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Carsharing and Partnership Management
An International Perspective

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Most cars carry 40% of persons and are used for less than 1 hour per day. A more economically rational approach would be to use vehicles more intensively. Carsharing, in which a group of people pays carsharing fees plus per-use fees for one car, is one means of doing so. Carringhers may be organized through affinity groups, large employers, transit operators, neighborhood groups, or large carsharing businesses. Relative to car ownership, carsharing has the advantages of mass transit vehicles access to the advantages of a large range of vehicles, fewer car ownership responsibilities, and lower cost (if vehicles are not used intensively). The uncoincidence of car ownership and use affects the potential for sharing vehicle usage and directing individuals toward other mobility options. The perceived convenience (e.g., preferred parking) and cost savings of carsharing have promoted a new modal shift for many carsharing participants throughout the world. Societal benefits include the direct benefits of less demand by parking space and the indirect benefits arising from linking costs to actual usage and matching vehicles to trip purpose. The use of carsharing in Europe, North America, and Asia is reviewed, and its future prospects through expanded services, ownership management, and advanced technologies are explored.

The vast majority of automobile trips in U.S. metropolitan regions are drive-alone or trips. In 1998, approximately 90 percent of work trips and 99 percent of nonwork trips in the United States were made by vehicles with only one passenger (3). Vehicles are unused at average of 23 hours per day. This form of transportation is expensive and consumes large amounts of land.

Private vehicles are attractive. Their universal appeal is demonstrated by rapid motorization rates, even in countries with high fuel prices, good transit systems, and relatively compact land development. But the environmental, resource, and social costs of widespread use are high. One strategy for realizing the benefits of car use while limiting costs is to create institutions for shared vehicles.

The principle of carsharing is simple: individuals gains the benefits of private cars without the costs and responsibilities of ownership. The experience of owning and maintaining a vehicle, a household account for a fraction of the cost of owning a car. Carsharing may be thought of as one among a broad range of car rental. Individuals gain access to vehicles by joining organizations that maintain a fleet of cars and light trucks in a network of vehicle locations. Generally, participants pay a usage fee for each time they use a vehicle.

Carsharing provides a cost-effective way to use the costs of vehicle travel for the individual as well as society. When a person owns a car, much of the cost of owning and operating the vehicle is fixed. The variable cost of using the owned vehicle is relatively low, and the driver has the incentive to drive more than is economically rational. In contrast, payments by carsharing participants are closely tied to actual vehicle usage. A carsharing system in effect uses the fixed costs of vehicle ownership into variable costs.

Carsharing is one of the most effective and attractive ways for one or a transportation mode that fills the gap between transit and private cars and can be linked to other modes and transportation services. For long distances, one may use a household vehicle or a transit, cycle, bus, or a rental car; and for short distances, one might walk, bicycle, or use a taxi. But for intermediate travel distances, even distant ones, one might use a shared vehicle. The shared-economy option allows other carsharing attractors: it can serve as mobility insurance in emergencies and as a means of satisfying occasional vehicle needs and desires such as carrying goods,Peers driving in a sports car, or taking the family on a trip.

Over the last decade, carsharing has become more common, especially in Europe and North America. Most involves the shared usage of a few vehicles by a group of individuals. Vehicles typically are deployed in a lot located in a neighborhood, a workplace, or a transit station, a majority of existing carsharing programs and businesses still manage their services and operations manually. Users place a vehicle reservation in advance with a human operator; obtain their vehicle key through a self-service, manually controlled key box; and record their own mileage and usage data on forms that are picked up in the vehicle, key box, or both. As car-sharing programs expand beyond 100 vehicles, manually operated systems become expensive and inconvenient, subject to mistakes in reservations, access, and billing, and vulnerable to theft and fraud.

Automated reservation, key management, and billing constitute one response to these problems. The largest European carsharing organizations (CEOs), especially in Germany and Switzerland, have begun to deploy a wide range of automated technologies that facilitate the operation and management of services, offer greater convenience and flexibility for users, and provide additional security for vehicle and key management systems. In northern California, a "smart" a carsharing demonstration program called Car2Go, with 1200贯彻ed cars, has been testing and evaluating a variety of state-of-the-technology communication and reservation technologies in January 1998 (3). A second, suitably matched, was launched in March 1999 in the southern California city of San Diego, which had 1505 electric vehicles called CART2CAR, and-encouraged computer technology. The shared vehicles are available for day use by faculty, staff, and students at the University of California, Riverside campus.

