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Carsharing and Partnership Management
An International Perspective

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Most cars carry one person 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 a subscription plus a per-use fee, is one means of doing so. Carsharing may be organized through affinity groups, large employers, transit operators, neighborhood groups, or large carsharing businesses. Relative to car ownership, carsharing has the disadvantage of less convenient vehicle access but the advantages of a large range of vehicles, fewer ownership responsibilities, and less cost (if vehicles are not used intensively). The uncoupling of car ownership and use offers the potential for altering 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 split for many carsharing participants throughout the world. Societal benefits include the direct benefit of less demand for parking space and the indirect benefits arising from linking costs to actual usage and matching vehicles to trip purpose. The experience of carsharing in Europe, North America, and Asia is reviewed, and its future prospects through expanded services, partnership management, and advanced technologies are explored.

The vast majority of automobile trips in U.S. metropolitan regions are drive-alone car trips. In 1990, approximately 90 percent of work trips and 58 percent of nonwork trips in the United States were made by vehicles with only one occupant (*1*). Vehicles are unused an 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 car use are high. One strategy for retaining the benefits of car use while limiting costs is to create institutions for sharing vehicles.

The principle of carsharing is simple: individuals gain the benefits of private cars without the costs and responsibilities of ownership. Instead of owning one or more vehicles, a household accesses a fleet of vehicles on an as-needed basis. Carsharing may be thought of as organized short-term 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 each time they use a vehicle.

Carsharing provides the potential to reduce 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 thus the driver has an 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 transforms the fixed costs of vehicle ownership into variable costs.

Carsharing is most effective and attractive when seen as a transportation mode that fills the gap between transit and private cars and that can be linked to other modes and transportation services. For long distances, one may use a household vehicle, air transport, rail, bus, or a rental car; and for short distances, one might walk, bicycle, or use a taxi. But for intermediate travel activities, even routine ones, one might use a shared vehicle. The shared-car option provides other customer attractions: it can serve as mobility insurance in emergencies and as a means of satisfying occasional vehicle needs and desires such as carrying goods, pleasure 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. Mostly it 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 worksite, or at 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 stored in the vehicles, key box, or both. As carsharing programs expand beyond 100 vehicles, manually operated systems become expensive and inconvenient, subject to mistakes in reservations, access, and billing, and vulnerable to vandalism and theft.

Automated reservations, key management, and billing constitute one response to these problems. The larger European carsharing organizations (CSOs), especially in Germany and Switzerland, have begun to deploy a suite of automatic technologies that facilitate the operation and management of services, offer greater convenience and flexibility for users, and provide additional security for vehicles and key management systems. In northern California, a "smart" carsharing demonstration program called CarLink, with 12 compressed natural gas Honda Civics, began testing and evaluating a variety of state-of-the-art advanced communication and reservation technologies in January 1998 (*2*). A second, smart field test was launched in March 1999 in southern California; known as Intellishare, it had 15 Honda EV Plus electric vehicles, smartcards, and on-board computer technologies. The shared vehicles are available for day use by faculty, staff, and students at the University of California, Riverside campus.

Smart carsharing makes intermodalism more viable, thereby creating the potential for even greater benefits. For example, on returning from work at the end of a day, a traveler rents a shared-use vehicle at a transit station (or other rental site) close to 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 in the morning. After riding the train for the line-haul part of her 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 her office. Alto-

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gether, a shared-use vehicle could be used for up to 10 distinct trips per day, and it could facilitate up to 4 additional transit trips.

HISTORY OF CARSHARING IN EUROPE

Most carsharing efforts are still small scale and in Europe. One of the earliest European experiences with carsharing can be traced to an early cooperative, known as Sefage (Selbstfahrergemeinschaft), which initiated services in Zurich in 1948 (*3*). Membership in Sefage was motivated primarily by economics. It attracted individuals who could not afford to purchase a car but found sharing one appealing. Elsewhere, a series of "public car" experiments were attempted but had failed, including a carsharing initiative known as Procotip that was started in Montpellier, France, in 1971, and another, called Witkar, 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 Car Sharing Association, established in 1991 to support carsharing lobbying 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 (as of mid-1999), and Stadtauto Drive (formerly StattAuto 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 26,000 members. Stadtauto Drive, begun in 1988, now has nearly 6,500 members; the current membership size reflects a 1998 merger of StattAuto Berlin and Hamburg (*7*).

