CAR SHARING AND MOBILITY MANAGEMENT: FACING NEW CHALLENGES WITH TECHNOLOGY AND INNOVATIVE BUSINESS PLANNING

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Introduction

During this century several transportation modes, including transit, personal automobiles, and airplanes, have competed for market share. Despite this competition, the personal vehicle has become the dominant form of mobility in many countries throughout Europe and North America. In turn, public transit has found it increasingly difficult to attract and retain passengers. This paper describes an important movement towards new "Mobility Management" in which competition no longer favors a particular mode. Rather, this new mobility framework could be used to increase the demand for multimodal transportation by linking new transportation business models and incentives (e.g., convenience and cost savings) with advanced technologies (e.g., cell phones and contactless smart cards that can facilitate intermodal transfers and payment). In the future, the integration of collective and private transportation modes could lead to energy savings and a more sustainable approach to mobility.

In this model, customers would construct a set of transportation tools to accomplish their mobility goals that reflect their individual set of mobility criteria, such as time and cost savings, convenience, and comfort. Mobility Management can be likened to a shopping center that offers its customers a range of mobility services and options. This form of "one-stop" transportation shopping can empower individuals by offering them a choice of modes that best fits their needs on a daily basis. On Monday, this might mean taking the train and a bike; car sharing on Tuesday; telecommuting Wednesday through Friday; and walking on weekends. Everyday is a new choice, depending on the needs and goals of the individual.

At present, advances in electronic and wireless communications are making innovations in transportation products and services possible. Due to these developments, as well as the congestion and air pollution associated with the automobile, the success of the personal vehicle may begin to diminish. In the future, personal vehicles are likely to play a significant role in transpor-

tation; however, their importance could shift. In contrast to their current status as a "dominant" mode, automobiles might be viewed as just one alternative among a wide range of attractive mobility options. With the same enthusiasm that planners invested in personal automobiles in the past, transportation planners and policymakers now have an opportunity to "reengineer" transportation into a diverse set of mobility services by employing advanced technologies. Car sharing is one important step in this process.

During the past decade, car sharing has experienced a successful pioneering stage in Europe. At present, car sharing has begun a transformation into a professional and profitable business framework, which includes mobility services, in a number of regions throughout Europe. Car sharing is offered as one service in a broader context of mobility services, such as car rentals and transit linkages. Car sharing offers an alternative to satisfying the demand for individual mobility, while encouraging collective transportation when it is convenient and cost effective for the individual. With time and experience, many car-sharing participants employ shared-use vehicles less and use other modes of transportation more often, such as transit and cycling.

Car-Sharing Systems: The Basics
Car sharing is a system where customers time-share vehicles located at car-sharing lots or stations. Customers use car-sharing vehicles by the hour or day and pay on an hourly and kilometer basis each month. The principle of car sharing is simple. Individuals gain the benefits of private cars without the cost and responsibilities of ownership. Instead of owning one or more vehicles, a household has access to a fleet of vehicles on an as-needed basis. Car sharing may be thought of as organized short-term car rental. Car sharing is more successful when access is easy and assured, costs are low, payment is straightforward, and vehicle choices are plentiful. Individuals gain access to car sharing by joining organizations that maintain a fleet of cars and light trucks, which are often distributed throughout a network of vehicle locations.

There are many car sharing organizations (CSOs) in Europe and North America. In Switzerland and Germany, car sharing has offered a transportation service for over 10 years. At present, Mobility CarSharing Switzerland (Mobility CarSharing) serves over 20,000 people at 600 stations in 300 cities and towns throughout Switzerland and manages a fleet of 900 cars.

Using a car-sharing system involves three steps. First, customers place a reservation for a vehicle. Individuals can typically make a telephone reservation on a 24-hour basis by speaking directly with a car-sharing operator or a computerized "Interactive Voice Reservation System," using a touch-tone telephone. Recently, Mobility CarSharing introduced an Internet reservation system. Reservations can be made days or weeks in advance. For example, an elderly individual can make a vehicle reservation for a doctor's appointment that he or she has in two weeks. In Europe, most reservations are made spontaneously at the immediate time the vehicle demand occurs. In Switzerland, each car-sharing station usually maintains two to five vehicles. Stations are located in residential areas, work sites, train stations (i.e., for intermodal use), gas stations, car dealerships, and shopping areas.

