

Assessing variables supporting and impeding the development of car sharing

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1. SYNOPSIS

A study of recent trends in car sharing shows a significant potential for growth given alliances with public transportation and public support in the early establishment phase.

2. ABSTRACT

Car sharing, the practice in which anywhere from a few to thousands of people decide to share access to the driver's seat of one or more automobiles, constitutes a major innovation in automobility without carrying with it a need for any major infrastructural changes. A car sharing organisation can be set up with a minimum of new technology, organisational know-how and capital investment. At the same time, car sharing takes pressure off of expanding infrastructure by reducing the number of cars on the road. There is also evidence that members reduce their person-kilometres significantly, thus reducing energy use and emissions. In this article, we report the main findings of a study of car sharing carried out for ADEME by Ressurskonsult A/S, Oslo, and ICE, Paris. The point was to assimilate information on car sharing developments, with emphasis on elements of success and barriers to making it work. The investigation shows that the number of car sharing organisations around the world are growing and that memberships are increasing. As organisations become more established, attitudes are also changing. While the environmental aspects are still emphasised, there is a recognition that professionalism in organisation, practical routines, service and marketing are essential to member loyalty and to growth. New forms of "mobility management", which link car sharing, public transportation and car renting cast car sharing as an improvement on reliance on the private car, with its parking problems, maintenance fees, depreciation, insurance costs, etc. Car sharing has led to increases in public transportation, taxi and car rentals in every city in which these have been assessed. Governments could give a boost to nascent car sharing organisations through marketing the mutual benefits of car sharing and public transport, and in providing seed money to get through the difficult establishment phase.

3. INTRODUCTION

Congestion and pollution due to the use of the private automobile are increasing in many European cities. This is one of the explanations behind the growth of various forms for car sharing, in which ownership is shared among a number of users. There is evidence that car sharing reduces both the number of cars per family and car utilisation, measured in both trips and kilometres, both important goals for environmental and urban transport authorities. Car sharing arrangements have also been shown to be popular with participants. On the other hand, economic solvency has been a struggle for many organisations.

Car sharing is any arrangement which allows shared access to the vehicle's drivers seat. It is a relatively new phenomenon but it is growing rapidly. For it to continue to grow will demand a significant social innovation in the form of an altered relationship between car user and the car. Car sharing participants trade reduced control, access and independence for practical advantages such as better economy (reduced fees, insurance, maintenance, depreciation), easier parking, and access to different kinds of vehicles.

Car sharing organisations have been established in a number of European countries, in North America and in Asia. The biggest and oldest organisations are in Germany, Switzerland, Austria and Netherlands, with newer organisations in Norway, Sweden and Ireland. The four most active car sharing countries in Europe collectively have over 100,000 participants (Shaheen et al 1998). Many of these are members in the European Car Sharing Organisation, established in 1991. In 1999, the organisation has 60000 members, and 2700 cars at 850 locations.

In this article, we report the main findings of a study of car sharing carried out for ADEME (the French Agency for Environment and Energy Management) by Ressurskonsult A/S, Oslo, and ICE, Paris. The point was to assimilate information on car sharing developments, with emphasis on elements of success and barriers to making it work. The method has consisted of a review of the existing literature on car sharing, as well as personal contacts and on-site interviews with representatives of a few selected car sharing projects inside and outside France. Four organisations were analysed in depth: StattAuto (Germany), DENZELDRIVE (Austria), Bilkollektivet (Oslo) and Praxitèle (France).

4. BACKGROUND ON AUTOMOBILITY AND PROBLEMS ASSOCIATED WITH CAR USE

The role of the car in modern life

The story of development in the industrialised countries of the 20th century is intimately linked to the story of automobilisation, by which we mean the transportation of goods and people by roadway. In economic terms, since the 1980's, each 1% increase in GDP has been accompanied by an increase of 1.40% in private automobile traffic (Nijkamp 1994). Between 1950 and 1990 the number of road vehicles in the world grew from approximately 75 million to 675 million, and in OECD countries, the number of vehicle-kilometres travelled grew from 3.2 trillion to 6.9 trillion (OECD 1997). Sales of passenger cars in Europe has been in a period of strong growth over the last few years. In 1998, sales increased by an average of 7%. France experienced a 13.5% increase in car sales in 1998 (Swartzberg 1999).

The USA has the highest per capita car ownership in the world, today about 60 cars per 100 inhabitants. In Europe the cars per 100 inhabitants are as follows: Switzerland (53); Austria (52); Germany (50); France (43); UK (41); the Nordic countries (39); NL (37) (Schipper, personal communication). Interestingly, the countries in which car sharing have had the fastest growth in Europe are in the most car-dependent countries of Switzerland, Austria and Germany.

Today, it is next to impossible to accomplish the tasks of everyday life without access to a car. This is especially true for families with children. Schools, workplaces, shopping centres, etc., are located such that except in urban zones with highly developed public transportation systems, a daily routine of commuting requires a car.

