

## **Car-Sharing as an Environmental Policy Tool: A Preliminary Analysis**

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### **Abstract**

*In recent years, energy prices have become increasingly more expensive. This trend has added to auto ownership costs and uncertainty about future operating expenses. Furthermore, parking in many of the world's largest cities is limited and costly further adding to private vehicle expenditures. Many nations worldwide have adopted car-sharing (or short-term auto access) as a mean of reducing personal transportation cost and the negative impacts of wide spread auto use (congestion, inefficient land use, energy consumption and emissions). The objective of this paper is to present the notion of car-sharing. Therefore, it begins with the definition, the function and the pricing policy of car-sharing. Then, the history and growth of car-sharing are presented. Additionally, advantages and disadvantages of this alternative choice of mobility are analyzed. Finally, the implementation of car-sharing in different continents is mentioned and a number of ways that could improve the effectiveness of car-sharing are proposed.*

**Keywords:** Car-sharing, Environment, Sustainable, Cost-efficient

### ***1. Introduction***

Nowadays, millions of people live in large cities and they have to commute between cities and their outskirts every day. Basically there are two ways which satisfy their mobility needs. The first one is public transport systems (different fixed services cover a given area) and the second one is point-to-point type traffic tools such as cars, bikes etc. It is a well-known fact that these two mobility systems are not sufficient. Also, they are responsible for a variety of major social, traffic, energy and environmental problems on a worldwide scale. The problems above lead more and more people to seek for alternative forms of transportation. Effective transport strategies need to recognize and reflect the whole spectrum of mobility. Such an effective system is car-sharing which confronts the negative impacts of car (traffic jam, lack of parking spaces and pollution) and cover the weaknesses of public means of transport. Car-sharing is regarded as a niche solution and has gained ground in recent years. It exists in around 200 cities and 28.3 million people (34.5% of all inhabitants) have the option to access car-sharing. There are approximately 90 car-sharing organizations, the 15 biggest providers serve 85% of all customers (Huyer, 2004).

### ***2. Transportation and Environmental Policies***

Air pollution is a persistent concern in the cities of developing countries (Wang and Zhang, 2009) and one of the highest contributors to total external costs. Whereas road transport emissions of nitrogen oxides (NO<sub>x</sub>), non-methane volatile organic compounds (NMVOC) and particulate matters (PM) have been reduced as a result of exhaust gas treatment and improvements in combustion technology, the carbon dioxide (CO<sub>2</sub>) emissions continue to increase (Johansson and Åhman, 2002).

A presumable consequence of the above situation is that the environmental effects of transport are of increasing public concern: people believe that one of the main transport-related problems is air pollution (European Environment Agency, 2001). As a result, the environmental performance of transport has been the subject of many studies concerning various technological and non-technological issues (Van Wee and Annema, 1999; Georgakellos, 2008) and governments all over the world use a variety of policy instruments aimed at reducing environmental risks. These may include the use of new vehicle technologies or the modification of citizens' transportation behavior patterns, such as car-sharing.

There are many ways to achieve it, which range from regulations that directly control the activities of polluters to incentive-based plans that use market forces and the price mechanism to achieve a better environmental quality. Standards are the fundamental basis of most environmental policies that are included in the first category. Particularly, there are three basic types of standards used for this purpose: ambient standards that designate the level of environmental quality; technology-based standards that indicate the abatement method to be used by polluters; and performance-based standards that specify an emission limit to be achieved by polluters. Although the use of standards sounds uncomplicated enough, there are two important economic implications to be considered. The first deals with the level at which standards are set (a quite important issue since standards define environmental quality objectives), while the second one relates to how they are implemented across polluting sources (Callan and Thomas, 2000). As a consequence, a leading problem with standard setting is the question of cost-effectiveness (i.e. to achieve the environmental objective using the least amount of economic resources) since in most standards programs the administrative bias is to apply the same standards to all sources of a particular pollutant (Field, 1997). Furthermore, in the regulatory setting, the question of cost-effectiveness of a standard is a very difficult task even if there is a single polluting source. This is due to the fact that it seems quite reasonable to assume that firms have much better information about their productive capabilities and abatement opportunities than does the regulator (Gottinger, 2001).