Smart carsharing makes automation more viable, thereby creating the potential for even greater benefits. For example, on returning from work at the end of the day, a traveler rents a shared-use vehicle at the transit station or another rental site) near home. She drives the car home and, should she wish, to other activity locations during the evening and then drives it back to the station the next morning. After riding the train for the last half of the trip that morning, she rents another vehicle to get to work from the train station. During the day, the vehicle is used as a fleet vehicle at office, Allo-
gether, shared-shun vehicle could be used for up to 15 distinct trips per day, and it could facilitate up to 3 additional roundtrips.

**HISTORY OF CARSHARING IN EUROPE**

Most car-sharing efforts are still small scale and in Europe. One of the earliest European experiences with carsharing is traced to an early cooperative, known as S-fahrten (Selbstfahrtenvereinigung), which initiated services in Zurich in 1948 (1). Membership in S-fahrten was motivated primarily by economics. It attracted individuals who could not afford to purchase a car but found sharing to be appealing. Elsewhere, a series of “public car” experiments were attempted but had failed, including a carsharing initiative known as PicoCar that was started in Montpelier, France, in 1971, and another, called Wilker, that was deployed in Amsterdam in 1973 (4). More recent and successful experiences with carsharing began in Europe in the mid-1980s (5). Approximately 200 CSOs are active in 450 cities throughout Switzerland, Germany, Austria, the Netherlands, Denmark, Sweden, Norway, and Italy. These carsharing countries collectively claim more than 100,000 participants. The European CarSharing Alliance, established in 1991 to support carsharing (offering activities, reports a membership of 62 CSOs that collectively serve more than 60,000 individuals with 2,700 cars at 850 locations (6).

Until a few years ago, virtually all CSO start-ups were subsidized with public funding (with a few supported by corporate subsidies). Although many organizations received start-up grants, operational costs typically are not subsidized in European CSOs.

The two oldest and largest carsharing organizations are Mobility CarSharing Switzerland (with 1,200 cars in 16 cities, 1999), and Stadt-auto Drive (formerly StadtAuto Berlin), with about 200 cars. The Swiss program, begun in 1987, now operates in 800 locations in more than 300 communities and has more than 25,000 members. StadtAuto Drive, begun in 1988, now has nearly 6,500 members; the current membership size reflects a 1998 merger of StadtAuto Berlin and Hausberg (7).

Although founded only 1 year apart, these two organizations evolved independently and quite differently. Mobility CarSharing Switzerland (a May 1997 merger of Auto Tiel’d Oenossenschaft and ShareGon) starts from a grassroots effort to spread carsharing throughout neighborhoods and transit stations in Switzerland. In contrast, StadtAuto Drive was launched at a university research project to demonstrate that carsharing could offer a viable transportation alternative for Germany. These two organizations are recognized worldwide as modern pioneers of carsharing. Both grew about 50 percent per year until 1996 (8). Monthly CarSharing Switzerland continues to grow at about 35 percent per year, while StadtAuto Drive’s growth rate has slowed considerably (9).

StadtAuto Drive attributes these revisions for this stagnation (7):

1. Many members have moved from the inner city to the countryside, where public transit is limited. This has forced many individuals to purchase private cars because they can no longer easily access carsharing vehicles and transit.
2. Another group of members realizes after using the CSO that they require a shared car only on rare occasions. Many in this group drop out because the yearly CSO membership fees do not justify occasional use. As a result, StadtAuto Drive members pay an annual fee of 170 Swiss, or $100. If an individual’s vehicle use is less than 200 miles, or $120, a year, this individual typically will drop out of the organization and use traditional means to fulfill their transportation needs.
3. Finally, other members require vehicles so often that frequenting the CSO serves them too great a burden. Often, these individuals also accept CSOs because they prefer dedicated private vehicles to carsharing.