Aside from the practical necessity of having a car, car ownership and use are loaded with symbolism. They provide thrills, assure freedom of mobility, offer quiet spaces, exhibit machismo, and display social status (Wilhite and Lutzenheiser 1999). Several decades ago, a single "family car" served a multiplicity of tasks. Today, there are different cars for different uses (work versus free time), and increasingly, each adult in the family has access to his or her individual car. In North America and parts of Europe, the car is a social marker of the coming of age of teenagers. According to Shove (1999), to own a car is to be seen as full social adult, with the concomitant power to access anywhere in space.

Another trend in the 1990's is a reversal of a general decrease in the size and weight of cars over the previous two decades. In North America, jeeps, vans, and pickup trucks, which once were considered "work" vehicles, have increasingly been seen as "play" vehicles and now are standard "family" vehicles. These all record fairly low fuel efficiency ratings - often significantly less than 0,12 litre/km. In 1998 more than 11 million units of these sports utility, light commercial and multipurpose vehicles were produced world-wide, as opposed to a few thousand 10 years ago. This trend towards the use of off-road vehicles as family vehicles is also picking up in Europe. The total world-wide sales is predicted to rise 25% over the next five years, powering the automobile industry as a whole to a 12.5 percent increase in output (Swartzberg 1999).

To summarise, the numbers, size and energy inefficiency of cars are increasing in OECD countries. This can be linked to social necessities, physical infrastructure and a plethora of symbols linking automobiles to freedom, independence and in some cases to the owner's identity.

Societal problems attributable to cars

Car ownership and use are positively valued by the vast majority of politicians, commercial institutions and users. In fact in developing countries, the state of economic development is often measured in terms of the degree of automobility. There are nonetheless a number of problems associated with car use and ownership which are growing, and which are increasingly entering the public discourse.

- *Pollutants.* Cars use energy and emit pollutants such as NOX, CO, and VOCs. These contribute to degraded local air quality in urban areas. In a report by Ademe in 1997, it was estimated that the health costs of local air pollution in Paris were around FF 1 billion. A single day of moderate pollution was estimated to cost up to FF 4,5 million in medical expenses and lost production, increasing to FF 9 million when levels of sulphur and nitrogen dioxide climb to the "high" pollution level
- *Greenhouse gases.* In OECD countries, on average about 20% of all CO₂ emissions come from private automobiles (OECD 1997)-
- *Congestion, noise and accidents.* According to the OECD, wasted time, air pollution, noise and accidents due to auto transport consume an average of 10% of OECD nation's GNPs. This is roughly equivalent to national health care costs and is escalating at the same pace (Kingsley 1996)
- *Time and economic concerns from the perspective of the car owner.* Owning and maintaining a car consume significant amounts of time and money for routine servicing, repairs, parking, coping with traffic, break-ins, accidents, depreciation, registration renewals, road fees, insurance, and permits.

5. ESSENTIAL INFORMATION FROM THE EXPERIENCES TO DATE WITH CAR SHARING

Organisational forms

Car sharing organisations can be divided into the two distinctive organisational forms: the "StattAuto-type organisation" (in reference to one of the most established car sharing organisations in Germany), in which standard non-electric vehicles are distributed in neighbourhoods in city centres; and the "station car model", aimed primarily at commuters in which electric vehicles are placed near transit stations, major shopping areas and large companies. StattAuto-type organisations are by far the larger, more widespread and more mature of the two types. Almost all of the station car systems are in the test or initial set-up phase

Car sharing uses fall roughly into three different categories:

1. Leisure time use by individuals
2. Use by company employees during working hours
3. Use by individuals in conjunction with commuting

StattAuto-type organisations have mainly aimed at a), while station cars are aimed at uses b) and c). There are efforts among many StattAuto-type organisations to try to capture more b) type uses in order to reduce idle time for vehicles during the day. Station car models in the United States are aiming at eventually capturing a) type uses. In the Car Link model in San Francisco, the organisation is recruiting individuals who will have full access to a single car which they drive home from the commuting transit station after work. Evaluations of both Praxitéle (France) and Car Link show that the most frequent uses were by those who lived near the parking stations.

In the early phases of car sharing, organisations tended to be bottom-up, grass roots organisations, with non-profit charters and idealistic goals. Some continue to operate this way, especially the Scandinavian organisations and a few of the new StattAuto-type organisations in the United States. However, the older and more mature organisations have opted for a more professional profile and more service-oriented goals. All of the largest car sharing organisations (StattAuto, Mobility, DENZELDRIVE) operate on corporate, commercial principles.