Although founded only 1 year apart, these two organizations evolved independently and quite differently. Mobility CarSharing Switzerland (a May 1997 merger of Auto Teilet Genossenschaft and ShareCom) sprang from a grassroots effort to spread carsharing throughout neighborhoods and transit stations in Switzerland. In contrast, Stadtauto Drive was launched as 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*). Mobility CarSharing Switzerland continues to grow about 25 percent per year, but Stadtauto Drive's growth rate has slowed considerably (*3*).

Stadtauto Drive attributes three reasons for this stagnation (*3*):

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 joining 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 usage. At present, Stadtauto Drive members pay an annual fee of 170 marks, or $100. If an individual's vehicle use is less than 200 marks, or $120, a year, this individual typically will drop out of the organization and use traditional auto rentals to fulfill their occasional vehicle needs.
3. Finally, other members require vehicles so often for tripmaking that the effort to reserve shared-use cars becomes too great a burden. Often these individuals leave the CSO because they prefer dedicated private vehicles to carsharing.

For the first group of individuals, who move to the country, no solution has been found. To regain their former clients and attract new ones, Stadtauto Drive has started some new initiatives (*3*).

Both organizations are preparing to enter a modernization phase, moving from manual "key box" operations to a system of smartcard technologies for making automatic and advanced reservations, accessing vehicle keys, securing vehicles from theft, and facilitating billing. The shift to smartcards simplifies vehicle access for customers and eases the administration and management of large systems. However, the large investment required for the new communication and reservation technologies puts pressure on these organizations to continue expanding to generate revenue to pay off these investments.

A few smart shared-use vehicle tests already have been implemented in Europe. Lufthansa Airlines instituted automatic rental systems at the Munich and Frankfurt airports in 1993, in which a computer releases a key and starts 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 this "carpool" system. Lufthansa reportedly has saved more than $20 million in avoided parking infrastructure costs (*9*). These cost savings have been used as a justification for corporate subsidies of the program. As of 1999, the system is being modernized with a smartcard system and coordinated with local transit operators (*10*). A similar program called CarShare was introduced in 1993 by Swissair at the Zurich airport for flight attendants. It is technologically simpler and works in collaboration with Hertz Rent-a-Car (*11*).

The French Praxitèle program, described by Massot et al. in this *Record*, also uses advanced technologies. In October 1997, Praxitèle began operation of 50 Renault electric vehicles that are rented and driven between 11 "Praxiparcs" located near transit stations and office blocks. At present, there are more than 520 users, and there 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 systems, contactless smartcard technologies, and a central computer to manage the system (*12*). Recently, Praxitèle announced that the city of Paris plans to deploy a similar operation in 2000 with 2,000 cars.

Along with the few success stories are many failures. Most organizations have found it difficult to make the transition from grass roots, neighborhood-based programs into viable business ventures. They miscalculate the number of vehicles needed, place too great an emphasis on advanced technology, or expend 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 as a Purdue University research program from 1983 to 1986 in West

Lafayette, Indiana (*13*). Each household leased a very small "mini" car for short local trips and was given access to a shared fleet of special purpose vehicles (i.e., large sedans, trucks, 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 organization, 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 miles 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 percentage of a household's total VMT that was made with a special-purpose fleet vehicle.) Although this program was considered a success 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 Short-Term Auto Rental (STAR) demonstration in San Francisco (*13*). The STAR company operated as a private enterprise from December 1983 to 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 Urban Mass Transportation Administration and the California Department of Transportation.

STAR was operated from the parking garage of a 9,000-resident 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 auto 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 a mile. The members shared a fleet of 51 vehicles (44 cars, 5 wagons, and 2 light-duty 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*).

This project failed halfway through the planned 3-year program. The primary problem was the low and erratic income of many of the tenants. Many were later discovered not to be credit worthy for car ownership; many were students who shared an apartment 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 old, often poor-quality cars broke down several hundred miles from San Francisco. STAR's management tried to cut costs by purchasing used, economy-class vehicles, but this resulted in high repair costs. Also, STAR apparently offered too many models in each vehicle class, leaving members dissatisfied when a particular car was unavailable (M. Russell, 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 distance from their homes or work sites, and they make carsharing reservations over the phone. At present, none of these CSOs use smart technologies to facilitate reservations, operations, and key management. Four are run as for-profit businesses, and the rest are non-profit cooperatives.