The incentive approach seeks to change this situation. These instruments typically provide monetary and near-monetary rewards for polluting less, and impose costs of various types for polluting more. According to economic theory and modelling exercises, incentive-based instruments are more cost-effective than traditional forms of regulation. In addition, incentive-based approaches also can address small sources of pollution that are not easily controlled with traditional forms of regulation, as well as provide a reason for polluters to improve performance relative to existing regulatory requirements (Georgakellos, 2007; Pearce and Turner, 1993). There are two types of incentive policies: (a) charges and subsidies and (b) transferable discharge permits. The first is a centralized system, as it requires some administering agency to put the program into effect and to deal directly and continuously with polluters. The second is a decentralized approach as, once the system has been established and basic rules have been set, it is designed to work more or less automatically through the interactions among polluters themselves and/or other interested parties (Field, 1997).

### **3. Car-Sharing - a Concise Overview**

Car-sharing can be defined as sharing vehicle services amongst members, giving them access to a fleet of vehicles (Loose *et al.*, 2006). Car-sharing systems are an alternative to private vehicle ownership. Instead of owning one or more vehicles, a household or business accesses a fleet of shared-use automobiles benefiting from choosing the one that best fits its needs for a specific purpose (Shaheen *et al.*, 2004). The idea of car-sharing using a car co-operative scheme is to allow individuals to have access without having to own it (Seik, 2000). Individuals gain the benefits of private cars without the costs and responsibilities of ownership one or more vehicles that a household has access to a fleet of vehicles on an as-needed basis. It may be thought of as organized short-term car rental (Shaheen *et al.*, 1998). The concept of car-sharing is based on the distinction between automobile access and ownership. Car-sharing divorces the notion of automobile use from ownership by providing individuals with convenient access to a shared fleet of vehicles, rather than a single privately owned one. In this sense, car-sharing is an example of the growing number of alternatives to private ownerships of property. It is suggested that the world is moving from a market-based economy to one in which private possessions are no longer as important as having access to them (Katzev, 2003).

Organized car-sharing is a specific way of gaining access to means of travel and of organizing individual transport. It means the common use of cars by members of an organization (be it a professional firm, an association or a co-operative) in succession.

The duration and target of individual car trips is self-determined by the respective car users. Car-sharing has always been a very common practice in families and neighborhoods. These informal ways of sharing a car are distinguished as private car-sharing, in which one person holds ownership rights to the car and access is organized informally. The most important feature of organized car sharing is a de-coupling of ownership and use of cars: the individual right of disposal is substituted by a collective one (Truffer, 2003).

There are three types of car sharing systems. The first one is the conventional system that requires users to pick up and return vehicles at the same parking stations. In this case car-sharing operators impose various restrictions on vehicle return stations and times. Users have to specify return time and adhere to it or otherwise face a penalty. Stiff competition from public transportation systems and competing car-sharing companies has prompted some operators which have multiple stations to provide users with flexibility in return times. The second system is based on this motive offering users the capability of picking up and returning the vehicles in different parking stations (members are not required to return their vehicles to the same location). Specifically, some operators create a network of stations in a city allowing users to return vehicles to another station. A significant number of car-sharing organizations follow this strategy. Finally, the third system offers even more convenience to users while it allows them to return vehicles whenever and wherever they like. This provokes additional problems for the operators to maintain vehicle inventories across the stations to meet user demands and parking stall inventories across the stations for users to return. It should be noted that there is another form of car-sharing which differs from traditional car-sharing that is called peer-to-peer car-sharing. This allows car owners to convert their personal vehicles into shared cars which can be rented to other drivers on a short-term base. This business is based on the fact that most private cars remain unused over 90% of the day (Hampshire and Gaites, 2011). Peer-to-peer car-sharing services facilitate the rental process by providing gas, an online reservation system, a method to access the car and insurance. Usually, the owner of the car receives 70% of the rental revenue and the other 30% goes to the service provider to cover the expenses of facilitates that are mentioned above and the profit. This alternative car-sharing can be considered more economical and offers greater accessibility than traditional car-sharing.

