumption that coal-fired electricity generating a capacity of 100% of the total cases, each 1L of gasoline combustion of greenhouse gas emissions is about 2810g. Coal consumption per kWh is about 320g; the production of electricity for each release of greenhouse gases is about 910g. In addition, consumption of power converted to the power plant. According to the pure electric car average, there is a 100 km average consumption over an 11 kilowatt/hour range. Traveling 10,000 kilometers in years is estimated that the average power consumption of each electric vehicles 1100 Kilowatts a year. The average car consumes 10L per hundred kilometers of oil and its greenhouse gas emissions of approximately 2,810,000g, and the consumption of electric

vehicles is about 1,001,000g per year, compared to an ordinary cars, is far below the current impacts on the environment. The production and use of these electric cars is more environmentally friendly than a car driving 10,000 km of oil consumption that produces carbon dioxide emissions (per gallon of gasoline produces about 25 tons of carbon dioxide, of which five tons of oil extraction and refining process produce the other 20 tons are produced in the car driving). In addition, a pure electric vehicle produces only a small amount of electromagnetic noise and mechanical noise, the noise produced is lower around 10-15dB (Rui, 2010).

Electric vehicles for China can provide a breathing room for oil production. Pure electric vehicles powered by electricity, and even hybrid electric vehicles, can greatly reduce oil consumption for the automotive industry. It is estimated that the traditional fuel vehicle from mining to energy use, the average utilization rate is only 14%, while the hybrid vehicle energy use can be increased to about 30%, greatly improving the utilization of the oil. A car costs about 2.3 tons of harmful emissions in China every year. Assuming about 72.06 million private cars, the annual fuel consumption is about 170 million tons. The use of electric cars can release the dependent for the oil. This is increasingly dependent on oil imports for China and has a strategic importance for Chinas future (Jiong, 2008).

International crude oil prices, have led crude oil prices to rise. Zhejiang oil price averages in 2011 include: 93 gasoline price 7.46 Yuan / liter, 97 # gasoline price 7.93 Yuan / liter, and the current international crude oil prices have continued rising trend in the future the price may have to be refreshed. And compared to prices of refined oil, electricity, Hangzhou is the peak electricity current 0.53 Yuan / kWh, Valley Electricity was 0.29 Yuan / kWh, electricity ladder

0.56 Yuan / kWh, according to above are talking about, each electric vehicle consumes per year 2200 degrees, and more with the Valley power, then the cost is 638 Yuan a year, far below the normal fuel car fuel costs a year. Spending gap will attract car owners to switch to electric vehicles, but also make people buy a car in the future to choose when more electric cars, to ensure the low cost car (Rui, 2010).

5.4 Marketing Aspects of Car-sharing in Hangzhou

The marketing-process is used to determine what products or services may interest customers, and the strategies to use in sales, service, communications and business development. In order to make car-sharing successful in Hangzhou we need to implement effective forms of advertising, know who our target customers are, and be able to have a few strategic marketing plans. In order to make higher profit margins and promote our services, we need to implement an effective and strategic plan which starts with the following three topics of advertising, target customers, and planning.

5.4.1 Advertising Car-sharing

Advertising is a way to let people know information about the goods or service you will provide. There are many kinds of advertising choices, such as TV advertising, newspaper ads, radio ads, billboards, car body advertisement, brochures, network advertisement and so on. In the process of car-sharing propaganda, we mainly chose the following as means of advertising:

TV advertising

Television advertising is a kind of advertising which can quickly permeate people to receive advertising content in the shortest possible time. For advertising car-sharing in Hangzhou we would use Zhejiang people's livelihood leisure channel. This is a very high rated TV channel and would get high publicity for the car-sharing service. The age of the audience, and with this great span the rating of the program, can increase the awareness of the car-sharing in Hangzhou and this is a necessary step to extension the market of car-sharing in Hangzhou.

The 1818 gold eye opened in January of 2004 and is the one program we recommend using our advertising schemes on. At the beginning, a "three Zhejiang first" : Zhejiang program is the longest of news program (every time of day for 55 minutes); Zhejiang first opened 24 hours of television news line media; Zhejiang first open public welfare column "searching" TV show, for the audience to provide searching for people without a free service. (罗建, 2011)

In order to maximize the value of advertisement, we chose "1818 gold eye" as our advertising channel. We chose this channel due to the times it airs and high ratings it receives. Advertising on this channel adds on a 30% extra charge, so the cost is $\$8800 * (1 + 30\%) / 5$ Yuan. Although the cost compared other time will be improved, but high ratings will bring us a better effect.

Newspaper advertising

The newspaper is a very popular kind of media in the daily life. Although the Internet is now developing rapidly, it still can't replace the newspaper in mass media status. A lot of Hangzhou citizens like to read the morning paper because reading newspapers is a part of their daily lives. In Hangzhou, the urban express, "the Qianjiang Evening News", "the Hangzhou Daily", "The Youth Times Newspaper" are the most popular newspapers. We chose "Qianjiang Evening News ", because this newspaper has a special layout used to do propaganda for the car and is very convenient for our car-sharing advertising. The newspaper advertising is easier to show car layouts and attract people's attention.

The "Qangjiang Evening News" has a large circulation in Hangzhou, everyone knows it. In such a market influence of the newspaper advertising can improve the car-sharing has the popularity and we want to see the advertisement effect.

In "Qianjiang Evening News" we chose to run our advertisement on Wednesdays, with a black and white page layout. The daily price for this is 10,500 Yuan, which we are going to do it for a month, four times (住在杭州网, 2006).

The Internet

With the development of economy and the improvement of people's income, the computer penetration rate is continually upgrading. The development of the Internet in recent years has risen significantly. The average household owns at least one computer according to the latest poll from China Telecom.

The website homepage advertising has become very popular in recent years on popular search engines. The BBS or Bulletin Board System is a widely used internet website that offers people to see new products and services that are available. Here people can read recommendations and reviews about the products and services so they have an idea of what to expect before they use the service or purchase the product. The BBS network platform will also give car-sharing advertising a boost with its unique platform. The BBS website may not be as good as some other advertising websites, but it is free and can save a large sum of advertising costs.

Radio

It is advertising for car-sharing, so we chose the voice of traffic FM93. This is a very popular radio station people listen to in their cars. Especially for taxis and buses, the voice of traffic will be very timely pass on Hangzhou in all of traffic information, because its convenience and the useful information. Many drivers like to listen to traffic reports on their commutes to and from work on a daily basis. So this is a good publicity platform and the media for car-

sharing, through the voice of traffic, more drivers and passengers will learn about what is the sharing.

The price for radio advertising is relatively cheaper than other sources of advertising. For 10 days of the radio, we intend to do 15 days, every day can broadcast 24 times, this is similar to the way for the car bombing type Shared services at the beginning will have the help very much, every time is 9100 Yuan. (汽车之家, 2011)

Outdoor Billboards

In Hangzhou almost all of the highways display billboards; it is a very good kind of advertising way due to numerous people on the roads. Because car-sharing is a new type of service, and it requires people who must have a driver's license, it would be great advertisement on the busy roads of Hangzhou.

The billboards should be located in Genshan Road and Peng Gen port entrance, which is near the high speed toll stations. This is a great place to advertise since the traffic flow through this area is very heavy and people will see the advertisement on a daily basis. So the effect here of advertisement will be very good, a billboard price is 300000 each year, a year of advertising should be a great way to get the service noticed. (拱墅区人民政府, 2011)

Brochures

Advertising in Brochures is the most direct way to make people realize the company's products or services that are being offered. We will show the most important information in the collateral, and let people directly know to what is car-sharing, and understand car-sharing service. Brochures are relatively cheap at about 3 Yuan a brochure (according to a local graphic shop) and we could make numerous of these to hand out on the streets.

Live TV Advertisement

This is a very novel form of advertising, but is only in activities limitations of the advertisement. Advertisings job is to let people at the scene of the concept of car-sharing deepen and offer service form. In the scene audience will have a very intuitive understanding of the car-sharing opportunities.

There are many kinds of advertisement. We choose the above seven ways and some other advertising methods we haven't use because of the advertising budget or the advertisement effect, and other aspects of the limited budget. Such as many of these products use the advertising about the car body advertisement, but we do the car advertising, the car manufacturers advertising or companies are our competitors, such advertisement to do way of car body advertisement was caused by the pressure of competition.

Information about advertising

Type	Cost	Time
TV advertising	80,080	A week
Newspaper advertising	42,000	A year
The Internet	Free	No limit
Radio	136,500	15 days
Outdoor billboard	300,000	A year
Brochures	2,000	A year
Broadcast live	50,000	Half hour

Figure 27: Advertising Costs

5.4.2 Target Customers

Target customers are the customers we wish to attract our products and services towards. Finding the Target customer is the work in front of marketing. Only certain target customers can be reached and we must make sure we reach the ones willing to use the service we will provide.

Market segmentation

Car-sharing service is similar to the Hangzhou public bicycle service; it needs better infrastructure facilities, like the parking support and electric cars require charging stations support. Car-sharing service prices according to time, so the customers require road conditions should be a smooth traffic and reach a degree of accessibility requirements. For the car-sharing service to the set locations; development of car-sharing service bases on membership system, and application for membership requires a good social credit history, so the idea of the target customer base is well-educated or faithful group. In Hangzhou car-sharing is a new concept, the idea of target audience tend to the young groups, because they are more receptive to new things.

Urban Area

The area needs to have good infrastructure, perfect health care system, a high level of education, dining and entertainment facilities, and more adequate parking; convenient and smooth roads, there are many transportation choices; many communities around the area , young live age structure . For example, around Citizen center.

New city area

Firstly, the region has young age structure of residents, it has active atmosphere, universities gathered in a college town effect, the university students are the most active

groups in the community, and they are willing to try new things. Secondly, high-tech industries are concentrated, white-collar is also the active group in this area and the high income social groups with high levels of consumption; Thirdly, the new city area is away from the downtown, but the road is smooth and parking space is an ample. For example: Xiasha Economic Development Zone (Xiasha Higher Education Park), Riverside High-tech Park.

Population Subdivision According to the Survey

The following figures represent our detailed findings in our survey about people that were interested in car-sharing. This analysis below only shows the people interested in car-sharing and tells how we analyzed the data in order to find out who our target customers are.

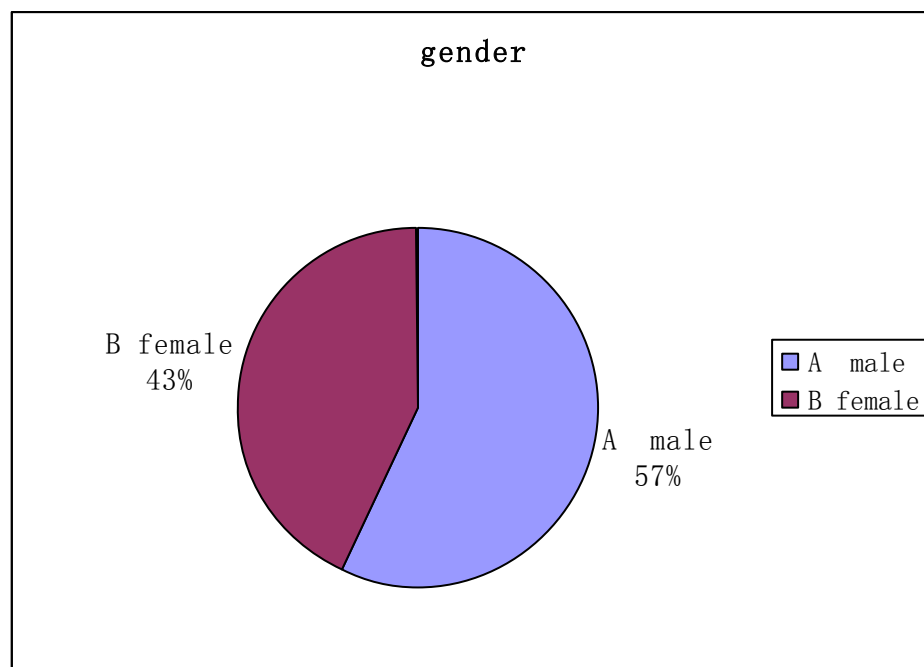


Figure 28: Survey Analysis Question 1

We see from the figure above, 57% of consumers are male, 43% are female, it is reasonable. Firstly, in the "Bulletin of Hangzhou sixth census data" shows the ratio is 51.23:48.77, in Hangzhou, men are slightly more than women; Secondly, according to the social

habits, men are more independent than women and take more attention to career development; they take on more family responsibilities. In Chinese social values, car ownership as a symbol of social status, while men more emphasis on social status, so the target audience of males proportion than females. This is consistent with the gender ratio and social habits. Therefore when we promote the process of car-sharing service, and color of cars and the type of cars should be more biased in favor of masculine or neutral. The age structure of target customers is biased towards younger consumers.

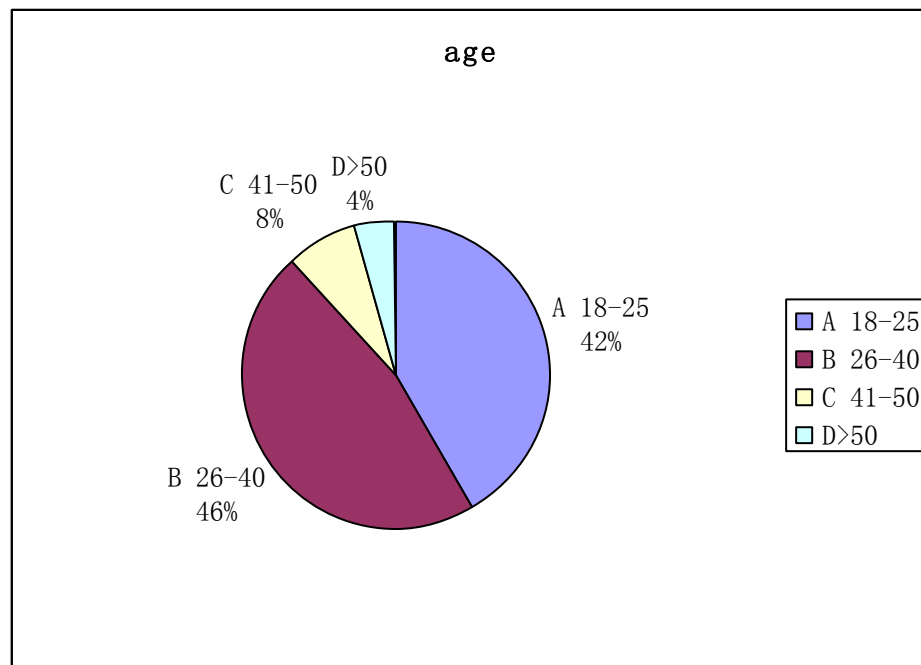


Figure 29: Survey Analysis Question 2

From the Statistic results, 46% of the consumers are in the 26-40 years age bracket, the age characteristics of the groups, who have graduated from school, they are at the peak of career development, major including: Young people have just started their career, they are generally higher-income consumers with corresponding high level of consumption, their lives are full of passion, and they face pressures to buy a house and car. The survey also showed 26

to 40 years old with a driver's license is in 50% of the population, the number of who don't use private cars as daily transportation mode is 65% of population who has a driver's license. Those people will be the customers with highest degree of enthusiasm to try car-sharing service, they have a need for a car and the data shows that car-sharing service will save them unnecessary costs. This part of the group will choose a more affordable way by using a Car-sharing service. These people have a successful career and have a substantial income, they own a car, they also care about environmental protection and attention to improve the quality of life, and they are willing to try new modes of transportation.

In the results, we can also see that 38% of the population is in 18-25 years old as the best educated generation. These people are mostly college students or young people into the community initially; they have lower income levels, willing to try new things. People who don't have a driver's license may be inclined to get one if there was a car-sharing service.

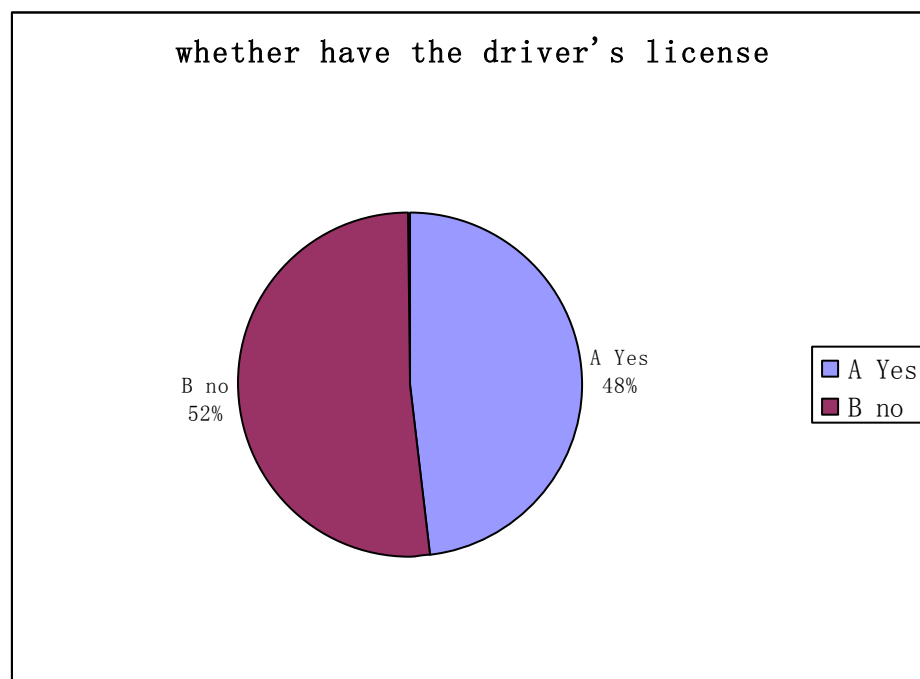


Figure 30: Survey Analysis Question 3

In the survey of driver's license holders' rate, almost half the population have a driver's license and with a car-sharing service, they become the direct beneficiaries; while another 52% of the population to become car-sharing services' potential consumers, their car-sharing services have great interest and have expressed the motivation for driving test or have the idea to ask relatives, friends, to try car-sharing service. This result inspired us during the process of marketing and advertising should cover all of the people, because the survey found that even without a driver's license but there is great interest in car-sharing service.