For the first group of individuals, who move to the countryside, no solution has been found. To acquire the former clients and attract new ones, StadtAuto Drive has started some new initiatives (10). Other organizations are considering merging because the demand for new communication and reservation technologies puts pressure on these organizations to continue expanding to generate revenue to pay off these investments.

A few small, shared-used vehicle tests have already been implemented in Europe. Luftans Airline (instituted automatic rental systems at the Munich and Frankfurt airports in 1995, in which a computer generates a key and stots the billing (9). After the car is returned, the vehicle communicates distance traveled and fuel consumed to a central computer system. By the end of 1994, 12,000 employees at the two German airports had access to these “carport” systems. Lufthansa reportedly has saved more than 350 million in avoided parking infrastructure costs (9). Tire cost savings have been used as justification for corporate subsidies of the program. As of 1999, the system is being modernized with a web-based system and coordinates with local transit operators (10). A similar program called CarNet was introduced in 1995 by Swissair at the Zurich airport for flight attendants. It is technologically similar to tests in collaboration with Hertz Rent-a-Car (7).

The French Praxitel program, described by Mansu et al. in this Record, also uses advanced technologies. In October 1997, Praxitel began operation of 50 Renault electric vehicles that are rented and driven between 11 “Praxitel”-located rental stations and office blocks. From April to June, more than 520 employees at the stations are plans to expand to 1,000 in the near future. All cars eventually will have global positioning system (GPS) location and global navigation satellite system, conduct inspection structures, and a central computer to manage the system (11). Recently, Praxitel announced that the city of Paris plans to deploy a similar application in 2000 with 2,000 cars.

Along with the few success stories there are many failures. Most organizations have found it difficult to make the transition from grass roots, neighborhood-based programs into viable business ventures. They miscounted the number of vehicles needed, placed too great an emphasis on technology, or expended funds for marketing with little return. Many of the failed organizations have merged or been acquired by larger European CSOs.

**HISTORY OF CARSHARING AND STATION CARS IN NORTH AMERICA**

The North American experience with carsharing is far more limited. There have been two formal carsharing demonstrations in the United States. The first was Mobility Enterprise, operated in a Purdue University research program from 1983 to 1988 in West
Lafayette, Indiana (2). Each household leased a very small "mini" car for short local trips and was given access to a shared fleet of spe-
cial purpose vehicles (i.e., large sedans, taxis, and recreational vehicles). Mobility Enterprise created a hypothetical cash flow for its operations. They claimed economic viability, but only if the shared-use vehicle services were run through an existing organiza-
tion, such as a large fleet operator.

In this field test, the mini vehicles leased to participants were used for 75 percent of the households' vehicle mile of travel (VMT). In contrast, the shared-use vehicle fleet was used only 35 percent of the time that it was available to households throughout the experiment. (The Mobility Enterprise study findings did not provide the per-
centage of a household's total VMT that was made with a special-
purpose fleet vehicle.) Although this program was considered a suc-
cess in promoting shared use, Mobility Enterprise did not continue because it was deployed as a research experiment.

A second major U.S. carsharing project was the Show-Farm Auto
Rental (STAR) (demonstration in San Francisco (3)). The STAR com-
pany operated as a private enterprise from December 1983 in March
1985, providing individuals in an apartment complex use of a short-
term rental vehicle, for a few minutes up to several days. Feasibility
study funds were made available from the 15-train Mass Transportation
Administration and the California Department of Transportation.

STAR was operated from the parking garages of a 9,000-unit
apartment complex located near San Francisco State University.
Users paid on a per-minute and per-mile basis until a maximum
daily rate was reached. This rate was kept low to discourage au-
tomobile ownership and encourage transit use. The maximum daily rate for subcompact, midsize, and full-size vehicles ranged between $8 to $9 with an additional charge of 10 cents per mile. The members shared a fleet of 51 vehicles (44 cars, 5 wagons, and 2 lightweight trucks), with 10 additional vehicles available as backups during periods of peak demand. The fleet size was maintained until January 1985, when it shrank to 35 vehicles. Membership peaked at approximately 350 participants (14).