Car rental organisations are often compared to, and sometimes classified as car sharing organisations. The differences are that car share vehicles:

- Can be rented by the hour
- Are available for pick-up during the night hours (24 hour service)
- Are new with good ecological standards
- Are placed in the centre of cities, where people live, whereas rental cars are usually placed where big roads cross each other or near stations and airports

In the Netherlands, Europcar and Budget have initiated services which resemble those of car sharing. Coupons are issued for use of cars for a minimum of a half-day rental. Subscribers are issued coupons which are discounted in relation to the normal rental rate, and they are given a special telephone number to use for reserving cars.

Goals and marketing strategies

Marketing strategies for car sharing organisations centre around three messages: improved environment, mobility efficiency (relieving congestion and parking), and improved mobility. As organisations have matured, there has been a change from an emphasis on environmental and mobility efficiency to an emphasis on service. The environmental arguments are still used, but the environmental benefits are portrayed more as a consequence, rather than the main purpose of car sharing.

Mobility Switzerland's marketing and information campaign provides a good example of the messages of mature car sharing organisations. The following is summarised and paraphrased from Mobility Car Sharing Brochure "Car on Call":

On the road by all means of transportation: car sharing starts where public transportation comes to an end. The car is at your disposal like public transportation, but it can be used like a private car.

Diversified. There is a car for every need, including a runabout car, a family car, a 7 seats van, a goods transporter or a convertible.

Easy and convenient. The car is conveniently booked by Internet or phone around the clock..

Low costs. If you are on the road for less than 15,000 km per year and combine car sharing with public transportation, you can save SFr 250 (156 _) per month compared with owning a car.

Ecologically sound. The combination of public transportation and "car on call" represents the most modern form for mobility, because it allocates resources more efficiently, uses up to 57% less energy and is less harmful to the environment.

Equipped for the future. More and more people pursue greater independence and view traffic from a practical angle. They choose their most suitable means of transport, enjoy changing cars and do not mind driving a car which they do not own.

Note that the first three messages have to do with service, the fourth with economic advantages, and the fifth with the environment. The final message, "equipped for the future", is designed to give a general cutting edge flavour to car sharing.

A good example of the U. S. approach to marketing is that of Car Link, which headlines its marketing strategy: «Car Link – The convenience of a car without the hassles of ownership». From their brochure,

"When too many of us choose to use cars, their benefits diminish. With so many drivers competing for road and parking space, Americans waste millions of hours each year just sitting in their cars, which translates into lost productivity and leisure time, higher stress, and worsening pollution. Furthermore, individual car ownership encourages car use. By the time we pay all the costs of owning a car, we have an incentive to drive as much as possible. Is there a way to get the mobility and flexibility of a car, while reducing the costs to each owner and the impacts of pollution and congestion on society? Car link is a system in which several different people drive the same car throughout a day. Each driver rents the vehicle only for the trip they want to make. Car link offers the freedom, mobility and convenience of a personal automobile, without the expense and hassle of individual car ownership. Enjoy the privacy and instant mobility of a private car, without having to worry about parking or maintenance. Pay as you go; use as you need."

Again, while the environmental effects resonate throughout the message, the emphasis is on increased mobility efficiency and benefits for the individual.

These trends in marketing, which put service in the foreground and environment in the background are also reflected in the relative involvement of environmental NGOs and automobile manufacturers, respectively. In general, NGO activity and support was high a decade ago but is much less significant today. Car manufacturers,

on the other hand, who were at first sceptical, are increasingly asserting themselves into car sharing developments. Many car manufacturers, including Daimler Benz, Volkswagen, and Honda, see car sharing as having a significant growth potential and apparently want to work with it, not against it. Volkswagen conducted a market survey which predicted that car sharing will grow at a rate of 50 percent per year leading to a potential market of 2.45 million shared-use vehicles across Europe by 2005 (Britton, 1999). Another motive for car manufacturers is to improve their environmental image - engaging in car sharing is also a way for manufacturers to project a willingness to explore innovative ways to reduce some of the environmental and congestion problems associated with cars.

Yet another evidence of the increasing importance of the service aspect is the increasing tendency to package a number of services with car sharing, such as discounts on public transportation and for car rentals, as well as providing access to travel agency services, food deliveries, bicycle rentals, and other services.

A profile of current and potential users

In the organisations which have profiled their members through surveys, a similar pattern emerges. Members tend to be highly educated, in the age group from 30-40, and live in or near the city centre. A number of organisations are making efforts to tap into other market segments, mainly through a new tariff designs, described in the next section "Tariffs and fee setting" below.

Commercial businesses and governmental organisations constitute a virtually untapped member category for car sharing organisations(less than 10% of the membership in a typical StattAuto-type organisation). They are one of the main targets of the station car organisations, but most of these organisations are still in the test or demonstration phase. Of course the exception to this is the businesses which set up their own car sharing plan for their employees, usually with the primary purpose of freeing up parking space (Luftanza for example).