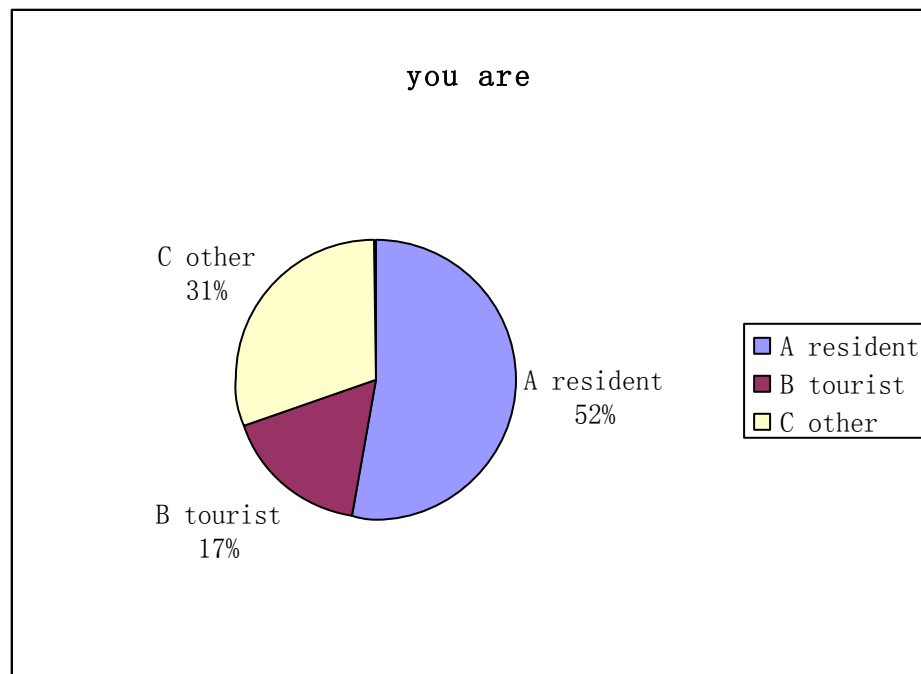


Figure 31: Survey Analysis Question 4

According to the survey, it showed that more than half of the customer base are the local resident population, and 31% is other, such as workers in Hangzhou and college students or on business people in Hangzhou; the majority of those 31% people are the students in Hangzhou, the number of days in Hangzhou rather long, but also more stable; car-sharing service's another market is for the tourist crowd in Hangzhou, but due to car-sharing service

have the requirements of membership and required to pay an annual fee both credit background checks required , temporarily unable to service this part of people, through the establishment of new ways such as: no annual fee, the credit requirements are higher, adjust the pricing method to facilitate the refund of rent and other means to attract tourists for business. Therefore, car-sharing service start-up phase should tend to localize. Nearly 60% of car users are willing to support car-sharing service.

According to survey results, it showed that only 11% of the population in Hangzhou are using private cars as the main way for daily travel, while car-sharing services in support of the population (Figure 32) accounted for 18% of total customers that private car user are more concerned about car-sharing service than the group without using private cars, they also expressed great interest in car-sharing service. According to Figure 32, it shows that the number of private car users, who are ready to support car-sharing services, and be willing to try the service is more than half. This means that car-sharing service can help in reducing the existing number of private cars on the road, and the purpose of easing the traffic pressure.

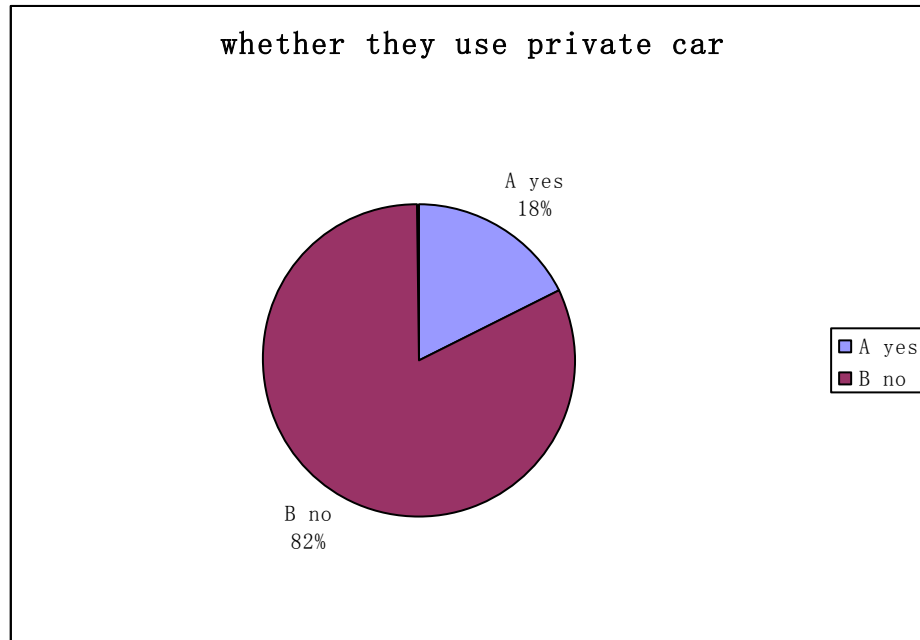


Figure 32: Private Car Use

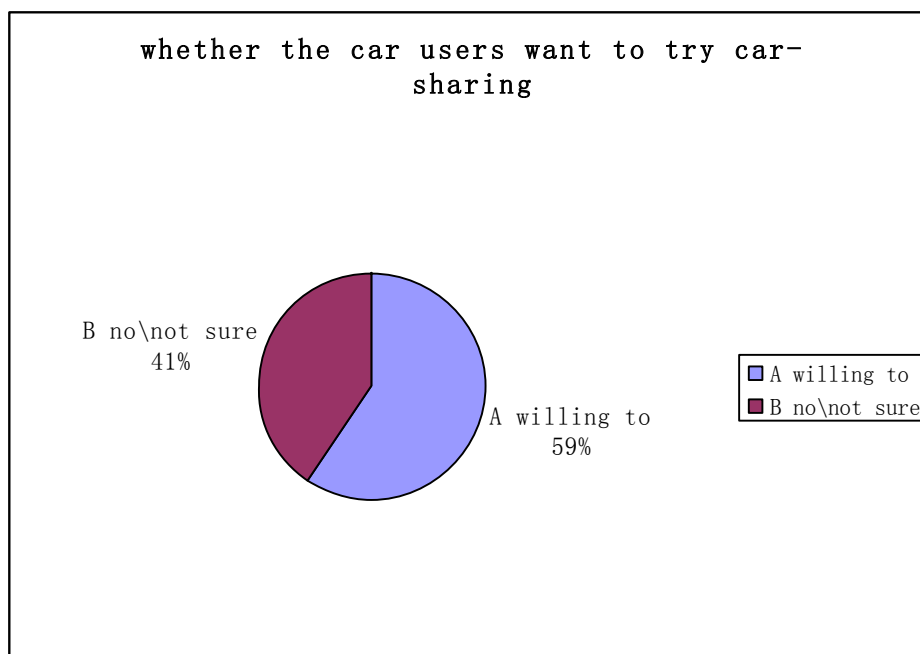


Figure 33: Car-sharing Opinions

Car-sharing target customer base concentrated in the new city area of Hangzhou or the urban area with good transportation infrastructure. Main target group is young, more men than

women, and well-educated, have higher levels of consumption, have a good credit record Hangzhou local residents.

5.4.3 Marketing Similarities of Electric Cars and Zipcar

Almost every company has advertisements to promote their products such as Zotye and Zipcar. According to our research, Zotye has three kinds of advertisement. First, they put the logo EV on their cars. EV is short for electric vehicle and is shown on all of their electric vehicles in the area they serve. They do this because many people can't realize it is an electric car. The electric car companies want more people to know that there are electric cars in city and they want more and more people to use electric car in the future. Secondly, Zotye puts many attractions of Hangzhou on the body portion of the electric cars. They apply scenic spots of Hangzhou to publicize their electric car and how it makes the city greener with their unique logo. So many tourists can remember the attractions of Hangzhou and relate it to the electric car. Third, the advertisements on the car are seen at the Ambassador Ritual in Beijing. The Ambassador Ritual is a great chance for Zotye to get their electric car known to other countries around the world. It is also good chance to show the electric car to all the people and educate other places that electric cars are becoming readily available (Zotye, 2011).

Zotye uses very similar tactics used by the car-sharing provider Zipcar. They advertise on their cars, on billboards, on the internet, and in brochures in the areas they provide services. They expand the market influence through advertising and use it as a way to increase their business. By delivering a variety of advertisements, Zotye and Zipcar get well known in the area and people get interested in what they do.

The word of mouth is also very important to electric car. After all, the electric car is not the mainstream in the society like gas powered vehicles. Almost 60% of Zipcar's marketing budget was to use word of mouth and free media to their advantage. This is a similar tactic Zotye is using to gain the support of their electric vehicles. If people think electric car can protect the environment, reduce the traffic crowded, and it can make it more convenient for people's everyday lives. People are always willing to new ideas the things which can be benefit them and the environment. So the electric car companies need to gain people's support. By getting known by the public people, the electric car will be a fast growing car to own.

Zipcar has two kinds of cars, one is traditional car and one is electric car, but the electric car is not popular and only San Francisco has adopted electric cars. With not enough charging stations and people not knowing how they work, it makes it very difficult for them to be known and used. People feel like they may run out of battery quick or they may not enjoy features in the electric cars provide. Convincing people that they are very similar to traditional cars is the best way to get them known. If more charging stations can become readily available and more can be done to promote the benefits of electric cars, there will be a better chance for the future use of electric cars.

The target customers are very significant for companies providing electric cars and car-sharing services. Electric cars are not popular now, but most people who have a driving license like using the traditional car. According to the research, we realized white collar is the target customers for electric car company in China, they like the popular things, they have enough money to pay for the car, or they can rent an electric car for half a year or one year. The white collar people are highly educated, sophisticated workers that are working in traditional office

buildings and not interacting in manual labor. They can realize the benefit of electric car and what they are doing to help society become greener. So, electric car companies should meet their needs. At the same time, electric car companies should give the price discount for them even if the government had given the discount. Promoting both the electric car and car-sharing services towards the white collar crowd, will yield a better opportunity of success for both companies.

Zipcar's target customers are local people who are unable to afford the large costs of maintaining a car and university students. There are more than 230 universities that are the members of Zipcar community that provide cars available on campus to students at discounted prices. As well as students, Zipcar markets to individuals in cities which parking is hard to come by, people who can't afford the costs of owning a car, and any individual looking to save money. By targeting these individual market segments, Zipcar can focus its marketing tactics in places which have an abundance of these types of individuals (2011, Zipcar).

The high costs of promoting the development of electric vehicles and the ownership costs are keeping people away from. Cars are expensive and charging stations are expensive. In order to enlarge market share, electric companies should find ways to reduce the costs in order to attract more people to use their electric cars. Lowering production costs can make more electric cars be available in the market. Not only will it open the market up more, but it will provide a larger customer base to those individuals who earlier could not afford owning an electric car. It is one of the reasons why governments are irresolute to this program. If the government sees that more people will use the cars, they will be more willing to offer more incentives to promote the use of these cars.

Convenience is also another way to attract customers. But having limited charging stations available is making the use of the electric car obsolete. If electric car companies or the government can build more charging stations, expanding the electric car will be easier and more convenient for people who want to own them. With limited charging stations available, people are limited to the distance they can travel and are drawn away from the idea of using an electric car.

Although electric cars are difficult to promote, it is a new energy vehicle. With the development of the society and the economy, every government wants to build a resource-conserving society. Electric car is a kind of trend in the future. The market of electric car will be increase year by year. But it will take time for electric cars to be implemented into our daily lives and only time will tell when we will accept the use of electric vehicles.

5.4.4 Marketing and Implementation Plans

One of our first and more aggressive marketing schemes to help promote the idea of car-sharing is to demo it at the Huanglong Gym. The Huanglong Gym located in downtown Hangzhou is a very congested and popular area. In order to get the people of Hangzhou familiar with the concept of car-sharing we need to get them to understand what it is all about. One of our main marketing techniques is to have a demo day of car-sharing outside of the Huanglong Gym. This will open up any question people have about the car-sharing system and to let people know what it is all about. We will set up panels that will help explain the idea of car-sharing and what it can do to help the traffic and environment problems in Hangzhou. The highlight of the demo day will allow any licensed driver to try the car-sharing system out with a representative walking them through the whole process. We will have 10 cars available to

demonstrate to anyone willing to give car-sharing a try outside of the Huanglong Gym. The potential customers will be walked through the whole car-sharing process from reserving the car, driving the car, fueling the car, and leaving the car after your reservation is over. It will be a time where we can demonstrate the car-sharing process the way an everyday user will use car-sharing and give the potential customers the perspective of how the whole system works. This marketing idea will target our white collar customers and will show the many ways on why people should use car-sharing. We will focus car-sharing around three main aspects; convenience, environmentally friendly, and cost saving. We will pitch the idea of car-sharing in a way that will convince people of these three aspects and use the busy area of Hangzhou to our advantage. Using this type of marketing will be both beneficial for the future of car-sharing and the promotion of it as long as the government will accept our request to demonstrate outside of the Huanglong Gym.

Our second marketing plan is to have an event at the Leisure Thematic Exhibition Hall. The Leisure Thematic Exhibition Hall is located in the White Horse Lake Convention & Exhibition Center. The Exhibition Hall is divided into 5 floors aboveground and 2 floors underground, with an area of 45,000 square meters for exhibition. Booths and other functional and supporting services will be organized within this area. (香港达泰投资咨询有限公司, 2011)

The Leisure Thematic Exhibition Hall plans to invite 50 cities and 50 leisure enterprises from home and abroad, through the case exhibition of the leisure-featured cities from home and abroad, and the leading leisure enterprises for product or service, to profoundly show the theme of the Leisure EXPO, interpret the value of leisure in human life, and reveal the importance that leisure industry plays in urban development.

The following is how we will represent the car-sharing service at the exhibition hall. The car parking for the event organizers to provide shared services, will be provided free of charge for five electric vehicles, limited distribution of data cards to have a driver's license test drive free for tourists. There we will educate people on how car-sharing works and give them demos in our electric vehicles to make them familiar of how the service works. The demoing provides real life experience of how car-sharing actually works and will be our best way to express the new service. By handing out brochures and having people sign up at the event will be a great way for the service to get off its feet. We see both these marketing plans as great ways to get the service implemented correctly in the city of Hangzhou to gain great publicity.

City Comparison in Hangzhou

In a car-sharing service, coming up with the correct amount of cars to implement into a city and how to go about analyzing a city's demographics to figure out the correct number can be difficult. In figure 34 it shows how we went about finding the possible number of cars to implement based on Zipcars information and city demographics. We took the population and popular cities that Zipcar serves in order to help estimate this figure. By going on Zipcars website we went to see how many Zipcar neighborhoods there were in each city. Zipcar neighborhoods are areas within a city that can hold anywhere from 2 to 50 Zipcars parking lots. We took the amount of neighborhoods within each city listed below and multiplied it by the average Zipcars in the neighborhoods within the city to give us an approximate amount of Zipcar vehicles the city has. Once we got this number we then go ratios from Bus to population, Subway to population, and Zipcars to population in order to see if there were similarities in ratios to see if this may have been to way Zipcar analyzed city demographics in order to find the

proper amount of Zipcars to implement into each city. We concluded that Zipcar may have not used Bus and Subway ratios to find this figure, but may have used a city's population to analyze the number of cars. Meaning Zipcar may have taken a city's population and said we want one Zipcar per 5,000 people in that city's population. So in the figure below we show some of the popular Zipcar cities and their cars to population ratio to help prove our point. Most of the cities averaged around 4656 people per Zipcar. We had some outliers such as Boston which was lower ratio due to it being the founding city and also left out places such as London which was a new city that Zipcar has entered. Then to follow up on our research we took Hangzhou, and used the average Zipcar to population number to come up with the figure of about 1869 cars implemented in Hangzhou according to the population density. We felt that this would be the optimal amount of vehicles to implement into the system to have an adequate supply of Zipcars to users. Zipcars system currently has no issues with demand for its cars using this number of cars to population ratio, so it seems like it would be a great start for the car-sharing service in Hangzhou. Like we said, these figures are estimates and may not work for every car-sharing system. But it will give you an idea of how many cars should be implemented into a system.

Cities	Population	ZipCars (estimate)	Buses	Subway	Bus to Population Ratio	Subway to Population Ratio	Zipcars to Population Ratio
Atlanta	420,003	102	505	338	0.001	0.0008	4118
Boston	617,594	1280	927	608	0.002	0.0010	482
Chicago	2,695,598	540	1782	1190	0.001	0.0004	4992
London	7,825,500	40	8000	10000	0.001	0.0013	195638
New York	8,175,133	600	4372	6336	0.001	0.0008	13625
Philadelphia	1,526,006	375	1183	395	0.001	0.0003	4069
Portland	583,776	108	660	127	0.001	0.0002	5405
San Francisco	805,235	1480	507	151	0.001	0.0002	544
Seattle	608,660	375	1618	159	0.003	0.0003	1623
Toronto	2,503,281	250	1811	704	0.001	0.0003	10013
Vancouver	578,041	110	1477	298	0.003	0.0005	5255
Washington DC	601,723	550	1480	1130	0.002	0.0019	1094
Hangzhou	8,700,000		7120		0.001		
Total zipcars		5810					
Average zipcars to population		4656.470817					
Possible Zipcars in Hangzhou		1868.367771					

Figure 34: City Comparison of Hangzhou

5.5 Technological Aspects of Car-sharing in Hangzhou

There are several technologies that are necessary to operate a successful car-sharing business. Most car-sharing systems consist of the following technological components: central database, user interface, on board vehicle system and communication system (City CarShare, 2005).

5.5.1 The Central Database

The central database integrates all components of car-sharing operation. The database guards operation information such as member applications, members' contact information, member passwords and IDs, vehicle and pod data, vehicle availability, reservations, time and mileage data and employee data (City CarShare, 2005). This database will also be used to keep track of new members, vehicles and parking spaces. It will also do billing transactions at the end of the month. These transactions can be accessed by the members and staff from the database. The car share reservation database can also provide general information to the user, such as customers who are students with driving violations, popular pickup locations, cars that hold a certain number of passengers, and rental trends (The Car Share Reservation Database).

5.5.2 User Interfaces

User interfaces, another type of reservations technology, allows members to make a reservation at all times. Most operators provide an internet interface allowing member to make reservations at all times. Some operators provide phone reservations as well. Phone reservations are allowed by either a live operator service or by an automated voice-activated phone reservation. The customers may use these services to get help as well.

A user friendly interface will make it easy for customers to make reservations and get help and information about the service. If it is not user friendly it might drive customers away from the service.

The user control and freedom prevent users from submitting the wrong information or unwanted data. The page should have several confirmation and cancellations options.

Consistency and standards is another quality that the interface should have. The same words and expressions should be used to provide a consistent design of the page. The web site should also provide the same kind of operations, and follow a sequence. This is useful for the user when making reservations, since he/she should follow an order of steps using the same process. Another quality, error prevention, should take into account since users tend to make mistakes, especially when they are new users. There should be methods designed that check for the users input. This connects with helping users recover from errors. There should be a module that helps the users recover from errors by recognizing, diagnosing and then recovering them from mistakes (Efis, 2007).

5.5.3 On Board Vehicle System

The vehicle involves an on board vehicle system, which allows members to open the car with the system's card reader and enable car ignition. The vehicle system includes an on-board computer that stores and communicates the members information, such as member IDs, time, and a mileage tracking device (City CarShare, 2005). In some cases this vehicle system may include GPS receivers. According to City CarShare, this technology system provides more convenience for members, more accurate billing, reduces staff costs, and avoids relying on members' honesty.

