

U.S. Shared-Use Vehicle Survey Findings on Carsharing and Station Car Growth

Obstacles and Opportunities

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Shared-use vehicle services provide members with access to a vehicle fleet for use as needed, without the hassles and costs of individual automobile ownership. From June 2001 to July 2002, there was a survey of 18 U.S. shared-use vehicle organizations on a range of topics, including organizational size, partnerships, pricing, costs, and technology. Although survey findings demonstrate a decline in the number of organizational starts in the last year, operational launches into new cities, membership, and fleet size continue to increase. Several growth-oriented organizations are responsible for most of this expansion. Several factors were explored that challenge shared-use vehicle growth, such as high capital investment (or start-up costs), dramatic insurance rate hikes, and scarcity of cost-effective technologies. Although the findings of early niche markets are encouraging, the ability of this emerging sector to actualize its total environmental, economic, and social goals may be limited without the collective support of private industry (e.g., automobile manufacturers, insurance providers, technology producers); public agents (e.g., transit and governmental agencies); and shared-use vehicle programs. Indeed, public-private partnerships and cooperation among shared-use vehicle providers may play a key role in addressing insurance and technology costs and ensuring the long-term viability of this market.

Travel choices are often limited by lack of connectivity among travel modes, such as transit and highways. Shared-use vehicles (linked to key activity locations and transit) can help to expand the mobility options of individuals who use transit, walk, or bicycle, but who still require access to a personal vehicle for a trip segment. The principle of shared-use vehicles is simple: individuals gain the benefits of private car use without the costs and responsibilities of ownership. Instead of owning one or more cars, a household or business accesses a fleet of shared-use vehicles on an as-needed basis. Members typically provide a deposit or monthly fee for access to a vehicle fleet distributed throughout a region or concentrated at a transit station, activity center, or worksite. Usually, members pay an hourly and per mile fee that reflects their vehicle use. Insurance, maintenance, and reservations are included in the fixed costs of the service (1, 2).

Many U.S. programs operate in a way similar to that of the majority of European carsharing organizations. In Europe, individuals access cars from nearby neighborhood lots and return them to the

same lot, one not typically linked to transit. This European approach, which started as a grassroots, cooperative effort in Switzerland, represents classical carsharing (1). There is a contrast, however. "Station cars" in the United States serve transit and rail commuters primarily, often employing electric vehicles. These cars typically provide a demand-responsive extension to fixed-route rail services and may not be shared by multiple individuals (1-3). Increasingly, the carsharing and station car concepts are merging to include both elements: transit linkages that serve commuters and distributed lots for spontaneous users (4, 5). One can envision a shared-use vehicle continuum, ranging from carsharing to station cars, in which several new models fall in between these classifications. For an in-depth discussion of this classification system, see Barth and Shaheen (4).

Common goals among shared-use vehicle organizations (as reported in the authors' 2001-2002 survey) include the following:

- Facilitating more efficient land use (e.g., reducing number of parking spaces needed);
- Providing cost savings since customers pay per use, sharing vehicle leasing costs, maintenance, and insurance;
- Increasing mobility options and connectivity among transportation modes; and
- Reducing pollution, if vehicles link to alternative travel modes—for example, commuters' using transit augment travel with a shared car—or if the fleet consists of clean-fuel vehicles.

This paper provides an overview of the growth and market developments of the shared-use vehicle system in the United States from 1998 to 2002. From June 2001 to July 2002, the authors conducted a longitudinal survey of 13 operational carsharing programs and 5 station car programs, to monitor trends and developments. Organizations were surveyed through a combination of e-mail questionnaires and telephone interviews three times throughout the period. Researchers also updated data from each organization's website, if available, and from media releases and articles. They designed the initial questionnaire to collect data on a range of issues—organizational size, business costs and financing, operational models, technology, and marketing. A database was created to monitor reported changes. A second questionnaire was implemented as a phone interview in March 2002, and it focused on new developments and membership. During this phase, several organizations were added and eliminated, resulting in a total of 18 programs. The predominant reason for termination was an increase in insurance rates following September 11, 2001 (9/11). The final survey, conducted from June 2002 to July 2002, focused on membership and cost concerns, primarily insurance and technology. In addition, researchers interviewed insurance providers and technology companies to gain a better understanding