The project failed halfway through the 3-year program. The primary problem was the low and erratic income of many of the tenants. Many were later discovered not to be "for-profit" users for car-
ownership; many were student shared, or an additional charge were and were
not listed on the lease, another failing was the pricing structure of
STAR: It encouraged long-term, as well as short-term rentals. Long-
term rentals sometimes resulted in long-distance towing charges when the unit, often poor-quality cars broke down among members
from San Francisco. STAR's management tried to cut costs by
buying, used, economy-class vehicles, but this resulted in
high repair costs. Ajaan, STAR apparently offered too many
modern in each vehicle class, leaving members dissatisfied when a particu-
lar car was unavailable (M. Rustad, unpublished data).

Today, there are nine existing carsharing organizations in North
America. They share a similar operational model. Members access
vehicles at a neighborhood lot, which is located a short walking dis-
tance from their homes or work sites, and they "lock in" carsharing
reservations over the phone. At present, some of these CSGs use
technology to facilitate reservations, operations, and key
management. Four are not for-profit businesses, and the rest are non-profit cooperatives.

Five of these North American CSGs are located in Canada. The
first and oldest is Auto-Car, located in Quebec City. Auto-Car, which
began operating in August 1994, currently has 450 members and
34 cars. Interestingly, the organization began as a nonprofit
cooperaive, but it changed to a for-profit business in 1997. In Sep-
tember 1995, the same group launched a second CSG in Montreal—
CarFusion Inc., whose Auto-Car is larger than 50 members and
32 cars. CarFusion was founded as a for-profit business, but not as
a nonprofit cooperative. Less than 2 years later, two new Canadian
groups emerged. In January 1997, the Competitive Auto-Network
(CAN) began offering carsharing services in British Columbia. At
present, CAN has 250 members and 18 vehicles. This CSG operates
as a nonprofit cooperative. In February 1997, Victoria CarShare
Co-op launched its operations in Victoria. This nonprofit coopera-
tive currently has 70 members and five vehicles.

In October 1997, the City of Seattle and King County Network, Inc., began in private
operations with nine cars in downtown Toronto. During its first
month of operation, 40 members joined, exceeding initial mem-
bership expectations. At present, the network has 60 members and
five cars.

Four carsharing organizations, all of which are younger, operate
in the United States. Another two are being planned in the Pacific
Northeast, and three in San Francisco. Boulder CarShare Coop-
operative was launched in Boulder, Colorado, in May 1997. The Bou-
der CarShare has seven members from five households who share
one vehicle. Members pay a modest monthly fee and mileage charges for
vehicle use. This CSG also provides assistance to other neighbor-
hood groups interested in forming a car car-co-op.

Dancing Rabbit Vehicle Cooperative (DRVC), located in Rut-
ledge, Missouri, has been in operation since July 1997. This CSG
currently has eight members and two biodiesel vehicles and supplies
an average of 370 VMT per week to its members. DRVC operates
under a nonprofit, cooperative business structure.

The Oregon Department of Environmental Quality and the U.S.
Environmental Protection Agency funded a 1-year carsharing pilot
program in Portland that began operation in February 1998 with two
Dodge Neon. The Portland City CarShare (PCC) has 40 mem-
bers and 11 vehicles and operates as a for-profit business
(with powerless, start-up subsidies). The fourth U.S. CSG, Olym-
pia CarCoop, located in Olympia, Washington, has been in
operation since November 1998 as a for-profit, cooperative
organization. In January 2000, Olympia has six members and one
vehicle.

A fifth CSG, Motor Pool Co-op, is planned to be launched as an
early 2001 in Corvallis, Oregon. Motor Pool will "start its program
with three vehicles and be run as a nonprofit cooperative, in the fall of
1999, the City of Seattle and King County Metro plan to begin car-
sharing in Seattle in two or three high-density neighborhoods. Metro
is exploring partnerships with a private vendor with the goal of
deploying 100 vehicles and enrolling 1,500 subscribers by the end of
its first year. In fact, funding for this project has been so successful
because of the strength of Seattle's suburbs, the King County
executive, and several council members. The Seattle organizers
hope to cultivate this project into a profitable private-sector venture
during the second year of operation.