The access equipment which allows the members to enter the cars with their card involves the Radio Frequency Identification technology. A typical RFID application consists of an RFID tag, an RFID reader, and a backend system. An RFID tag is a fixed or mobile chip that can be placed within cards, barcodes, and many other objects that needs to be tracked. The RFID reader on the other hand, lets us read the information on the RFID tag. Once an RFID tag is placed over an RFID reader, the backend system (system that processes RFID information) analyzes what has been scanned. With a simple radio frequency (RF) chip and an antenna, an RFID tag can store information that identifies the object to which it is attached. With this kind of technology available, it makes it very convenient to process data and track anything you need to (Min Chen, 2010).

RFID come in a few different configurations and need to be suited for the needs they will be used for. The first aspect we need to compare is the difference between active and passive RFID tags. Passive is an RFID tag that uses no battery and is activated by scanning it over an RFID reader. The tag incorporates information which is put on by a computer and when it is placed over the reader the backend system reads the information. On the other hand, the active system incorporates a battery inside to power it. The battery is only activated when it is brought over a RFID reader. Both of these configurations are helpful, its picking the correct one for your needs that will make them the most effective.

Besides the configurations of tags, RFID readers can be used in both fixed and mobile configurations. The fixed configurations are placed in certain areas for use and cannot be moved. An example of fixed are the readers used in fast lane toll systems. On the other hand, the mobile readers like the ones used in Zipcars, are able to be moved and still be read. Zipcar's

readers also incorporate GPS and can communicate with the Zipcar server to let them know what RFID chips to let in and at what times. Zipcar configures their readers on the top left windshield of their cars for members to access the cars.

In Zipcar's system they provide members with an RFID tag in the form of a membership card which lets the customer unlock the cars. The way the system works is by placing your card over the transponder on the cars reader and unlocks the cars. The RFID's job is to provide tracking assistant for the member and access to the service. Other than that the rest of the Zipcar system incorporates actions that are all controlled by the user like driving the car.

The RFID system allows unattended access to the cars. This is one the unique characteristics on car-sharing. Without the RFID system this would not be possible and therefore this technology is very crucial for any car-sharing service.

5.5.4 Communication System

Most car-sharing businesses use Global Positioning System (GPS) technologies to allow each vehicle to communicate with the central database. This communication link provides useful information such as reservation information to each car, relay time and mileage data from the cars to the central database. Also through GPS, the central database can locate each car (City CarShare, 2005).

Global position system was invented by the U.S. Department of Defense in 1970s. The system is composed of twenty four satellites in the space, and it provides users with positioning, navigation, and timing services (U.S. government, 2011). In car-sharing business, there are two purposes for GPS devices: one is for the driver to navigate, and another is for the car-sharing central database to communicate with the cars.

In order to use GPS to navigate, you need a GPS receiver in your car. The GPS receiver displays its location on the planet in terms of latitude, longitude, height and time. To locate its position, the receiver gets signals from at least four satellites. In theory, using signals from three satellites are sufficient, but in practice four satellites are used to improve accuracy (The GPS Guid Website, 2009). The GPS receiver has an electronic map stored in the memory. Using the location information obtained via the receiver, a GPS navigation system plots the position of the user in an electronic map using mapping software.

A typical GPS navigation system provides the user with very useful features as follows:

- The traveling distance between source and destination
- Which road you are on
- Optimization of route
- Current speed
- Time since departure
- Estimated time of arrival

The use of GPS navigation systems in cars is becoming more popular every day. Many people find the above mentioned information useful while driving. The ease provided by the GPS navigation system would attract people to become members of a car-sharing service.

Another use for the GPS is the communication between the central database and the vehicles. It is important for the car-sharing company to know where their vehicles are, and whether it is in good use. With the help of vehicle tracking system, they can even know the fuel level of the vehicle, relay times, mileage data, engine temperature and etc. This information is important for the company to operate the system smoothly.

There are two types of vehicle tracking devices: active tracking and passive tracking. Passive tracking can be used when there is access to the car. The information on the locations that car has been to can be obtained. Active tracking can get the location information in real-time via GSM (Sonotronics Website, 2010). Vehicle tracking is also a good way of preventing the car from stolen. If the car is stolen, police can simply follow the signal emitted by the tracking system and locate the stolen vehicle. The GPS tracking device is hidden in the vehicle so that car-sharing members can't break it.

Without the aforementioned technologies it is not possible to operate a car-sharing service. All of these technologies easily accessible in China and do not possess any barriers to start a car-sharing business.

5.6 Financial Aspects of Car-sharing in Hangzhou

In this section of our project we prepared a financial plan for the car-sharing service in Hangzhou; compared the cost of private car and car-sharing, cost of car-sharing and taxi and did a location analysis to select good locations to have parking spots.

5.6.1 Financial Plan

The budget is the most critical component of a business plan. The initial budget is the indicator for whether the organization has sufficient capital or how much funding it needs to start the business. The financial plan will also show how the business plans to reach financial self-sufficiency. Our team prepared the following financial plan for the first five years of the car-sharing service in Hangzhou. The following figure is our financial plan for the first five years of the car-sharing service in Hangzhou and the details of the preparation of the financial plan can be found in Appendix C.

Financial Plan for Car Sharing Service in Hangzhou 2011							
	Assumption (per unit)	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues							
Trips / Member / Month	4						
Km / Trip	35						
Hours / Trip	4						
Beginning Members			0	500	1000	2000	4000
Attrition	0.15		0	75	150	300	600
Ending Members			500	1000	2000	4000	8000
New Members			500	575	1150	2300	4600
Average # of Members			250	750	1500	3000	6000
Application Fee (per new member)	200		100,000	115,000	230,000	460,000	920,000
Annual Fees (per average member)	100		25,000	75,000	150,000	300,000	600,000
Per Km Charge	0		0	0	0	0	0
Per Hour Charge	40		1,920,000	5,760,000	11,520,000	23,040,000	46,080,000
Security Deposits	2,000		500,000	1,500,000	3,000,000	6,000,000	12,000,000
Interest Income	3.5%		17,500	52,500	105,000	210,000	420,000
Total Revenue			2,062,500	6,002,500	12,005,000	24,010,000	48,020,000
Costs							
<u>Variable Costs / Regular Car</u>							
Beginning Cars			0	50	63	125	251
Ending Cars			50	63	125	251	368
Average # of Cars			25	56	94	188	309
Lease Cost (car / year)	20,300		507,500	1,143,567	1,908,200	3,816,400	6,279,467
Access Equipment (per new car)	3,000		150,000	38,000	188,000	376,000	352,000
Fuel (car / year)	18,000		450,000	1,014,000	1,692,000	3,384,000	5,568,000
Insurance (car / year)	8,000		200,000	450,667	752,000	1,504,000	2,474,667
Maintenance (car / year)	4,500		112,500	253,500	423,000	846,000	1,392,000
Parking (car / year)	20,000		500,000	1,126,667	1,880,000	3,760,000	6,186,667
Total			1,920,000	4,026,400	6,843,200	13,686,400	22,252,800
<u>Variable Costs / Electric Car</u>							
Beginning Cars			0	0	4	8	16
Ending Cars			0	4	8	16	32
Average # of Cars			0	2	6	12	24
Lease Cost (car / year)	24,000		0	48,000	144,000	288,000	576,000
Access Equipment (per new car)	203,000		0	812,000	812,000	1,624,000	3,248,000
Electricity (car / year)	540		0	1,080	3,240	6,480	12,960
Insurance (car / year)	9,000		0	18,000	54,000	108,000	216,000
Maintenance (car / year)	900		0	1,800	5,400	10,800	21,600
Parking (car / year)	20,000		0	40,000	120,000	240,000	480,000
Total			0	920,880	1,138,640	2,277,280	4,554,560
Total Variable Costs			1,920,000	4,947,280	7,981,840	15,963,680	26,807,360
<u>Fixed Costs</u>							
Corporate Insurance			4,800	4,800	4,800	4,800	4,800
Reservation System			600,000	600,000	600,000	600,000	600,000
Administration			532,800	900,000	1,140,000	1,260,000	1,980,000
Benefits	35%		186,480	315,000	399,000	441,000	693,000
Office Space			152,000	152,000	152,000	152,000	152,000
Office Equipment		500,000	120,000	30,000	40,000	20,000	120,000
Phone			21,600	27,000	34,200	37,800	59,400
Marketing			700,000	700,000	700,000	700,000	700,000
Background Checks	120		60,000	69,000	138,000	276,000	552,000
Total Overhead Costs			2,377,680	2,797,800	3,208,000	3,491,600	4,861,200
Total Costs		500,000	4,297,680	7,745,080	11,189,840	19,455,280	31,668,560
Net Income Before Tax			-2,235,180	-1,742,580	815,160	4,554,720	16,351,440
Cumulative Income			-2,235,180	-3,977,760	-3,162,600	1,392,120	17,743,560
Net Income After Tax	25%		-2,235,180	-3,977,760	-3,162,600	1,044,090	13,307,670
Initial Investment	4,477,760						
Internal Rate of Return	18%	-4,477,760	0	0	-3,162,600	1,044,090	13,307,670

Figure 35: Financial Plan for Car-sharing in Hangzhou 2011

Based on our survey results our team concluded that 40¥ per hour charge would be appropriate for the business. It is affordable and also generates enough income so that the business is profitable. Other sources of income are the application fee, annual fee and the interest income generated by the security deposit. Our team did a sensitivity analysis and found out that “the per hour charge” has the highest impact on the revenue generated.

Name	Final Value	Reduced Gradient
Application Fee (per new member) Assumption (per unit)	200	500
Annual Fees (per average member) Assumption (per unit)	100	250
Per Hour Charge Assumption (per unit)	50	36,000
Security Deposits Assumption (per unit)	2,000	9
Average # of Members Year 1	250	7,370

Figure 36: Sensitivity Analysis

The figure above illustrates the sensitivity analysis we conducted for the revenue generated in the first year. High reduced gradient values mean that the variable has more effect on the revenue generated. From the table, we can see that the revenue is mostly dependent on the per hour charge.

As seen in the financial plan there is a significant cash flow deficit in the early years of the service. The company requires funding from the local government, foundations, auto manufacturers and similar organizations. However, the cash flow deficit is shrinks rapidly in the following years for several reasons:

- The significant obstacles such as determining initial locations, securing parking, building partnerships and fund raising will be over. This way the company can focus on improving the customer service and profitability.

- Utilization rates of cars will increase as the organization reaches a critical mass of members and vehicles.
- Economies of scales will be realized as the company reaches a certain size. Discounts for vehicles, insurance and similar costs can be obtained.
- As the business grows, the fixed costs such as office space and salaries will be spread over a large number of vehicles. For example the ratio of staff members to the number of vehicles will decrease.

Through car-sharing, the cost of owning a car is moved from the individual to the car-sharing business. Due to the reasons mentioned above the business can save money in places where individual cannot. This makes the business profitable after the early stages of the organization. With an initial investment of nearly 5,000,000¥, the business can break even in the fourth year and achieve an internal rate of return of 18%. These calculations do not factor in the time value of money.

Our team thought that having 500 members at the end of the first year may be too conservative considering the population of Hangzhou. Therefore, we compared different scenarios where we have different number of member at the end of the first year. We kept the 100% growth in the number of members the same. The following table shows this comparison.

Number of Members at the End of the First Year	Number of Cars	Revenue	Variable Costs	Internal Rate of Return (5 years)
500	50	2,062,500	1,920,000	18%
1000	100	4,125,000	3,840,000	96%
2000	200	8,250,000	7,680,000	169%

Figure 37: Scenarios with Different Number of Members

From this comparison we can see that the rate of return is very sensitive to the number of members the company has. With enough effort higher number of members can be achieved and the business can be more profitable.

5.6.2 Car-sharing versus Private Cars

Private automobiles are the main competitors for any car-sharing service. The success of the car-sharing service in Hangzhou will be dependent on the extent which people can be persuaded to share cars instead of owning them.

Cost saving is one of the most important motivation for members to join a car-sharing service. Car-sharing turns the use of automobiles into a service. This way the fixed costs of owning a car become variable costs. Owning a car has high fixed costs associated with the purchase price, insurance, maintenance and parking. Car-sharing however allows people to pay according to how much they use the automobile. The fact that car-sharing turns fixed costs into variable costs means that the greatest savings will be realized by people who drive “occasionally”. In an attempt to put a definition on “occasionally”, our team analyzed the costs of owning a car and sharing a car and found when car-sharing is more profitable for the customer.

The following figure shows the comparison of the yearly cost of private cars and car-sharing. The costs in the table belong to Volkswagen Lavida, a middle class car. Our team has done a similar comparison for different types of cars and the details can be found in Appendix D.

The Yearly Costs of Private Car	Cost (¥)
Depreciation	26,980
Insurance	4,000
Annual Inspection	150
Maintenance	1,200
Gas	6,160
Parking	1,800
Toll Fees	1,600
Total	41,890
The Yearly Costs of Car-sharing Service	Cost (¥)
Costs of Car-sharing Service(200hours and ¥40/h)	8,000
Other Increased Transportation Costs	2,500
Total	10,500
Cost savings	31,390

Figure 38: Car-sharing versus Private Car

As a result of this comparison we found out that for a person who drives a Volkswagen Lavida around 200 hours a year, car-sharing saves almost 31,000¥. During this study we also found out the owning a Volkswagen Lavida becomes more financially feasible if the owner drives more than 980 hours per year. Car-sharing service is more feasible than owning a car for people who don't drive frequently.

5.6.3 Car-sharing versus Taxi

Another competitor for car-sharing services is taxis. According to the public information of Hangzhou government, there are currently 65 taxi companies and more than 9200 taxis. There are two types of taxis that have slightly different pricing. The following table is a

comparison between these two types of taxis. Between the taxis in Xiasha and the taxis in downtown only beginning price differs.

	Taxis in Xiasha	Taxis in Downtown
Starting Fare	¥5 for 3 Km	¥10 for 3 Km
Fuel surcharge	¥1 for each time	¥1 for each time
Charge (3-10Km)	¥2/km	¥2/km
Charge (>10Km)	¥3/km	¥3/km
Calling Service	Free	Free
Waiting Fee	¥1/2.5minutes	¥2/5 minutes

Figure 39: Taxi in Hangzhou

Our team has used this information to compare the cost of taxis to the cost of car-sharing. The following table provides several examples on how they compare. For instance, it takes approximately 45 minutes to drive to downtown from Xiasha. The round trip cost of the taxi for this trip is 130¥. If a person decides to go to downtown from Xiasha and spends around three hours there, he/she will have to use car-sharing for around five hours. The cost associated with that is 250¥. Therefore, it is cheaper to take a taxi for this kind of situation. On the other hand, car-sharing is cheaper when picking up someone from the Xiaoshan Airport and returning to Xiasha. There are different scenarios when car-sharing is cheaper and when taxi is cheaper.

Explanation	Distance (km)	Hours of Travel (Hours)	Total Cost of Car-sharing (¥)	Round Trip Cost Of Taxi (¥)
Xiasha - Downtown (One hour spent in downtown)	18.4	1.5	120	130
Xiasha - Downtown (Three hours spent in downtown)	18.4	1.5	200	130
Xiasha - Xiaoshan Airport (Picking up someone from the airport)	22	1.33	80	180
Downtown - Xiaoshan Airport (Picking up someone from the airport)	38	1.8	80	216
Grocery Shopping in Xiasha (Two hour spent during shopping)	2.8	0.17	80	12
Grocery Shopping in Downtown (Two hour spent during shopping)	3	0.17	80	22

Figure 40: Car-sharing versus Taxi

From this comparison our team concluded that car-sharing is usually cheaper when the car is utilized efficiently. For example, if the car will be shared for five hours but only going to be used for two hours, taking a taxi would be cheaper than car-sharing. On the other hand, if the car is shared for five hour and driven most of that time, car-sharing would be cheaper than taking a taxi.

5.6.4 Car-Sharing versus Car-Rental

Car-rental companies are another competitor for car-sharing business in Hangzhou. Car-rental and car-sharing is very similar in nature. Since car-rental companies have been around

for a longer time in China, people may prefer to rent a car than share a car. However, car-sharing can provide cost savings in several situations.

Car-rental companies offer a variety of cars like car-sharing. However, their pricing changes greatly according to the type of the car they rent unlike car-sharing. With car-sharing the hourly price changes only a little if it changes at all. Our team has compared the cost of renting a car for a day to the price of sharing a car for a day. We assumed that the car will be shared for ten hours. The following table shows the comparison between car-rental and car-sharing in terms of daily costs.

Costs	Low Vehicle (Mazda)	Middle Vehicle (Volkswagen Passat)	Car-Sharing
Lease Cost	120/day	200/day	40/hour
Insurance	30/day	40/day	-
Gas Fee	150/day	150/day	-
Average Miles	150	150	150
Other Fees	35/day	35/day	-
Total Hours	10	10	10
Total Cost per Day	335	425	400

Figure 41: Car-Sharing versus Car-Rental

As a result of this comparison we found out that low-end vehicles that can be rented from car-rental companies can be cheaper than sharing a car. On the other hand, renting better quality cars can be more expensive than sharing them. Both services include security deposits that is returned when the service is no longer is used. Price of car-sharing could be lowered if the car is shared for more than certain hours. This would allow the car-sharing service to be better compete with the car-rental services.

5.7 Location Analysis

Car-sharing is a unique source of transportation for individuals and businesses. It provides transportation for people who do not own a car and allows them to do occasional trips. Car-sharing service is ideal for individuals who own a car and drive fewer than 5,000 miles a year. This method is convenient for those individuals, since it provides cost savings. Businesses can benefit from car-sharing by making it a transportation option to their employees. In order for a car-sharing organization to succeed, the potential locations need to have several qualities. “High density, a mix of land uses, good transit access, and already-low vehicle ownership levels are important if car-sharing is to be viable.” All factors are equally important when introducing car-sharing into a community (City CarShare, 2005).

5.7.1 Selection Criteria

Density is the first quality to take into consideration in an area when determining the viability of that location. When providing car-sharing as an alternative to car ownership, it is convenient to have a wide array of potential customers. It is also important to consider that households living in dense neighborhoods tend to own fewer cars (City CarShare, 2005). Areas with high density indicate quality of transit, a pedestrian environment, and local shops and services. These qualities make car-free lifestyle a realistic option for local residents. High density locations are more convenient for car-sharing than low density locations due to the greater number of nearby destinations and the shorter trips (Transit Cooperative Research Program (TCRP), 2005).

Urban neighborhoods that are dense offer the best potential locations for car-sharing. These neighborhoods include characteristics such as mixed-use development, scarce parking, and good transit. It is difficult to establish car-sharing without these elements. Low density

areas are most likely to have no convenient transit service which makes it difficult to serve different modes of transportations. If the potential locations have low density, then the company will have to spend more money in marketing and outreaching customers.

