Carsharing and Partnership Management
An International Perspective

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Most cars carry 40-60 persons and are used for less than 1 hour per day. A more economically rational approach would be to (a) vehicle use more efficiently. Carsharing, in which a group of people pays carsharing per user-use, for example, is doing so. Carsharing may be organized through affiliation groups, large employers, transit operators, neighborhood groups, or large carsharing businesses. Relative to car ownership, carsharing has the disadvantage of (a) being less convenient to use than a private vehicle and (b) the advantages of being less convenient to use and sharing the volume of private vehicles. The perception of convenience, (a) preferred parking, and (b) the potential for cost savings of carsharing has formed a new modality in many carsharing participants throughout the world. Societal benefits include the direct benefit of less demand or more space and the indirect benefit 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 the future prospects through expanded services, partnerships, and advanced technologies are explored.

The vast majority of automobile trips in U.S. metropolitan regions are drive-alone car trips. In 1995, approximately 90 percent of work and 18 percent of nonwork trips in the United States were made by vehicles with only one occupant (1). Vehicles are used an average of 22.5 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 wide-spread use are high. One strategy for obtaining the benefits of car use while limiting costs is to create institutions for shared vehicles. The principle of carsharing is simple: individuals gain the benefits of private cars without the costs and responsibilities of ownership. Carsharing is the key for sharing vehicles, a threshold approach to meet the transport needs of an increasing number of people. Carsharing may be thought of as an expanded 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 for each trip they use a vehicle.

Carsharing provides a car replacement option to the costs of vehicle owning for the individual as well as the society. When a person owns a car, much of the cost of owning and operating the vehicle is fixed. The variable cost of owning the owned vehicle is relatively low, and the owner 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 transforms the fixed costs of vehicle ownership into variable costs.

Carsharing systems are effective and attractive because they offer a transportation mode that fills the gap between transit and private cars and can be linked to other modes and transportation services. For short distances, one may use a household vehicle, as transpo, oil, bus, or a railroad; and for short distances, one might walk, bicycle, or use a taxi. But for intermediate travel activities, even short ones, one might use a shared vehicle. The shared-cepption 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, offering 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 are typically deployed in a lot located in a neighborhood, a worksite, or in a transit station. A majority of existing carsharing programs and businesses still match their services and operations manually. There is place a vehicle reservation in advance with a formal operator, obtain their vehicle key through self-service, manually return key box, and record their own mileage and usage data in forms that are used 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 systems, and billing systems are used in response to these problems. The largest European carsharing organizations (CEOIs), especially in Germany and Switzerland, have begun to deploy a suite of automated technologies that facilitate the operation and management of services, offer greater convenience and flexibility for users, and provide additional activity for vehicle and key management systems. In Northern California, a "smart" carsharing demonstration program called Car2Go, with 12 equipped cars, has been evaluating a variety of state-of-the-art advanced communication and reservation technologies in January 1998 (2). A second, more fully tested was launched in March 1999 in a southern California, known as Chula Vista, and it had 15 Work EV Plus electric vehicles. Customers, rented from on-board computer technolo- gies. The shared vehicles are available for day use by faculty, staff, and students at the University of California, Riverside campuses.

Smart carsharing makes internalization more viable, thereby creating the potential for even greater benefits. For example, on return- ing from work at the end of the day, a traveler rents a shared-usage vehi- cle 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 stations in the morn- ing. After riding the train for the final 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 office, Alto-

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gether, shared-use vehicles could be used for up to 18 distinct trips per day, and it could accommodate up to additional maintenance trips.

HISTORY OF CARSHEARING 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 cooperation, known as S-Facts (Selbststreuergemeinschaft), which initiated services in Zurich in 1948 (3). Membership in S-Facts 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 failed, including a carsharing initiative known as Pricoche 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. Three carsharing countries collectively claim more than 100,000 participants. The European Car Sharing Association, established in 1991 to support carsharing (leasing) activities, reports a membership of 30 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 in Mobility CarSharing Switzerland (with 2,100 cars) and Suubike (with 2,000 bikes) (as of mid-1999), and StadtAuto 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 base effects a 1989 merger of StadtAuto Berlin and Hasberg (7).

Although focused only 1 year apart, these two organizations evolved independently and quite differently. Mobility CarSharing Switzerland (a May 1997 merger of Auto Teltow Gomisschaft and ShareCom) sprang 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 about 15 percent per year, but StadtAuto Drive’s growth rate has slowed considerably (9).

