Car Rental 2.0

Car club innovations and why they matter

Scott Le Vine

June 2012

RAC Foundation

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RAC Foundation
89–91 Pall Mall
London
SW1Y 5HS

Tel no: 020 7747 3445
www.racfoundation.org

Registered Charity No. 1002705

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About the Author

Scott Le Vine is a transport planner at Imperial College London. His programme of research primarily focuses on emerging forms of personal mobility and the implications for infrastructure provision, energy usage, and well-being.

He serves on the Transportation Research Board's standing committee on Public Transport Innovations. He is a member of the American Planning Association and holds a professional planning licence (presently in hiatus) in New Jersey, USA.

Scott holds degrees from McGill University (BSc Geography), New York University (Master's in Urban Planning / Transportation Planning) and Imperial College London (PhD in Transport Studies).

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Contents

Executive Summary

Car clubs are growing quickly in the UK, and entirely new types of services are beginning to emerge. Their impacts are small today, but as car clubs grow in scale increasing attention is being paid to this sector. This report investigates the implications for:

- **Consumers:** How, in practical terms, does the 'car access' offered by car clubs differ from owning a personal car or relying on one-off services such as taxis or car hire?
- **Industry:** What are the implications for existing markets? What opportunities exist to support or provide car-club-style services?
- **Road users:** What do car clubs mean for emissions, road traffic conditions, and use of alternative forms of transport?
- **Policymakers:** What is the appropriate role of the public sector?

From a customer's point of view, the main pros and cons of car clubs can be summarised as:

Pros	Cons
• The fixed costs of owning a personal car are not incurred. • There is no ongoing responsibility for the car: insurance, maintenance, MOT, finding a secure parking location, and so on, are all looked after by another party. • A variety of models can be hired to suit different mobility needs on different occasions.	• Usage costs are higher than the cost of petrol for a personal car. • The driver has less control over where, when, and for how long a car is used.

In any type of car club, a driver accepts responsibility for the state of the car at the beginning of their usage episode – accepting both that it is fit for use and that it has no unreported damage. When a driver uses a car club vehicle, they agree to inspect it at the outset and be satisfied that the current condition of the vehicle is accurately recorded – or risk accepting responsibility for damage caused by a previous user. Responsibility is not shared between customers – rather, it is passed along from user to user as with car hire.

Increasingly, traditional car clubs (such as Zipcar and City Car Club) are one amongst several business models. Peer-to-peer car

clubs (such as WhipCar in the UK) allow car owners to rent their cars out to other people who wish to use them. One-way car clubs (see the definition in Section 1) such as car2go and DriveNow have yet to appear in the UK, but such clubs are showing a keen interest in the market here and a car2go system is planned to start operating in Birmingham in late 2012. They are already in service in continental Europe (in the cities of Paris, Berlin and Amsterdam, amongst others), Canada and the USA. Further innovations in services will result from new organisational structures and technological advances. As the market matures, car clubs will increasingly offer a diversity of services.

Although it is recognised that there are uncertainties in how services and markets will evolve, it appears that one-way car clubs provide larger benefits in terms of widened car access, whilst traditional car clubs offer greater environmental benefits. Both types of services are predicted to have a majority of subscribers that drive somewhat more than they otherwise would, and a minority that on average drive considerably less. The analysis of the potential market in London forecasts just over 400,000 active subscribers to traditional car clubs as compared to just over 100,000 today. More strikingly, the forecast is for around 1.5 million subscribers to a prospective one-way system in Greater London. The largest reductions in vehicle-miles of travel were found to be associated with traditional car clubs operating in Outer London.

Car manufacturers are beginning to design cars specifically for use in car club operations. At present, vehicles in car club fleets are typically standard models that have been fitted with aftermarket telematics. By way of contrast, bike-sharing systems, such as London's cycle hire scheme, use purpose-built bicycles. Despite automotive engineering being much more complex and working to longer timescales, car models built specifically to suit the demands of car club operations are now emerging, and will continue to do so.

Car club systems at scale would work very differently to the prevailing system of personal car ownership. When demand is greater than available capacity, 'virtual congestion' occurs within a car club's reservation system rather than traffic congestion on the roads: some users cannot access a car whilst others can, in contrast to the pervasiveness of road congestion. In principle such advance knowledge is an improvement over the unreliability that results from road traffic congestion. On the other hand, car clubs rely on wireless communications and back-office IT systems that are vulnerable to system-wide disruption. Moreover, access to a car club fleet can also be controlled in ways that access to road space cannot, raising a host of provocative questions.

At this point in the market's development, the overriding principle for the public sector should be to preserve its flexibility: there is no need to rush into long-term contracts or large-scale publicly funded projects. The single most important point of interaction with car club

operators arises in tendering for privileged access to on-street space. Failure to take action at scale in the short term does not preclude a rethink over a longer period, by which time – it must be presumed – technologies will have improved and there will be lessons to be learned from others' experiences.

It is suggested that other public sector actions should include: developing joint public transport / car club ticket products, ensuring that under-represented lower-income groups are not excluded, and engaging car clubs for staff use, thus allowing a reduction in the (non-emergency) publicly owned car fleet.

Car club activity – and other non-traditional ways in which cars are used – should be integrated into wider transport data collection efforts (e.g. the National Travel Survey). The guiding principle would be to track both subscriptions, and, for any journey made in a car, the means by which the car was accessed. This would provide greater credibility regarding impacts: to date, nearly all understanding of car clubs' effects relies on data from surveys where respondents are surveyed specifically because they are customers of a car club. Changes to household travel surveys must be carefully considered in the light of the possibility of introducing a discontinuity into time trends. A relevant precedent, however, is the separate treatment of taxis and minicabs in travel surveys; each is used for a rather small share of travel, but the distinction is important for policy reasons.