Another important factor, when introducing car-sharing, is to have land for both residential and commercial purposes. This mix of land uses is important to ensure that cars are utilized enough to make a profit. These lands are also beneficial in terms of having a variety of customers. Business members have an important role in increasing utilization rates and evening out the demand cycle since they tend to use car-sharing during work days (Transit Cooperative Research Program (TCRP), 2005) . On the other hand, other people use car-sharing for personal trips either on evenings or weekends. With different demand patterns, mixed-use neighborhoods can attract both business and individual members. If there is a variety of customer then the cars will be efficiently utilized most of the time. This helps avoid sharp periods of peak demand.

Even though car-sharing has many benefits, it is usually not the best type of transportation. Another quality of a possible location is to pick an area with good transit access. Car-sharing will be introduced as another transportation alternative besides transit, taxis, rental cars, walking, cycling, and more. These areas usually have a heavy flow of people. Having a car-sharing location at these locations would provide great publicity and numbers of potential customers.

Low vehicle ownership, another key location quality for car-sharing to succeed, indicates that the area has potential car-sharing users. Car-sharing is most likely to succeed in areas where people cannot afford to have a car but need mobility and travel choices. This quality

makes car-sharing a realistic option for many households. Since car-sharing includes fuel, maintenance, insurance, and reserve parking, members will save money and continue avoiding the difficulties of vehicle ownership; these are the key attractions for car-sharing users.

Vehicle ownership is also a competitor for car-sharing organizations. Car owners are the largest potential market for car-sharing, and it is important to attract these individuals to achieve environmental and social enhancement (City CarShare, 2005). In order for car-sharing to be successful both financially and environmentally, having a population with low vehicle ownership is important. Car-sharing also encourages individuals to sell their cars since users are motivated by the cost savings provided by the system. Therefore, areas with people who are willing to sell their cars, car-free households, and people who are thinking about buying a car are the potential target markets for car-sharing.

According to City CarShare, there are some 'special niches' where car-sharing are likely to succeed. Car-sharing may work with lower densities in special niches such as transit stations, university campuses and new development areas. Having car-sharing stations near transit stations gives the option for those members that transit in the surrounding neighborhoods. Stations in university campuses will attract the younger population and are the center of activity for this market. Car-ownership is usually restricted in university campuses due to the lack of parking space or university rules. New development areas are another 'special niche' for car-sharing since businesses are potential customers for the service. In these areas, car-sharing helps reduce parking demand and developers are often willing to include car-sharing in their projects (City CarShare, 2005).

Taking these four key factors, high density, low vehicle ownership, transit locations and mix of land uses, our team has come up with several locations in Hangzhou that would be plausible for implementing car-sharing in Hangzhou.

5.7.2 Locations of Car-sharing Service in Hangzhou

There are eight districts in Hangzhou: Shangcheng district, Xiacheng district, Gongshu district, Xihu district, JIanggan district, Binjiang district, Xiaoshan district and Yuhang district.

Figure 42 shows a map of Hangzhou and ten suggested locations for car-sharing stations. Seven stations are in or close to the downtown area of Hangzhou and three stations are in the suburban districts.



Figure 42: Car-sharing Locations in Hangzhou

Downtown has a higher population density, therefore a location in this area will be able to reach more customers. Downtown is also a good area for car-sharing stations since people living there have a higher income compared to the people in suburban areas. If these people do not own a car, the chances of them using the car-sharing service are higher. Another advantage

for having locations in downtown is tourism. Hangzhou is famous for its tourism, and most of the tourist attractions are located in the downtown. A large part of eHi's business comes from tourists (eHi, 2011). Downtown is known to be a safer area than suburban districts, meaning that there will be fewer problems with the security of the cars.

Parking space is limited and expensive in downtown; meaning that parking cost will be expensive in this area. At the same time, there are many car-rental companies in downtown which may affect the car-sharing business due to the stronger competition. Due to these constraints we also selected three locations in the suburban area. Suburban areas have a lower population density and a high concentration of companies. The target audience for the car-sharing service in these areas is business members and university students. There are more than 200,000 university students in the suburban areas, meaning that we can target a young population. The following section explains the ten locations we recommend for the car-sharing service.

Location 1- Qingchun Square

Qingchun Square, part of Qianjiang new town and Jianggan district, is located in the center of Hangzhou, north of Qingchun road and east of the West Lake. With a total area is 43,000 square meters, the Qingchun Square is a public location that has many attractions such as supermarkets, a shopping mall, several office buildings, and residential areas (Best, 2009).

Jianggan district, with a total area of 210.22 square kilometers has a permanent population of 1,000,000 and a floating population of 380,283 (Assurewu, 江干区_百度百科, 2011). This is an indicator of an urban dense population and this is due to the great number of nearby destinations shown in Figure 43 which shows a map of Qingchun Square. The red circle

indicates a 700 meter radius for potential locations of car-sharing stations. There are several buildings with potential car-sharing customers: one government office, one people's square, one hospital, five residential areas and five office buildings inside the radius. Figure 44 gives more detail explanation of each building. Since there is a mix of residential and employment land uses, Qingchun Square has an important quality for a successful business and will assure a high utilization rate for car-sharing.

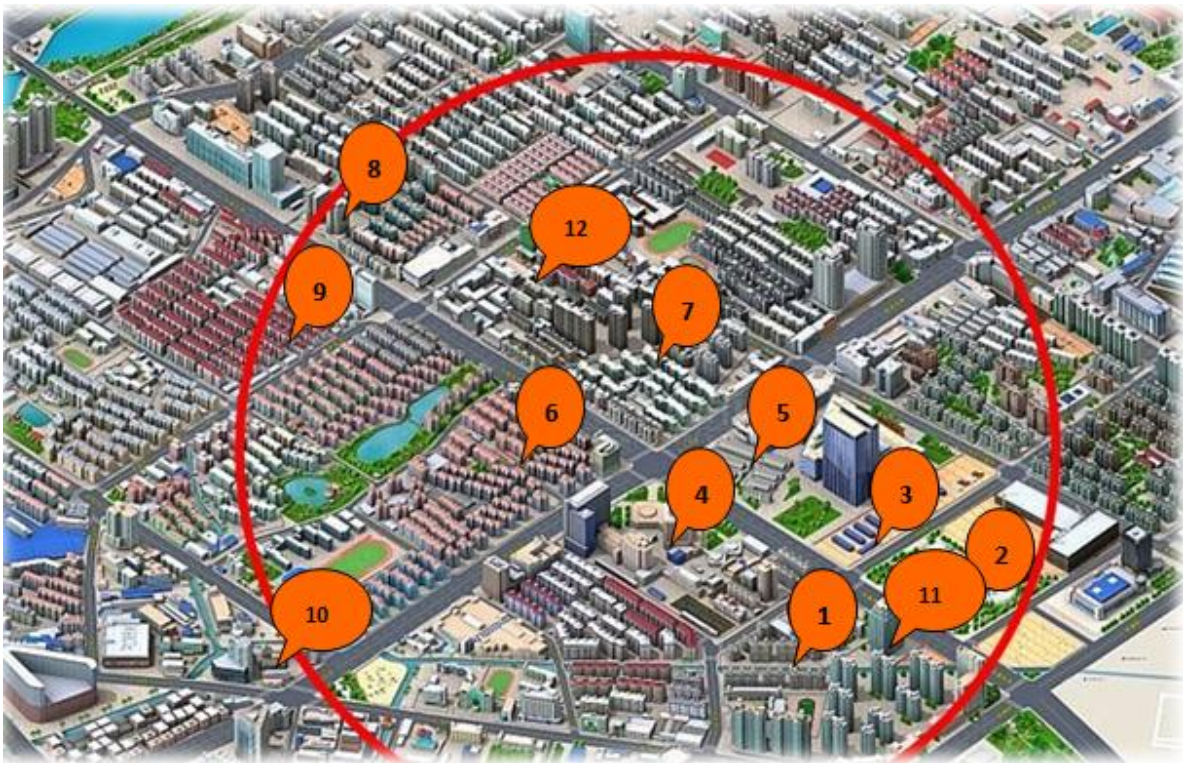


Figure 43: Qingchun Square

Location 1		
#	Name	Description
1	Government of Jianggan	Government Office
2	The Qingchun Square	People's Square
3	Sanxin Building	Office Building
4	Shaoyifu Hospital	Hospital
5	Dinghai Residential Area	Residential Area
6	Caihe Residential Area	Residential Area
7	Qingchun Apartment	Residential Area
8	Qingchun Fazhan Building	Office Building
9	Shuanglin Residential Area	Residential Area
10	Kongque Building	Office Building
11	Sanxin Building	Office Building
12	Nanxiaobu Yueji Apartment	Residential Area

Figure 44: Qingchun Square Key Location

The district's financial revenue was ¥4,598,830,000 in 2010 and the average annual growth was 57.7% (余丽丽、傅一览, 2010). The financial revenue indicates financial sustainability for the car-sharing business because people are able to afford this service. Within this population, the financial revenue of Qingchun Square area is ¥2,826,630,000, and the percentage of financial revenue is 61.5 (白衣童生, 2010).

There are seventeen bus stations in Qingchun Square, which indicate that there are many points of transit access in this area. Outside the radius in Figure 43 there is a supermarket and a shopping mall which are locations our customers will be interested in going. Car-sharing is convenient for individuals who do not have a car because bus or taxis are not convenient transportation methods when going shopping.

Location 2 - Hangzhou Tower

Hangzhou Tower, located in Wulin Square, is part of the Xiacheng district, center of downtown in Hangzhou. North of the Hangzhou Tower is Beijing-Hangzhou old canal, to the south is West Lake, to the west is provincial government and the east is the city river: Tiesha River. The permanent population of Xiacheng district is 328,400 which is relatively small compared to other areas in Hangzhou (Assurewu, 2011). Even though this is not a residential area, there is high density at all times due to its attractions. The economy in Xiacheng district is very wealthy. There are 743 factories in Xiacheng and the total industry output was ¥2,240,000,000 in 2001 (Assurewu, 下城区_百度百科, 2011). In 2009, the GDP in Xiacheng was ¥40,550,000,000 and the financial revenue was ¥9,811,000,000 (赵明、王成, 2008).

Hangzhou Tower Hotel has 1,485 employees which are good potential business members for car-sharing. The Hangzhou Tower is a very profitable business with sales of ¥3,270,000,000 in 2007 (杭州大厦, 2008). The 2007 sales made the Hangzhou Tower the number one tower in China with the highest number of sales. In 2008, the operating income was ¥1,950,000,000, and the profit was ¥257,000,000 (杭州大厦, 2008). The high number of sales and good operating income show that many people visit Hangzhou Tower.

The Hangzhou Tower has a total area of 31.46 square kilometers (杭州大厦, 2008). Figure 45 shows a map of the area surrounding the Hangzhou Tower. The red circle indicates this surrounding area of 800 meters, which is our radius for the potential car-sharing location. The map shows four residential areas, eight office buildings, one hotel, one shopping mall and one government department. This area is a good option for a location of a car-sharing station because many people visit this location for shopping, restaurants and it has a high population of

tourists due to its hotel. There are eighteen buses that transit around the Hangzhou Tower, which shows it is a good transit area.



Figure 45: Hangzhou Tower

Location2		
#	Name	Description
1	Hangzhou Tower	Shopping Mall
2	Baima Residential Area	Residential Area
3	Zhejiang Mobile Building	Office Building
4	Hangzhou Wanhao Hotel	Hotel
5	The City Government	Government of City
6	Jinhui Building	Office Building
7	Zhejiang Publish Building	Office Building
8	Donghai Chuangyi Center	Office Building
9	Zhedi Jewelry Building	Office Building
10	Jinghu Residential Area	Office Building
11	Zhejiang Global Center	Office Building
12	Chaohui residential area	Residential Area
13	CXizi garden residential area	Residential Area
14	Taihe international building	Office Building

Figure 46: Hangzhou Tower Key Locations

Location 3 - Binjiang

Binjiang district is located in south of Hangzhou, near to the Qiantang River. The district's total area is 73 square kilometers, and its population is 319,000 (杭州国家高新技术产业开发区管委会, 杭州市滨江区 2010 年第六次全国人口普查主要数据公报, 2011) . This district is famous because of the New and High Economic and Technological Development Zone. Binjiang district has more than 5,000 companies today and 3,000 of these companies are high-technology companies (杭州国家高新技术产业开发区管委会, 杭州国家高新技术产业开发区_走进滨江). There are also seven universities in this district with more than 40,000 students living there.

This area is thirty-six kilometers away from downtown, therefore there is a high probability that people living or transiting this area may use car-sharing for traveling to the downtown during evening and weekends. The high-technology companies' employees are also potential customers for car-sharing because other transportation methods may be inconvenient for their use. There is no car rental companies located in Binjiang, and there is only one bicycle-sharing station. There is an opportunity in this area for a car-sharing service to enter.

Figure 47 shows a map of a selected district area. The red circle shows a 500 meter radius for potential car-sharing stations. Inside this selected radius there are five universities, eight communities, five office buildings and many companies. The land has a mix of usage from young population to an older population. This range will assure car-sharing usage by different types of potential customers and a high utilization rate. University students are a target

customer of this area because they have low-vehicle ownership. There are five bus stations within 200 meters, which is convenient for a car-sharing business.



Figure 47: Binjiang

Location 3		
#	Name	Description
1	Several Universities	University
2	Baoyichuangyi Office Building	Office Building
3	Liangzhuang Community	Residential Area
4	Zhiben Office Building	Office Building
5	Companies	Companies
6	Liuhe Community	Residential Area
7	Chuangxin Office Building	Office Building
8	Qiantang Community	Residential Area

Figure 48: Binjiang Key Locations

Location 4 - Heaven Software Park

The Heaven Software Center is located in West Lake district which is in the downtown of Hangzhou. This area is unique because of its industrial and business activities. The Heaven Software Center has a total area of 308.7 square kilometers and its registered population is 544,600 people (杭州宝葫芦电子商务有限公司, 2009) . The GDP of the West Lake district is ¥5,880,000,000 and the average annual growth is 17.08%. The financial revenue is ¥3,135,000,000 and the average annual growth is 27.9% (王瑛, 2010). These income levels show that the area has high activity and there is opportunity for business.

There are around 140 companies in the Heaven Software Center and there is more than 5,000 people working. The types of companies include high-tech companies and network marketing, meaning people working here have high income with high education levels. Figure 49 shows a map of the Heaven Software Center and its surrounding. The map shows a red circle, 800 meter radius, which includes three residential areas, four office buildings, and one university. There is a mix of land use in this area and high density of residents and employees which show that this area has good qualities for car-sharing locations. There is also financial potential for a car-sharing business to succeed due to the area's yearly revenue. There are 5,000 people working there and not enough parking spaces. (杭州高新技术产业开发区资产经营有限公司). The lack of parking space in the building is a good opportunity for car-sharing company since it shows there is a low-vehicle ownership from workers in this area.



Figure 49: Heaven Software Park

Location 4		
#	Name	Description
1	Heaven Software Center	Office building
2	Hangzhou Digital Industry	Office Building
3	Maojiaqiao Apartment	Office Building
4	Hangzhou Radio and Television University	University
5	Cui Yuan New Village	Residential Area
6	Qinglong Village	Residential Area
7	Zhejiang Era Electronic	Office Building
8	Dengyun Road Residential Area	Residential Area

Figure 50: Heaven Software Park Key Locations

Location 5 - Xiaoshan

Xiao Shan district is located south of Hangzhou and has a population of 1,209,935 people; which is the largest of all Hangzhou's districts (百度百科, 2011). Xiao Shan International Airport, the only airport located in Hangzhou, is located in this district. Hangzhou South Station, one of two train stations located in Hangzhou, is also located in Xiao Shan district. The total area of this district is 1420.22 square kilometers. This area contains 2,485 corporate businesses, 1,427 service-corporate businesses and 147 big markets (百度百科, 2011). This area is big in size and population compared to other districts in Hangzhou, therefore there are many potential customers for car-sharing. Xiao Shan also has a tourism income of ¥10.8 billion (百度百科, 2011). Most of the tourism in Xiao Shan district is due to the Qiantang River and Shu Mountain, which are natural attractions. The average income of people is ¥129,529 per year (百度百科, 2011). There are 118 bus lines, 1168 buses and 778 taxis in Xiao Shan (百度百科, 2011). These transportation methods show that the area has good transit access.

Xiao Shan has many modes of transportation and therefore there is a heavy flow of people. The selected radius in Figure 51, of 500 meters (e 都市, 2011), is between the train station and the airport. This area is convenient for car-sharing because it offers people to drive to the station or airport to pick up someone. Near this area, there is a square, three office buildings, one residential area and three government apartments, which are shown in Figure 51. The variety of locations in this area would provide a variety of potential customers for the car-sharing service.



Figure 51: Xiaoshan

(e 都市, 2011)

Location 5		
#	Name	Description
1	Government of Xiaoshan District	Government Office
2	The Court House of Xiaoshan	Government Office
3	Service Center of Government	Government Office
4	Xinyi Building	Office Building
5	International Business Center	Office Building
6	Dikai Building	Office Building
7	JinpumingYuan	Residential Area

Figure 52: Xiaoshan Key Locations

Location 6 - Huanglong Stadium

Huanglong Stadium is located in Xihu district which is in the downtown of Hangzhou. The Huanglong Stadium is located West of the Hangzhou Tower, and north of the West Lake. Due to its location, the Huanglong Stadium has many advantages for a car-sharing station. West Lake is a touristic place that attracts many people. The Zhejiang University, Zhejiang Library and Zhejiang World Trade Center are in this area. These three places are the important places of education, culture and business of Hangzhou. Many lectures, shows and exhibitions are held at these locations. As a big tourism center, transportation is convenient and people usually walk to their destination. Currently, there is a bus station center, a car rental company and three future subway lines.

The main attraction in Xihu district is Huanglong Stadium. Since the area is near the West Lake, people may use car-sharing to travel around the West Lake. The stadium is also near a university campus with 39,000 students and workers (百度百科, 2011). Students may travel in groups to different destinations. Having a station near the Zhejiang World Trade Center opens the opportunity of attracting business members. A big electronic market, Bainaohui is also located near the stadium. This market creates opportunity for employees to deliver goods.

Figure 53 shows a map of this area, with a 700 meter radius red line. There is a time square, three office buildings, one residential areas and three government apartments. Right outside this radius there is a government apartment which also can bring potential customers for car-sharing (e 都市, 2011). Having a station near government property may build relationship with different departments of the government. Having a car-sharing station near

Huanlong Stadium, an area with high population density will provide good publicity about the car-sharing system in Hangzhou.