In San Francisco, a group of environmental organizations, plans,
and transportation researchers has formed a public-private
partnership, called City CarShare, consisting of public agencies and
nonprofit organizations. City CarShare began seeking funds in late
1997. Hopes to begin operations in the fall of 1999, with 50 mem-
bers and a minimum of eight cars. City CarShare is a nonprofit orga-
nization and is located in the dense, transit-rich neighborhoods
within San Francisco.

RECENT DEVELOPMENTS IN ASIA

Since 1997, there have been increasing developments in carsharing
in Singapore and in Japan by two auto manufacturers, In August
1997, NTUC Income Car Cooperative Limited (Car Co-op) launched its first list of a carsharing system, using an electronic key box and on-board computers, at the Toh Yi estate in Upper Bukit Timah, Singapore. Within the first few weeks of the launch, more than 150 people registered to join, although the Car Co-op could accept only 80 members. The residents of the estate now share four Mitsubishi Lancers. The Car Co-op is being extended to private homeowners. Residents of Villa Marina and Riverrade will automatically become members of the Car Co-op and have access to a fleet of cars, including a Meteor-Renault Logan and several mid-size passenger vehicles. There will be one car for every 60 residents. The developers of the two condominiums will each pay approximately $100,000 toward this operation during the first 3 years of the program. Members will pay a membership fee during the first year, but they will pay for usage. For example, a will cost $20 per hour to book the limousine. Carsharing lots will be located near public transit stations, so users can rent vehicles at the end of a transit trip. The estates will provide shuttle services to the transit stations.

In October 1997, Honda Motor Company announced its version of carsharing, known as the Intelligent Community Vehicle System (ICVS), which is being tested at its Twin Ring Motegi site in Japan. The ICVS site in Motegi comprises multiple lots from which four different types of electric-powered vehicles can be selected for use. In the future, ICVS could be used in conjunction with an individual’s private vehicle and public transportation to relieve traffic congestion and parking problems. The advanced technologies used in this system allow users to rent a vehicle as they choose from various ICVS lots by using their smartphones. This same card is used to unlock and start the vehicle, thereby eliminating the need for a vehicle key. User fees are calculated automatically, and members may have their fees automatically deducted from their bank accounts. The lots and vehicles are equipped with technologies, including GPS, that allow the ICVS management center to monitor vehicle location in real time. Further, the vehicles are outfitted with panning technologies that allow a system worker, driving the first vehicle, to lead up to four unmanned, and could be another port. These same vehicles can be used to drive and take a vehicle toS car sharing system, this system employs a network of carsharing services and is a fleet of 50 small electric vehicles. Employees working at Toyota headquarters in central Japan will drive the vehicles between home and work. Sixty charging stations will be installed at the Toyota facility. Employees will also charge the vehicles at their homes by using a household 110-volt current.

INNOVATING THROUGH SOHO LIFESTYLE

To date, all non-government carsharing organizations have begun as small, local operations, usually with government funding and inspired by ideological concerns about independence and the negative impact of cars on urban settlement. On the basis of a study tour and literature review of carsharing in Europe, Lightfoot found that people seeking novel and less expensive ways of owning and employing cars instead were the core constituents of pilot carsharing projects in the Netherlands, the United Kingdom, and Ireland (6). Given strong local ideological roots, Lightfoot concluded that new start-up CSOs are more likely to succeed if they remain at a self-organizing local level as long as possible. Recent history has shown that it is difficult to transform a small grassroots CSO into an economically viable business.

Large, successful European CSOs are developing a range of new services. Given the absence of successful models, CSO pioneers are exploring a variety of new services and technologies, including partnerships with transit, car leasing programs, car rental agencies, and taxis. This partnering process includes business and marketing collaborations or use of advanced information and communication technologies, or both (15). Existing examples are described in the following.

Autostate, Netherlands

Autostate, founded in 1995, is an umbrella organization that serves 85,000 CSO participants in the Netherlands. In addition to applying conventional information and marketing functions, Autostate also provides the following services (15):

1. Facilitates linkages between private carsharing services and other businesses (e.g., taxi cooperatives and car rental agencies);
2. Links carsharing providers to private companies interested in sharing their fleet vehicles;
3. Promotes the use of shared-vehicle management in land development (e.g., establishment of carsharing in new residential areas).