Five of these North American CSOs are located in Canada. The first and oldest is Auto-Com, located in Quebec City. Auto-Com, which began operations in August 1994, currently has 450 members and 34 cars. Interestingly, this organization began as a nonprofit cooperative, but it changed to a for-profit business in 1997. In September 1995, the same group launched a second CSO in Montreal—CommunAuto, Inc. CommunAuto has more than 550 members and 32 cars. CommunAuto was founded as a for-profit business, not as a nonprofit cooperative. Less than 2 years later, two new Canadian CSOs emerged. In January 1997, the Cooperative Auto Network (CAN) began offering carsharing services in British Columbia. At present, CAN has 250 members and 18 vehicles. This CSO operates as a nonprofit cooperative. In February 1997, Victoria Car-Share Co-Op launched its operations in Victoria. This nonprofit cooperative currently has 70 members and five vehicles.

In October 1998, AutoShare–Car Sharing Network, Inc., began its private operations with three cars in downtown Toronto. During its first month of operation, 40 members joined, exceeding initial membership targets. At present, the network has 60 members and five cars.

Four carsharing organizations, all 2 years old or younger, operate in the United States. Another two are being planned in the Pacific Northwest and a third in San Francisco. Boulder CarShare Cooperative was launched in Boulder, Colorado, in May 1997. The Boulder CSO has seven members from five households who share one vehicle. Members pay a modest monthly fee and mileage charges for vehicle use. This CSO also provides assistance to other neighborhood groups interested in forming a car co-op.

Dancing Rabbit Vehicle Cooperative (DRVC), located in Rutledge, Missouri, has been in operation since July 1997. This CSO 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 project in Portland that began operation in February 1998 with two Dodge Neons. The project, Car Sharing Portland, Inc., currently has 140 members and 11 vehicles and operates as a for-profit business (with government start-up subsidies). The fourth U.S. CSO, Olympia Car Coop, located in Olympia, Washington, has been in operation as a nonprofit cooperative since March 1998. Olympia has six members and one car.

A fifth CSO, Motor Pool Co-Op, is planned to be launched in the near future 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 carsharing in Seattle in two or three high-density neighborhoods. Metro is exploring a partnership with a private vendor with the goal of deploying 100 vehicles and enrolling 1,500 subscribers by the end of its first year. In part, funding for this project has been secured because of the strong interest of Seattle's mayor, 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, planners, 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. It hopes to begin operations in the fall of 1999, with 50 members and a minimum of eight cars. City CarShare, a nonprofit organization, plans to locate vehicles in 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 test 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 Rivervale will automatically become members of the Car Co-op and have access to a fleet of cars, including a Mercedes-Benz limousine and several multipurpose vehicles. There will be one car for every 40 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 not pay membership fees during the first years, but they will pay for usage. For example, it 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 its users to rent a vehicle at any ICVS lot by using their smartcards. 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 platooning technologies that allow a system worker, driving the first vehicle, to lead up to four unmanned, cued vehicles to another port. These same vehicles have an autodriving feature—guided by magnetic nails, induction cables, and ultrasonic sensors—that allows them to enter and leave a port unmanned. Finally, the vehicles are equipped with an autocharging system that instructs the vehicles to dock at a charging terminal when batteries are low.

In 1999, several hundred Toyota employees will use a smart carsharing system. This system employs a suite of advanced electronics and a fleet of 50 small electric E-com cars. 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 also can charge the vehicles at their homes by using a household 110-volt current.

INNOVATING THROUGH CSO LIFECYCLE

To date, all noncorporate carsharing organizations have begun as small local operations, usually with government funding and inspired by ideological concerns about car dependence and the negative impact of cars on urban settlements. 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 indeed were the core constituents of pilot carsharing projects in the Netherlands, the United Kingdom, and Ireland (*8*). 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.

Autodate, Netherlands

Autodate, founded in 1995, is an umbrella organization that serves 85,000 CSO participants in the Netherlands. In addition to supplying conventional information and marketing functions, Autodate also provides the following services (*3*):

1. Facilitates linkages between private carsharing services and other businesses (e.g., taxi companies 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).