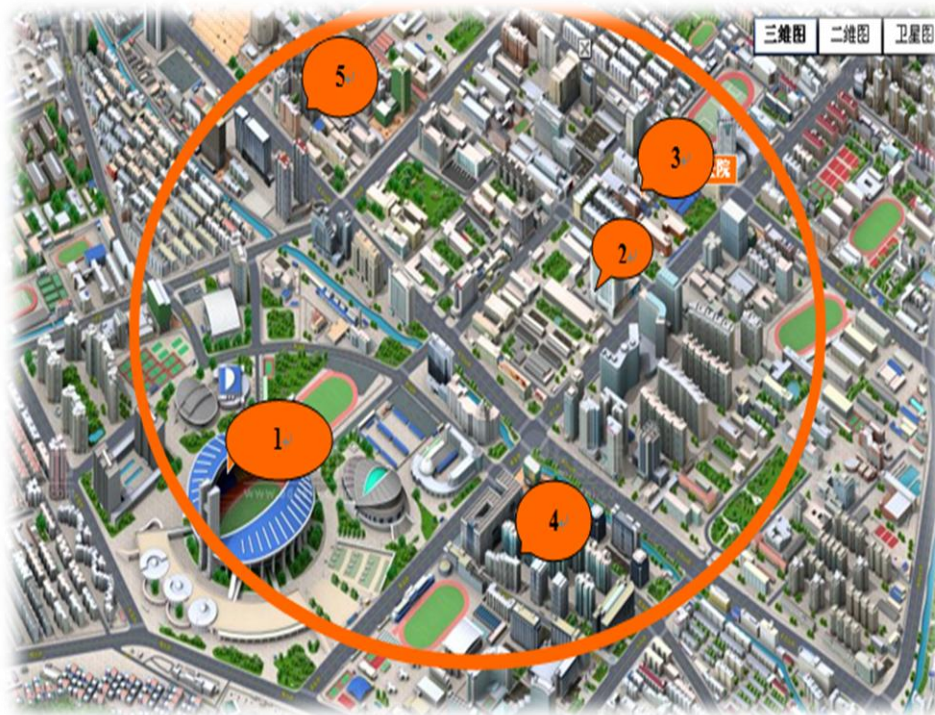


Figure 53: Huanglong Stadium

Location6		
#	Name	Description
1	Huanglong Stadium	Stadium
2	Bainaohui Market	Electronic Market
3	Tongji Hospital	Hospital
4	Huanglong	Residential Area
5	Huahong Building	Office Building

Figure 54: Huanglong Stadium Key Locations

Location 7 - Gongshu

The size of Gongshu district is eighty-seven square kilometers and it is very close to the downtown. The population of Gongshu is 600,000 and there are ten sub-districts, forty administrative villages and ninety-two communities with 383 companies and twenty-four markets. 80% motor industry in Hangzhou is found in this district. Since many auto repair shops and several vehicle dealerships are located at this location, it would be convenient to have a car-sharing location close by (拱墅区人民政府, 2011).

Gongshu is an important district of Hangzhou because people with high income live in the many residential areas. Individuals with cars may sell their cars due to the cost savings motivation provided by car-sharing. Our target customers for this area are the high-tech businesses and the government buildings. Savings in fuel, maintenance, insurance, and reserve parking, are factors that may attract these organizations, while avoiding the difficulties of vehicle ownership.

Figure 55 shows a map of Gongshu district and a radius of 400 meters for the potential locations of car-sharing stations (e 都市, 2011). There are not many available parking spaces near the high tech business center (location 2 on the map); therefore the circle is near the residential areas, making parking space more available. There are three residential areas, one office building and business center shown in the map meaning we can target different groups of people.

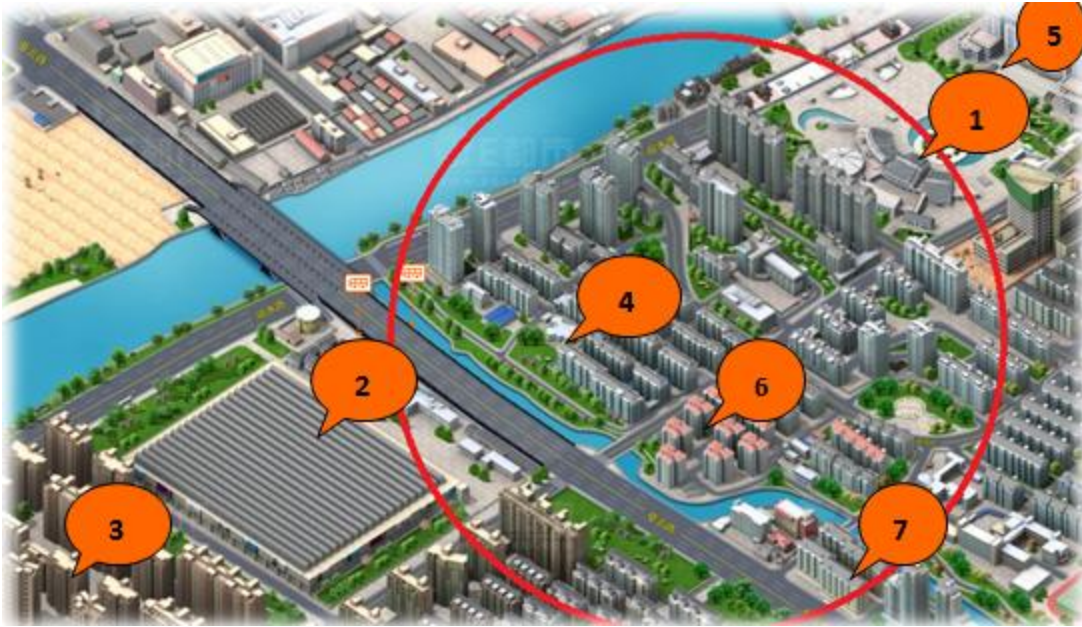


Figure 55: Gongshu

Location 7		
#	Name	Description
1	Yunhe Square	People's Square
2	Silian Creation Center	High-tech Business Center
3	Dengyunge Residential Area	Residential Area
4	JingchangwenhuaYuan Residential Area	Residential Area
	Gongshu district	Government Apartment
6	YuxingYuan Residential Area	Residential Area
7	Lihua Building	Office Building

Figure 56: Gongshu Key Locations

Location 8 - Lingwu Office Building



Figure 57: Lingwu Office Building

Location 8		
#	Name	Description
1	Lingwu Office Building	Office Building
2	Sanxin Community	Residential Area
3	Qingchundushi Community	Residential Area
4	Jingfang Community	Residential Area
5	Nanxiaofuwen Community	Residential Area
6	Zhejiang University	University
7	Times Square	Square

Figure 58: Lingwu Office Building Key Locations

Lingwu Office Building is located in Jianggan district which is near to the downtown of Hangzhou. Jianggan district is found at the north of the Qiantang River, and across the river is the Bingjiang district. There is a bridge, Qianjiangsan Bridge, which connects the two districts together. This facilitates mobility for many people living in Jianggan districts that have to work

in Binjiang district. To the east is Beijing-Hangzhou Canal which is very important for the district's economic wealth.

Figure 57 shows a map of the surrounding area of Lingwu Office Building. The figure shows a red circle, a selected area of 500 meters as the radius, which covers four communities, one university and one office building. The house price of the four communities is high, so most of the people living in this area of Jianggan district have high income. They may be more willing to accept the price of car-sharing. The university is the most famous one in Zhejiang province, and the students there have low-vehicle ownership levels. This target group can use car-sharing to meet their special demand, just like shopping or having a party with their friends on weekends. It will be convenient for the car-sharing business to put a car in this university campus due to its high population. The companies in the Lingwu Office Building are banks and new energy companies (E 都市, 2008). People who work here have a strong consciousness to protect the environment and therefore would like to use car-sharing.

About five kilometers from the Lingwu Office Building, there are two very important transportation hubs. To the north-west there is a train station, Hangzhou Train Station, and to the south-west there is a bus station, Hangzhou South Bus Station. Having this transportation stations near this area increases the changes of people using car-sharing. The people here can use car-sharing service to pick up or send their friends to each station. There are also two hospitals to the north of the Lingwu Office Building and two big super markets. Both of these locations have a high transit density, meaning that the area has important car-sharing location qualities. There is also a cloth center called Sijiqing Cloth Center which is 526,000 square

meters, and it is the biggest cloth center in Hangzhou (百度, 2010). People can also use car-sharing service for shopping, or moving around this area after going to these attractions.

Location 9 - Xiasha

Xiasha is located eighteen km east of West Lake, in the east of Hangzhou. This is a suburban area and it is known as Hangzhou economic and technological zone. Xiasha is thirty-six square kilometers, and area's residential population is 310,733 (Information center of HEDA, 2011). There are fourteen universities with 200,000 students located in Xiasha and many industries have their factories in this zone (Hangzhou Bureau of Statistics, 2011). This area can be considered as a 'special niche' for car-sharing location due to its high student population. Students will be the main target of car-sharing in this area.

People in Xiasha often travel to downtown for different reasons. Due to our surveys, 40% use bus as a transportation method. When taking a bus from Xiasha to downtown, an individual pays ¥4 each way and it takes approximately one hour to arrive there. Car-sharing will benefit people who go from Xiasha to downtown with limited time, since it takes forty minutes to arrive there. This may also be an option for people who go to downtown for shopping purposes since the buses are often crowded. Taxi, which takes the same amount of transit time, will be a competitor for car-sharing. A taxi from Xiasha to downtown costs ¥65 each way, but taxis are hard to find at different times and are not convenient for transportation in downtown at certain times. The surveys conducted in Xiasha show that 70% of people willing to try the car-sharing service and 68% think the government should implement this project.

Figure 59 shows the map of the part we have selected of Xiasha. The figure shows a red circle which is the selected radius for potential car-sharing stations. Inside this radius there are

one supermarket, two office buildings and six residential communities. Wu Mart is one of the biggest supermarkets in Xiasha is shown in Figure 59 and it's the center of the six residential communities. Having a car-sharing station in the center of the town will attract people from all surroundings to use this service for different purposes, such as traveling to downtown or taking groceries to their home. The Hangzhou subway station is under construction in this area, meaning that people from other areas have access to Xiasha. The more people transiting around this area imply the more potential users for car-sharing.

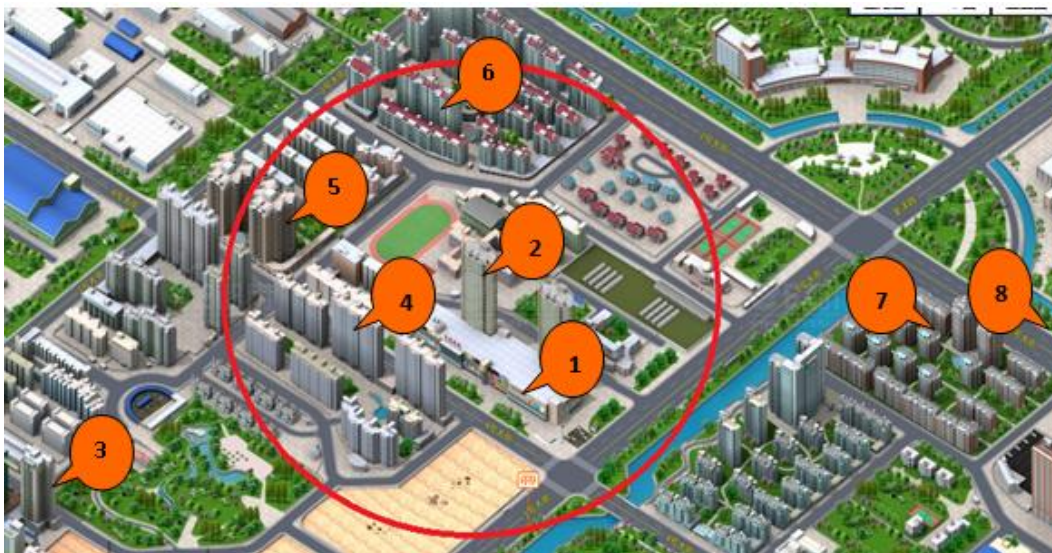


Figure 59: Xiasha

Location 9		
#	Name	Description
1	Wu Mart	Supermarket
2	West sunshine town	Office Building
3	Zhijiang Office Building	Office Building
4	XiangxielihuaYuan	Residential Area
5	Beiyin Apartment	Residential Area
6	Dadu Apartment	Residential Area
7	YueyaYuan	Residential Area
8	Wenze Rode Subway Station(under construction)	Subway Station

Figure 60: Xiasha Key Locations

Location 10 - West City Square



Figure 61: West City Square

Location 10		
#	Name	Description
1	Greentown Jingui Office Building	Office Building
2	YijingYuan Office Building	Office Building
3	Greentown Hospital	Hospital
4	Guihua Town	Residential Area
5	Technological villige	Residential Area
6	ZiguihuaYuan	Residential Area
7	Luojiashuang	Residential Area
8	MingshijiaYuan	Residential Area
9	YijingYuan	Residential Area

Figure 62: West City Square Key Locations

West City Square, part of Xihu district, is located in the west of Hangzhou, and it is also in the downtown. The total area is 18,000 square meters (罗建, 2011). In this area people can shopping, go to entertainment places, relax, do sports and visit the scenery. It is the only

commercial center in the west of Hangzhou. It is five kilometers from West Lake and Xixi Wetland, and both of the two places are important tourist attractions.

Figure 61 is a map of the West City Square. There are at least 98 companies inside the red circle, which is the radius we selected for car-sharing station locations. These companies are all technical companies and the employees are all with average income levels. Due to their good income, employees are more willing to accept the price of car-sharing than in other areas. West City Square is also a major residential zone with 1,153 households (住在杭州网, 2006). The residents and company employees could be our target customers. This is a good distribution of members since residents most likely will use car-sharing in the evenings and weekends, and employees are most likely to use the service in working days. The communities and residential areas are new and expensive; therefore most of the people living here have high income to that afford the charge of car-sharing.

5.7.3 Parking Analysis

A reserved parking space for each vehicle is part of the car-sharing operator system. This parking space provides its users where to pick up the car and have it returned. Picking the where the car should be parked is an important aspect of running a car-sharing organization and this location may determine potential members. To obtain maximum optimum unitization should be the key when deciding the pods location. “Locating pods simply because parking is free or cheap and easily available is a recipe for long-term disaster” (City CarShare, 2005). In the case of Hangzhou the parking space location will be determined by government departments due to the city laws and regulations.

There are several criteria for locating parking spaces. Vehicles and pods are the most important marketing tools for an operator; therefore visibility of these resources is important when selecting the parking space. In any transit station members and passing pedestrians should clearly see the station. Underground spaces are not good locations to park the car-sharing car due to the lack of visibility. The parking structure is also important when selecting the parking space because the cars should be parked in the entrance of the place. Locating them close to the entrance also helps for advertisement purposes (City CarShare, 2005).

Another important factor to consider when picking the parking location is the parking facility access. The parking facilities should never close at night or have limited access to residents or employees; they need to be accessible 24/7 (City CarShare, 2005). This factor is important for customer convenience when accessing the vehicle.

Cost is also an important factor to take in consideration when picking the parking location. It is important to consider the extra revenue that is generated from well-located parking spots. This extra revenue may cover additional costs (City CarShare, 2005). In many

situations, transit agencies, developers and businesses will be providing free parking for car-sharing. There are several good parking sources that will contribute to the company's cost savings for parking: developers, transit agencies, stores and other businesses, individual members and private parking operators (City CarShare, 2005) .

It is also important to be aware of locations that are considered illegal parking, such as on-street spaces and small lots in busy commercial districts. If the company isn't aware of legal issues concerning parking, there may be financial problems in the future. Another way to avoid illegal parking is to get support from lot owners and local parking enforcement agencies. In the case of Hangzhou City, to get support for the Public Transportation Group is essential for this project. These connections create more convenient access to the car for members.

Chapter 6: Discussions and Recommendations

The overall project posed many significant challenges in finding valid ways to allow car-sharing implementation in the city of Hangzhou, China. We analyzed many key features about car-sharing from its social impacts, marketing aspects, financial analysis, technological aspects, locations analysis, and the overall risks of implementing such a system. Some of the data was easier to analyze by using Zipcar Inc. business models and other data that was unattainable was analyzed using our own techniques that we found to produce valid solutions. Overall, we created a baseline of what needs to be done on Hangzhou in order to accept the car-sharing service. But we still have many recommendations on other aspects that need to be further researched and developed in order to make car-sharing in Hangzhou the way of the future.

6.1 Risks of Implementing Car-sharing

A major risk that a car-sharing organization faces is the pressure to expand their services geographically and programmatically (City CarShare, 2005). Demand may arise in nearby cities and towns, but to over commit in other areas, without analyzing the location may bring future problems to the company. Even though this business plan show good business possibilities, the proposal need to be analyzed such as previous locations. Making a decision because official, transit agencies or citizens believe expanding is necessary is the wrong thing to do. Having people, who are not familiar with the business development of car-sharing, make decisions may affect the business since they are not familiar with the factors needed to be consider for the business to succeed. These individuals may think there is a good business opportunity, but different customer targets need to be involved to assure the utilization rate of the cars. There needs to a viable market willing to use this service in order to make a profit.

Bringing new programs such as electric vehicles and special systems for business companies is also a risk to take. Battery electric vehicles raise awareness of car-sharing and give the organization an environmental image by their potential for emission reduction. For the decision analysis of this project, electric vehicles are not introduced to the business plan until year two, and this is if Hangzhou City provides the facilities needed, such as charging stations in different locations around the city. Even though electric cars are a positive look for the car-sharing organization, battery electric vehicle has many disadvantages. Cost is the main disadvantage for the business. Electric vehicles need several hours of charging, most vehicles require up to hours hours to be fully recharged which makes time a loss of potential profit. Since vehicles will be out of service, they are unable to generate revenue which is inconvenient for car-sharing (City CarShare, 2005). This affects the utilization rate of the vehicles and may cause less desirable members of the service. Another disadvantage of battery electric vehicles is reliability of the service it can offer. The technology of electric vehicles is not developed enough to offer independence of the vehicle and this becomes an obstacle to car-sharing success.

Another risk for car-sharing is to implement 'station cars' service, meaning a group of users share one car to commute trips at different times a day. Based on early car-sharing operations in the United States station cars are rarely cost effective and often used by only one group of potential customers (City CarShare, 2005). Station market may work for a niche location for some operators, but particularly if the employer is willing to cover the cost. This method is not the best function because it has a limited market compared to other opportunities of car-sharing.

One-way trips are another risk that car-sharing faces and it's recommended not to do when introducing the system to a community. One-way trips are often requested by members since it can be a constraint for many users to return the car to the same location where it was picked up. The company should not over commit to the customer demands. The one-way trips option provides practical difficulties for the business. To avoid imbalances at a particular location, staff would have to relocate the vehicle which is expensive for the company and time consuming. One-way trips would also complicate reservations, and the reserved parking spaces would need to be greater than the number of vehicles.

Picking wrong locations to build a car-sharing station is another risk a car-sharing company faces when giving their customers the opportunity of car-renting similar to car-ownership experience. Customers will often demand cars stations near a convenient location for them, but this should never be the reason of locating a station. Different criteria, such as high density, mix of land uses, good transit access, low-vehicle ownership and financial sustainability, need to be considered for car-sharing stations.