One problem with attracting people in younger age brackets is the higher accident rates and accompanying higher insurance rates. As a result, German organisations have set lower limits for entry at 24 years old. On the other hand, Mobility and DENZELDRIVE see the younger market segment as important in spite of the accident issue and are making efforts to recruit younger people. A marketing argument used to attract the younger segment is that they will get access to a wide variety of new cars. Mobility also sponsors driving lessons.

Tariffs and fee setting

The StattAuto procedure for administrating fees is one which has served as a model for new car sharing organisations across the world. Members join the organisation by paying a deposit, returnable on leaving the organisation. A yearly (or sometimes monthly) fee is paid to cover administrative costs. Otherwise, people pay for the time which they use cars and for the distance driven. They are billed monthly.

A recent trend among European organisations and the newer US organisations is to offer a more diversified fee structure. The entry fees range from almost nothing to around 765 €. Use fees are higher for the low entry plan. The idea is to attract infrequent users and also those who do not have access to the higher entry capital. StattAuto offers to act as a bank for new members and to finance the cost of the entry fee. Several options for interest rates and payment plans are made available.

An innovative fee system in Bremen attaches car sharing membership to a monthly pass on public transportation. Purchasers of the monthly pass get automatic usage of the car sharing vehicles without paying deposits or entry fees. The use fees are slightly higher than those for regular members.

Another innovation is the StattAuto cash car plan. Members lease vehicles on a longer term from StattAuto. They have the option to make the car available to other members on weekends or during other peak usage periods. StattAuto and the car leaser share the proceeds from the use of the car.

Obtaining, maintaining and disposing of vehicles

Some organisations in the start-up phase, having few members and limited capital, lease their fleet of cars from an automobile dealership or agency. This is partly due to the high cost and rapid depreciation of new vehicles. Otherwise, the general practice is for car sharing organisations to purchase their cars and sell them after use. With the exception of Mobility, which buys and sells their cars on the open market, most organisations seek agreements from a single automobile manufacturer or car dealer for the purchasing, maintaining and selling of

vehicles. DENZELDRIVE has been purchased by an automobile trading company, so that obtaining and selling vehicles is done through the mother company.

A widespread practice is for organisations to start with a relatively uniform fleet of standard sedans, and as the organisation grows, to diversify the fleet to include station wagons and vans. A few of the larger organisations have added a sports car and luxury vehicle to the fleet.

In the beginning phase, most organisations choose to make one car available for about every 10 members, the number of members per car usually increasing as the organisation grows. StattAuto and Mobility have both increased to a member-car ratio of about 25:1. DENZELDRIVE has chosen to keep the ratio closer to 10:1 as it grows, reasoning that while it is more costly for the organisation, the better service will lead to more satisfied members. It should be said that DENZELDRIVE's relationship with a large, international car trading company gives an advantage over other car sharing organisations when it comes to obtaining cars at reasonable prices.

For those organisations which buy their cars, the practice on when to sell them varies. StattAuto sells their vehicles after two years of use but before they reach 80 thousand kilometres (at which time cars usually enter a phase in which mechanical problems increase dramatically). DENZELDRIVE sells its cars after only a year of use and less than 50 thousand kilometres, opting to go for a higher resale price rather than hold onto the vehicles for a longer period. Again, the relationship to Denzel gives an advantage in the market for buying and selling of cars.

The responsibility for maintaining the general cleanliness of the vehicle is most often given over to individual members. This chore is not always carried out conscientiously, so that a back-up system is needed. Two typical ways of dealing with the problem are to ask for volunteers from the organisation to check and clean vehicles, or to hire students or others willing to do the job for low pay.

Stationing vehicles

The StattAuto-type car sharing organisations station cars in neighbourhoods around the city centre. Unless deals can be made with the municipality or with other organisations which have parking facilities, car sharing organisations must pay commercial rates for parking. A recent and growing trend is for car sharing organisations to work together with entrepreneurs of new apartment developments, offering residents a membership in car sharing. Cars are then placed in designated parking places at the apartment complex.

Co-ordination of car sharing with public transport and car rental organisations

Almost every car sharing organisation surveyed has understood the importance of making an arrangement for its members for discounts on public transportation and with car rental organisations. We elaborate this point in chapter 6, subsection "Co-operation with other mobility organisations" below.

6. KEYS TO SUCCESS AND POTENTIAL BARRIERS

In this section, we discuss "key elements of success" and "barriers" to the success of car sharing organisations. In a certain sense, barriers and "success factors" are related in that achieving success often hangs together with overcoming one or more barriers. We have nonetheless found it useful to isolate and discuss both, even though there may be some overlap in the discussions.

Key elements of success

No major infrastructural changes necessary

The StattAuto version of car sharing constitutes a major innovation in automobility without carrying with it a need for any major infrastructural changes. The roads, petrol stations, automobile technology, etc., and also the service brought by a private car can continue to be used in much the same ways. A car sharing organisation can be set up with a minimum of new technology, organisational know-how and capital investment. At the same time, car sharing takes pressure off of expanding infrastructure by reducing the number of cars on the road.