Autostate is financed entirely by the Dutch Ministry of Transport, but it expects other governmental agencies and private businesses to assume an expanding share of net budget (2).

EASYDRIVE, Austria

EASYDRIVE, a for-profit organization in Austria, was founded in August 1997. The Denzel Group, a large automotive sales company, runs EASYDRIVE. The Denzel Group rents the CSO’s 83 vehicles from Europcar, a division of Denzel. Every 6 months, Europcar replaces EASYDRIVE vehicles with new ones. At present, EASYDRIVE has 70 stations and 1,100 members. In 1999, EASYDRIVE plans to expand its fleet to 200 vehicles. These vehicles will be equipped with on-board computers.

EASYDRIVE has several innovative partnerships that facilitate management and attract new members. Partners include Europcar, Wien Municipal Public Transport, ÖBB (Austrian Rail), and OAMTC (an Austrian car club with more than 2 million members). OAMTC acts as a mobility provider, not just a car club, by advertising for EASYDRIVE, providing information about carsharing, and taking EASYDRIVE reservations. Furthermore, EASYDRIVE is exploring partnerships with developers to establish carsharing in new housing communities. Finally, in cooperation with the Austrian Ministry of the Environment, EASYDRIVE has planned the project "Sundrive" to encourage car-free tourism, providing tourism with easy access to electric vehicle rentals.

Edinburgh City Car Club

The Edinburgh City Car Club likely will be the most advanced carsharing system in Europe, using on-board computers and GPS tech-
Mobility CarSharing Switzerland

Mobility CarSharing Switzerland recently deployed two new mobility service programs. The first, Zuri Mobil, is a successful mobility package that is based on a regional public transport offer that also includes carsharing and car rental. The second, Zuger Paus Plus (ZPP), provides a discounted combination of carsharing, public transit, car rental, taxi, bicycle, and other, non-transport-related services for its customers (similar to a frequent flyer program). ZPP is a partnership of several transportation providers and other businesses. On September 1, 1996, a third partnership was launched with the Swiss National Rail System (SBB), offering a mobility package to 1.5 million SBB passholders (approximately 37 percent of the country's adult population). This package provides users with special discounts and easy access to carsharing vehicles, rental cars, and taxis. Finally, a pilot project starting in 2001, EASY-RIDE, will encompass most Swiss transportation activities by 2005. EASY-RIDE will make all services accessible by smart card. This will simplify ticketing and marketing and will open new options for intermodal enrollment. Almost every public transportation company in Switzerland is a partner in a carsharing mobility package. In the future, the relationship is likely to grow even stronger.

Although partnerships with public transportation agencies are a very successful mobility strategy, partnerships should be based on a broader set of patterns (e.g., employment centers, car rental, auto companies, car dealers, air stations, and car clubs). For instance, mobility packages can be designed in collaboration with auto manufacturers to meet the needs of heavy car users. Mercedes-Benz's "Swissnet," a small, two-seater combustion engine vehicle, is a complementary vehicle to carsharing and intermodal trips (i.e., it is easy to park). When an individual buys a Swissnet in Switzerland, he or she can purchase a mobility package for a value of $245 for just $5 per week. This package includes free access to all carsharing vehicles—with no membership fees—at a slightly higher hourly rate and the same mileage rate paid by Mobility customers. This package also includes a half-price pass for the Swiss transportation system. This allows the passholder to purchase train and bus tickets for half-price throughout the year. In this partnership, Swissnet fits smoothly into a new consumer-oriented mobility package that provides individuals and households with an expanded set of mobility options.

StadtAuto Drive

Similarly, StadtAuto Drive, based on a strong collaboration with Volkswagen/Audi, has designed new innovative services including the lease of the "company of highly organized and integrated city traffic elements" (CHOICE), which allows clients to lease a vehicle through the CISO. With CHOICE, a customer has the option of making the leased vehicle available for CISO use when he or she is out of town. This innovation, based on flexible rates that are adjusted every hour to reflect supply and demand, can reduce the cost of lease by about $100 per month if the leased vehicle was rented for just one weekend each month (27).