Autodate is financed entirely by the Dutch Ministry of Transport, but it expects other governmental agencies and private businesses to assume an expanding share of the budget (*3*).

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 85 vehicles from Europcar, a division of Denzel. Every 6 months, Europcar replaces the EASYDRIVE vehicles with new ones. At present, EASYDRIVE has 70 stations and 1,050 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, OeBB (Austrian Rail), and OeAMTC (an Austrian car club with more than 2 million members). OeAMTC 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 lots in new housing communities. Finally, in cooperation with the Austrian Ministry of the Environment, EASYDRIVE has planned the project "Sun&Ride" to encourage car-free tourism, providing tourists 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-

nologies for authorizing use, data collection, and vehicle security. City Car Club hopes to have up to 100 vehicles in its fleet, supplied by Budget, by the end of its first year. A full operational launch, with an initial fleet of five cars, was planned for March 1999.

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 transit offer that also includes carsharing and car rental. The second, Zuger Pass Plus (ZPP), provides a discounted combination of carsharing, public transit, car rental, taxi, bicycle, and other, nontransport-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, 1998, a third partnership was launched with the Swiss National Rail System (SBB), offering a mobility package to 1.5 million SBB passholders (approximately 35 percent of the country's adult population). This package provides users with special discounts and easy smartcard access to carsharing vehicles, rental cars, and transit (*16*). 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 smartcard. This will simplify ticketing and marketing and will open new options for intermodal tripmaking. Almost every public transportation company in Switzerland is a partner in a carsharing mobility package. In the future, this 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 partners (e.g., employment centers, car rental, auto companies, car dealers, gas stations, and auto clubs). For instance, mobility packages can be designed in collaboration with auto manufacturers to meet the needs of heavy car users. Mercedes-Benz's "Smart," 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 Smart in Switzerland, he or she also can purchase a mobility package (a value of $400) for just $50 per year. 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, Smart 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 those of the "company of highly organized and integrated city traffic elements" (CHOICE), which allows clients to lease a vehicle through the CSO. With CHOICE, a customer has the option of making the leased vehicle available for CSO use when he or she is out of town. This transaction, based on flexible rates that are adjusted every hour to reflect supply and demand, can reduce the cost of the lease by about $100 per month if the leased vehicle were rented for just one weekend each month (*10*).

Another innovation of Stadtauto Drive is its Mobil Card, which carsharing customers can use for accessing an expanded set of services and discounts. This smartcard provides a 15 percent cost reduction on public transportation and allows users to take taxis without exchanging cash, pay for food and beverage home delivery, reserve a cargo-bicycle, and even book a canoe in Brandenburg, Germany. In early 1998, Mobil Cards could be used at 46 StadtAuto locations throughout Berlin and Potsdam. Beginning in 1995, Stadtauto Drive also began offering its members a food and beverage delivery service called Stattkauf. For a moderate fee, members can receive a Stattkauf 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 greater than 2 days) or when carsharing demand is at a peak (C. Petersen, unpublished data).

StadtAuto Bremen

Another German CSO, StadtAuto Bremen, 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 pass to the CSO's smart auto 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 those products and attributes (*18*). Determining the demand for shared cars is especially difficult because it implies some reorganization of a household's travel patterns and lifestyle. 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 (*19,20*). More sophisticated studies are under way at the University of California, Davis (*2*) 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, did not use control groups nor travel diaries to 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 (*4*). 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*). Muheim and Partner (*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 (*21*).

SOCIAL AND ENVIRONMENTAL BENEFITS OF CARSHARING

Individuals deciding whether to participate in carsharing generally do not consider indirect and nonmarket effects (with the notable

exception of a small group who may be ideologically motivated). Yet these environmental and social benefits may be large. If these effects are large, then it is important for the success of carsharing to quantify them so that government, employers, and others will be encouraged to support carsharing. For instance, Lufthansa financially supports carsharing for its employees because it can avoid the substantial cost of providing additional parking infrastructure. Large environmental, economic, and social benefits can be generated with carsharing, primarily through a reduction in vehicle usage but also by reducing the demand for parking space. Vehicle travel will tend to be reduced because drivers are more directly confronted with the per-usage cost of driving, and presumably they will respond rationally by reducing vehicle use.