The station car version of car sharing carries with it the need for an infrastructure for electric vehicles, making the start-up more technology- and capital-intensive. Thus a key element of success for the StattAuto-type organisation does not apply to the station car model.

Marketing and information dissemination

Marketing and aggressive information dissemination are important elements in the success of car sharing organisations. Car sharing is a concept which is not generally well known, either by the general public or by governmental authorities. For many people the very idea of “sharing” implies a degraded service and a sacrifice of freedom and independence. Thus marketing and information is needed both to make people aware of the existence of car sharing and to draw out the ways in which it can actually improve the service of automobility for the individual and at the same time reduce problems of pollution and congestion. The marketing of the larger and more mature car sharing organisations reflects a professional approach and positive images attached to car sharing. According to Swiss governmental documents, the marketing message is that the mobility service of the future must satisfy a growing demand for mobility which is simple, inexpensive, comfortable and ecological. The key is to market car sharing as a key element in a package of “combined mobility” which links car sharing with public transportation in creative ways. The marketing message in Switzerland is that

“With combined mobility – the third alternative in mobility – there are only winners: clients, public transportation, the environment and also cities.” (Muheim 1998).

In addition to the “combined mobility” message, an important element of information is the ways in which car sharing reduces costs for the individual. The costs of a car are determined by six factors: depreciation, interest costs, taxes, insurance, fuel costs, parking and repair and maintenance. Only the latter two are related to the actual use of the car (variable costs).

In its information campaign, the National Car Sharing Association (NCSA) in the United States makes a case that because of the idle time of an owned car, it is an extremely unproductive form of mobility. Privately owned vehicles are unused on average 23 hours per day (USDOT 1995), even though cars are the third largest investment most families make.

The Dutch Automobile Association has come up with a table which shows the percentage of costs for the major factors contributing to fixed and variable costs for average use in the Netherlands.

Table 1. The relative contribution of various cost factors in car usage (Meijkamp 1999)

Costs (in average percent)	Compact New	Compact Used	Medium New	Medium used	Large New	Large Used
Depreciation	41%	37%	45%	37%	48%	39%
Interest costs	11%	8%	10%	11%	11%	10%
Taxes	5%	7%	6%	9%	6%	9%
Insurance	16%	10%	17%	12%	16%	12%
Total fixed costs	73%	62%	79%	68%	81%	70%
Fuel costs	23%	28%	18%	25%	17%	25%
Repair/maintenance	4%	10%	3%	7%	2%	5%
Total variable costs	27%	38%	21%	32%	19%	30%

Thus the total fixed costs range from between 62 – 81% and the total variable costs from 19 – 38%. Of course for those who use the cars much higher than average, the variable costs increase and the profitability of car sharing decreases. Both StattAuto and the Portland CarShare estimate that car sharing is profitable for the individual car owner if the kms driven per year come to less than around 16000. In Portland, the calculation is as follows for a new small sedan:

Table 2. Costs of car sharing and car ownership measured against car usage

Kms driven per year	4500	9000	16000
Car Sharing (\$/ _)	1007	2038	3700
Car Ownership (\$/ _)	3173	3363	3734

(source Portland car sharing- <http://www.carsharing-pdx.com>)

A calculation done by the Norwegian Newspaper Verdens Gang (28 April 1998) showed that for an average Norwegian car (price about 18.100 £), driven 15.000 km per year, it would cost the owner 5.440 £ per year or 15 £ per day. The included costs were: depreciation, loss of interest on sunk capital, insurance, yearly public fee, maintenance, gasoline, oil, tires, servicing and repairs. A member of the car sharing association could use a car 26 weekends per year (300 km per weekend) and one weekday per week (30 km per day) at a yearly cost of 2950 £, almost half that of the car owner. The article pointed out that up to 2418 £ could be used for taxis before one came in balance with the cost of car ownership.

These efforts at making the cost of car ownership and use more transparent are important in the marketing and information efforts of car sharing organisations. Marketing and information is one area in which public support might make an effective contribution in disseminating information on the existence of car sharing and on the advantages of car sharing, such as the reduced automobility costs for both individuals and the community. An example of how this might be done is in conjunction with the issuing of the drivers license. Another opportunity is in conjunction with the "In town without my car ?" day in September of each year across Europe. In some countries as in France, the development of mobility management and other service oriented indicators – to go beyond the "traditional" transportation indicators which have to do with numbers, sizes, fuel efficiencies and other dimensions of the car fleet and car use - could be helpful in marketing and in orienting transport policies.