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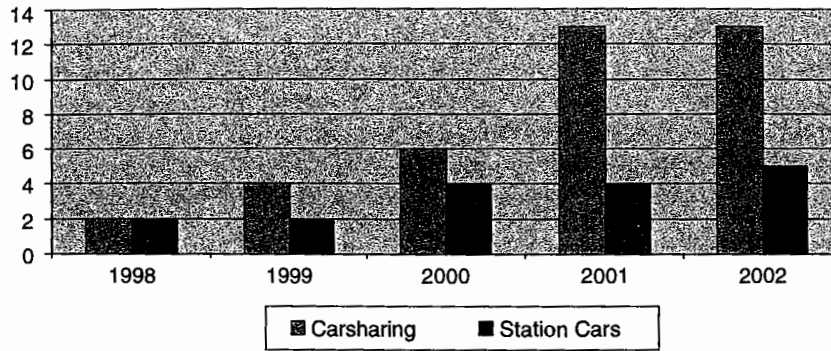


FIGURE 1 Growth in station car and carsharing organizations.

of key issues and possible solutions. Whereas a dozen planned shared-use vehicle efforts were identified throughout this study, only seven had developed detailed business plans. Of these organizations, three were unavailable for comment, and four were interviewed as part of the final survey.

**SHARED-USE VEHICLE SERVICES:
U.S. MARKET DEVELOPMENTS**

Shared-use vehicle services became popular in Europe during the late 1980s. Before the 1980s, European carsharing had been experimental and limited to small, localized organizations. Then two influential carsharing organizations were formed in the late 1980s—StattAuto in Berlin and Mobility Carsharing Switzerland. Mobility Carsharing Switzerland has continued to grow—now claiming 55,000 members—whereas StattAuto’s growth began to stagnate in the mid- to late-1990s (1). Switzerland’s success has been credited to a more business-oriented approach, which has been emulated by many organizations. In North America, carsharing was first successfully established in Canada in 1994 by a cooperative, which later adopted a commercial model (CommunAuto). By 1998, four nonprofit organizations had emerged in the United States. In their nascent stages, U.S. shared-use organizations sought European guidance. During the mid-1990s, U.S. rail transit operators, seeking to relieve parking shortages at stations, launched several electric station car programs (1).

In July 2002, there were 18 shared-use vehicle organizations: 11 carsharing organizations; 5 station car programs (2 in California, 2 in New York, and 1 in New Jersey); and 2 carsharing research pilots (both in California) (see Figure 1). At the time of publication, there were at least 12 U.S. shared-use vehicle deployments planned. As of July 2002, station car programs claimed 163 members and 121 vehicles, whereas carsharing programs collectively claimed 12,098 members and operated 455 vehicles. Furthermore, the majority of shared-use vehicle members, 80%, lived in the 25 most densely populated cities in the nation.

Although survey findings demonstrated a decline in the number of organizational starts, from June 2001 to July 2002, the rate of operational launches into new cities (i.e., existing organizations replicate and enter new regions), total membership, and fleet size continued to increase (see Figure 2). This finding indicates several possible trends:

1. An unmet demand for short-term vehicles that supplement existing transportation networks;
2. Emergence of more growth-oriented organizations that can quickly enter new cities; and
3. A change in market forces—for example, fixed costs, such as vehicle leasing, and insurance expenses have increased or start-up grant funding has declined, or both.

A few organizations serve the majority of U.S shared-use vehicle program members in multiple regions. For instance, City CarShare,

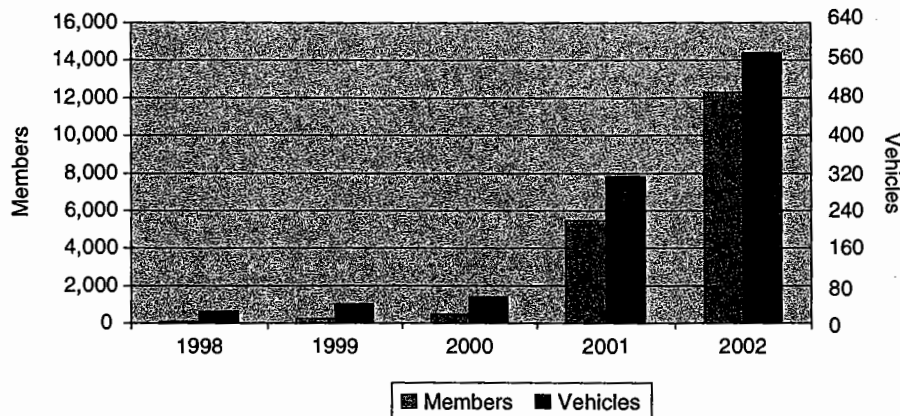


FIGURE 2 Growth in vehicles and membership of shared-use vehicle programs.

Flexcar, and Zipcar each operate in several cities. As of July 2002, collectively these organizations served 92% of all U.S. members and deployed 64% of the total vehicle fleet.