The magnitude of these nonmarket and indirect 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 three different carsharing surveys conducted between 1990 and 1994. Autodate reports a 39 percent reduction in vehicles (*22*), and 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 former ATG) reported 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 usage to meet many of their other transportation needs (*4*).

Similarly, for Germany, Baum and Pesch reported that carsharing reduces private car mileage by 58 percent, from 7044 km to 4073 km (4,375 mi to 2,530 mi) per year, after membership (*24*). Most of this reduced travel appears to be foregone travel, but some is transferred to other modes. Baum and Pesch, for instance, report that public transportation use by CSO members increased by about 1546 km (960 mi) per year. Table 2 summarizes the change in modal split due to carsharing in Germany. This dramatic reduction in car use by CSO members—of half or more—is much greater in Europe than would be expected in North America.

Overall, CSOs provide the promise of large reductions in car usage and associated adverse 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 established and on notable growth trajectories. These CSOs appear to provide large social benefits. Car travel and ownership diminish greatly when individuals gain access to carsharing, which is far greater than with virtually any other demand-management strategy known. Particularly appealing is that carsharing represents an enhancement in mobility and accessibility for many people, especially those who are less affluent.

Some lessons in how and where to launch carsharing are becoming apparent. On the basis of a review of the literature and personal experience, this report concludes that CSOs are more likely to be economically successful when they provide a dense network and variety of vehicles, serve a diverse mix of users, create joint-marketing partnerships, design a flexible yet simple rate system, and provide for easy emergency access to taxis and long-term car rentals. They are more likely to thrive when environmental consciousness is high; driving disincentives such as high parking costs and traffic congestion are pervasive; car ownership costs are rather high; and alternative modes of transportation are easily accessible.

An even more important lesson, 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 nonmobility

TABLE 1 Vehicle Ownership Before and After Joining CSO

PASSENGER CAR-OWNERSHIP BEHAVIOR OF CSO MEMBERS	SHARE OF USERS		
	Wagner (1990)	Hauke (1993)	Baum and Pesch (1994)
Would never buy a car	37.2%	35.7%	12.9%
Would forgo the planned purchase of a private car because of car sharing		15.6%	31.5%
Have given up a private car because of car sharing	26.2%	42.4%	23.0%
Have given up their car independent of car sharing	31.1%		29.7%
Continue to own a private car	5.5%	6.3%	3.0%

NOTE: These statistics are four to eight years old and generally reflect the behavior of early adopters of carsharing.
SOURCE: Muheim and Partner, 1996 (*4*), which cites: C. Wagner, ATG-UMFRAGE 1990. ATG, Stans. German, 1990; *U. Hauke*, Carsharing—Eine Empirische Zielgruppenanalyse unter Einbeziehung Sozialpsychologischer Aspekte zur Ableitung einer Marketing-Konzeption. Hauke, Feldstrasse, 1993; Baum and Pesch, 1994.

TABLE 2 Change in Modal Split (*3*)

Means of Transport	Without Carsharing	With Carsharing
Private or borrowed car	60.5	13.4
Carsharing	—	24.9
Car rental	2.9	3.1
Taxi	.8	1.3
Public transportation	35.8	57.3

SOURCE: Harms and Truffer, 1998 *(3)*, which cites Baum and Pesch, 1994 (*24*).

(e.g., food providers) services; and (*b*) incorporate advanced communication, reservation, and billing technologies in conjunction with significant membership growth. However, advanced technologies are expensive, and linking with other services is successful only if the customer base is large. Thus, CSOs either remain quite small or follow a spiraling growth trajectory.

Taking a longer view, CSOs may be the prototype of an entirely new business activity: mobility service companies. As car ownership proliferates and vehicles become more modular and specialized, entrepreneurial companies may see an opportunity to assume the full care and servicing of mobility needs in neighborhoods, work sites, transit stations, and shopping centers, based on a partnership management strategy (*25*). These new mobility companies might handle insurance, registration, and maintenance, and they could substitute vehicles as household situations change. One can imagine a future in which the pioneering CSOs combine their operational expertise with the entrepreneurial capabilities of advanced technology suppliers and other businesses to create mobility services that enhance our social, economical, and environmental well being.

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