A number of important research questions remain unanswered. Evaluation methods are still in their infancy; this is particularly acute with regard to peer-to-peer and one-way car clubs. The nature and extent of 'induced travel' is also poorly understood: whether and how people adjust their destinations (and how frequently they visit them) to take advantage of a car club subscription. Life-cycle analyses of the environmental impacts of car clubs are needed; in other words using methods that take into account manufacturing, scrappage, and effects on the second-hand car market. A related issue is to do with the long-term impacts of car club subscription on people's desires for future personal car use: this is a complex matter about which little is known; it is suggested that a starting point would be to institute regular exit surveying of car club users.

1. Why Car Clubs Matter

Car clubs make up a rapidly growing part of the UK's transport sector: since their inception in 2000 they have expanded to number over 100,000 subscribers today. Their customer base continues to grow at double-digit rates annually – by 40% in 2010.

Despite car clubs' roots in Edinburgh (see Cairns et al., 2004), London dominates the market today, with over 85% of the UK's subscribers (Carplus, 2011). In Islington, Inner London, nearly one adult in ten now subscribes to a car club. Some observers estimate that by 2020 there may be one million subscribers in the UK (Carplus, 2010); Section 4 presents a forecast of 1.5 million subscribers in Greater London alone, depending on how the features of car club services evolve.

A range of benefits are commonly associated with car clubs:

- They engender greater efficiency of car use than private cars – more usage per car per day, something that managers call 'yield management'.
- They have complex environmental impacts which, on balance, are thought to result in net benefits, as car club subscribers drive fewer miles in less-emitting cars than does the average private car owner.
- They enable wider access to car usage across society, with the potential – as yet not fully realised in the UK – for extending the benefits of car use to socially excluded groups.
- They may also bring about less-tangible benefits, such as tighter social links and the greater sense of community cohesion associated with sharing a common resource (the car club's fleet of cars) as opposed to owning cars privately (see, for example, Botsman, 2011).
- They provide commercial opportunities, as there are clearly underserved markets for accessing cars that are being unlocked through innovative applications of information technology.

Important questions are raised by this rapid growth of car clubs:

- How should incumbent firms in the automotive sector adapt to these changes in the marketplace?
- What should the posture of the public sector be towards car clubs? Should clubs be actively encouraged, or should it be left to the market to find solutions? Should certain types of car clubs be encouraged and others not?
- What do we know about the knock-on impacts on carbon emissions and other forms of travel – such as public transport patronage?
- What policy-relevant insights can be gained about personal mobility in a broader sense, by observing how people react to the novel offers from car clubs?

Much of the popular discussion about car clubs places the phenomenon within a broader social and economic trend of 'collaborative consumption', in which consumers purchase *access* to a service instead of owning and maintaining the physical asset that provides the service. In the case of car clubs, the idea is that people are buying access to cars rather than acquiring a car itself.

The term collaborative consumption is somewhat ambiguous, though. It can also refer to other business models beyond the 'access in place of ownership' one: for example, companies like Groupon offer people deals which only take effect if enough other people participate. Car clubs are quite different to this, and work more like car rental or hotels do – with the exception of the 'peer-to-peer' (P2P) business model (see box below), people rent cars that are owned by a central organisation. This type of system is 'collaborative' in the sense that the same physical asset (a car, or a room in the case of a hotel) is used by different people at different times, none of whom is the owner.

Purchasing a car is expensive, and whilst parked it can actually be a liability for its owner (a car parked in a public place is an expensive asset that can be damaged). In many places, parking is expensive, limited and politically contentious. Owning a car also requires upkeep and maintenance, though for many people getting through their day-to-day routine without one is thoroughly impractical. Car clubs pose the question: why own a car when what people really want is just to use one as and when they need it?

Car clubs are, however, not alone in offering on-demand access to cars: car hire firms have been in this business for many decades. Modern information technology (such as smartcards) is enabling new forms of service delivery – but it is a new twist on an old story: structured access to resources that others use as well.

An interesting question is where to draw the line between car hire and car clubs: both are services that offer car rental on a pay-as-you-go basis, and both are evolving, becoming in some ways more alike. What sets car clubs apart is that after the initial sign-up, a subscriber is able to use the cars in its fleet many times without ever interacting directly with a member of staff or visiting a shopfront location.

Reservations, access to the cars, and billing are all fully automated, but even here some membership programmes offered by car hire firms (e.g. Avis Preferred and the Hertz #1 Club) offer similar services. Also, whereas car hire is typically offered on a daily basis, traditional car clubs provide a different type of car access: for as little as 30-minute increments, and via cars that are distributed in neighbourhoods rather than at shopfronts or airports. New types of car clubs already operating in other countries will allow people to use a car for one-way journeys and pay on a per-minute basis. Such 'one-way' car clubs are studying the UK market closely, and are discussed in detail in this report.

Car clubs market themselves as offering an alternative to car ownership. This report will discuss the major distinctions between 'car access via subscription' and 'car access via ownership': for instance, the degree of control over the timing and nature of access to the car differs markedly between the two.

This report investigates how subscription car access is changing the ways in which people travel, and looks at how car clubs will develop in coming years. The original research reported is sourced from the author's doctoral study (Le Vine, 2011), which was funded in part by the RAC Foundation. It is shown that car clubs have ample room to grow – and that innovative operating models will allow them to attract a far larger share of the travel market than they presently account for.

The central research and policy questions are explored, as is the appropriate role of the public sector.

Three types of car clubs defined (see Figure 1)

Car clubs are called *carsharing organizations* in North American English.