Almost exponential growth in U.S. shared-use vehicle membership further demonstrates that existing organizations are developing effective strategies to attract a growing membership base. From 2000 to 2001, the high growth rates were due to two new organization launches—both characterized by large start-up funding, capital investments (i.e., advanced technologies), and rapid growth rates. The total carsharing fleet size revealed a similar trend (see Figure 2). Also, total station car program membership grew from 25 in 1998 to 163 in July 2002, and the number of vehicles increased from 16 to 121. A significant increase in membership and vehicles from 2001 to 2002 resulted from the launch of the New York Power Authority Ford Station Car Program in December 2001.

Shared-use vehicle programs continue to grow. However, only a few are responsible for most of this expansion. Several growth-oriented organizations have emerged that are pioneering new market segments, diversified rate structures, partnerships with the public and private sectors, and advanced technology applications (6). However, such developments may be hindered owing to increased insurance costs and the scarcity of cost-effective shared-use vehicle technologies, as reported by respondents.

MARKET GROWTH: OBSTACLES AND OPPORTUNITIES

The lower number of organizational launches in the midst of continuing market, membership, and fleet expansion indicates that entry barriers probably exist and could be growing. The high fixed costs of vehicle leasing and purchase, technology development, and insurance are significant deterrents to the market entry of a new organization. Indeed, in a survey of four planned organizations, all respondents ranked insurance costs as their greatest concern. The second most frequently cited challenge was vehicle leasing and purchase costs (according to 75% of respondents). Also, 75% reported technology as a key success factor for growth, although 50% considered current technology costs as prohibitively expensive. Furthermore, management costs ranked among the top three concerns reported by 50% of respondents. Although insurance was not listed as a major cost or concern in the 2001 survey, by July 2002, the researchers found it a major challenge to expansion and sustainability among the majority of respondents.

Insurance Coverage: History, Current Issues, and Potential Solutions

Since late 2001, U.S. shared-use vehicle services have found it more challenging than previously to obtain affordable insurance coverage. The authors interviewed existing and planned carsharing organizations to assess the severity of sharp insurance rate increases on business development. Not surprisingly, station car and carsharing research programs are more insulated from these difficulties; their insurance policies are typically supported by transit agency relationships or partnerships with automobile makers and rental car companies. Furthermore, the station car business model resembles that of a lease or a company fleet, which is more familiar to insurers. Nevertheless, the recommendations provided apply to all shared-use vehicle models.

Researchers conducted expert interviews with several brokers and underwriters with shared-use vehicle experience. They also

conducted a literature review of insurance trends, underwriting methods, and basic definitions. This discussion focuses largely on the roles of brokers and underwriters. Underwriters determine insurance classifications and corresponding premium prices. Brokers act as intermediaries between shared-use vehicle organizations and underwriters. Four disclosed past and present shared-use vehicle insurers were contacted; another six were referenced but not identified. Research was partially hindered by the complexities of the insurance industry (e.g., a diverse range of approaches) and the confidentiality of insurer–client relationships. From the expert interviews, researchers identified several strategies that could lead to lower insurance rates and attract additional providers.

Past Challenges, Recent Market Shifts

From the onset, organizations experienced difficulty in procuring shared-use vehicle insurance. Most firms were willing to provide only minimum insurance, and they required members to provide additional coverage—an approach modeled after rental car insurance policies. Eventually, interest in carsharing by VPSI (a vanpool fleet provider) led to a contact at Insurance One [now called the Hilb Rogal and Hamilton (HRH) Company of Metropolitan Washington], a brokerage primarily serving vanpool fleets (D. Brook, unpublished data, 2002). Through HRH, many U.S. organizations have acquired coverage. In addition, several smaller organizations have obtained insurance through relationships with local providers, which do not have an interest in writing new policies for shared-use vehicle services (according to policyholders). In July 2002, two nonprofit insurers began to provide auto insurance for nonprofit carsharing organizations. The Alliance of Nonprofits for Insurance, Risk-Retention Group (ANI-RRG) and the Nonprofits' Insurance Alliance of California insured one carsharing program each. The policies feature premiums comparable to the costs of a regular commercial fleet policy and include automobile liability and physical damage coverage. Both insurers cover only nonprofit organizations classified as 501(c)(3) institutions and evaluate potential insureds on a case-specific basis. At the time of publication, ANI-RRG offered services in 12 states (S. Moody, unpublished data, 2002).

In July 2002, there were approximately eight insurance companies actively carrying carsharing policies. Because many station car programs are comparable to those of company fleets or rental cars—serving commuting employees of one employer or a single household—just one of five U.S. station car programs examined was insured by an insurance carrier. The remaining programs were either self-insured or covered by members' personal or commercial insurance policies.