During the second step, an individual travels to the car-sharing station where his or her car has been reserved and accesses the vehicle key from a manually-operated key box. Every user has access to this box by a personal key. At the car-sharing station, a customer takes the key for a

specific car and drives off. In late 1998 or early 1999, this manual box system will be replaced by on-board computers that will be installed in every car and a smart card will be distributed to each user for accessing vehicles (i.e., opening the car door).

Advances in electronic and wireless technologies are helping to provide security, reliable access to vehicles, and data tracking. This automation makes sense for a high volume of shared-use vehicles. The quickly developing market for navigational devices, such as global positioning systems (GPS), will likely have a significant impact on car-sharing businesses and the market for Mobility Management.

However, car sharing is not the only product provided by new mobility services. As a consequence of technological advances and the demands of new lifestyles, customers will be able to take advantage of a range of products and services that best satisfy their changing mobility demands. Already, some mobility services exist in Europe, such as Autodate in the Netherlands, which services over 85,000 customers. At present, many transit agencies, CSOs, and mobility centers are beginning to provide a variety of car-sharing products and other mobility services based on smart cards and communication technology. Some examples include:

• Car sharing organizations (CSOs), like Mobility CarSharing and several other organizations in
• • Germany, Austria, and the Netherlands, are expanding the scope of their services;
• Traditional car rental (CR) companies that are also combining mobility packages with car sharing and transit;
• Car-lease-sharing (CLS), for example "CashCar" in Berlin;
• Car pooling (CP) or van pooling; and
• Taxi or collective taxi services.

Finally, the third step in car sharing is the monthly billing of all customers. In Switzerland, hourly rates for a medium-sized car are 1.30 ECU/hour (11:00 pm - 7:00 am free of charge) and kilometer rates are .25 ECU/km (rates are slightly cheaper for longer distances). All costs for the car are covered, including insurance, gasoline, maintenance, and depreciation. To use a shared-use vehicle, customers can choose from three options:

• "Member:" Deposit of 600- ECU (refundable when leaving the system) and an entrance fee of 120- ECU (non-refundable). The customer obtains the best rates by hour and kilometer with this package.
• "User:" Annual fee of 60- ECU/year (non-refundable). The customer pays slightly higher rates by hour and kilometer.
• "User special:" Annual fee of 40- ECU/year (non-refundable) in combination with an annual public transit pass.

Car Sharing in Europe and Worldwide
In 1987, Switzerland began car sharing. Based on a merger of existing companies in 1997, Mobility CarSharing Switzerland emerged as one nationwide car-sharing company. The uniform standards and quality services provided by Mobility CarSharing have helped this organization grow significantly over the past ten years. At present, this organization holds almost 50 percent of the market share for all car-sharing users in Europe and is currently increasing its market

share. Based on the principle of partnership management, Mobility CarSharing now serves over 20,000 customers and is expecting to grow by 100 percent within the next year. Partnership management is a business framework in which car-sharing providers partner with other businesses, such as transit operators, gas stations, and car rental companies, to offer a combined mobility package that enhances their products and services.

Due to different standards and operations, German CSOs have experienced slower growth. In contrast, many German CSOs are still in a pioneering stage, which emphasizes grass roots organizations, local strategies, and operations. Average growth in Germany is only about 10 to 20 percent annually due to relatively high monthly fees and regular membership attrition. At present, there are approximately 25,000 car-sharing participants in Germany. However, Germany may soon find its way to an increased market share due to the recent merger of two car-sharing umbrella organizations (i.e., the European Car Sharing Organization of Germany (European Car Sharing Deutschland) and BOA (Bund organisierter Autoteiler)), and the incorporation of Stattauto Berlin and Stattauto Hamburg in an effort to "standardize" CSO operations and services.

Other European countries providing professional car-sharing services are the Netherlands and Austria. In addition, new car-sharing businesses will soon be launched in Sweden, Denmark, Italy, and the United Kingdom. Furthermore, several interesting and advanced car-sharing developments are taking place in the United States. Many of these operations are either researching or considering advanced car-sharing technologies and services. In February 1998, CarSharing Portland began offering services. In the fall of 1998, the City of Seattle plans to launch a large car-sharing operation. Later this fall, the Institute of Transportation Studies of the University of California, Davis (in conjunction with its partners: the Bay Area Rapid Transit District (BART); American Honda Motor Company, Inc.; Lawrence Livermore National Laboratory (LLNL); Teletrac, Inc.; and INVERS) will launch the "CarLink: Smart Car-Sharing System" program. The purpose of this demonstration project is to implement and evaluate a smart car sharing program, emphasizing advanced technologies (i.e., compressed natural gas Honda Civics, a smart car-sharing management system, and an automatic vehicle location unit), multiple car-sharing stations, and reliability. In addition, several other U.S. cities have proposed car sharing projects, mainly cities with populations above 500,000 people.