A '**traditional**' car club (is an organisation that rents cars to customers on a short-term basis, frequently in 30-minute increments. Examples include Zipcar and City Car Club.

Cars are owned by the car club, which is usually a private company. The fleet is dispersed in neighbourhoods, in dedicated parking spaces which may be on-street or off-street.

Customers must subscribe, which means an initial DVLA driving record check, and then frequently the payment of a fixed annual fee.

To use a car one must first make a reservation; typically this is done via a web interface or smartphone app. At the appointed time, the customer accesses the vehicle by swiping a smartcard on the windscreen. In order to avoid liability, it is the customer's responsibility to ensure that any damage to the vehicle is reported before using it.

By the end of the agreed reservation period, the vehicle must generally be returned to the same parking space from which it was accessed. Some car clubs outside the UK permit open-ended reservations, where the customer can return the vehicle when they please and pay only for the additional time used.

'**One-way**' car clubs are centrally owned like traditional car clubs, but they allow subscribers to use cars for one-way journeys within a defined geographic area.

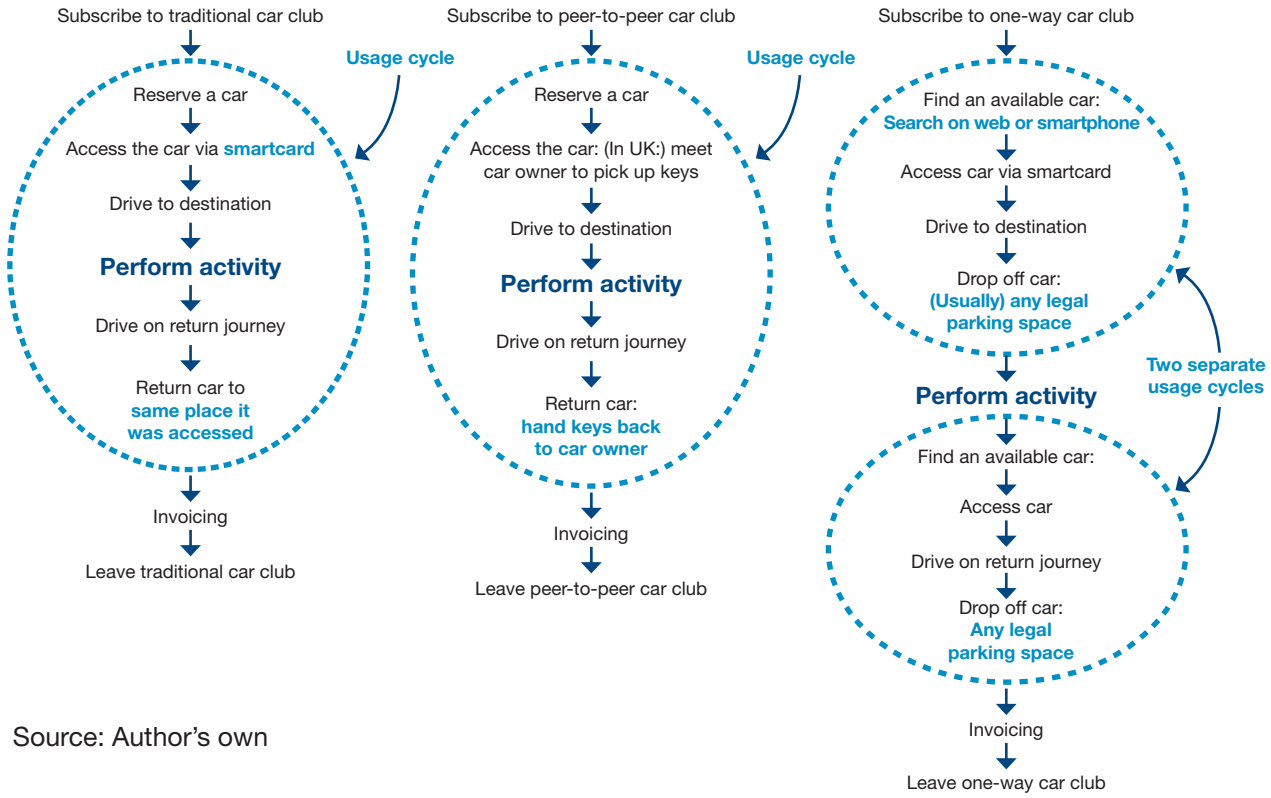
Advance reservations are possible, but most use is spontaneous. Customers thus pay by the minute for only the time they are driving one of the cars, whereas in a reservation-based system the customer pays for the entirety of the reservation period regardless of whether they pick up the car late or return it early.

A '**P2P**' car club serves as a middle-man between car renters and car owners who wish to rent their car out to them. The cars are owned privately – not by the central organisation – and used on a round-trip basis. The P2P car club arranges insurance and facilitates the market. The revenue stream typically comes from a percentage of each rental within the system. Car renters find available cars on the system's website; requests to rent a car are passed along to its owner for their approval.

Both owners and renters rate each other; these ratings, which all users can see, help people to determine who they are comfortable interacting with in future.

Some P2P car clubs have telematics systems installed that can read smartcards and allow an authorised renter to access a car independently. WhipCar, the largest operator in the UK, does not currently have such systems, and thus renters and car owners must meet before and after each booking to exchange the keys.

Figure 1: Comparison of three types of car club operating models
Traditional, Peer-to-peer, One-way e.g. Zipcar, City Car Club e.g. WhipCar, RelayRides, e.g. car2go, DriveNow



Source: Author's own

How many people use car clubs?

International surveys show that in January 2011 about 1.25 million people were subscribed to car clubs in 26 countries (Shaheen, 2011).

The charity Carplus runs a certification scheme for car clubs in the UK, and also maintains a count of UK subscribers.