From 1998 to 2001, shared-use vehicle insurance premiums were within a range of \$1,200 to \$2,100/vehicle/year. However, the rates increased dramatically in 2001 across the entire insurance industry, resulting in significant changes for the shared-use vehicle market. One reason for increased costs is the economic position of the insurance industry. In 2001, the industry reported a negative 2.7% rate of return—the worst in the insurance sector's history. The following factors have contributed to the insurance industry's tremendous losses:

- The 9/11 terrorist attacks,
- High catastrophe losses,
- Rising medical costs,
- High litigation expenses,

- The Enron debacle,
- Underpricing of insurance services during a soft market in the late 1990s,
- The economic recession, and
- Falling financial markets (7, 8).

Furthermore, several factors in particular contributed to rising automobile insurance costs. They include

- Inflation in medical costs;
- Higher jury awards in automobile liability cases;
- Increased vehicle repair costs; and
- Severe fraud problems in several states, such as New York, Florida, and Massachusetts.

Moreover, a recent Georgia Supreme Court decision mandated that insurance companies must compensate car owners for the diminished value of automobiles involved in accidents. This requirement applies even if the vehicle is repaired and fully functional (9). In light of these market forces, insurance companies have become more conservative in selecting markets to insure. Insurers are less likely to take on newer, undefined risks. Of the total U.S. shared-use vehicle insurers, three terminated coverage. At the time of publication, many insurers were unwilling to insure carsharing. Indeed, one broker reported rejections by 250 companies the previous 4 years (M. Boylan, unpublished data, 2002); another contacted nearly 20 insurance companies before terminating a recent search.

Current Status and Market Barriers

During the period 2001 to 2002, several shared-use vehicle organizations experienced increases in renewal rates of 50 percentage points or more. One organization even terminated operations stemming from a 500-percentage point increase in premiums. As of July 2002, shared-use vehicle organizations reported premiums ranging from \$1,200 to \$6,000/vehicle/year, reflecting a \$1 million to \$2 million liability limit and \$500 to \$1,000 deductibles. Four of the five station car programs that were included in the U.S. survey are not included in these figures, for their vehicles were insured as company fleets or through private insurance policies. Also, a few carsharing organizations reported a variety of unique arrangements that were not available to others.

In July 2002, the majority of shared-use vehicle organizations paid \$4,800 to \$6,000/vehicle/year, accounting for 20% to 48% of an organization's total costs. On the high end, shared-use vehicle organizations reported approximately 1.7 collision claims per 10 vehicles/year—resulting in costs of \$600 to \$900 per claim. No medical liability or bodily injury claims had been reported at the time of publication. Costs are also reflected in total staff hours dedicated to obtaining affordable insurance coverage. A few organizations reported concentrating up to 25% of high-level staff time on this problem.

Currently, shared-use vehicle services have not yet been assigned a risk class within the insurance industry. Classification is the process of assigning a proposed party to a group or class of insureds—those with approximately the same expected loss probabilities (10). To develop a premium for a new class of insureds, an underwriter relies on credible historical data to characterize risks across time and factors. Credible data require a large sample size over at least 3 years.

Significant data are generated from 10 years of experience and several millions in premiums (M. Boylan, unpublished data, 2002). When historical data do not exist, the underwriter can use expert judgment to aggregate similar risks and infer applicable ones for a new class (11).

Several disadvantages are associated with an unclassified insurance status. First, policies will vary widely among carriers, who interpret shared-use vehicle risks differently, making it difficult for carsharing providers to predict premium costs (i.e., there is no standard). Second, in the current economic climate, insurers are less likely to explore new markets, so shared-use vehicle organizations have fewer options and less consumer power owing to less competition. Finally, premiums are raised to cover unknown risks and the expense of developing a new classification category.

Possible Strategies: Lowering Insurance Premiums

From this examination, the authors recommend four strategies for addressing the recent insurance hikes experienced throughout the shared-use industry during 2001 and 2002. These strategies, to be discussed, include

1. Developing risk-rating factors and actuarial tables for U.S. shared-use vehicles,
2. Applying advanced technology applications,
3. Pursuing a captive self-insurance strategy, and
4. Investigating usage-based insurance approaches.

Risk-Rating Factors and Actuarial Tables Risk-rating factors provide a means for appropriating and measuring driver and vehicle risk. Thus, they are important to carsharing providers in calculating risks and corresponding premiums. Actuarial tables summarize risk-rating factors and assign pricing structures for each. Determining accurate rating factors requires the expertise of an actuarial analyst, who applies vehicle and driver statistics in assessing risks. Developing a new class can be time consuming and costly for insurers.

As a first step in lowering premiums, risk-rating factors and actuarial tables must be developed to help shared-use vehicle organizations minimize and manage risk exposure. To accomplish this, the authors recommend that

1. Shared-use vehicle organizations collaborate in helping underwriters establish standard risk-rating factors through the documentation of accident history, vehicle and driver profiles, fleet usage patterns, and preventive actions (e.g., theft prevention devices); and
2. Public assistance opportunities be explored to establish shared-use vehicle risk-rating standards.