#### ***4. Advantages and Disadvantages of Car-Sharing***

People today have several ways of transport, for instance public means of transport or alternative modes (car, bicycle or walking). However, users choose a specific way to move because they are influenced by particular factors that are mentioned below:

- Use patterns and travel routines: daily travel needs are organized in a routinized way by users. Habits and routines reduce the information and decision load of an individual. Cars versatility is a big advantage because transport is a demanding activity. Breaking up these routines is associated with considerable costs and uncertainty. Moreover, these routines affect longer term decisions such as choice of living and workplace.
- Perception of product quality and users' needs: the users' perception of their own needs and the understanding of the product quality that cover these needs come from former experiences with the same travel mode. Loss of a known and accepted quality of a decision option often weights more heavily than the increase in another dimension. This leads to a strong path dependency in users' decisions.
- Perception of cost and benefits: costs and fair cost-benefit rates establish routines. Car drivers sometimes base their travel mode decisions on only partial costs (like fuel costs of petrol car) ignoring full cost assessments. This puts public transport at a considerable penalty as cost differentials seem excessive even though when compared on a full-cost basis the relationship would actually be reserved.
- Expectations and satisfaction: users have to trust specific travel mode. They should be able to manage the technology safely even in exceptional situations. For instance, car drivers have to learn how to face break downs, be able to make small repairs or to know where to look for help. Furthermore, they have to accept a particular level of dysfunctional behavior of the car. If expectations, competence and actual functionality are met, high satisfaction may be expected. An important role here plays the perceived quality of the support system in the event of unexpected situation (garages, emergency systems, legal conditions of liability, etc.).
- Social response and status: finally, the car also has to be handled in a competed way in each technical and social environment. This includes involving with other users of the system, for example with regard to liability in the case of accidents, rules of lending and renting cars to other people and show on. Additionally, the social status which is conveyed to others when using a specific technology may play an important role for travel mode choice (Truffer, 2003).

Despite all these factors that lead to a particular transport behavior, car-sharing advantages have changed people's behavior and it has gained a great number of users.

### **Advantages**

Initially, there are advantages for whole community. Car-sharing provides access to mobility for those who cannot afford a purchase of private car. Also, as car-sharing members are charged by usage (time and distance charges), they are more cost conscious and generally drive less. In this way they help in reducing of traffic volume. Many studies have shown that lack of car access has bad impact on employment and health outcomes. This is true especially for households with low income that often are unable to buy their own car (Hampshire and Sinha, 2011). In addition, experience shows that each shared car replaces five privately owned cars. This leads to the decrease of the congestion and the number of parked cars resulting in more space for people (Antonia Roberts, 2011). Hence, redistribution of land can take place and satisfy the increasing demand for green space and landscaping (Ying and Wang, 2010). In this case, car-sharing is also cost efficient knowing that parking places are usually scarce and expensive (Correia and Antunes, 2011). Social interaction and local services can flourish as people walk to the local shops. Public transport may enjoy stronger support especially when partnerships are created (Roberts, 2011). Moreover, car-sharing offers great flexibility while members can often use and return the shared vehicles wherever and whenever they want. Car-sharing means more efficient use of resources while many private cars remain parked for a long period of time each day.