StadtAuto Drive attributes these revisions for this stagnation (1):

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 cannot get easily access carsharing vehicles and transit.

2. Another group of members realiza that after passing the CSO that they require a shared car only on rare occasions. Many in this group dropped 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 $10. If an individual vehicle is less than 200 miles, $120, a year, this individual typically will drop out of the organization and use traditional auto rentals to fulfill their occasional transportation needs.

3. Finally, other members require vehicles so often for trips that effecting the effort to move shared-car users to become too great a burden. Often these individuals have 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 retain these clients and attract new ones, StadtAuto Drive has initiated some new initiatives (10).

Other organizations have examined the CSO business because they prefer dedicated private vehicles to carsharing.

A few small shared-car vehicle tests have already been implemented in Europe. Lufthansa Airlines instituted automatic rental systems at the Munich and Frankfurt airports in 1995, in which a computer receives a key and starts the vehicle (9). After the car is returned, the vehicle communicates distance traveled and fuel consumption to a central computer system. By the end of 1994, 12,000 employees at the two German airports had access to this "carport" system. Lufthansa reportedly has saved more than 530 million in avoiding parking infrastructure costs (9). Test cost savings have been used as a justification for corporative subsidies of the program.

As of 1999, the system is being modified with a worldwide system to coordinate and local train operators (10). A similar program called CarHell was introduced in 1995 by Swissair in the Zurich airport for flight attendants. It is technologically simpler and more work in collaboration with Hertz Kent-a-Car (11).

The French Praximal program, described by Manus and col in this article, also uses advanced technology. In October 1997, Praximal began operation of 50 Renault electric vehicles that are rented and driven between 11 "Praximal" located near transit stations and other offices. At present, there is more than 500 vehicles in service and plans are to expand to 1,000 in 3 years. All cars are eventually will have global positioning system (GPS) location and global navigation satellite system, conduct on-board structural technologies, and a central computer to manage the system (12). Recently, Praximal 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 misinterpret the numbers of vehicle needed, place too great an emphasis on subsidies, technology, or expand services for the market with little return. Many of these 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 fossil carsharing demonstrations in the United States. The first was Mobility Enterprises, operated as 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, 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 organiza-
tion, such as a large fleet operator.

In this field test, the mini vehicle leased to participants were used for 75 percent of the household's 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-Form Auto Rental (STAR) demonstration in San Francisco (15). The STAR company 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 Urban Mass Transportation Administration and the California Department of Transportation.

STAR was operated from the parking garage of a 9,000-squarefoot apartment complex located near San Francisco State University. Volunteers paid 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 ranges between $8 to $9 with an additional charge of $10 per mile. The members shared a fleet of 51 vehicles, out of 44 cars, 5 wagons, and 2 light-duty trucks), with 17 additional vehicles available as back-ups during periods of peak demand. The fleet was maintained only until January 1985, when it shrunk to 35 vehicles. Membership peaked at approximately 350 participants.(14)

Today, there is an increasing carsharing organization 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 make carsharing reservations over the phone. At present, some of these CSOs use smart technologies to facilitate reservations, operations, and key management. For now it is for profit business, and the rest are non-profit cooperatives.

Fives of these North American CSOs are located in Canada. The first and oldest is Auto-Com, located in Quebec City. Auto-Cos, which began operating in August 1994, currently has 450 members and 34 cars. Interestingly, the organization began as a nonprofit cooperative, but it changed to a for-profit business in 1997. In Sep-
tember 1995, the same group launched a second CSO in Montreal—
Carsharing Inc., Canada's Auto-Cos has fewer than 50 members and 32 cars. Carsharing 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 17 vehicles. This CSO operates as a nonprofit cooperative. In February 1997, Victoria CarShare Co-Op launched its operations in Victoria. This nonprofit carsharing oper-
cation currently has 70 members and five vehicles.

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

Four carsharing organizations, all 12 years old or younger, operate in the United States. Another two are being planned in the Pacific Northwest and will be in San Francisco. Boulder CarShare Cooper-
avtive was launched in Boulder, Colorado, in May 1991. The Boulder CarShare has seven members from five households who share one vehicle. Members pay a monthly service fee and mileage charges for vehicle use. This CSO also provides assistance to other neighbor-
hood groups interested in forming a car co-op.