From the authors' review of the literature and interviews with brokers and underwriters with shared-use vehicle experience, the following rating factors emerged as the most significant in affecting premiums (see Table 1) (12, 13).

Currently, the small scale of the shared-use vehicle market deters insurers from investing time and resources in analyzing appropriate rating factors for a classification. Data should be aggregated across the shared-use vehicle industry to make this new classification as transparent as possible for insurers in developing risk-rating factors and actuarial tables. Automated vehicle tracking technologies could

TABLE 1 Rating Factors for Shared-Use Vehicles

FACTOR	DESCRIPTION AND RESEARCH FINDINGS
Unauthorized Drivers	This category was the most common concern among brokers and underwriters. Advanced technologies present a strategy for addressing this concern and minimizing risk exposure.
High Member/Vehicle Ratio	The insurance company takes on the risk of covering multiple drivers on one vehicle policy. Underwriters suggested that screening and continuous monitoring of drivers would slightly lower the risk.
Geographical Location of Fleet/Vehicle	Underwriters perceive that shared-use vehicle services are offered in metropolitan areas primarily, where risk exposure is generally higher. Underwriters were unclear regarding geographical driving restrictions. One broker recommended that shared-use vehicles be limited to an 80-km (50-mi) radius of respective lots to reduce risks.
Fleet Scale	The "Law of Large Numbers" means that the scale of the insured contributes to policy profitability, data credibility, and price competition among insurers. All insurers interviewed suggested that carsharing fleet scale and potential market growth are key factors in a decision to offer carsharing insurance. Approximations of ideal fleet size were not provided; however, analogies were drawn to large car rental companies, with fleets ranging from 148,000 to 486,138 vehicles (12).
Driving Records and Personal Driver Profiles	Underwriters were supportive of shared-use vehicle efforts to screen drivers and did not want to be responsible for this duty.
Claims History	There was a difference in opinion among insurers regarding how much claims data are needed to provide credible evidence for a risk-rating factor (e.g., from 3 to 10 years). Underwriters for a majority of carsharing organizations were unaware of any significant claims in 2001–2002.
Vehicle, Make, Model, and Age	All of these vehicle attributes influence premiums. Car rental risk rates are reduced when cars are from 1 to 2 years old, as opposed to 3 to 5 years or older.
Usage Statistics	The assumption that shared-use vehicles are driven more than average vehicles contributes to higher premium prices. An underwriter for a U.S. carsharing insurance provider (as of July 2002) estimated that the average carsharing vehicle is driven approximately 28,800 km/year (18,000 mi). According to the shared-use vehicle survey, the majority of vehicles are driven from 19,200 to 23,040 km/year (12,000 to 14,400 mi). In comparison, the average operator of a personal vehicle drives nearly 19,920 km/year (12,388 mi) and pays \$700 in total premiums per car/year (13). Three U.S. station car programs did not report average mileage; however, two programs reported annual mileage from 5,760 to 8,000 km/year (3,600 to 5,000 mi). Accurate usage statistics would assist insurers in determining appropriate premiums.

also be used to accurately track and report actual vehicle usage for risk assessment.

Advanced Technologies A number of vehicle security technologies can also be employed to lower insurance costs. First, shared-use organizations could lower their bodily injury and medical insurance premiums by incorporating automated seatbelts into their fleets. Discounts can account for up to 25% of total medical liability premiums (14). Medical liability coverage accounts for up to 60% of total insurance premiums [California Partners for Advanced Transit and Highways (California PATH) shared-use vehicle survey, unpublished data]. Second, several antitheft devices can earn discounts of up to 35% off comprehensive coverage—including vehicle immobilizers that prohibit unauthorized users, smart keys that facilitate vehicle access to specified keyholders only, and vehicle tracking devices that increase stolen vehicle recovery rates. Although antitheft devices impose a one-time initial cost, they can provide greater security and insurance benefits over several years (14, 15). Comprehensive coverage premiums constitute from 10% to 15% of total insurance costs in shared-use vehicle programs (California PATH survey, unpublished data, 2002). Nevertheless, a cost-benefit analysis should be conducted before investing in antitheft technologies. Because vehicle type and geographical location are the two major

factors used to set comprehensive premiums, insurance costs and the feasibility of antitheft devices can differ based on these factors.

Finally, a vehicle tracking system can also allow for automated information on vehicle usage and can recognize misuses. Accordingly, insurers could receive automated vehicle-usage data for risk assessment and quoting purposes. Indirectly, vehicle tracking can also positively influence user treatment of vehicles. Despite these benefits, most insurers interviewed were unaware of vehicle tracking benefits for shared-use vehicle programs and were unable to provide corresponding premium discounts.