Carplus reports that as of 1 January 2012, about 160,000 people subscribe to car clubs in the UK. As recently as 2005 there were fewer than 5,000 subscribers.

The UK estimate arises from summing the numbers of subscribers reported by each of the UK's car clubs. There is thus the possibility of double-counting people with multiple subscriptions to different car clubs, though the extent of this potential problem is not known. As there has been major consolidation amongst car clubs recently, the estimates have also been revised accordingly.

It is reported that 29% of UK subscribers have not used a car club vehicle for a year or more. The other 71% are therefore considered to be 'active.' This leads to an estimate of about 115,000 active subscribers in the UK, with an acknowledgement that this estimate could include some double-counting and that the proportion of inactive members may in fact be lower today than in previous years. The number of active subscribers living in London is thus estimated at roughly 100,000, on the basis that between 85% and 90% of all UK subscribers live in London.

In Section 6 the subsection titled 'improved tracking of car club activity' discusses data issues in more depth.

2. Current Developments

This section considers the ways that car clubs are evolving as the market matures and grows.

Any such review must begin by placing recent developments in the car club sector within a broader context. What is different about car clubs is that they offer a new type of 'middle ground' option between the expense and responsibilities of car ownership and the 'no commitment' option of one-off car services such as taxis, and – to a lesser degree – car sharing and car hire.

At one extreme, travel by a taxi/minicab involves no advance planning and no responsibility for maintaining a vehicle (or indeed for driving it), but is expensive and offers a low degree of control over when and where the vehicle is accessed. At the other end of the spectrum can be found various forms of possessing a personal car, such as outright ownership, car leasing, and keeping a company car. Though each of these forms of car 'ownership' have their distinct features, they all offer a high degree of control over one's access to car-based mobility, at the expense of purchase/maintenance costs and ownership responsibilities (e.g. arranging suitable residential parking).

The services which car clubs offer lie between these two extremes, in common with both car hire and informal arrangements for borrowing a car. But whilst car hire can be accessed on a one-off basis, car club offers are designed for an ongoing supplier–customer relationship.

The car club concept dates from the 1940s (Harms & Truffer, 1998), but early low-tech systems using key boxes, reservation-by-voice-phone-call and paper-and-pencil usage recording failed to scale up commercially. By the late 1990s, commercially available IT systems had fallen in price sufficiently for the usage and billing cycle to become fully automated processes, greatly improving the customer experience.

2.1 Vehicle damage and liability

When one considers the car's defining features, it can readily be seen that it ticks many of the boxes of an ideal candidate for on-demand services: cars are expensive, durable, only in motion for an average of roughly 5% of the time, and are manageable (in the sense that a vehicle is a unique and easy-to-track asset). Further, for some journeys there are few realistic substitutes for using a car.

It is, however, inherently difficult to determine responsibility for damage to a car club car, such as minor body damage or engine wear from aggressive driving. The car club operator must strike a balance between being too assertive in allocating damage to specific users and the risk of incorrectly charging a driver for damage which they did not cause. This uncertainty means that it is the driver's responsibility to perform a systematic visual inspection of a car club car at the beginning of each usage episode, and to ensure that any damage has been recorded before using the car.

> Anne and John
>
> Anne and John are car club members in south-west London who took part in research for this study and discussed their experiences.
>
> They report frequently arriving early to pick up their nearest car club car and finding themselves waiting next to it until their reservation starts.
>
> Anne spoke of a nervous feeling each time they took a car – about whether they had checked the car thoroughly enough to avoid being charged for damage caused by a previous user.

The uncertainty can be mitigated somewhat through innovative insurance products that better match drivers with their risk profile. More speculatively, it can be expected that models of vehicle purpose-designed for car clubs will, in the medium term, have much richer networks of sensors that can more precisely allocate damage to specific times and places and hence a particular driver – thus greatly reducing this uncertainty. Even today, some car clubs equip their fleet with technology that transmits onboard diagnostic readings to a central database. In principle this can be used to identify drivers who operate their cars smoothly as opposed to those with aggressive driving patterns, allowing the operator to treat them differently through any of a variety of means. 'Good' users can be encouraged through promotions, privileged access to the fleet, or favourable fee structures, whilst users that engage in undesirable behaviour can be correspondingly discouraged or even banned: car clubs can simply prevent such users from participating in the system in future.

2.2 Peer-to-peer networks

The predominant business model of car clubs in the UK today is one where the fleet and all management systems are owned by an independent private operator. Parking is secured through public tendering for on-street spaces or private arrangements for off-street ones. Vehicles are acquired from car manufacturers in the normal way, and fitted with after-market telematics systems before entering revenue service. The relationship of the operator to their members is generally a supplier–client one, though examples of cooperative organisational structures can be found (e.g. Moorcar).

A change now underway is the emergence of the P2P operating model. Systems of this type, such as WhipCar in the UK and, amongst others, RelayRides in the USA, provide a managed online marketplace for car owners to hire out their cars to drivers at an agreed rate. As these systems entail a central locus of responsibility (for providing insurance, checking driver records, managing the online profiles of users, handling transactions, mediating disputes, etc.), they are not strictly speaking P2P networks, but nevertheless the name has stuck. Sir Stelios Haji-Ioannou, the founder of easyJet, announced plans in late 2011 to introduce a second UK-based P2P system (Wembridge, 2011).

The principal innovation here is that the vehicle fleet is not owned by the system manager, as with traditional car clubs. These services have grown rapidly, as the typical constraints of securing space for parking and ensuring high vehicle utilisation are dealt with by the individual car owners, rather than being the responsibility of the central system manager. Novel temporary insurance products that overlay the car owner's cover were necessary to enable the P2P car club business model, which has found success in lower-density places that do not support traditional car club services.