If the car-sharing station is located in an area with low density, then the company will not generate the approximate revenue to succeed. To generate revenue and customer satisfaction should be the car-sharing company's main goal, if this isn't accomplish then the company will face negative results. Another risk when picking a location is selecting an area with no mix of land uses. In other words, there is no balance between different target customers. This balance is needed to assure the utilization rate of the customers, since different groups of individuals may use the vehicle for different purposes and at different times. To maximize the probability of potential customers, the car-sharing station should be in an area

with good transit access. This is a risk for the organization since an area with different transportation modes doesn't always imply potential customers. For example, it wouldn't be useful to have a station next a bus station, if all potential customers transiting the area do not own a driver license. Therefore, the area should also have low-vehicle ownership. These imply households with only one car, or no car but the individuals own driver licenses. An analysis of the area will need to be done in order to know if car-sharing will be a business in certain communities. Private automobiles are car-sharing's number one competitor, therefore it is important for a community to have the need of alternative transportation options

6.2 Financial Recommendations

To analyze the profitability of car-sharing we prepared a financial plan for a car-sharing service in Hangzhou. We determined what kinds of costs that the business would have and found data on those costs. Taking these costs into consideration and the information we obtained through our surveys we came up with a price scheme for the car-sharing service. We recommend that every new member is charged a onetime application fee of 200¥ as well as a 2000¥ security deposit. The application fee will be used to cover the costs related to new members such as background checks and outsourcing the membership card production. The security deposit will be kept until the customer decides to no longer be a member. Revenue will be generated through the interest income on the security deposit. The security deposit will be used to cover any costs related to accidents and theft. The main source of income however is the per hour charge. Our team recommends to have a 40¥ fee per hour. This price will make car-sharing a very realistic option of transportation for many people. We did not include a per distance fee for the service. In the future a combination of per hour and per distance charge can be used if found more profitable.

The main competitors of car-sharing in Hangzhou will be private cars and taxis. To be able better compete with these competitors we have some suggesting for the car-sharing service. We found out that if a customer wants to travel a place and spend more than couple of hours there, taxi becomes a cheaper option. To be able to compete with taxi the car-sharing service could offer cheaper per hour charge after a certain amount of hours. For example after the fourth hour the hourly fee can go down to 30¥. This price could be justified with the cost reductions that can be achieved through partnerships.

6.3 Partnership Recommendations

Partnerships are recommended when introducing car-sharing into a community because the business rarely succeeds in isolation (City CarShare, 2005). Participation with transit agencies, parking authorities, and cities in car-sharing can bring a successful operation for the business. Benefits of partnership include: funding, parking, advertising space, and more. The benefits from other organization's support help the car-sharing business have a better financial outcome in the long-run.

Funding, such as usage fees and grants, can be used for either for general operating support or specific projects. In order for an organization to qualify for funding the business plan should establish principles of the organization and answer critical questions, including expenses of the organization. Many government agencies have funded costs at the beginning of car-sharing operations (City CarShare, 2005). We recommend that car-sharing in Hangzhou to be government funded since it has brought a lot of benefits for bicycle sharing in Hangzhou.

Partnerships with parking authorities are recommended for this project since most of our locations are located in downtown where parking is of high cost. Partnership with Public Transportation Group in Hangzhou City will bring enormous cost savings to the company since the group owns the land for parking space. Parking partnerships will often provide ideally free use of land or discounts. If the car-sharing company accomplishes to get these benefits the company will break even sooner, bringing more revenue to the company, as well as a faster expansion of the service.

It is important when introducing a new concept to market the service to individuals. It is recommended partnership with companies for advertisement and publicity purposes. As seen in the bicycle sharing service provided in Hangzhou, high income is generated from

advertisement done by private companies; the stations provide three form of advertisement. If other companies are willing to advertise for car-sharing as well, this partnership will save cost to the car-sharing company as well as for the private company. The money saved will come from discounts due to the partnership, or even free publicity.

Partnership with organizations, such as listed above, can also bring potential business members. In locations around suburban areas, it was recommended stations to be near government offices. If government offices become a business member of car-sharing, the business will provide revenue and can accomplish a major improvement to the organization's membership. Hangzhou City has at least 50 different departments, which involve a large number of employees.

6.4 Relationship between Price and Demand

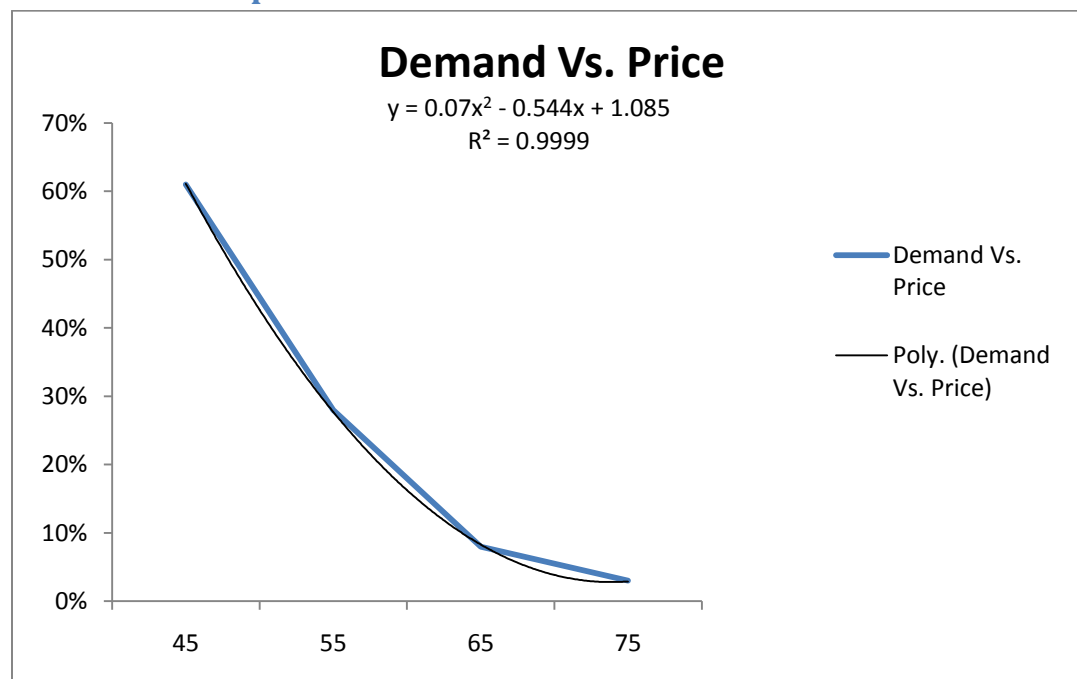


Figure 63: Demand vs. Price

A polynomial function shows the relationship between some variable to another variable with few restrictions limiting its behavior (Wikidot, 2011). In the case for Figure we are comparing the relationship between price and demand of car-sharing in Hangzhou. We selected this regression type since polynomial functions tend to contain no discontinuities in their behavior, have distinct slopes or features, and have multiple behaviors that approach infinity. The input variable, in this case x = price, was selected from the survey options in question 9 found in Appendix A. Since the pricing options varied from $<¥50$ to $>¥81$, we decided to select numbers to pick the numbers in the x -axis between this range.

The equation $y = 0.07x^2 - 0.544x + 1.085$ is a sum of three terms, and it shows that the degree of the polynomial function is 2. The degree is really important in a polynomial function since it shows the number of possible roots, or x -intercepts (Wikidot, 2011). A degree 2 graph is in the form of a parabola. We selected a polynomial function since the graph is half a parabola and due to its even exponent it doesn't go forever in both directions. The y stands for the percentage of people who are willing to pay a specific price. This formula is useful since it helps see a price scheme of the car-sharing service.

We also calculated the weighted average of these prices. "An average in which each quantity to be averaged is assigned a weight (Investopedia, 2011) ." The selected values were the prices and the occurrences were the percentage. The weighted average we calculated from the percentages in Figure 16 is 50.3. This value will be influenced depending on the amount of surveys being responded.

We recommend that before implementing a price for car-sharing service to do a further study of this graph, as well as more surveys to get a more precise weight average. The

relationship between price and demand can be a basis pricing strategy in the future. If we analyze this graph from a good business perspective, we can pick a higher price than the weighted average since people are willing to pay high for a good service.

6.5 Reflections on the Design Process

In order for a car-sharing service to succeed, the locations for the car stations need to be selected very carefully. The network of car stations provides the backbone of the car-sharing service system. The stations should be located in places where it can attract enough business to generate profit for the company. The number and the locations of these stations need to satisfy these demands. We designed a process for selecting locations for the car-sharing service in Hangzhou to meet these needs. The following figure is a representation of our network design process. Firstly, we tried to forecast the demand. Using this information we estimated the number of cars and stations that would satisfy this demand. Then we selected the criteria that should be used in order to determine the locations. Finally, we selected locations where having a car-sharing station would be plausible.



Figure 64: Network Design Process

Forecast the Demand

Hangzhou is the capital of Zhejiang Province and the center of economy, culture, science and education. As for 2020, the permanent population should be around 9.3 million, the urban

household population around 8.2 million (City Planning Board, 2001). Several surveys were conducted around Hangzhou in order to estimate how many potential customers would be interested in the service and what group of people will be willing to use it.

We decided that it would be helpful for our project and our sponsors if we identified some characteristics of the population in Hangzhou. We prepared a survey that would help us understand the opinion of potential customers towards car sharing. We asked questions on the background of the customer as well as their opinions about the service. We surveyed people at tourist attractions, supermarkets and busy streets. This way we aimed to get a mixture of the population in Hangzhou. These surveys helped us to decide whether implementing such a service in Hangzhou would be successful or not. It also helped us to come up with a price scheme for the service. The overall data that we obtained from the surveys helped us better analyze the feasibility of car sharing in Hangzhou.

The surveys were conducted in downtown, as well as in suburban areas. Due to time constraints and limitation, surveys were not conducted in all areas of Hangzhou. Looking at comments and responses from individuals from different sex, age and purpose of transiting Hangzhou, helped us select several areas. Hangzhou Tower, West Lake area and Xiasa were three areas where surveys were conducted. The survey responses in these show high interest for car sharing and many people thought introducing an alternative transportation was a great opportunity for the city to decrease its traffic crisis. However, we also noticed that many people were not familiar with the idea of car-sharing.

To estimate the number of members at the end of the first year of the car-sharing service in Hangzhou, we looked at the financial plan of Zipcar. Zipcar had 440 members at the end of its

first year. This number grew very slowly over the next five years. Our team thought that since car-sharing is now a mature business plan and since Hangzhou has more than ten times of the population of Boston, the number of members will increase much faster. We wanted to be conservative with the beginning number of members since the car-sharing idea is very new in China. We decided to have 500 members at the end of the first year and assumed that this number will be doubled at the end of every year. Based on these numbers we calculated the number of cars and stations we will have and prepared a financial plan.

We have also looked at other alternatives. What if we have 1000 or 2000 member at the end of the first year? The fact that the bike-sharing service has five million members in Hangzhou shows that there might be a greater number of potential customers for a car-sharing service. If only 1% of these members use car-sharing then the business would have 50,000 members. We looked at different scenarios with different number of beginning members and the impacts on the revenue, cost and the rate of return. This brief what-if analysis can be found in section 5.6.1.

Calculate the Number of Cars and Stations

In a car-sharing service, coming up with the correct amount of cars to implement into a city and how to go about analyzing a city's demographics to figure out the correct number can be difficult. In order to get an estimate on how many car-sharing will be needed to accommodate for the population we looked at the cities that Zipcar has cars in. We looked at each city's population and the number of zipcars available in each city. We tried to compare cities that have similar populations to Hangzhou. We compared New York to Hangzhou because

both cities have very similar populations. However, New York is a city where Zipcar hasn't fully grown yet and has a very low zipcar : population ratio. This is why we think that the population to zipcar ratio in New York is not a good indicator for Hangzhou. Therefore, we calculated the population per zipcar in each city and averaged those numbers. We used that average to come up with a number of car-sharing vehicles for Hangzhou. We estimated that when the car-sharing service reaches maturity in Hangzhou there will be around 1800 cars. This calculation doesn't factor in the maturity of Zipcar in the cities. The details of these calculations can be found in section 5.4.4.

During our research we found a study on car-sharing services done by the Institute of transportation Studies UC-Davis. This study suggested that "although precise member-to-vehicle ratio data are not available for car-sharing organizations worldwide, average national ratios are approximately 20:1 and are lower in new markets in which operators must first position their vehicles to gain membership". Based on this information we decided to use a 10:1 ratio for the first year, 15:1 in the next three years and 20:1 in the fifth year. We estimated the number of members at the end of year one to be 500. With the 10:1 ratio, we decided to have fifty cars in the first year.

To calculate the number of stations we would need in the first year, we looked at the number of cars Zipcar has in its stations. The number of zipcars in each station range from two to fifty. However, expect for the very central locations zipcar has only a few cars in each station. We decided to have no more than five cars in each station in Hangzhou. Since we decided to have fifty cars, we came to the conclusion that ten locations would be sufficient. We think that the number of cars in these stations can be adjusted after the first year performance results.

Having more than ten cars has several advantages and disadvantages. Having more locations would mean better publicity for the company. Locations will spread to a larger area and reach more people. This would help advertise the car-sharing idea better. Also at the end of the first year, the company would have performance information on more locations if there are more than ten locations. A disadvantage of having more locations is the financial burden on the company. Parking spaces can be expensive and troublesome to obtain. Each parking lot would add to the initial investment required to start the business.

Identify the selection criteria

Car sharing is a unique source of transportation for individuals and businesses. It provides transportation for people who do not own a car and allows them to do occasional trips. Car sharing service is ideal for individuals who own a car and drive fewer than 5,000 miles a year. This method is convenient for those individuals, since it provides cost savings. Businesses can benefit from car sharing by making it a transportation option to their employees. In order for a car sharing organization to succeed, the potential locations need to have several qualities. "High density, a mix of land uses, good transit access, and already-low vehicle ownership levels are important if car sharing is to be viable." All factors are equally important when introducing car sharing into a community (City CarShare, 2005).

Density is the first quality to take into consideration in an area when determining the viability of that location. When providing car sharing as an alternative to car ownership, it is convenient to have a wide array of potential customers. It is also important to consider that households living in dense neighborhoods tend to own fewer cars (City CarShare, 2005). Areas with high density indicate quality of transit, a pedestrian environment, and local shops and

services. These qualities make car-free lifestyle a realistic option for local residents. High density locations are more convenient for car sharing than low density locations due to the greater number of nearby destinations and the shorter trips (Transit Cooperative Research Program (TCRP), 2005).

Urban neighborhoods that are dense offer the best potential locations for car sharing. These neighborhoods include characteristics such as mixed-use development, scarce parking, and good transit. It is difficult to establish car sharing without these elements. Low density areas are most likely to not have convenient transit service which makes it difficult to serve different modes of transportation. If the potential locations have low density, then the company will have to spend more money in marketing and outreaching customers.

Another important factor, when introducing car sharing, is to have land for both residential and commercial purposes. This mix of land uses is important to ensure that cars are utilized enough to make a profit. These lands are also beneficial in terms of having a variety of customers. Business members have an important role in increasing utilization rates and evening out the demand cycle since they tend to use car sharing during work days (Transit Cooperative Research Program (TCRP), 2005). On the other hand, other people use car sharing for personal trips either on evenings or weekends. With different demand patterns, mixed-use neighborhoods can attract both business and individual members. If there is a variety of customer then the cars will be efficiently utilized most of the time. This helps avoid sharp periods of peak demand.

Even though car sharing has many benefits, it is usually not the best type of transportation. Another quality of a possible location is to pick an area with good transit access.

Car sharing will be introduced as another transportation alternative besides transit, taxis, rental cars, walking, cycling, and more. These areas usually have a heavy flow of people. Having a car sharing location at these locations would provide great publicity and numbers of potential customers.

Low vehicle ownership, another key location quality for car sharing to succeed, indicates that the area has potential car sharing users. Car sharing is most likely to succeed in areas where people cannot afford to have a car but need mobility and travel choices. This quality makes car sharing a realistic option for many households. Since car sharing includes fuel, maintenance, insurance, and reserve parking, members will save money and continue avoiding the difficulties of vehicle ownership; these are the key attractions for car sharing users.

Vehicle ownership is also a competitor for car sharing organizations. Car owners are the largest potential market for car sharing, and it is important to attract these individuals to achieve environmental and social enhancement (City CarShare, 2005). In order for car sharing to be successful both financially and environmentally, having a population with low vehicle ownership is important. Car sharing also encourages individuals to sell their cars since users are motivated by the cost savings provided by the system. Therefore, areas with people who are willing to sell their cars, car-free households, and people who are thinking about buying a car are the potential target markets for car sharing.

According to City CarShare, there are some 'special niches' where car sharing are likely to succeed. Car sharing may work with lower densities in special niches such as transit stations, university campuses and new development areas. Having car sharing stations near transit stations gives the option for those members that transit in the surrounding neighborhoods.

Stations in university campuses will attract the younger population and are the center of activity for this market. Car-ownership is usually restricted in university campuses due to the lack of parking space or university rules. New development areas are another 'special niche' for car sharing since businesses are potential customers for the service. In these areas, car sharing helps reduce parking demand and developers are often willing to include car sharing in their projects (City CarShare, 2005).

Taking these four key factors, high density, low vehicle ownership, transit locations and mix of land uses, our team has come up with several locations in Hangzhou that would be plausible for implementing car sharing in Hangzhou.

Choose the Locations

Our team has selected ten locations were selected to implement car sharing stations into Hangzhou and its communities. The selection criteria were taken into consideration to select these locations.

Seven locations were selected for downtown of Hangzhou: Qingchun Square, Hangzhou Tower, Heaven Software Park, Huanglong Stadium, Gongshu district, Lingwu Office Building. All locations share similar characteristics. There is high potential for car-sharing to succeed in downtown due to its high density at all times. People enjoy moving through downtown because of its high activity, and divers' options of restaurants, shopping centers and attractions. The area has a good balance of business and residential potential users for car-sharing. As an advantage for car-sharing, traffic is a problem in downtown and as a transportation alternative it has potential to be attracted to many users. As for the negative aspects, parking space is expensive in downtown compared to suburban areas. This cost affects picking the location.

We analyzed future financial outcome of the station location, and how demand will eventually balance the parking cost. We recommend doing this cost analysis when deciding to expand the number of cars in each station, or to increase the number of stations in one area. Purchasing a parking space in downtown costs around 400,000¥ (Pu, 2011). The rent for such a parking space costs 5% of the purchasing price. Therefore, we calculated the parking fee per car per year to be 20,000¥. Partnerships with parking authorities are recommended for this project since most of our locations are located in downtown where parking is of high cost. Partnership with Public Transportation Group in Hangzhou City will bring enormous cost savings to the company since the group owns the land for parking space. Parking partnerships will often provide ideally free use of land or discounts. If the car sharing company accomplishes to get these benefits the company will break even sooner, bringing more revenue to the company, as well as a faster expansion of the service.

Three locations were selected to implement car sharing in Hangzhou's suburban areas: Binjiang, Xiaoshan and Xiasha. The target customer for this area is different than in downtown. Suburban areas in Hangzhou have high population of university students, business employees and residents. This involve a young population, therefore a lot of this individuals do not own drivers licenses or may only need a car on the weekends. The 3 locations have high density, mix of land uses, good transit access, low-vehicle ownership, and financial sustainability; therefore they show potential for car sharing to succeed. There are many government office located in suburban areas, as shown in the location analysis. Having government officials be our potential customers, open many opportunities for car sharing. Parking space is also cheaper in suburban

areas than in downtown, therefore there is a balance in parking space cost and revenue for these areas.