Also, advanced technologies present another opportunity for shared-use vehicle organizations to provide accurate risk-factor data to insurers, which could ultimately lower insurance rates.

Captive Self-Insurance Strategy Self-insurance, another strategy for reducing high carsharing insurance premiums, can be advantageous for many small-scale organizations that could not otherwise self-insure, and it offers an alternative to commercial policies. With self-insurance, the individual or organization assumes financial risk directly, instead of paying an insurance company to cover risks (16). Another form of self-insurance is a high deductible. Recently, one shared-use vehicle organization began insuring its fleet through a high deductible. In this case, the

insurance company insures their liability only. The low comprehensive and collisions claims history of U.S. shared-use vehicle programs also suggests that these programs may be good candidates for self-insurance.

Another strategy is to create a "captive" self-insurance pool. This approach would entail four steps. First, shared-use vehicle organizations would agree to participate in and identify a number of operational standards (e.g., degree of driver screening). Second, in addition to premium payments, organizations would attract private or public (or both) investments proportionally to their fleet size for creating a risk retention pool to cover risks. On the basis of the national fleet size (576 vehicles as of July 2002), the pool would require approximately \$4 million to \$6 million. Investors would be compensated from the profit pool in a manner negotiated. Third, an association captive (a noninsurer or an existing insurer, or a noninsurer or an insurer created or owned by the group to underwrite collective risks) would be established. The association captive would administer claims, primarily those covered by premiums. Fourth, a reinsurer would be identified to cover part of the risk retention pool fund costs and any possible costs exceeding the fund. In exchange for taking on this role, the reinsurer would receive a portion of premiums and residuals.

From estimates from the principal U.S. shared-use vehicle broker and correspondence with underwriters, the following price structures seem reasonable in this approach:

- Premiums would be \$2,500/car/year. This figure is based on 4 years of experience in brokering for shared-use vehicle organizations and inference to vanpools and other fleet applications.
- Approximately 42% of premiums collected would cover the following expenses: specific claim losses, claim settlement costs, payments to agents or brokers, taxes, administrative costs, and initial acquisition expenses to establish the association captive.
- Expected losses per year would be approximately \$750/vehicle.
- Seven years is the time frame anticipated before the premium surplus would sufficiently support the risk pool (and investors are no longer needed) (M. Boylan, unpublished data, 2002).

There are several potential benefits of the captive self-insurance approach. First, shared-use vehicle service providers would have more influence over their risk-rating structure. The formation of this shared-use vehicle pool would facilitate the collection of significant historical data after a period of 3 to 10 years. Pooling would also leverage the scale of respective fleets, so that underwriting is streamlined and more profitable for insurers, resulting in lower premiums. Furthermore, premiums could be lowered if organizations shared the costs of insurance overhead, agent commissions, and taxes. Finally, investment income would be generated from premiums paid to insurance companies on reserve. Also, this approach could empower shared-use vehicle providers in determining their risk exposure and in refining business practices to minimize risks (M. Boylan, unpublished data, 2002).

Overall, many surveyed organizations expressed an interest in self-insurance. However, they were concerned about generating monies to contribute to the risk fund pool and maintaining a competitive edge while cooperating. Furthermore, the formation of a captive self-insurance approach would require some degree of standardization in business practices. If such an approach were pursued, it would greatly benefit from the guidance of an advisory board consisting of shared-use vehicle practitioners and experts, insurers, and other public interest representatives.

Usage-Based Insurance This represents a concept that was piloted and copyrighted by Progressive Casualty Insurance Company in July 2000. In addition, Norwich Union, a U.K. automobile insurer, offers usage-based insurance through an agreement with Progressive (Progressive Public Relations, unpublished data, 2002). This system bases automobile insurance rates largely on when, where, and how much a vehicle is driven (17). Although the driving record, vehicle, and location are still essential in this model, the customer's rate varies largely according to mileage. Progressive's system, named "Autograph," employs a combination of Global Positioning System (GPS) and cellular technology to track vehicle usage. This concept is one that resonates well with the shared-use vehicle model. Car-sharing typically aims to assess fees for variable vehicle use, and several large-scale operations have employed automatic vehicle tracking systems to monitor usage.

A number of obstacles hinder the implementation of usage-based insurance, however. Some parallel those faced by shared-use vehicle organizations trying to obtain more affordable coverage. From the insurer's perspective, a shift to a new rating structure is risky without a guaranteed large consumer demand. Also, this new rating system requires the deployment of affordable in-vehicle technologies to monitor use. Additionally, there are numerous political sensitivities, such as privacy, associated with the use of on-board monitoring equipment and mileage as a principal risk-rating factor. If a viable business case is developed for usage-based insurance, the shared-use vehicle market should be considered for piloting and marketing this concept.