Some P2P systems (e.g. RelayRides) require that car owners install a telematics system in their car; this allows users to access the vehicles via smartcard as with a traditional car club. Those P2P operators which do not install such in-vehicle telematics (e.g. WhipCar) instead require that users physically meet with the car owner to pick up and drop off the keys.

"RelayRides [a P2P car club] is in the trust business. That is the essence of the business."

– Rob Chestnut, RelayRides advisory board member and former head of trust and security at eBay (Time, 2012).

A little-noticed aspect of P2P car clubs is that the direct link with the public sector is broken: P2P services in the UK do not depend on support from local authorities in the same way as traditional car clubs do. Traditional car clubs rely heavily on dedicated access to on-street parking space – hence local authorities with responsibility for that road space have the opportunity to influence outcomes to advance public interests. For better or worse, the public sector is largely a spectator when it comes to the rapid evolution of P2P services.

2.3 One-way car clubs

One-way car clubs have begun emerging in a number of cities on continental Europe and in the USA and Canada. Traditional car clubs (such as Zipcar) require round-trip usage: a customer must return a car to the same parking space from which it was taken, and pays by the hour for the entire duration.

There are several interesting aspects of one-way car clubs. Whilst most traditional car clubs are start-up firms, two prominent large-scale one-way systems are managed by automotive manufacturers: Daimler's car2go (which entered service in 2009 and as of 1 April 2012 is operating in twelve cities) and BMW's DriveNow (started in 2011; active in three cities in Germany).[1] These two systems have free-floating fleets, where customers may drop off a car at any legal parking space within a defined geographic area.

The third major system, Paris' Autolib', works differently: the vehicles are fully electric, and subscribers access and return them at dedicated parking bays. This is more similar to how bike-sharing systems work; they also have dedicated docking bays. In all of these systems it is possible that a user may find that no nearby cars are available. One of the big differences between the free-floating car2go/DriveNow fleets and the Autolib' system is that in the former systems the vehicles can be parked in any of many on-street parking spaces. Thus users do not need to worry about reserving a parking bay at their destination, as can be done with Autolib'.

In each of these three cases public sector support is necessary: all three require individually negotiated arrangements with local authorities to allow cars in the car club fleet to use public street space in non-standard ways (e.g. allowing parking in pay-and-display/metered parking spots without incurring infractions for non-payment).

Prevailing fleet management technology for one-way car clubs means that reservations are not as straightforward as they are with traditional car clubs. A free-floating fleet means that the operator does not know where their cars will be at any given point in the future. In the case of car2go, the subscriber, having made a reservation, will receive a text message 15 minutes before the scheduled start time, with information on how to find the nearest vehicle (which can only be unlocked by the customer who made the reservation). By way of contrast, a reservation with a traditional car club means that the subscriber has reserved a specific vehicle (that will be accessed at a known location) for a fixed block of time. Also, car2go accepts reservations only 24 hours or less in

1 car2go: Amsterdam, Austin, Berlin, Düsseldorf, Hamburg, Lyons, Portland, San Diego, Ulm, Vancouver, Vienna, Washington DC. DriveNow: Berlin, Düsseldorf, Munich.

advance, whereas traditional car clubs will accept reservations several months in advance.

Perhaps the most intriguing development to do with one-way car clubs is the potential for a substantially larger consumer market than that for traditional car clubs. Cairns and Harmer (2011) report that about 20% of licensed drivers in Ulm are subscribers to car2go – a much higher rate than has been achieved by traditional car club services. This headline number should be viewed with some caution, however: car2go at present has an initiation fee, but no recurring fees for remaining a subscriber. It will be very interesting, as more becomes known about the system's usage patterns, to assess how widely spread usage is amongst this large number of subscribers.

Daimler has expressed interest in bringing the car2go system to the UK; Section 4 of this report looks at the potential market and the associated knock-on effects of one-way car club systems in London.

2.4 Vehicles purpose-designed for car club use

Whilst traditional car clubs fit standard production vehicles with third-party after-market telematics, a number of car manufacturers have begun to take account of the developing car club market. This includes both strategic partnerships (e.g. between Zipcar and Ford) and outright ownership of car club schemes (e.g. Daimler's car2go). As the design of car club cars evolves to serve this niche market, there is an analogy to bike sharing (for example London's Barclays Cycle Hire Scheme), where the bicycles are purpose-engineered for shared use.

This can be expected to lead to a better fit between automotive design and the unique demands of car club use. car2go, for instance, uses a fleet of special edition smart fortwo cars that were designed with a built-in touch-screen interface (see Figure 2) and a smartcard reader on the windscreen, together with more robust seats to handle the wear and tear of rental use. Other car manufacturers are also evaluating design solutions to suit the shared-use market, which can be expected to lead to further improvements in ease of use for customers. Design decisions will have to take account of possible needs for conversion after service use if vehicles are then sold on in the second-hand car market.

Figure 2: car2go's touch-screen interface integrated into the centre console, showing an example of a vehicle purpose-designed for car club usage

Source: car2go GmbH

Another notable development is the partnership announced in 2011 between General Motors and the P2P car club RelayRides. In general, P2P car clubs must make a major business decision about whether or not to ask car owners to install a dedicated telematics system in their car; some (such as RelayRides) do, whilst others (such as WhipCar) do not. In the case of WhipCar, the lack of such a system means that car owners must meet with car renters to physically hand over and pick up the car keys. The arrangement between General Motors (GM) and RelayRides allows a car renter in North America to unlock and access an 'OnStar'-equipped[2] GM car via a mobile phone app, thus eliminating the

2 'OnStar' is a system available on GM vehicles in North America since the late 1990s. It uses GPS technology and communications via the mobile phone network to provide services such as automatic crash response, turn-by-turn directions, despatching for roadside assistance, and hands-free mobile phone calling. The critical function for use with RelayRides is the ability to remotely unlock a vehicle without a key.

need for either a purpose-installed telematics system or physical meetings between owners and renters.