Each location in the analysis shows a radius for potential parking stations. We were not able to come up with exact parking locations due to several reasons. Constructing parking lots requires special permissions from different government departments. For example, the police department needs to approve the parking location in order to make sure it doesn't block the view of any security cameras and obstruct the police department in any way. We were not able to get in touch with the departments in order to make a deeper analysis on the parking lots. Also we were able to obtain specific information such as population and income levels of some areas to be able to do a comparison. To be able overcome these obstacle we would need more time.

We recommend taking the ten suggested locations into consideration if a car-sharing service is to be implemented in Hangzhou. Also we suggest that the selection criteria we came up with to be improved and used to select future locations. Picking locations, such as 'special niches' or without any analysis are risk taking decision that the company will have to face in the future. If the locations are selected without a rational analysis, the company may face more expenses than expected and generate loss.

6.6 Suggestions for Future Studies

The analysis of car-sharing feasibility study in Hangzhou has brought us numerous sources of information we need in order to successfully implement a car-sharing system in the city. It has also led us to realize that there can be much more research analyses done in order to further analyze the future opportunities of car-sharing in Hangzhou.

1. Examine more models of electric vehicles and analyze future development of the electric cars to see if it will be a suitable vehicle for car-sharing's future. Go beyond Zoyte and see what other manufacturers are providing. A more detailed analysis on the feasibility of electric cars should be done.
2. Future analysis can provide a more detailed analysis of how many cars should first be implemented, how to go about finding the exact locations and the number of vehicles in specific location.
3. We have several estimations for cost information in our financial plan. More detailed cost data can be found for the financial analysis. This would provide a more accurate financial plan.
4. The financial analysis can look more specifically into how much profit is made per hour of car-sharing. Meaning analyze how much fuel, insurance, membership fees, etc. is deducted for one hour of car-sharing in order to find the most optimal per hour charge.
5. To capture the population's opinions on car-sharing better, surveys can be conducted on a larger sample size. New questions can be added into or current questions can be improved to get more specific results.

Appendices

Appendix A: Sample Survey

Location: _____

Date: _____

Car-sharing Service Questionnaire

Definition of car-sharing: Car-sharing service is a car rental model where people can rent a car for a specific amount of time.

1. Gender:

☐ Male ☐ Female

2. Age:

☐ 18-25 years ☐ 26-40 years ☐ 41-50 years ☐ >50 years

3. Do you drive or have a driver's license?

☐ Yes ☐ No

4. Are you a:

☐ Resident ☐ Tourist ☐ Other: _____

5. If you are a tourist, what form of transportation do you prefer?

☐ Car-sharing ☐ Renting a Car ☐ Taxi ☐ Other: _____

6. What are your monthly transportation expenses (including maintenance for private cars)?

☐ < ¥100-150 ☐ ¥150-300 ☐ ¥300-450 ☐ ¥450-600 ☐ >¥600

7. Your primary form of transportation in Hangzhou (check all that apply):

☐ Car ☐ Taxi ☐ Bicycle ☐ Walk ☐ Bus ☐ Other: _____

8. If a car-sharing service was provided, would you be interested in using it?

☐ Yes ☐ No ☐ I do not know, why: _____

9. How much would you be willing to pay per hour for car-sharing service?

☐ <¥50 ☐ ¥50-60 ☐ ¥61-70 ☐ ¥71-80 ☐ > ¥81

10. Do you think the Hangzhou's government should implement a car-sharing service?

☐ Yes ☐ No ☐ Not sure, why: _____

Appendix B: Excel Data for Survey Results

Question 1 Gender	Male	Female			Total Surveys	414
	240	174				
Question 2 Age	18-25	26-40	41-50	>50		
	186	188	22	13		
Question 3 License?	Yes	No				
	194	220				
Question 4 Are you A?	Resident	Tourist	Other			
	204	74	136			
Question 5 If Tourist?	Car Sharing	Rent Car	Taxi	Other		
	40	13	45	48		
Question 6 Expenses?	100-150	150-300	300-450	450-600	>600	
	185	106	44	17	62	
Question 7 Transportation	Car	Taxi	Bicycle	Walk	Bus	Other
	72	104	104	88	258	33
Question 8 Interested?	Yes	No	Don't Know			
	296	31	86			
Question 9 willing to pay?	<50	50-60	61-70	71-80	>81	
	230	96	28	8	3	
Question 10 Gov't Impliment?	Yes	No	Not Sure			
	286	32	96			

Appendix C: Financial Plan Details

This appendix provides details on the financial analysis. Each source of income, fixed and variable cost are explained individually. This appendix also includes the reasoning behind our assumptions and sources of data.

- **Revenues**

- Customer Characteristics

There were several assumptions that we needed to make before we could prepare a financial plan. According to the research done by Zipcar's founders "mature European companies had found that 50% utilization of each vehicle (i.e., 360 hours per month) was the most that could be achieved if customer satisfaction was to be maintained". This is why Zipcar decided to target 40% utilization at the initial stages of the business. Based on this number, it is assumed that the average member would take four trips per month at an average of four hours and 22 miles per trip. (Myra Hart, 2005) Our team decided to use the same numbers for the car-sharing service in China.

- Beginning Members

This number represents the number of members at the beginning of every year. It is equal to the ending number of members of the previous year. At the beginning of the first year the company has zero beginning members.

- Attrition

Attrition is the percentage of customers that the company will lose every year. We decided to use 15% as attrition like Zipcar did in their financial plan. (Myra Hart, 2005) The beginning

number of members is multiplied by the percentage to calculate how many customers will be lost every year.

- Ending Members

This number represents the number of members at the end of every year. Zipcar estimated that they would have 440 members at the end of the first year and that this number would increase by less than 50% every year. We have estimated to have 500 members at the end of the first year. We picked a similar number because the idea of car-sharing is very foreign in China and we do not expect a lot of members in the first year. Since the population of Hangzhou is more than eight times the population of Boston we assumed that the number of members will grow faster. Our team estimated that the number of ending members will be doubled every year.

- New Members

This number represents the number of new members the company gets in each year. It is calculated by the following equation:

$$\text{Ending Members} + \text{Attrition} - \text{Beginning Members}$$

This number is important because each new member is charged a fee to become a member.

- Average # of Members

This number is calculated by taking the average of the beginning members and ending members. This is done because customers can become members anytime during the year and not just the beginning. This number captures the amount of members the company has better.

- Application Fee (per new member)

This is a one-time fee that every new member needs to pay to become a member. We estimated this fee to be 200¥. This number was decided upon by taking into consideration Zipcar's financial plan and the transportation expenses from our surveys.

- Annual Fees (per average member)

This numbers is the annual fee that every member needs to pay to stay a member. We estimated this fee to be also 200¥. This number was decided upon by taking into consideration Zipcar's financial plan and the transportation expenses from our surveys.

- Per Mile Charge

This is the fee that the customer is charged for every mile he/she travels with one of the company cars. Currently this number is zero; meaning that we will not be charging according to the distance that the customer travels. If in the future this decision is to be changed, it is already incorporated in the financial plan. The income generated by this fee is calculated by the following equation:

$$12 \text{ Months} * 35\text{Km/trip} * 4 \text{ trips/member/month} * \text{Per Mile Charge} * \text{Average \# of Members}$$

- Per Hour Charge

Every customer will be charged depending on the number of hours they use the cars. According to our surveys results 61% of the people said that they would be willing to pay less than 50¥ and 28% between 50¥ and 60¥. The revenue generated is very sensitive to the hourly charge. Based on these results we used 40¥ as the hourly charge. The income generated by this fee is calculated by the following equation:

$$12 \text{ Months} * 4 \text{ Hours/trip} * 4 \text{ Trips/member/month} * \text{Per Hour Charge} * \text{Average \# of Members}$$

- Security Deposits

This is a refundable deposit that will be charged every year. The amount is 2000¥, equivalent of the 300\$ that Zipcar planned to charge their customers. This deposit is very similar to the 200-300¥ that bike sharing service deposit. This money will be kept by the business until the member decides to no longer be a member. Then the money will be returned to the customer.

- Interest Income

This number represents the income that will be obtained from the interest of the security deposits. The simple interest rate is currently 3.1% in China (中国工商银行, 2011). The income generated through the interest on the security deposit is calculated by the following equation:

*Security Deposit (2000¥) * Average # of Members * Interest Rate (3.1%)*

- **Variable Costs**

- Beginning Cars

This number represents the number of vehicles at the beginning of every year. It is equal to the ending number of vehicles of the previous year. The numbers for regular cars and electric cars are tracked separately because the costs associated with them are different. At the beginning of the first year the company has zero cars.

- Ending Cars

This number represents the number of vehicles at the end of every year. The number of ending cars is proportional with the number of customers. According to a study done by the Institute of Transportation Studies the average national member-to-vehicle ratio in car-sharing services is approximately 20:1. It is also shown in the study that this number is lower in markets in which operators must first position their vehicles to gain membership. Based on this information our

team decided to use a 10:1 ratio in the first year, 15:1 ratio in the following three years and 20:1 ratio for the fifth year.

- Average # of Cars

This number is calculated by the taking the average of beginning cars and ending cars. New cars can be added in to the system any time during the year and this number best captures the number of cars the company has at all times. This number is also used to calculate the costs and examples can be seen in the following bullet points.

- Lease Cost (car/year)

This is the cost of renting a car for one year. This number was calculated based on the costs to purchase a Volkswagen Lavida (易车网, 2011). We chose this type of car because it is the most commonly rented car in eHi. Through our research we found that the present value 152,000¥ and the residual cost after five years is 60,000¥ (汽车之家, 2011). The following calculation shows how our team obtained the 20,300¥ lease cost per year.

$$\text{Annual Worth} = (152,000¥ - 60,000¥) * (A/P, 10\%, 5) = 20,300¥$$

Through our interview with Zotye we found that it costs 24,000¥ to rent an electric car for a year. The cost generated by this is calculated for each year with the following equation:

$$\text{Lease Cost (car/year)} * \text{Average \# of Cars}$$

- Access Equipment (car/year)

This cost includes the implementing the RFID system into the cars which is roughly 3,000¥ (Chainway, 2011). Also for electric cars, this number includes the construction of a charging station which is 200,000¥. These numbers are multiplied by the number of regular and electric cars to find the total cost.

- Fuel (car/year)

According to Mr. Zhou's study the fuel for an average car costs 6,000¥. Our team decided that a car-sharing vehicle will be used three times more than a regular car. Therefore we used 18,000¥ as the yearly fuel cost (香港达泰投资咨询有限公司, 2011).

- Insurance (car/year)

The insurance cost for a regular car is 7,300¥ and 8,800¥ for an electric car. We obtained these numbers through our interview with Zotye. From the information that we got from China Pingan, an insurance company, fully insuring a Volkswagen Lavida costs 6,000¥. However, we think that since car-sharing cars will be utilized much more than privately owned cars, the insurance price will be higher. Therefore, we decided to use 8,000¥ for regular cars and 9,000¥ for electric cars.

- Maintenance (car/year)

The maintenance cost includes the cleaning and the basic needs of the car such as oil and tire rotation. For a medium class car this number averages at 4,500¥ (香港达泰投资咨询有限公司, 2011). The maintenance cost also includes the annual inspection fee which is 100¥. This fee is government mandated.

- Parking (car/year)

Purchasing a parking space in downtown costs around 400,000¥ (Pu, 2011). The rent for such a parking space costs 5% of the purchasing price. Therefore, we calculated the parking fee per car per year to be 20,000¥.

- **Fixed Costs**

- Corporate Insurance

Business assets like manufacturing units, trading and service properties are covered under corporate insurance. Emergencies occur unexpectedly, investment on corporate insurance would safeguard the business. From our research online we found out that 4,800¥ is a reasonable price for corporate insurance_(与尔同轩, 2006).

- Reservation System

The business will need a system to keep track of customers, billing and information about cars. A similar software system costs 580,000¥ for the bike sharing service in Hangzhou. Based on this number we estimated that such a system would cost 600,000¥ for a car-sharing service. This cost also includes the incorporation of the Global Planning System into the service.

- Administration

This number includes the salaries of all the employees. The different type of employees include sales managers, marketing manager, operations manager, salespeople, technicians, call center staff, human resources representatives and accountants. The number employees grow as the business grows. The information on the salaries of different positions was researched online (金静敏, 2010). The number of employees was determined by the current employee to vehicle and employee to member ratios of Zipcar. Zipcar currently has a vehicle to employee ratio of 31:1 and a member to employee ratio of 2,170:1. Our ratios are 12:1 and 242:1 respectively. We think that this difference is reasonable in the fifth year of the car-sharing business in Hangzhou.

- Benefits

The company will be providing health insurance and other similar benefits to its employees.

35% of the salaries will be cost of benefits for the company (中国律师网, 2011).

- Office Space

The office space will be rented. Through our research we found that the annual rent for the office space would be approximately 152,000¥ (金静敏, 2010).

- Office Equipment

Our team estimated the initial cost for the office equipment to be around 500,000¥. This number includes the cost of furniture, decoration, printers, air conditioners and other equipment. The cost for the following years is proportional with the number of new employees. Our team estimated the equipment cost per new employee to be 10,000¥. This cost includes desks, chairs, computers and phones (Yueqi, 2011).

- Phone

Through interviews we found out that the phone bill averages around 150¥ per person in a company. To calculate the cost for the phone we multiplied the number of employees with this number.

- Marketing

The cost of marketing is determined to be 700,000¥ each year and the reasoning can be found in the marketing section of our paper.

- Background Checks

Background checks on every new member needs to be conducted in order to avoid unreliable customers. The cost of conducting background checks is determined to be 120¥ (Myra Hart,

2005).

Net Income Before Tax

This number is calculated by subtracting total costs from revenues. It gives insight on the profitability of the business.

- **Cumulative Income**

The cumulative income is calculated to see when the business pays off the initial investment.

The following equations are examples of how cumulative income values are calculated:

$$\text{Cumulative Income (Year 2)} = \text{Income before Tax (Year 1)} + \text{Income before Tax (Year 2)}$$

$$\text{Cumulative Income (Year 3)} = \text{Cumulative Income (Year 2)} + \text{Income before Tax (Year 3)}$$

- **Net Income After Tax**

When the business pays off the initial investment and starts making net profits, the profit will be subject to tax. The tax rate was found to be 25%. Therefore, the net income after tax is 75% of the cumulative income.

- **Initial Investment**

Initial investment is the capital required to start the business and support it in the early stages.

In the first two years of the business there is a net loss. Initial investment is calculated by the following formula:

$$\text{Costs in Year 0} + \text{ABS} [\text{Net Income before Tax (Year 1)} + \text{Net Income before Tax (Year 2)}]$$

- **Internal Rate of Return**

The internal rate of return (IRR) is a rate of return used in capital budgeting. The term internal refers to the fact that the calculation does not incorporate environmental factors (Fiebel, 2003).

The internal rate of return is calculated to decide whether this project is worth investing in. The

calculation was done using the IRR function in excel using our net income after tax values as the input.

Appendix D: Annual Costs of Car-sharing versus Private Car Ownership

Our team compared the yearly cost of owning different types of cars. The cars were classified according to their purchasing prices. The following table shows how this classification was made.

The car grade(according to car price: Yuan)	
low	<50,000
middle-low	<100,000
middle	100,000-150,000
middle-high	150,000-300,000
high	300,000-600,000
luxury	>600,000

The table below shows the yearly cost of car-sharing service assuming the car will be shared for 200 hours. With the hourly charge of 40¥ the cost of sharing a car for 200 hour becomes 8,000¥. Other increased transportation costs include the security deposit, application fee, annual fee and the toll fees.

The Yearly Costs of Using Car-sharing Service	
Costs of Car-sharing Service(200hours and ¥ 40/h)	8,000
Other increased transportation costs	2,500
Total	10,500

The figure below is the comparison of the cost of different cars and their comparison to car-sharing. As seen in the figure different costs such as maintenance, parking and etc. were added to calculate the total cost of owning each car.

These total costs were compared to the cost of car-sharing. These numbers were calculated assuming the cars will be used for 200 hours per year. The cost saving of car-sharing was calculated by the following formula:

$$\text{Yearly Cost of Owning Private Car} - \text{Yearly Cost of Car-sharing}$$

Our team also calculated the break even hour where the cost of owning a private car is equal to car-sharing. This calculation was done through the following equation:

$$(\text{Yearly Cost of Owning Private Car} - \text{Other Transportation Costs of Car-sharing}) / \text{Per Hour Charge}$$

		Various grades of cars in Hangzhou, the average annual cost for keeping a car					
Grade		Low	Middle-Low	Middle	Middle-High	High	Luxury
Type		BYD F3 1.5L	Buick Excelle 1.6L	Shanghai Volkswagen Lavida 1.4L	Guangzhou Honda Accord 2.4L	Audi A6L 2.0T	BMW 7x 730i 3.0L
Price		45,000	92,000	142,000	249,800	389,900	1,018,000
Fuel (Liters/100km)		8.5	10	7.7	11.7	11.7	12.8
Depreciation (depreciation period for 5 years, residual rate of 5%)		8550	17480	26980	47462	74081	193420
Insurance		4,000	4,000	4,000	4,000	4,000	4,000
Annual Inspection		150	150	150	150	150	150
Maintenance Costs		850	1,000	1,200	2,500	3,000	4,000
Fuel (10,000 km / year, 8 yuan / L)		6,800	8,000	6,160	9,360	9,360	10,240
Parking Fee (150yuan/month)		1,800	1,800	1,800	1,800	1,800	1,800
Toll Fees		1,000	1,500	1,600	1,700	2,000	3,000
Total		23,150	33,930	41,890	66,972	94,391	216,610
Cost Savings using Car Sharing		12,650	23,430	31,390	56,472	83,891	206,110
Break even hours		516.25	785.75	984.75	1611.8	2297.275	5352.75
Cars off the road		2.204761905	3.231428571	3.98952381	6.378285714	8.989619048	20.62952381

Bibliography

(n.d.). Retrieved from Cultural Dictionary: <http://dictionary.reference.com/browse/air+pollution>

(n.d.). Retrieved from U.S. Environmental Protection Agency: <http://epa.gov/oar/oaqps/>

(n.d.). Retrieved April 04, 2011, from Ecological Society of America:
http://www.esa.org/science_resources/issues/TextIssues/issue1.php

(n.d.). Retrieved April 10, 2011, from Alpha Online:
<http://www.nutramed.com/environment/carsepa.htm>

(n.d.). Retrieved May 31, 2011, from Waikato Regional Council:
<http://www.waikatoregion.govt.nz/environmental-information/environmental-indicators/Air/Air-quality/air1c-report/>

(n.d.). Retrieved April 10, 2011, from Armstrong Monitoring: <http://30139.vws.magma.ca/nitrogen-dioxide-vehicle-exhaust-detection-equipment.html>

(n.d.). Retrieved April 10, 2011, from Hamilton County Environmental Services:
<http://www.hcdoes.org/airquality/Monitoring/CO.htm>