Driving Rabbit Vehicle Cooperative (DRVC), located in Rut-
ledge, 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 private fleet of eight cars is serviced by 14 members and 11 vehicles and operates as a for-profit business (with powercoeur start-up subsidies). The fourth U.S. CSO, Olympia CarCoop, located in Olympia, Washington, has been in operation since 1998 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 car-
sharing 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 fact, funding for this project has been secured "because of the strong interest of Seattle's stykes, 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, plan-
ers, and transportation researchers has formed a public-private partnership, called City CarShare, consisting of public agencies and nonprofit organizations. City CarShare began seeking funding in late 1997. Hoping to begin operations in the fall of 1999, with 50 mem-
bers and a minimum of eight cars. City CarShare is a nonprofit organization that seeks to locate its desks 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 Augu
1997, NTUC Income Car Cooperative Limited (Car Co-op) launched its first service of a car-sharing 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 its 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 Minilokai 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 500SEL and several multispaces, seven 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 recoup their membership fees during the first year, but they will pay for usage. For example, a car costs $20 per hour to book the minilokai. 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 Motor 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 any ICVS lot 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 pionning technologies that allow a system worker, driving the first vehicle, to lead up to four unmanned, and vehicles to another port. These same vehicles have an autopilot feature—guided by magnetic strips, induction cables, and ultrasonic sensors—that allows drivers to enter and leave a port unmanned. Finally, the vehicles are equipped with an autostoring system that instructs the vehicle to dock at a charging terminal when batteries are low.

In 1999, several hundred Toyota employees will use a smart car-sharing system. This system employs a suite of advanced electronics and a fleet of 500 small electric Ecom 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 ISO LIFECYCLE

To date, all noncooperative car-sharing 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 settlements. On the basis of a onsite 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 (by 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 (1). Existing examples are described in the following:

Austade, Netherlands

Austade, 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, Austade also provides the following services (2):

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).

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

EASYDRIVE, Austria

EASYDRIVE, a for-profit organization in Austria, was founded in August 1999. The Demel Group, a large automotive sales company, runs EASYDRIVE. The Demel Group rents the CSO's 83 vehicles from Europcar, a division of Denzel. Every 6 months, Europcar replaces the EASYDRIVE vehicles with new ones. As a result, EASYDRIVE has 70 stations and 1,100 members. In 1999, EASYDRIVE plans to expand its fleet to 250 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, CBB (Austrian Rail), and ÖAMTC (Austrian car club with more than 2 million members). ÖAMTC 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 "Sundrive" 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-
mobility services. 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 nonmotorized-transport services for its customers (similar to a frequent flyer program). ZPP is a partnership of several transportation providers and other businesses. On September 1, 1994, a third partnership was launched with the Swiss National Rail System (SBB), offering a mobility package to 1.5 million SBB passengers (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 carsharing (16). Finally, a pilot project started 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 stopover. 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 patterns (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. Mieco-Boettner's "Swissnet," a small, two-seater combustion engine vehicle, is a complementary vehicle to carsharing and intermodal trips (it is, in fact, easy to park). When an individual buys a Swissnet in Switzerland, he or she can purchase a mobility package (with a value of 240) for just 50 per year. This package includes free access to all carsharing vehicles with-onelife membership fees at a slightly higher hourly rate and the same mileage rate paid by mobility customers. This package is also included in a carsharing pass for the Swiss transportation system. This allows the passholder to reserve train and bus tickets for half price throughout the year. In this partnership, Swissnet fits smoothly into a new customer-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 a new innovative service including the "company of highly organized and integrated city traffic elements" (CHOICE), which allows clients to lease a vehicle through the C30. With CHOICE, a customer has the option of making the leased vehicle available for C30 use when he or she is out of town. This restriction, 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 (27). Another innovation of StadtAuto Drive is its Mobil Card, which carsharing customers can use for accessing the expanded set of services and discounts. This smartcard provides a 15 percent price 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 Bremerhaven, 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 Stadt restitution. For a moderate fee, members can receive a StadtAuto delivery once a week (27).

StadtAuto Drive, like Mobility CarSharing Switzerland, is partnering with major car rental companies and chooses to provide vehicles to C30 members when it is more economical to rent a vehicle (i.e., when rental periods are greater than 2 days) or when car sharing demanded is at a peak (C. Petersen, unpublished data).