2.5 Hybrid systems: integrated peer-to-peer and commercial-fleet car club services

P2P systems are also beginning to converge with car clubs where the fleet is centrally-owned: the North American operators Communauto and City CarShare have announced P2P systems that will work alongside their respective existing car club fleets with their existing customer base.

There is strong business logic for more of this type of integration as services grow: when partnered with an existing car club, a P2P system can provide flexibility to meet demand at peak times such as holiday periods, whereas it would be uneconomical to expand the car-club-owned fleet to serve all demand at the busiest times.

2.6 Links with other services

Car club services are also establishing closer links with the broader transport sector.

The line between car hire and car clubs has always been somewhat indistinct: in some places, car club services have been deemed to fall within the scope of taxes on car hire. In the coming years the two can be expected to become more similar. To take one example, the Mobility CarSharing car club operator in Switzerland now offers a service called Click & Drive, which is effectively by-the-hour car hire, as it does not require a driver to be preregistered with the car club.

Car club services will be better integrated with other forms of travel as well. Lessons can be learnt both from how car hire is functionally linked to commercial aviation and how car clubs in continental Europe interface with inter-city rail networks. This takes the form of privileged access to station parking, integrated rail-car-club ticketing, and bundled rail season tickets and car club subscriptions. (This point is discussed further in section 6.10.)

There are also niche market segments to be served. To take one example, for people who regularly spend periods of time in more than one region, one can envisage a car club subscription offering a solution that is more attractive than either maintaining multiple cars in different places or having much more limited forms of automobility.

2.7 Private car club systems

Another emerging operating concept is the application of car-club-style management principles to closed systems (i.e. those not open to the general public) – an example is Zipcar's offer of such a product for commercial and public fleet management. The 'FastFleet' service fits a customer's existing corporate fleet with Zipcar's logistics and fleet management systems.

The customer benefits from services made possible by the car club's economies of scale, which they would not be able to achieve on their own, whilst for the car club operator it is an opportunity to develop links with corporate customers that have traditionally been underserved by car clubs.

This concept can in principle be extended further: closed environments in general provide customers with greater control over the car fleet than car club services which are open to the general public. This higher degree of control must come at a cost, but there are situations where it could be a viable solution. A group of small firms on an industrial estate, for instance, may find it economical to hire a car club to operate a joint fleet for them, if each individual firm lacks the scale to justify running its own fleet.

2.8 Service differentiation

As car clubs expand into new markets they are diversifying the services which they offer.

Operators are offering more options, such as a variety of pricing plans and vehicle types – in addition to standard small and medium-sized cars, some offer vans and luxury cars.

Issues of service reliability are especially complex – subscription car club services will not be able to, in the foreseeable future, match personal car ownership as a way of reliably accessing a car at short notice. For some segments of the market this is a major problem, whilst other consumer groups are willing to accept a lower level of reliability in exchange for lower costs.

But there are wide differences between the various types of car clubs: the traditional car club business model of reserving a particular vehicle in advance provides greater assuredness of accessing a car when desired than is the case with the more limited form of reservations that are offered by floating one-way systems.

As noted in section 2.3, one-way system operators cannot predict for certain where cars will be available at any given moment in the future, thus reservations are inherently less reliable than in the more rigidly structured traditional car club operating model where cars are used on a round-trip basis.

What is more, a reservation in even a traditional car club system cannot provide a 100% guarantee that the reserved car will be available at the agreed time: that will depend, among other things, on the previous user returning the car on time.

Larger one-way systems can be expected to become more 'liquid' over time, and technology for managing vehicle availability will certainly improve, but these fundamental differences in system operation will continue to affect the degree of service reliability that can be offered to subscribers.

Issues of reliability are especially complex – a car club subscription will not, in the foreseeable future, provide car access as reliably as owning a personal car.

Regardless of how it is that services evolve, car club operators will inevitably be faced with trade-offs between maximising utilisation levels of their fleet and being able to meet the peaks in demand. Subscribers, for their part, will face a trade-off between cost and reliability of access. Given that car clubs aim to reach a variety of users by serving their differing travel needs, this analysis suggests that as services mature and the market expands, there is likely to be continued differentiation in service offers.

3. The Future of Car Clubs

Following on from the discussion of current trends in the car clubs sector, this section looks more speculatively at what will happen in the future as technologies improve, and if car clubs find commercial success at a large scale.

3.1 Road congestion vs reservation system congestion

Car clubs offer the possibility of the effects of congestion being experienced in different ways.

For many people the worst aspect of traffic congestion is dealing with the uncertainty of delays: when roads get congested, all journeys are slowed down; nevertheless, all drivers still have access to them. But when a car club is busy things work differently: at the busiest of times it can be difficult or impossible to reserve a car, but once a reservation is accepted the user can generally count on being able to access the vehicle at the agreed time. A mismatch between supply and demand thus leads to 'virtual congestion' within the reservation system rather than queued road traffic, which arises from the physics of vehicles impeding each other's progress.

This is a development to be welcomed. It would quite clearly be a better deal for motorists to know ahead of time whether their desired journey can be accommodated smoothly rather than to roll the dice with unreliable traffic conditions – this is similar to the premise behind real-time traffic information services.