(n.d.). Retrieved April 10, 2011, from MacroEvolution: <http://www.macroevolution.net/air-pollution-graphs.html>

(n.d.). Retrieved from World Bank:
<http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/EXTEAPREGTOPENVIRONMENT/0,,contentMDK:20266322~menuPK:537827~pagePK:34004173~piPK:34003707~theSitePK:502886,00.html>

(n.d.). Retrieved April 10, 2011, from Espere: <http://www.atmosphere.mpg.de/enid/23b.html>

China Statistical Yearbook. (2004). Retrieved June 09, 2011, from
<http://www.stats.gov.cn/english/statisticaldata/yearlydata/yb2004-e/indexeh.htm>

(2005). Retrieved April 10, 2011, from Bereau of Air Quality:
<http://www.maine.gov/dep/air/monitoring/carbonmonoxide.htm>

City CarShare. (2005). Retrieved August 03, 2011, from Bringing Car-Sharing to your Community:
http://www.citycarshare.org/download/CCS_BCcYC_Long.pdf

Houghton Mifflin Company. (2005). Retrieved 2011, from Cultural Dictionary:
<http://dictionary.reference.com/browse/air+pollution>

Transit Cooperative Research Program (TCRP). (2005, September). Retrieved August 03, 2011, from Car-Sharing: How and Where to Succeed:
http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_108.pdf

- (2006, June 06). Retrieved April 10, 2011, from PPRC:
http://www.pprc.org/hubs/subsection.cfm?hub=1008&subsec=10&nav=10&CFID=3182134&CF_TOKEN=95806902
- Global Health Organization*. (2006). Retrieved July 27, 2011, from
http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf
- Xinhua News Agency*. (2006, August 06). Retrieved June 12, 2011, from
<http://www.china.org.cn/english/2006/Aug/176872.htm>
- (2007, August 25). Retrieved March 29, 2011, from New York Times:
<http://www.nytimes.com/2007/08/26/world/asia/26china.html>
- (2007, January 04). Retrieved April 10, 2011, from World Resources Institute:
<http://earthtrends.wri.org/updates/node/135>
- (2007, June 12). Retrieved June 12, 2011, from China Daily: http://www.chinadaily.com.cn/china/2007-06/12/content_891904.htm.
- (2007). Retrieved 29 March, from New York Times :
http://www.nytimes.com/interactive/2007/08/26/world/asia/20070826_CHINA_GRAPHIC.html#
- China Cost of Pollution*. (2007). Retrieved June 09, 2011, from The World Bank.
- The World Bank*. (2007, February). Retrieved June 08, 2011, from China Cost of Air Pollution:
http://siteresources.worldbank.org/INTEAPREGTOPENVIRONMENT/Resources/China_Cost_of_Pollution.pdf
- (2008, August 21). Retrieved April 04, 2011, from The Encyclopedia of Earth:
http://www.eoearth.org/article/Air_pollution_emissions?gclid=CKbtjv3NgagCFcJx5QodTCdCtA
- (2008). Retrieved June 12, 2011, from
<http://factsanddetails.com/china.php?itemid=392&catid=10&subcatid=66>
- (2008, July 17). Retrieved April 10, 2011, from Espere: <http://www.atmosphere.mpg.de/enid/23b.html>
- (2009). Retrieved April 10, 2011, from Armstrong Monitoring: <http://30139.vws.magma.ca/nitrogen-dioxide-vehicle-exhaust-detection-equipment.html>
- (2010, November 04). Retrieved June 09, 2011, from Clean Biz : <http://www.cleanbiz.asia/story/first-report-china-vehicle-emissions-released>
- (2010, August). Retrieved April 10, 2011, from National Center for Biotechnology Information:
<http://www.ncbi.nlm.nih.gov/pubmed/20716291>

- Green Boston*. (2010, April). Retrieved July 28, 2011, from Sparking Boston's Climate Revolution:
http://www.cityofboston.gov/Images_Documents/BCA_full_rprt_r5_tcm3-19558.pdf
- (2011, March 01). Retrieved April 10, 2011, from United Press International:
http://www.upi.com/Science_News/Resource-Wars/2011/03/01/Pollution-a-threat-to-Chinas-growth/UPI-94781299004853/
- (2011). Retrieved May 31, 2011, from Waikato Regional Council:
<http://www.waikatoregion.govt.nz/environmental-information/environmental-indicators/Air/Air-quality/air1c-report/>
- City of Boston*. (2011). Retrieved July 28, 2011, from Green Business Awards:
<http://www.cityofboston.gov/environmentalandenergy/greenawards/winners07.asp>
- City of Boston*. (2011). Retrieved July 28, 2011, from
<http://www.cityofboston.gov/transportation/modes.asp>
- City of Boston*. (2011, April). Retrieved July 28, 2011, from A Climate of Progress:
http://www.cityofboston.gov/Images_Documents/A%20Climate%20of%20Progress%20-%20CAP%20Update%202011_tcm3-25020.pdf
- U.S. Environmental Protection Agency*. (2011, March 23). Retrieved July 21, 2011, from
<http://www.epa.gov/>
- Zipcar*. (2011). Retrieved August 03, 2011, from Mission: <http://www.zipcar.com/mission/>
- Zipcar*. (2011). Retrieved August 03, 2011, from What is a Zipster: <http://www.zipcar.com/is-it/zipster>
- American Lung Association*. (n.d.). Retrieved from <http://www.lungusa.org/associations/charters/mid-atlantic/air-quality/outdoor-air-quality.html>
- Assurewu. (2011, August 3). 下城区_百度百科. Retrieved August 4, 2011, from 百度:
<http://baike.baidu.com/view/706085.htm>
- assurewu. (2011, 8 3). 下城区_百度百科. Retrieved 8 4, 2011, from 百度:
<http://baike.baidu.com/view/706085.htm>
- Assurewu. (2011, July 10). 江干区_百度百科. Retrieved August 5, 2011, from 百度:
<http://baike.baidu.com/view/581593.htm>
- Best. (2009, 7 15). 庆春广场- 搜搜百科. Retrieved 8 5, 2011, from 搜搜:
<http://baike.soso.com/v4292868.htm>
- Chainway. (2011, July).
- Chase, K. J. (2011, 03 11). *Another by-the-hour car renter rolls into Boston*. Retrieved 04 01, 2011, from Another by-the-hour car renter rolls into Boston:

- http://www.boston.com/business/articles/2011/03/23/another_by_the_hour_car_renter_rolls_into_boston/
- ChinaAutoWeb. (2010, 09 05). *How Many Cars are There in China?* Retrieved 06 06, 2011, from <http://chinaautoweb.com/2010/09/how-many-cars-are-there-in-china/>
- ChinaAutoWeb. (2011, 03 02). *Update: How Many Cars Are There in China?* Retrieved 06 06, 2011, from <http://chinaautoweb.com/2011/03/update-how-many-cars-are-there-in-china/>
- Donkelaar, A. v. (2010, September 22). *NASA*. Retrieved April 10, 2011, from Map of air pollution graphs dirty air worldwide: <http://www.nasa.gov/topics/earth/features/health-sapping.html>
- eHi. (2011, 7 23). (Grop2, Interviewer)
- E 都市. (2008, 8 29). *陵武大厦| 杭州| 建筑楼宇| 黄页|E 都市*. Retrieved 8 4, 2011, from E 都市: <http://hz.edushi.com/YP/OwnerDetail.aspx?ID=34795>
- e 都市. (2011). *>杭州市地图| 公交查询地图| 旅游地图| 三维地图| 电子地图|E 都市*. Retrieved 08 01, 2011, from e 都市: <http://hangzhou.edushi.com/?q=%u8427%u5C71%20%u65F6%u4EE3%u5E7F%u573A>
- e 都市. (2011). *杭州市地图| 公交查询地图| 旅游地图| 三维地图| 电子地图|E 都市*. Retrieved 8 1, 2011, from e 都市: *杭州市地图| 公交查询地图| 旅游地图| 三维地图| 电子地图|E 都市*
- e 都市. (2011). *杭州市地图| 公交查询地图| 旅游地图| 三维地图| 电子地图|E 都市*. Retrieved 08 01, 2011, from e 都市: <http://hangzhou.edushi.com/?q=%u8427%u5C71%20%u65F6%u4EE3%u5E7F%u573A>
- Fiebel, B. J. (2003). *Investment Performance Measurement*. New York.
- Frei, F. X. (2005, 06 30). *Zipcar: Influencing Customer Behaviour*. Harvard Business School.
- Goldman, S. (2008, 05). *The North American Carsharing Industry Zipcar, Inc. and 3 Major Competitors*. Retrieved 04 03, 2011, from <https://portfolio.du.edu/portfolio/getportfoliofile?fluid=73397>
- Goodison, D. (2011, 03 31). *Zipcar revs up to hit the street*. Retrieved 04 01, 2011, from Zipcar revs up to hit the street: <http://bostonherald.com/business/general/view.bg?articleid=1327324&position=0>
- Hangzhou Bureau of Statistics. (2011, 6 18). *State-level Development zones*. Retrieved 8 6, 2011, from Statistical Information of Hangzhou: <http://www.hzstats.gov.cn/web/shownews.aspx?id=Y4mMozjDwXI=>
- Hayes, J. (2011, 04). *AIR POLLUTION IN CHINA*. Retrieved 07 11, 2011, from factsanddetails: <http://factsanddetails.com/china.php?itemid=392&catid=10&subcatid=66#3301>

- Hays, J. (2011, 04). *AIR POLLUTION IN CHINA*. Retrieved 07 11, 2011, from factsanddetails:
<http://factsanddetails.com/china.php?itemid=392&catid=10&subcatid=66#3301>
- Information center of HEDA. (2011, 6 2). *杭州经济技术开发区门户网 杭州开发区 下沙开发区 经济开发区 开发区*. Retrieved 8 6, 2011, from Hangzhou Economic&technological Developemnt Zone:
http://www.heda.gov.cn/jpm/portal?action=infoDetailAction&eventSubmit_doInfodetail=doInfodetail&id=8729
- Jiong, G. (2008). *The Impact of the Electric Car for Energy and Environment* .
- Li, X. (2011, 08 03). Car Salesman. (J. Papotto, Interviewer)
- McNamara, M. (2006, October 26). *CBS News*. Retrieved June 06, 2011, from
<http://www.cbsnews.com/stories/2006/10/26/fyi/main2126583.shtml>
- Min Chen, H. R.-C. (2010, 06). A Smart RFID System. *IEEE International Workshop on Quality of Service*. South Korea.
- Mull, C. (2011, May 11). Retrieved August 03, 2011, from Zip Car and Customer Loyalty:
<http://mlcwideangle.exbdblogs.com/2011/05/11/zipcar-and-customer-loyalty/>
- Myra Hart, M. J. (2005, 05 09). Zipcar: Refining the Business Model. Harvard Business School.
- Paster, X. Z. (2007, March 12). Retrieved June 12, 2011, from Sulfur Dioxide in China:
<http://www.columbia.edu/~xzp1/Facts.html>.
- Pu, H. (2011, 08 03). Professor. (A. Humbaraci, Interviewer)
- Qiyu, Z. (2010). *Make a Chain of Electric Car* .
- Rachel Botsman, R. R. (2010, 10). Beyond Zipcar: Collaborative Consumption. Harvard Business School.
- Rui, Z. (2010). *Eletric Car and Life*.
- Shan Carter, A. C. (2007). Retrieved May 26, 2011, from
http://www.nytimes.com/interactive/2007/08/26/world/asia/20070826_CHINA_GRAPHIC.html#
- Sonotronics Website. (2010). *Tracking Prouducts*. Retrieved August 1, 2011, from Sonotronics:
http://www.sonotronics.com/?page_id=43
- Tang, X. (2004). *The Characteristics of Urban Air Pollution in China*. Retrieved June 09, 2011, from The National Academies Press: www.nap.edu/openbook.php
- The GPS Guid Website. (2009, January 27th). *GPS Basics - What is GPS?* Retrieved August 1, 2011, from The GPS Guid: <http://thegpsguide.com/>

- Tian, H. (2003). Retrieved June 12, 2011, from CURRENT STATUS AND FUTURE TREND OF NITROGEN OXIDES EMISSIONS IN CHINA:
http://www.anl.gov/PCS/acsfuel/preprint%20archive/Files/48_2_New%20York_10-03_0703.pdf
- U.S.government. (2011, June 6). *GPS Overview*. Retrieved August 1, 2011, from Official U.S. Government information about GPS: <http://www.gps.gov/systems/gps/>
- Vitousek, P. M. (2007, August). *Ecological Society of America*. Retrieved April 04, 2011, from Ecological Applications: http://www.esa.org/science_resources/issues/TextIssues/issue1.php
- World Health Organization. (2008, 08). *Air quality and health*. Retrieved 04 05, 2011, from WHO: <http://www.who.int/mediacentre/factsheets/fs313/en/index.html>
- Yueqi, L. (2011, 08 04). Planning Director. (T. Hexin, Interviewer)
- Zipcar, Inc. (n.d.). *Car Sharing, an alternative to car rental and ownership - Zipcar*. Retrieved 04 03, 2011, from <http://www.zipcar.com/>
- Zotye. (2011, 07). (T. Hexin, Interviewer)
- 与尔同轩. (2006, 10 18). 开一个公司要什么程序 (要到那些部门登记) _ 百度知道 . Retrieved 8 3, 2011, from 百度知道: <http://zhidao.baidu.com/question/14054687.html>
- 中国工商银行. (2011, 7 7). 存贷利率—金融信息—中国工商银行中国网站. Retrieved 7 7, 2011, from 中国工商银行:
<http://www.icbc.com.cn/ICBC/%e9%87%91%e8%9e%8d%e4%bf%a1%e6%81%af/%e5%ad%98%e8%b4%b7%e6%ac%be%e5%88%a9%e7%8e%87%e8%a1%a8/%e4%ba%ba%e6%b0%91%e5%b8%81%e5%ad%98%e6%ac%be%e5%88%a9%e7%8e%87%e8%a1%a8/>
- 中国律师网. (2011, 4 30). 杭州五险一金 - 国律网. Retrieved 7 25, 2011, from 国律网:
http://www.chinalawyer.cc/zhishi/20100309030627_44968.html
- 住在杭州网. (2006, 8 30). 绿城·桂花城项目介绍-浙江在线-住在杭州. Retrieved 8 4, 2011, from 浙江在线: <http://zzhz.zjol.com.cn/05zzhz/system/2006/08/30/007841396.shtml>
- 余丽丽、傅一览. (2010, 7 23). 江干区集聚新产业促转型升级 财政收入同比增 57.7%-转型升级, 江干区, 新产业, 财政, 财政-浙江在线-浙商网. Retrieved 8 2, 2011, from 浙商网:
<http://biz.zjol.com.cn/05biz/system/2010/07/23/016785819.shtml>
- 拱墅区人民政府. (2011). “杭州·拱墅”门户网站——走进拱墅. Retrieved 08 01, 2011, from 拱墅区网站:
<http://www.gongshu.gov.cn/gongshucms/view/zjgs.jsp?siteunid=CEA370A5CBAB1D0539DEC81C06CF723D&pid=58F5220594AE9A2C1D16DA826984C367&id=A869E082918EE4084478ACAE6948DC94>

- 易车网. (2011). *【朗逸】上海大众朗逸_朗逸报价_朗逸论坛_油耗-易车网*. Retrieved 7 27, 2011, from 易车网: <http://car.bitauto.com/langyi/>
- 杭州国家高新技术产业开发区管委会. (2011, 5 18). *杭州市滨江区2010 年第六次全国人口普查主要数据公报*. Retrieved 8 4, 2011, from 杭州国家高新技术产业开发区: <http://www.hhtz.gov.cn/hhtz/DesktopDefault.aspx?TabID=5305a7c0-9139-44eb-ad68-702073366f71&ID=1ac1c414-e1b8-47f4-9238-e04f406f12fc,5d3bf3c7-036d-4dfb-8bbb-11cfd8984ea8,2011-5>
- 杭州国家高新技术产业开发区管委会. (n.d.). *杭州国家高新技术产业开发区_走进滨江*. Retrieved August 4, 2011, from 杭州国家高新技术产业开发区: <http://www.hhtz.gov.cn/hhtz/DesktopDefault.aspx?tabid=8297157a-989f-4469-bef2-b5aa1b2bd6f9>
- 杭州大厦. (2008). *杭州大厦有限公司*. Retrieved 8 5, 2011, from 杭州大厦官网: <http://www.hangzhou.com.cn/adv/hzwmw/hzds/>
- 杭州宝葫芦电子商务有限公司. (2009, 2 7). *公司新闻*. Retrieved 8 6, 2011, from 杭州宝葫芦电子商务有限公司网站: <http://www.steelcbd.com/home/ehomedocs/resourceHtml/news/1233888865484.html>
- 杭州高新技术产业开发区资产经营有限公司. (n.d.). *杭州高新技术产业开发区资产经营有限公司(天堂软件园) - 大学生创业网*. Retrieved 8 5, 2011, from 大学生创业网: <http://www.studentboss.com/yuanqu/yuanqujj.php?id=184>
- 汽车之家. (2011, 6 22). *浙江二手标致 307|2006 年购买|行驶 8.50 万公里*. Retrieved 8 2, 2011, from 汽车之家: <http://2sc.autohome.com.cn/dealer/61228/136078.html>
- 王瑛. (2010, 12 14). *杭州西湖区财政收入首破百亿 八年时间增长 9 倍-财政收入-浙江在线-浙商网*. Retrieved 8 5, 2011, from 浙商网: <http://biz.zjol.com.cn/05biz/system/2010/12/14/017161228.shtml>
- 白衣童生. (2010, 7 10). *上半年财政收入西湖区跃居第一，江干区增幅第一- 口水楼市- 住在杭州网- 口水杭州论坛*. Retrieved 8 5, 2011, from 口水杭州: <http://zzhzbbbs.zjol.com.cn/thread-3363115-1-1.html>
- 百度. (2010, 10 24). *中国四季青服装交易中心_百度百科*. Retrieved 8 4, 2011, from 百度: <http://baike.baidu.com/view/4936136.htm>
- 百度百科. (2011). *>萧山_百度百科*. Retrieved 08 01, 2011, from 百度百科: <http://baike.baidu.com/view/193141.htm>
- 百度百科. (2011). *浙江大学玉泉校区_百度百科*. Retrieved 08 01, 2011, from 百度百科: <http://baike.baidu.com/view/1455144daan>

罗建. (2011). *西城广场调研*. 杭州市.

赵明、王成. (2008, 4 30). *招商引资网*. Retrieved 8 5, 2011, from 杭州招商引资网:
<http://www.hzzsy.com/NEWSDETIAL.asp?ID=2693>

金静敏. (2010, 10). *一嗨租车连锁经营战略及实施策略研究*. Retrieved 7 15, 2011, from 万方数据库:
http://d.g.wanfangdata.com.cn/Thesis_Y1846092.aspx

香港达泰投资咨询有限公司. (2011, 5). *杭州汽车共享项目建议书*.