Car Sharing: Success Factors
Based on their experience and knowledge of technological developments, the authors recommend several important factors for implementing car sharing in the future. These factors include:

Complement Existing Transportation Systems and Services:
Mobility packages are based on a variety of traffic modes, which can be used by customers in conjunction with car sharing. Partnerships with existing transportation institutions (for example, gas stations, rental car companies, and transit agencies) are an important success factor for car-sharing operators and businesses.

For instance, car sharing is complementary to car rental and can be used to supplement the demands of car-sharing users when their travel needs exceed one to two days when car rental becomes more economical than car sharing. Car-sharing services can be used for a few hours a day, and car rentals can be used for one or more days for special occasions like business trips or vacations.

Maintain a Balanced Mix of Users and Locations:
Maintaining a "balanced" mix of users is important to car sharing success. For instance, neighborhood users typically reserve vehicles on the evenings and weekends. In contrast, business users generally reserve vehicles from Monday to Friday, during daytime hours. Hence, these two user groups complement each other.

Since car sharing has to compete with privately owned vehicles, car-sharing vehicles must be distributed in a decentralized manner to satisfy a wide range of customer needs. In such a small country as Switzerland, providing over 600 stations has been a critical factor to the success of car sharing.

Design Smooth Interfaces and Multimodal Interchanges:
Modal interfaces (e.g., smart cards that allow customers to access vehicles and transit) should be designed to reduce intermodal switching times, so that modal transfer requirements do not exceed three minutes (e.g., returning vehicle keys and paying for a transit pass). The attractiveness of stations and locations to facilitate modal interchanges can reduce a customer's perceived "transaction" costs (i.e., the perceived time and hassle required in making a transfer) and increase his or her subjective perception of the service (e.g., comfort, prestige, and a wide range of services). Smart cards (i.e., an electronic purse that can be linked to a bank account and used to pay for multiple services throughout a day) can facilitate these intermodal changes and reduce the perceived transaction costs associated with renting and accessing a shared-use vehicle.

Consider Advanced Electronic and Wireless Technology:
New technologies can provide real-time access to information, reservations, ticketing, and billing. Furthermore, these technologies can support operators in providing their products and services and satisfying the customers' demand for flexibility, spontaneity, and reliable access. Not surprisingly, new business challenges for car sharing and mobility services will grow from the added capabilities that advanced technologies can bring to service providers. Some new opportunities include "instant vehicle access" without a reservation or conventional key, "open-ended reservations," "one-way rentals," and even "virtual car stations."

Develop Market Standards:
In the future, national or even international standards for products and services will be increasingly important, so that customers can easily access mobility services in multiple locations (e.g., during a business trip or vacation).

New Lifestyles and Multimodal Mobility
We define new Mobility Management as accessibility that not only incorporates the shared usage of cars, but also reflects the "mixed usage" of various transportation modes. Based on a variety of travel options, individuals can select different travel modes and integrate them to meet their variable mobility demands and goals. When needed, individuals can even consult with a mobility counselor to determine the best mix of modes and services.

In a sense, each individual has his or her own "mobility painting," which is based on their individual needs. "Mobility Management" can also be thought of as "travel blending," similar to a blend of tea, coffee, or tobacco. An individual's "travel blend" would be characterized by its ability to reflect the values of each customer and to provide convenient options and more financial choices. Once mobility services are more widely available, these services will likely compete with the personal vehicle.

Mobility Packages: Some Examples from Switzerland
In the future, various transportation options will be combined into mobility packages and services to satisfy customer needs for simpler, effective transportation. In Switzerland, Mobility CarSharing is already developing, testing, and evaluating several mobility package programs, including "Fahrpass," "Zuri Mobil," "Zuger Pass Plus," "Auto auf Abruf," and "MAX-Car." Most of these projects are based on collaboration with public transit organizations and are supported with start-up funding by governmental institutions. However, no subsidies are provided for their actual operation.