Coalition building

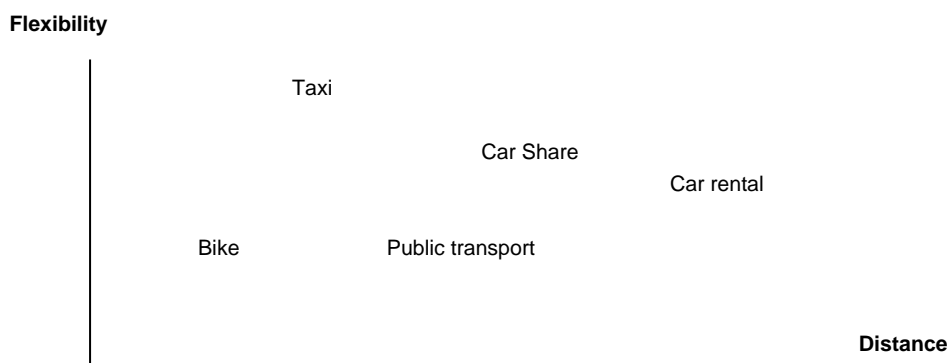
In order to grow and prosper economically, car sharing organisations must seek coalitions with other organisations which have an interest in mobility. The most obvious are the public transport and car rental organisations. Other important partners for the future are public organisations responsible for urban planning and housing developers: in Bremen, in the Netherlands and in Switzerland, urban planners are building parking stations into the future plans for city development. In many European countries, the Directive on air quality stimulated national laws and legal frameworks favouring urban transportation. Car sharing could find a place in these new frameworks. From the French case study, it seems important to identify the relevant authorities elaborating local rules (for parking, building development, etc), inform and train them on sustainable parking policies, such as limiting private spaces in residential and commercial building while providing alternatives such as car sharing stations in residential buildings, or public transportation solutions for commercial buildings.

In many places around the world, new housing communities join together with car sharing organisations to offer memberships in car sharing. The need for parking space is reduced and occupants get the economic benefits of avoided car ownership.

Co-operation with other mobility organisations

Experience from many parts of the world is that co-operation between car sharing, public transportation, taxi and rental organisation is in the best interests of all. Evidence from situations in which there has been co-operation shows that car sharers increase their use of public transport, taxis and car rentals. Thus these forms for mobility are not competitive, but rather are complementary.

Figure 1. Car sharing fills a mobility gap, complementing other forms for personal transport (after Glotz-Richter 1999)



The figure above shows how car sharing fills a mobility gap on two dimensional flexibility-distance axis. Flexibility means easily accessible, flexible routing and flexible carrying capacity. Taxis are very flexible means of transport, but are expensive for longer distances. The bicycle and public transport are less flexible than a private vehicle. Car rentals are more flexible than public transport but are not economically efficient for short distances. The car sharing vehicle is flexible and is suited for intermediate distances. Thus there is some overlap with other means of transport, but also a unique niche which none of the other transport means fills efficiently. Four car sharing organisations have monitored the changes in public transport practices in conjunction with increased car sharing. Changes are indicated in the following table.

Table 3. Consequences of car sharing on the use of public transportation

Car Sharing Organisation	Consequence for public transportation (PT) of co-operative agreement
StattAuto (Berlin) [Members get Smart Card for use on PT and a 15% discount on monthly pass]	Increase from 30% of all trips by PT to 40% of all trips by PT among members
Stadttauto (Bremen) [Purchase of an AutoCard gives PT season pass holders access to car share vehicles]	An increase by 24% of season pass clients who buy annual, as opposed to monthly, passes
DENZELDRIVE (Austria) [No special discount or agreement]	An increase of 1,2 million kilometres of PT journeys among members
Mobility (Switzerland) [Discounts on seasonal PT passes and pass holder access to car share vehicles, plus a half-price pass on Swiss rail system for car share members]	A change among members from 20% of all journeys by PT to 80% of all journeys by PT

There is also evidence that discounts and other forms for agreements on public transportation have a positive effect on car sharing memberships. An example is Switzerland, where car sharing began to take off in 1996, when car sharing, rental car and public transport were integrated. Within 6 months, 3,500 new members joined Mobility, a significantly higher enrolment than in the previous 6 months (Muheim 1998).

Resistance to co-operation can be high though: in France there seems to be a widespread conception that transportation is made of two universes, that of the private car and that of the public transportation system. Even though modal transfers are more and more mentioned, these universes tend to fight without admitting a common border. Any hybrid containing elements of the two, or a linking of these two universes has trouble being seriously considered - even if car sharing has not been totally ignored.

Agreements with car rental organisations are also important. Practically speaking, car rental provides a way for car sharing members to satisfy their longer distance mobility needs. It also provides the organisation a way to help alleviate weekend peaks in demand for cars. Rental car companies generally have different markets, focusing on business users, tourists and accident replacement cars, while the car sharers focus on residential use. Rental firms usually require minimum one day use. Rental car location tends to be at an airport or at a cheap location on the edge of town, while car share parking lots are spaced around. Rental car companies have on the whole decided to co-operate with, rather than compete with car sharing organisations. Car renters sometimes use rental cars on the weekends in the peak periods. In DENZELDRIVE, car sharing members have increased their use of rental cars by 200,000 person-kms. The Baum and Pesch (1994) study of all car sharing organisations in Germany showed that members had almost doubled their use of taxis after joining.