Advanced Technology: Accessing Cost-Effective Systems

Rapid growth in shared-use vehicle membership and fleet size creates a challenge to efficiently managing expansion and more complex operations (6). Advanced technologies are key to decreasing administration costs. Interoperability, supported by some degree of standardization among technologies, can further improve customer services, for example, the use of smart cards among shared-use vehicle programs and transit. Existing technologies already provide solutions for some shared-use vehicle challenges. However, technological systems tailored to the needs of shared-use vehicle providers (e.g., data collection to support insurance approaches, such as usage-based fees) could further enhance overall market growth and operations.

Several organizations have taken an active approach in researching and developing new technologies. Each system has been developed independently, limiting opportunities for interoperability among systems, organizations, and transit services. Because development expenses can easily exceed the budget of a single organization, partnerships among shared-use vehicle programs could leverage the resources to obtain necessary funding and attract technology manufacturers. In addition, technology providers could become potential stakeholders in the shared-use vehicle industry.

Challenges to Accessing Customized Technologies

The majority of shared-use vehicle providers surveyed—especially those with aggressive growth objectives—agreed that advanced technologies are a driving force behind successful operations. Organizations that did not recognize technology as essential in the survey

typically had more limited growth objectives. The majority of shared-use vehicle service providers reported that advanced technologies could greatly enhance operations, serving larger and more diverse populations. For example, smart technologies can facilitate one-way rentals (i.e., members are not required to return vehicles to the same location), increasing market penetration. Furthermore, several providers also noted the advantages of smart chip technologies in linking their services with other shared-use vehicle operators and transit systems.

Throughout the survey, many respondents expressed a need for more affordable technologies but lacked sufficient scale to justify system acquisition. Not surprisingly, high technology development costs have deterred most U.S. organizations from developing systems, with just a few exceptions. Such developments have occurred independently through large start-up grants or university-sponsored pilot programs in conjunction with the private sector. Additionally, these efforts are continuously burdened by the need to upgrade their technologies.

Current Technology Applications and Realized Benefits

Intelligent transportation systems (ITS) technologies are currently used to improve three main areas of operations:

1. Vehicle access (smart cards),
2. Member reservations, and
3. Data collection.

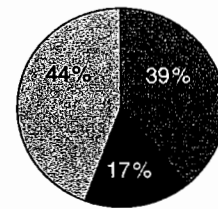
Smart cards and key fobs communicate user information to a centralized database that employs member IDs to track driver activities for billing and security purposes. Smart card technologies have the potential to streamline administration and fleet management and link with a variety of transportation services, for example, carsharing, smart parking, and transit.

Automated reservations via on-line, voice recognition, or Touch-Tone telephone systems enable quick and convenient customer scheduling in addition to lower labor and administration costs.

Finally, automated vehicle location technologies are used to track shared-use vehicle fleets over a cellular communication, radio frequency, or satellite-tracking network. Improved member tracking can be used for automated billing and increased security (e.g., vehicle immobilization), thus streamlining management and customer services.

Figure 3 illustrates the distribution of carsharing providers employing ITS technologies. They range from manual operations (e.g., operator phone services, in-vehicle trip logs) to partially automated operations (e.g., automated reservations via Touch-Tone telephone or Internet or both) to advanced operations (e.g., smart card access, automated reservations and billing, automated vehicle location, and cellular and radio frequency communications). As illustrated, in July 2002, 39% of U.S. shared-use vehicle organizations had advanced operations, 17% provided partially automated services, and 44% offered manual services. All five U.S. station car programs employed manual operations. Organizations employing advanced systems constituted 76% of the total shared-use vehicle fleet.

Although existing technologies can address many challenges of shared-use vehicle services, technological systems tailored to the needs of shared-use vehicle programs could further enhance mar-



■ Advanced Operation Systems
 ■ Partly Automated Operations
 □ Manual Operations

FIGURE 3 Technology approaches for U.S. shared-use vehicle systems.

ket growth and operations, such as requirements for insurance data collection. City CarShare, for example, is currently developing software that will be licensed at no cost to other nonprofit organizations. This open source system will allow license holders to modify and customize software to their specific needs. Similar to the Linux concept—a free computer operating system available to download and modify—this approach is based on the idea that collective input will accelerate innovations at a lower cost. Furthermore, start-up organizations have recently begun leasing customized technologies and services (e.g., billing) from larger organizations. Both strategies mentioned here support cooperation. In the final section, the authors explore the benefits of a cooperative approach to technology development.