Another innovation of StadtAuto Drive is its Mobil Card, which carsharing customers can use for accessing an expanded set of services and discounts. This smarcard provides a 15 percent percent reduction on public transportation and allows users to use taxis without exchanging cash, pay for food and beverage home delivery, reserve a bicycle, and even book a canoe in Brandenburg, Germany. In early 1998, Mobil Cards could be used at all StadtAuto locations throughout Berlin and Potsdam. Beginning in 1997, StadtAuto Drive also began offering its members a food and beverage delivery service called StadtKart. For a moderate fee, members can receive a StadtCard delivery once a week (17).

StadtAuto Drive, like Mobility CarSharing Switzerland, is partnering with major car rental companies and CHOICE to provide vehicles to CSO members when it is more economical to rent a vehicle (i.e., when rental periods are longer than 2 days) or when carsharing demand is at a peak (C. Petersen, unpublished data).

StadtAuto Brunnen

Another German CSO, StadtAuto Brunnen, which now has 1,700 carsharing members and 75 vehicles, launched a transit pass program in June 1998. The program links the city's transit system to the CSO's smart card and its vehicles equipped with on-board computers (Glotz-Richter, unpublished data).

USER CHARACTERISTICS AND MARKET POTENTIAL

It is difficult to estimate demand for new technologies and new attributes when customers have no experience with these products and attributes (28). Determining the demand for shared cars is especially difficult because it implies some reorganization of a household's travel patterns and lifestyles. How much inconvenience are people willing to accept in return for less cost? Some market studies have been conducted in the United States, but they are too tentative to be indicative (29). More sophisticated studies are under way at the University of California, Davis (25) and in Switzerland.

Several surveys of users have been conducted in Europe and North America by carsharing organizations. Although most of the surveys have small samples, they are not controlled groups that collect travel diaries or collect travel data, and employed simple questionnaires, they do provide useful insights. A survey in Switzerland and Germany found that users were between 25 to 40 years of age with above-average education, were more likely to be male, earn a below-average income (in part due to the low average age of participants), and were more likely to be sensitive to environmental and traffic problems. In a separate study, StadtAuto Drive reported similar characteristics: 65 percent male, average age of 33; well-educated; and modest incomes (U.S. $2,000 per month) (7). Molheim and Payne (4) reported that men have a greater tendency than women to demand a larger, more diverse fleet of vehicles for a wide range of trip purposes (22).

SOCIAL AND ENVIRONMENTAL BENEFITS OF CARSHARING

Individuals deciding whether to participate in carsharing generally do not consider indirect and market effects (with the notable
exception of a small group who may be ideologically motivated). Yet these environmental and social benefits are unlikely to be realized if the effects are large, then it is important to quantify them so that government, employers, and others will be encouraged to support carsharing. For instance, Lathrap has financially supported carsharing for its employees because it can avoid the substantial cost of providing additional parking infrastructure. Large environmental, economic, and social benefits can be realized with carsharing, primarily through a reduction in vehicle usage and, presumably, they will respond ratio-

nally by reducing vehicle use. The magnitude of these benefits is large, according to several carsharing surveys. As indicated in Table 1, about 30 percent of individuals sell their cars after joining CSOs, according to these 1990 and 1994, Aauta reports a 29 percent reduction in vehicles (20). In Oslo, Norway, 68 percent of individuals reportedly gave up a vehicle after participating in carsharing (23).

Reduced car ownership generally translates into reduced driving. Indeed, a Mobility CarSharing Switzerland study (conducted by the German 1990) found that car mileage for individuals who owned private vehicles was reduced by 33 to 50 percent after they joined the CSO. Most of these individuals increased public transportation use to meet many of their other transportation needs (4).

Similarly, for Germany, Baum and Pech reported that carsharing reduces private-car mileage by 59 percent, from 7,044 km to 4,073 km (4,250 mi.) per year, after membership (24). Most of this reduced travel appears to be for long-distance travel, but some transferred to other modes. Baum and Pech, for instance, report that public transportation use by CSO members increased by about 1,466 km (916 mi.) per year. Table 1 summarizes the change in modal split due to carsharing in Germany. This dramatic reduction in car use by CSO members—of almost a year—is much greater in Europe than would be expected in North America.