Professional approach to operational aspects

In almost all of the more mature organisations, there is a recognition that professionalism in organisation, practical routines, service and marketing are essential to member loyalty and to growth. Even the most idealistic of members state clearly that their continued participation depends on the efficient management of the reservation system, car placement, billing and other practical aspects of the organisation. In fact one of the main reasons for joining was to leave behind many of the practical problems associated with owning a car (found to be true among Bilkollektivet, Stadttauto, Bremen, and Mobility members

The failure of STAR (San Francisco) reinforces this point. Sound business practices and a professional approach to the organisation were sacrificed for idealism. The rate structure was not set high enough to cover expenses. Cars were not well maintained and the reservation system did not work smoothly.

A European study of non-car sharers found an image of non-professionalism to be one of the principle reasons for not participating. Car sharing organisations were said to have an unprofessional image, an insufficient variety of products and services, higher prices than public transport, a system that was perceived to be “complicated, impractical and time consuming”, and vehicles that were not readily available near home (Shaheen *et al* 1998). This image needs to be corrected if car sharing is to reach a larger public.

A creative approach to service

It is important that car sharing organisations distinguish themselves from the other mobility options. Creative service offers can contribute to this. Some of the creative services provided by the organisations we have reviewed are:

- Discounts on car rentals and public transport.
- Co-ordination of seasonal passes on public transport with car share memberships.
- Access to a wide variety of vehicles.
- The service derivatives of the smart card chip technology: easy access (no need for key boxes), visual display of kilometres under way, direct reporting of kilometres (no need for log books), direct billing.
- Allow members access to travel information and to book journeys on other forms for transport.
- Allow members to take up to three other people with them on public transportation (the virtual car).
- Allow female members to deliver cars on the morning after night use to avoid walking home at night.

New organisations are now advised by other car sharing organisations abroad to establish themselves as a corporation (as opposed to an association - their previous status) and to immediately begin to seek commercial businesses as clients, instead of waiting until load management difficulties emerge. In the case of Caisse Commune in Paris, commercial clients have been targeted in the first commercial brochure.

Certification by public authorities

The Swiss and German organisations see government recognition of car sharing as one of the important next steps in its evolution. This would have an effect on a number of important issues. One of them is criteria for deciding when an organisation qualifies to be designated as a car sharing organisation. For example, do two families sharing a car qualify? And what differentiates car rental and car sharing organisations? Second is a legitimising effect. Government certification (since May 1999 the Blue Angel Label for car-sharing organisations has been implemented in Germany) would generate trust and reduce the attitude that these are non-professional, fly-by-night organisations. Third, it would allow local government, commercial and non-profit organisations to provide benefits such as designated parking or tax advantages.

Barriers

General

There are several barriers which lie in the background for all of the organisations we have reported on. One is a general problem for alternative transport solutions, which is the positive macro-economic association of transport growth and economic growth. More cars, more roads and more infrastructure to support them have been positively valued in the indices constructed to reflect economic growth. An organisational form which has the consequence of reducing the number of cars is valued negatively. Another potential barrier is the automobile industry itself, though as we have reported, many manufacturers are exploring ways in which they can be a part of the emerging car sharing industry, rather than block the development. Finally there is the firmly rooted idea of the car as a part of the modern family. This can perhaps only be dealt with through the growth and increased visibility of car sharing, coupled with the marketing of the “mobility service” of car sharing as a better, less expensive and more modern alternative to car ownership. Also, transportation indicators need to be changed from an emphasis on size and numbers of cars, roads, etc. to a positive valuing of mobility management.

Access to parking

A recurrent theme in experiences from many parts of the world is that finding places to station vehicles is a problem. There is heavy competition for parking spaces in many cities of the world. This means that deals must be struck by the car sharing organisation with either the municipality, apartment complexes, commercial businesses or other enterprises in order to secure parking stations at reasonable rates.

In Germany and Switzerland there are new initiatives which may help reduce this barrier. One is the Blue Angel certification, which will allow city governments and other organisations to either dedicate or discount parking for legitimate car sharing organisations. In the Netherlands, city planners are building parking stations into plans for future city development. And in several parts of the world, building contractors and entrepreneurs are linking apartment ownership to car sharing and providing parking for car share vehicles.

However, in some countries as in France, there is a concern that if parking places are attributed on the streets and surface parking areas, as opposed to an underground watched parking, difficulties could arise concerning whether attributed areas are respected by other cars. There is evidence for this from the problems in respecting the designated parking areas for disabled persons. There is also a risk that key boxes could be broken into.