"Integration of use" is the innovative message linked to all of the programs listed above. One of the primary goals of these programs is to combine and integrate different travel modes to encourage intermodality. Between 1996 and 1997, "Zuri Mobil" attracted over 3,000 individuals, who joined this Zurich-based program. At present, the population of Zurich is approximately 360,000 people. After paying an annual fee of 60- ECU to join, customers can take a second person along with them on public transit at no extra charge; access traditional rental cars at lower rates and preferred status; and gain access to over 150 shared-use vehicles at 80 stations in Zurich and an additional 900 shared-use cars at 600 stations managed throughout Switzerland. In Zurich, customers have access to car sharing on every third street, and most car-sharing lots are closely linked to train and bus stations.

In comparison, the "Zuger Pass Plus" (ZPP) program goes one step further. In addition to integrating a variety of mobility providers into one mobility package, ZPP includes other retailers, such as food distributors. ZPP offers a broader range of services and benefits to customers, particularly those that drive. By expanding the scope of partners beyond transportation providers, ZPP implements a strategy that bundles diverse businesses into a mobility service package. ZPP has helped Mobility CarSharing evaluate the concept of Mobility Management and further ex-

plore the idea of a mobility shopping center, where customers can access a variety of products and services.

On September 1, 1998, Mobility CarSharing will launch a nationwide mobility package in collaboration with the Swiss National Railway System. Through this new program, rail passengers will gain easy access to car sharing and traditional rental car vehicles that are located throughout Switzerland. Approximately one-half of all 700 Swiss train stations will provide car-sharing lots. Hence, intermodal vacation trips or travel blending will be possible from most Swiss cities and towns. As a result of this new program, Mobility CarSharing expects to attract 20,000 to 30,000 new customers, a growth of 100 percent in the company's car-sharing market (i.e., a new customer base of at least 40,000 individuals).

A four-year project, known as "MAX-Car" in Lucerne, also evaluates intermodal transportation. Soon it will begin testing new car concepts, such as electric and low emission vehicles, that can be used as shared-use cars. These vehicles will be deployed from the main train station located in Lucerne. It is hoped that the short walking distance from trains and buses to the shared-use vehicles will motivate businesses and households to shift to multimodal transportation.

Other collaborations might include partnerships with the car industry. In the future, car manufacturers and dealerships also enlarge their field of car sales by providing mobility services. For example, "SMART," the small two-seater produced by a joint venture between from Daimler-Chrysler and Swatch, already provides mobility services to select suburban areas in Europe.

Conclusion
Until the past decade, almost all efforts at organizing car sharing organizations resulted in failure. For a variety of reasons, a new era began in the late 1980s in Europe. Several car sharing organizations are now firmly established and on steep growth trajectories. Experience from Europe has shown that car-sharing programs are most successful where environmental consciousness is high; driving disincentives such as high parking costs and traffic congestion are pervasive; car ownership costs are high; and alternative modes of transportation are easily accessible.

As car sharing takes root, an interesting growth dynamic can be observed. More business-oriented CSOs thrive by acquiring those that fail or lack strong leadership and developing a broader range of services. To retain customer loyalty, they continue to improve services and/or reduce costs. Two linked strategies are being followed: coordinate and link with other mobility services, and incorporate advanced communication, reservation, and billing technologies. But advanced technologies are expensive, and linking with other services is successful only if the customer base is large. Consequently, many 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 vehicle ownership proliferates and vehicles become more modular and specialized, entrepreneurial companies may see an opportunity to assume the full care and servicing of a household's or an individual's mobility needs in neighborhoods, work sites, transit stations, shopping centers, etc. These new mobility companies might handle insurance, registra-

tion, and maintenance, and could substitute vehicles as a household's situation changes. In the future, both the pioneering CSOs of Europe and North America could combine their knowledge of operations with the entrepreneurial advanced technology companies of the U.S. and Europe to create mobility services that contribute to our social, economical, and environmental well being.

We conclude that car sharing will play a significant role in helping to redefine mobility patterns, modal decision making, and mobility behavior. If mobility service companies guarantee vehicle accessibility and reliability, customers will likely follow this new trend. Nevertheless, it is important to keep the following points in mind. First, it is critical to educate and excite customers about new transportation options, such as car sharing and mobility services. Second, it is important to anticipate the need for future mobility products and services, such as those demanded by modern lifestyles. Finally, advanced electronic and wireless technologies should be considered thoughtfully as useful tools for improving the quality of transportation services, modifying current transportation options, and ultimately shaping travel behavior.