Textbook economic logic would, however, argue for allocating scarce resources – in this case access to a car and road space – on the basis of people's willingness to pay, rather than how far in advance one makes a reservation. As car clubs develop, and methods for predicting usage patterns are refined, operators can be expected to mimic 'yield management' techniques from the aviation and rail sectors that will allow them to more closely align access to their cars with travellers' willingness to pay (as opposed to how far in advance a reservation is sought, as is the case today).

A further complication is that, given that road traffic congestion will remain a problem, car club customers will experience complex interactions between it and 'reservation system congestion' for the foreseeable future. One example of an inefficiency arising from feedback between the two is the need for subscribers to add buffer time onto reservations to account for unreliable journey times and ensure that they avoid penalties for returning a car later than the agreed time. As a reservation cannot generally be shortened once it has started, returning a car 'early' means that the vehicle is still 'in use' from the operator's standpoint, but sitting parked and unable to be turned over for productive use by another subscriber.

All told, it seems clear that if car clubs increase in scale, motorists can expect changes in the experience of using cars. There could be a more rational allocation of resources than the prevailing system of first-come/first-served/all-inconvenienced road traffic congestion.

3.2 Allocating car use in new ways

Wide-scale car club adoption (with its inherent pay-as-you-go pricing structure) would have unfamiliar impacts on traffic patterns, bearing similarities to both the effects of the existing fuel duty system and a prospective system of road user charging.

As with fuel duty, car club charges are not linked directly to the use of congested roadway space, though there is a proxy effect as delays stuck in traffic lead to higher car club usage costs. But, like road pricing, car clubs can and do charge more for driving when the car club system as a whole is busiest. There is a further nuance to do with accessing a shared fleet: the busiest times for car clubs tend to be at weekends, not during the traditional weekday morning and afternoon periods for road traffic.

A related issue is the potential for access to cars to be allocated in a more differentiated manner than at present. Road congestion does not play favourites: all motorists in a queue are affected without regard to who they are, with a very few exceptions such as buses in dedicated lanes, emergency vehicles or those with a police escort. Road user charging generally does the same.

Allocating car use through a managed reservation system, however, offers the possibility of system manipulation. There are no technical impediments to providing higher priority within a reservation system to certain users, and, inevitably, lower priority to others, or to strategically limiting car access in particular times and places. Further, if car clubs become major users of road space, then car club operators and agencies responsible for road network operations may eventually form tighter working relationships in the interests of overall system management, along the lines of existing arrangements between airlines, airport operators, and air traffic management agencies.

To take one example of how car-club-based car use could be managed in the interests of network management, it is plausible that a system operator or regulator could manage the availability of the fleet in order to achieve policy goals: consider a scenario where a future Olympics host city might strategically withhold blocks of vehicle-time in shared-car fleets as part of a package of traffic management measures.

Though management mechanisms along these lines are common in other parts of the transport sector and the broader economy, a set of provocative questions are raised in the context of road transport, and these will become more pressing if car club systems continue to grow.

3.3 Resilience and reliability

It is worth noting that relatively little attention has been paid to the issue of how widespread car club adoption would affect transport system performance in unusual circumstances – to take an extreme example, in the event that a district or city needed to be evacuated. Emergency planning staff will have to consider both the challenge of how to deal with a larger proportion of non-car-owning drivers, and the possibility of accessing the car club fleet for public purposes in such circumstances.

Network resilience is also an issue in systems where access to cars is controlled by a central manager relying on computer systems and wireless telecommunications infrastructure: there is evidence that car2go's vehicle management system has suffered outages of several hours in duration on multiple occasions (KXAN, 2011).

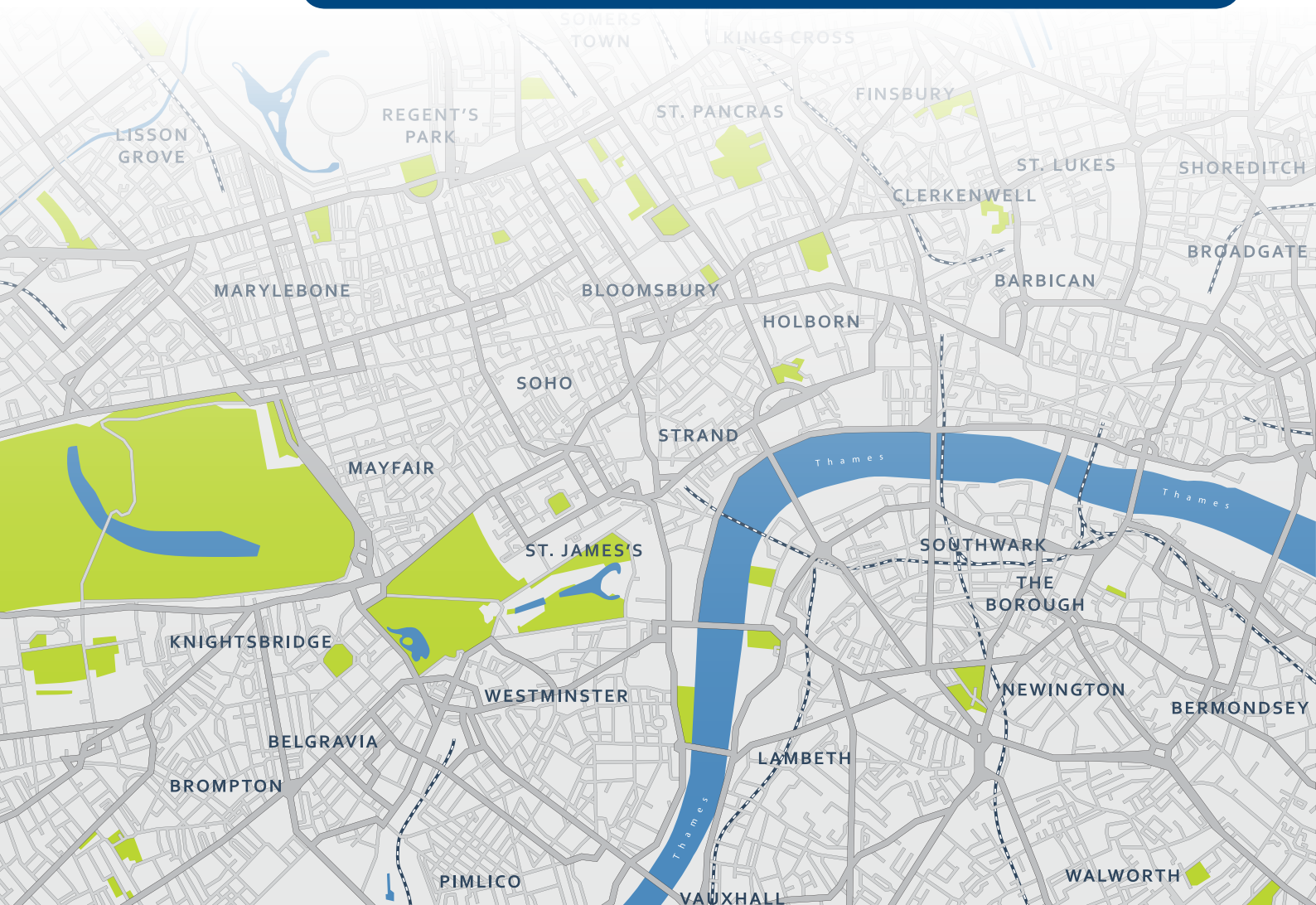
There is a parallel to complex electronic payment systems used by public transport; in recent years London's Oyster card system has also experienced unplanned downtime, for instance. But the comparison only goes so far – public transport can continue to operate, perhaps without charging fares, while the payment system is being brought back online. Car clubs are more vulnerable to such disruption and, given the liability issues, could not remain in service in similar circumstances.