Coping with uneven demand (variable load)

One of the biggest problems for car sharing is dealing with the peak demand for cars on weekends, particularly in the summer months. This is the source of an economic problem, since the income generated from car use is low in off-peak periods. It is also the source of a customer satisfaction problem when cars are not available to meet members needs.

Car sharing organisations have dealt with the problem in one or more of several ways. The first is the development of more sophisticated models for predicting demand (for example, StattAuto and Mobility), based on past practice, weather, holidays, etc. This allows for more efficient availability and placement of vehicles. The second is to make an arrangement with a rental car agency to make some of its cars available to the car sharing organisations during peak periods. A similar tactic is for the car sharing organisation to help its members to make reservations for rental cars. The new Cash Car programme by StattAuto is another initiative designed to make cars available on weekends. Cars are leased to members under the condition that they make the leased cars available for use by StattAuto on weekends when they are not using the car. Income for the rental is shared by StattAuto and the leaser.

Access to capital

As with any business, the start-up phase for a car sharing organisation presents economic challenges. A decade ago organisations were forced to generate capital through loans and membership deposits. Today, outside investors are more inclined to participate in the financing of new car sharing organisations. An example is the new organisation in Belgium, where the local organisation is only planning to put up one fourth of the capital. The remainder will come from public transport (1/4), the automobile sector (1/4) and from a foreign car sharing organisation (1/4).

These three sources of capital reflect trends which should make financing less problematic in the future. Public transportation organisations see the potential for co-operation with car sharing as does the automobile industry. In addition, the large car sharing organisations like StattAuto and Mobility see the possibility for using their accumulated know-how and capital as investments in new organisations.

Providing seed capital is one way public authorities could effectively intervene. There is increasing availability of information and know-how on car sharing, but as with any new concept, getting it financially off the ground is challenging. A sound argument can be made that the societal benefits justify public support for car sharing efforts which can demonstrate professionalism and commitment.

7. CONCLUSION

Based on this assessment and review of car sharing, we draw several unequivocal conclusions:

First, there are definite and measurable societal benefits to be derived from car sharing, the most notable being the reduction in the number of cars in the urban areas in which it is implemented, and an approximate 50% reduction of the total number of kilometres driven among its participants. In addition, car sharing cars are on average newer, smaller and more fuel efficient than the urban average.

Second, there is evidence from a number of countries that car sharing does not take market shares from either public transportation, taxis or car renting. On the contrary, there have been increases in public transportation, taxi and car rentals in every city in which these have been assessed. These four modes of transport form an intermodal alternative to car ownership. The car sharing member weighs the mode of transport according to the nature of the trip.

Third, from the point of view of the individual, there are a number of benefits. Car sharing is cheaper than owning a car for urban dwellers who drive less than 1000 - 1500 km per month, depending on the prices of the costs of owning and operating a car. The car sharing system turns fixed costs (insurance, parking, maintenance, repair, road fees) into variable costs. The car sharing member is released from the responsibility for fees and maintenance and is freed of concern for damage and thefts. The member has access to a range of different kinds of cars, so that the vehicle can be chosen to fit the task.

Finally, there are no significant negative consequences of car sharing which we have been able to identify. It does not require significant changes to or investments in infrastructure, nor does it necessitate a change in automobile technology. A study in Germany predicted that there would be no net loss of jobs related to the growth of car sharing (Baum and Pesch 1994). A French study using many of the same assumptions as the German study, came to the same conclusions on the effects on employment in France (CERTU 1999). We have pointed out that car manufacturers themselves, which might be hypothesised as the greatest losers from a growth in car sharing, have shown an interest in participating in, rather than working against car sharing in a number of countries.

So far the growth potential of car sharing has been estimated to be only a few percentage points in the countries where this has been investigated. Two studies in Germany, one by an independent research institute (Baum and Pesch) and another by Volkswagen (Britton, 1999) both predict a potential of 2 - 4% of the German population. The same order of magnitude was arrived at in a study by the Ministry of Transport in the Netherlands (Meijkamp 1999). In Switzerland, 600,000 (9% of the population) are either strongly or reasonably interested in car sharing and Mobility thinks it can capture 12% of the market share of drivers (Ziegler 1999). Since the total environmental effects of car sharing will depend on its growth, an important task for future research will be to begin to explore the size of the potential market segment.

The growth of the station car version of car sharing, which has received the most attention in France thus far, will likely be slower because it involves a double innovation. The first is sharing a car with others and the second is using an electric vehicle. If the government's goal with car sharing is the introduction of an electric-based supplement to the public transportation system, then the idea of station cars makes sense. If there is also an interest in capitalising on the environmental potential of car sharing, it might be wise to further explore the ways it can support the development of the StattAuto-type system.

Our conclusion from this survey of car sharing around the world is that it is a growing phenomenon with positive environmental benefits and as such deserves further investigation regarding its implementation countries where it has not been yet developed.

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