Furthermore, car-sharing reduces the environmental impact of driving. This includes a reduction of total CO<sub>2</sub>-emissions, while individuals have reduced the number of kilometers they travel and households the average number of vehicles they own (Firnkorner and Muller, 2011). Car-sharing vehicles are newer relative to the average personal vehicle and have higher fuel economy (Cervero and Tsai, 2004). Consumers' mobility needs are satisfied without the personal automobile, by car-sharing that has been considered a promising demand management tool capable of displacing gasoline consumption that would otherwise occur in its absence (Martin and Shaheen, 2011). It can be concluded that car-sharing practice improves air quality.

Moreover, car-sharing can offer significant benefits to businesses. They can gain by freeing up capital from pull cars and by saving considerable space from parking provision. Staff no longer needs to bring in their own vehicle each day if they can access a car for business or private use. Small companies could join a car-sharing organization, rather than having its own vehicles. Larger concerns could follow the example of Manchester Airport which ran its own car club as a part of its green transport plan. Direct benefits from reducing the dependency on the car include greater adaptability for local business, improved local transport network and new opportunities nationally for technological innovation in car club services. Another sector in which car-sharing organizations contribute to healthy economy is through urban regeneration. Low car parking provision, or even car-free developments are often required by the use of brownfield cities and the recycling of industrial buildings in city centers for housing and offices. Revised planning guidance has given local authorities a strong directive to insist on housing development schemes with increased density together with objectives to reduce car parking and traffic congestion. Car-sharing organizations provide a solution which offers residents flexible mobility choices while fulfilling planning restrictions (Roberts, 2011).

The benefits mentioned above associated with car-sharing are supported by a growing body of empirical evidence. However, differences in data collection and study methodology frequently produce inconsistent results. Other possible reasons for these inconsistencies are location specific variations and if such studies examine innovators, early adopters, or early majorities.

### **Disadvantages**

Car-sharing presents a great number of advantages. However, it has some disadvantages for both car-sharing organizations and customers. As far as businesses are concerned, they ought to maintain shared vehicles. For instance, cars have to be recharged, refilled and repaired. That means that the over possible time in duty is less than 24 hours. Hence, the availability of the vehicle is decreased, leading to profitability reduction. For example, if a vehicle needs a 6 hour changing time, the maximum number of hours that this vehicle can be used is only 18 hours. This fact may push the business to a vulnerable financial condition (Kriston *et al.*, 2010). Additionally, car-sharing organizations are difficult to develop their activities in neighborhoods with low population densities.

That happens because operators have to cover the high fixed cost of purchasing all of the vehicles in the fleet. In this case, car-sharing is not a substitute of insufficient public transportation (Hampshire and Sinha, 2011).

There are also disadvantages that affect consumers. If they determine to use car-sharing they have to plan their trips in advance, so in most cases spontaneity is lost. Also, they must remember and take the time to make a reservation. Additionally, users feel anxious of returning the car on time. Another negative of car-sharing is that customers should leave the car clean even if they are in a hurry. Furthermore, users have to deal with some form of paperwork, personal identification numbers lock boxes etc. for every trip. Customers face and some extra difficulty. In particular, they park farther from their residence when they use a shared car. With such a set of obstacles to overcome, many people avoid using car-sharing (Katzev, 2003). A survey called “Assessment and Opportunities of the Further Development of Car-sharing” which is funded by the German Federal Ministry of Transport, Building and Housing, has shown that only a few people could imagine using car-sharing themselves. A rate of 75% of participants preferred to use their own private car instead. This fact reflects the competitive edge of the private car which is the main obstacle that car-sharing organizations face (Loose *et al.*, 2005).

### 5. Concluding remarks

Car-sharing is a cost-efficient way of transport that disconnects the use of car from its possession. It is used worldwide and its’ implementation policies differ between continents and countries. Although there are margins of improvement, it is a well-known fact that car-sharing has a great number of advantages in social, environmental and business level. However, it also has some disadvantages that result mainly from the habit of people to use their private vehicles. Finally, the use of car-sharing can gain the rest world with the implementation of ameliorative meters from car-sharing organizations and governments.

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