StadtAuto Bremen

Another German C30, 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 C30's smart card and its vehicles equipped with on-board computers (Götz-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 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 these are too tentative to be indicative (29,30). More sophisticated studies are under way at the University of California, Davis (29) 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 do use control groups not travel diaries or collect travel data, and employed simple questionnaires, they do provide valuable insights. A survey in Switzerland and Germany found that users were between 25 to 40 years of age with above-average education, 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 were above average age of 33; well-educated, and modest incomes (U.S. $20,000 per month) (7). Molehen and Payter (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 (27).

SOCIAL AND ENVIRONMENTAL BENEFITS OF CARSHARING

Individuals deciding whether to participate in carsharing generally do not consider indirect and quasi-market effects (with the notable
exception of a small group who may be ideologically motivated). Yet these environmental and social benefits may prove of little value if the effects are large. This is important for the success of carsharing to quantify them so that government, employers, and others will be encouraged to support carsharing. For instance, carsharing is financially supported for its employees because it can avoid the substantial costs of providing additional parking infrastructure. Large environmental, economic, and social benefits can be generated with carsharing, primarily through a reduction in vehicle usage and also by reducing the demand for parking space. Vehicle travel will need to be reduced because drivers are more directly confronted with the per-unit cost of driving, and presumably they will respond relatively by reducing vehicle use.

The magnitudes of these nontariff and indirect benefits is large, according to several carsharing studies. As indicated in Table 1, about 30 percent of all individuals sell their cars after joining CISOs, according to three different carsharing surveys conducted between 1990 and 1994. A survey reports a 39 percent reduction in vehicles (22), and less Odo, 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 Car Sharing Switzerland study (conducted by the former ATO) reported that car mileage for individuals who owned private vehicles was reduced by 33 to 50 percent after they joined the CISO. Most of these individuals increased public transportation usage to meet most of their other transportation needs (4).

Similarly, for Germany, Basen and Prech reported that carsharing reduces private car mileage by 52 percent, from 7044 km to 4073 km (4750 mi to 2530 mi) per year, after membership (24). Most of this reduced travel appears to be for long-term travel, and some is transferred to other modes. Basen and Prech, for instance, report that public transportation use by CISO members increased by about 1496 km (930 mi) per year. Table 1 summarizes the changes in modal split due to carsharing in Germany. This dramatic reduction in car use by CISO members—of half or more—is much greater in Europe than would be expected in North America.

Overall, CISOs provide the promise of large reductions in car usage and associated negative effects. It remains to be seen what these effects persist as CISO 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 CISOs are now firmly established and on notable growth trajectories. These CISOs 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 young 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 CISOs 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 simplistic 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 incentives 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 expanding transportation needs key. But until well documented because of confidentiality agreements, is the need for partnership management to offer enhanced products and services (15). More business-oriented CISOs 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 accessibility

| TABLE 1 | Vehicle Ownership Before and After Joining CISO |
|---|---|---|
| PASSENGER CAR OWNERSHIP | BEHAVIOR OF CISO MEMBERS | SHARE OF USERS |
| Would rent a car | Would forgo the purchase of a private car because of car sharing | Would give up a private car because of car sharing | Would give up their car independent of car sharing | Continue to own a private car |
| 33% | 15% | 20% | 26% | 21% |
| 35% | 31% | 42% | 43% | 63% |
| 12% | 56% | 56% | 56% | 56% |

Note: These statistics are from eight years old and not necessarily reflect the behavior of early adopters of carsharing.

(e.g., tool providers) service, and (f) 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 estimate quite small or fail to a spiraling growth expectation.

Taking a longer view, CSOs may be the petri dish of an entirely new business activity: mobility service companies. As car ownership privileges and vehicles become more modular and special-purpose, entrepreneurial companies may see an opportunity to assume the full care and servicing of mobility needs in neighborhoods, work sites, campus settings, and shopping centers, based on a partnership management strategy (23). These new mobility companies ought to handle insurance, registration, and maintenance, and they could substitute vehicles in household situations altogether. One can imagine a future in which the pioneering CSOs combine their operational expertise with the entrepreneurial capabilities of advanced technology suppliers and other bastions to create mobility services that enhance our social, economical, and environmental well-being.

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REFERENCES