Overall, CSOs provide the promise of large reductions in vehicle usage and associated environmental effects. It remains to be seen whether these effects persist as CSO participation extends beyond early adopter groups and into North America and Asia.

**CONCLUSION**

Until the last decade, almost all efforts at organizing carsharing groups resulted in failure. For a variety of reasons, a new era began in the late 1980s in Europe. Several CSOs are now firmly estab-

lished and on notable growth trajectories. These USOs promise to provide large social benefits. Car travel and ownership diminish greatly when individuals gain access to carsharing, which is far greener than with virtually any other demand-management strategy known. Particularly appealing is that carsharing represents an enhancement in mobility and accessibility for many people, espe-

cially those who are less affluent.

Other lessons in how and where to launch carsharing are becoming apparent. Outside the realm of literature and personal experience, this expert concludes that CSOs are more likely to be economically successful when they provide a diverse output and variety of services, serve a diverse mix of users, create joint-marketing partnerships, design a flexible yet simple system, and provide for easy emergency access to taxis and long-term car rentals. They are more likely to thrive when environmental con-


cessions in high-driving diseconomies such as high parking costs and traffic congestion are pervasive; car ownership costs are rather high; and alternative modes of transportation are readily accessible. An evolution of CSOs is likely to result from these factors, and many are incorporating various forms of carsharing into their activities, although not well documented because of confidentiality agreements, is the need for partnership management to offer enhanced products and services (15). More business-oriented CSOs thrive by acquiring those that fail or lack strong leadership. To retain customer loyalty, they must improve services or reduce costs or both. Two linked strategies are being followed: (a) coordinate and link with other mobility and sommability

**TABLE 1 Vehicle Ownership Before and After Joining CSO**

<table>
<thead>
<tr>
<th>PASSENGER CAR OWNERSHIP</th>
<th>SHARE OF USERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Would rent a car</td>
<td>50.0%</td>
</tr>
<tr>
<td>Would forgo the purchased or leased private car because of car sharing</td>
<td>26.5%</td>
</tr>
<tr>
<td>Have given up the private car because of car sharing</td>
<td>28.4%</td>
</tr>
<tr>
<td>Have given up the car independent of car sharing</td>
<td>31.1%</td>
</tr>
<tr>
<td>Continue to own a private car</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

**NOTE:** These statistics are four to eight years old and generally reflect the behavior of early adopters of carsharing.

**TABLE 2. Change in Modal split (%)**

<table>
<thead>
<tr>
<th>Means of Transport</th>
<th>Without Cash Sharing</th>
<th>With Cash Sharing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Homeowner</td>
<td>60.5</td>
<td>53.4</td>
</tr>
<tr>
<td>Car rental</td>
<td>2.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Taxi</td>
<td>8</td>
<td>3.0</td>
</tr>
<tr>
<td>Public transportation</td>
<td>35.5</td>
<td>35.3</td>
</tr>
</tbody>
</table>


(e.g., tool providers) services, and (4) incorporate advanced communication, reservation, and billing technologies in conjunction with significant membership growth. However, advanced technolo-
gies are expensive, and linking with other services is successful only if the customer rate is large. Thus, CSOs either retain a small quan-
tity of or follow a spiraling growth trajectory. Taking a longer view, CSOs may be the pet project of an entirely new business activity: mobility service companies. As car ownership
problems and vehicles become more modular and special-
ized, entrepreneurial companies may see an opportunity to assume the full care and servicing of mobility needs in neighborhoods, work
sites, campus areas, and shopping centers, based on a partnership
management strategy (25). These new mobility companies might
handle insurance, registration, and maintenance, and they could sub-
stitute vehicles in household situations. One can imagine a future in which the pioneering CSOs combine their operational expertise with the entrepreneurial capabilities of advanced technol-
ogy suppliers and other business to create mobility services that
enhance our social, economical, and environmental well-being.

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