Cooperation: Expertise and Scale for Cost-Effective Technologies

Cooperation among shared-use vehicle organizations could be an effective means to lower the costs of technology development. There are essentially two possible approaches to furthering cost-effective, technological advances in shared-use vehicle systems. First, large, business-oriented shared-use vehicle providers invest in researching new technologies and applications. When applicable and feasible technologies are developed, they can be marketed to other shared-use vehicle organizations. Second, several shared-use vehicle organizations combine their research investments to implement and develop technology for industrywide operations.

The first approach partly resembles the current state of the industry. Because of the high costs of technology development, however, sales to other operations cover only a small portion of initial expenses. As a result, a developed system must prove to be quite viable for a given organization. To date, development has largely depended on grant availability. Innovations, even if determined essential, depend on subsequent grants or unique opportunities, such as private-sector grants. For evaluating the second, cooperative approach, a more detailed analysis of customized technology systems is given.

Customized technologies that address the specific needs of shared-use vehicle programs can provide a powerful tool in improving customer services and streamlining administration. Comprehensive systems with onboard computers and vehicle tracking can process and transmit data on vehicle usage and location for administrative and security purposes. Simultaneously, these systems can offer

customer-friendly features including telephone access; directions and parking information (e.g., through GPS); reminders on low-fuel levels and rental-time limits; and customer-specific features, such as preferred radio station, seating adjustments, and mapping information. Furthermore, advanced onboard computers can be adapted to new customer demands by adding or changing software or hardware. Doing so is crucial when vehicle services target new market segments and a more diverse customer base.

According to industry expert interviews, the costs of a customized system, including onboard computers and tracking devices, can range from \$500/vehicle when several existing components are incorporated, to \$4,000/vehicle for a state-of-the-art system with highly specified software and hardware components and a high degree of upgrade flexibility. Installation typically does not exceed 2 h of labor. Owing to costs and long development times—that is, typically more than 6 to 12 months—technology providers are unlikely to design customized systems for small fleets. When interviewed, technology developers reported that fleets of several hundred to 1,000 vehicles would be economically viable from a manufacturer's perspective.

Given that the combined fleet of U.S. shared-use vehicle operators totaled 576 vehicles in July 2002, cooperative efforts would appear to be beneficial in attracting the technology sector. Large-scale partnerships among shared-use vehicle providers could lead to necessary funding, and a larger aggregate fleet size could attract technology manufacturers. This situation would also encourage continuous development efforts stemming from larger, more sustainable industry relationships.

Finally, technology partnerships could lead to a greater degree of technology standardization and facilitate interoperability among shared-use vehicle organizations and transit providers. Improved interoperability can enhance customer service. For example, four carsharing organizations located in four different cities in Ontario agreed that the members of a particular organization should have the option to conveniently access the services of another when traveling. To facilitate such a partnership, the four organizations share the same insurance carrier, which helped them overcome challenges related to insurance coverage and interoperability. In the United States, nonprofit organizations may have the opportunity to create such synergies with the recent emergence of a nonprofit insurer and City Carshare's technology-sharing program. To summarize, these partnerships positively affect the market, because overall carsharing vehicle use and customer satisfaction increase.

CONCLUSIONS

Despite the promising growth rates in U.S. shared-use vehicle operations and membership, the relatively small scale of shared-use vehicle organizations presents a challenge to obtaining affordable insurance and covering other high capital costs, including technology, vehicles, and labor. Although advanced shared-use vehicle technologies can help organizations to reduce administrative costs and potentially lower insurance premiums, technology deployment has typically required large private investments or public development grants.

Strategic cooperation among shared-use vehicle organizations could address these challenges on several levels. First, limited cooperation could help organizations collectively address some insurance issues, for example, the development of risk-rating factors. Furthermore, more involved cooperative efforts could support more aggressive strategies, such as captive self-insurance.

Second, cooperation among shared-use vehicle organizations could also accelerate the development of interoperable, customized technologies and continued innovation, by creating the scale necessary to attract technology providers. Additionally, a combined insurance-technology cooperative strategy may be even more beneficial—lowering insurance premiums, enhancing customer services and capabilities, and lowering capital costs.

Third, cooperation could also manifest highly desirable social and environmental benefits. The potential of new and existing shared-use vehicle service organizations to continue expanding and serving new markets could be greatly enhanced through supportive public-private partnerships. Policy makers and transit operators, for example, should continue to explore the social and environmental benefits of shared-use vehicle services through grant making, preferential parking, supportive policies (e.g., high occupancy vehicle lane access), and outreach and marketing. Strong public-private partnerships are needed to facilitate the ongoing development and sustainability of viable U.S. shared-use vehicle programs. Thus, it will be important for the public and private sectors to continue working together. They could monitor system designs and impacts as well as facilitate and encourage collective partnerships among shared-use vehicle organizations—particularly where tremendous synergies could be realized, such as insurance policies and customized technologies.

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