4. London: Market Potential and Effects of Growth

Two important questions relating to car clubs are:

(1) how big their potential market is; and

(2) what their knock-on effects are, both on levels of car ownership and in terms of people's travel patterns – and hence congestion levels and transport-related emissions.



Car clubs are experiencing rapid growth at present, which plainly cannot be sustained indefinitely – extrapolating the more-than-tripling in active subscriptions between 2008 and 2012 (from 32,000 to 115,000) is implausible for anything more than a few years into the future. Carplus, a charity which promotes car clubs across the UK, predicts about 1 million members in the UK by 2020; others are forecasting upwards of 5 million subscribers in Europe (Zhao, 2011) and 35 million globally (Zipcar, 2009). A recent study of the demographics of two Inner London boroughs (Camden and Islington) predicted a potential market of around 100,000 car club subscribers out of a population of 420,000 residents (Clark, 2010).

These forecasts are based on extrapolations of current growth patterns, in some cases by considering the membership rate amongst people in places that are already served by car clubs. It is of note that the headline subscription numbers include many very infrequent users: Carplus' 2010/11 survey of car club members found that three quarters of the UK's 160,000 subscribers use a car club car five or fewer times a year (Harmer & Cairns, 2011). This does not necessarily imply that being a member is unimportant for low-usage subscribers: it is possible that knowing that a car can be accessed fairly easily allows a person to be car-less who would otherwise own one 'just in case' or for very occasional car travel needs.

4.1 Transport model system

In recent research that was partially sponsored by the RAC Foundation (Le Vine, 2011), in-depth transport modelling was undertaken to investigate the market for car clubs, using Greater London as a case study.

The type of transport model that was used in this research is known as a 'discrete choice model', in which people's choice of one amongst several 'discrete' alternatives is analysed by inferring statistical relationships between the choice they make and the characteristics of the options thought to be

available to them. In this case, the discrete choice, explained in detail below, was which combination of resources to equip oneself with – a car club subscription being one of the available resources. This choice was analysed by assessing the fit between people's travel patterns and various forms of travelling, including car clubs.

Two types of data were used together in this analysis: data from the National Travel Survey (NTS), and from a bespoke stated-choice survey targeted at the decisions as to whether to subscribe to and use a car club.

The analysis considered both the existing car club business model and a prospective one-way operating model that functions in a manner similar to the car2go and DriveNow systems described in section 2.3.

The transport model system underpinning the analysis predicts which combination of five 'mobility resources' a person will choose to own:

- a personal car;
- a public transport season ticket;
- a bicycle;
- subscription to a traditional car club; or
- subscription to a one-way car club.

A person may own none, one, or any other combination of these resources – the precise combination is treated in the transport model as their 'discrete choice'.

Each resource facilitates travel in some way. Having bought a personal car, for instance, a person is then at liberty to drive it. Car clubs work similarly: a subscription to a car club allows a person to use its fleet of cars. The analysis also considered other ways of getting around that were specified to not require owning a mobility resource: walking, taking a taxi, riding as a car passenger, and taking public transport on a pay-as-you-go basis.

A person's choice of which combination of resources to own involves balancing, on the one hand, how well the methods of travel enabled by the various resources would serve their travel needs, and on the other hand, the fixed expense and responsibility of owning them. People's travel needs were characterised by a week's worth of their observed travel patterns.

The transport model was estimated using a subset of data from the 2004/05 NTS consisting of 300 households living in Greater London. The NTS is a unique dataset that gathers a week-long snapshot of people's travel patterns – most travel surveys only ask respondents to complete a one- or two-day travel diary. In the case of car clubs, longer-duration diaries are preferable as they are able to better identify potential subscribers: people with occasional but real needs for car travel.

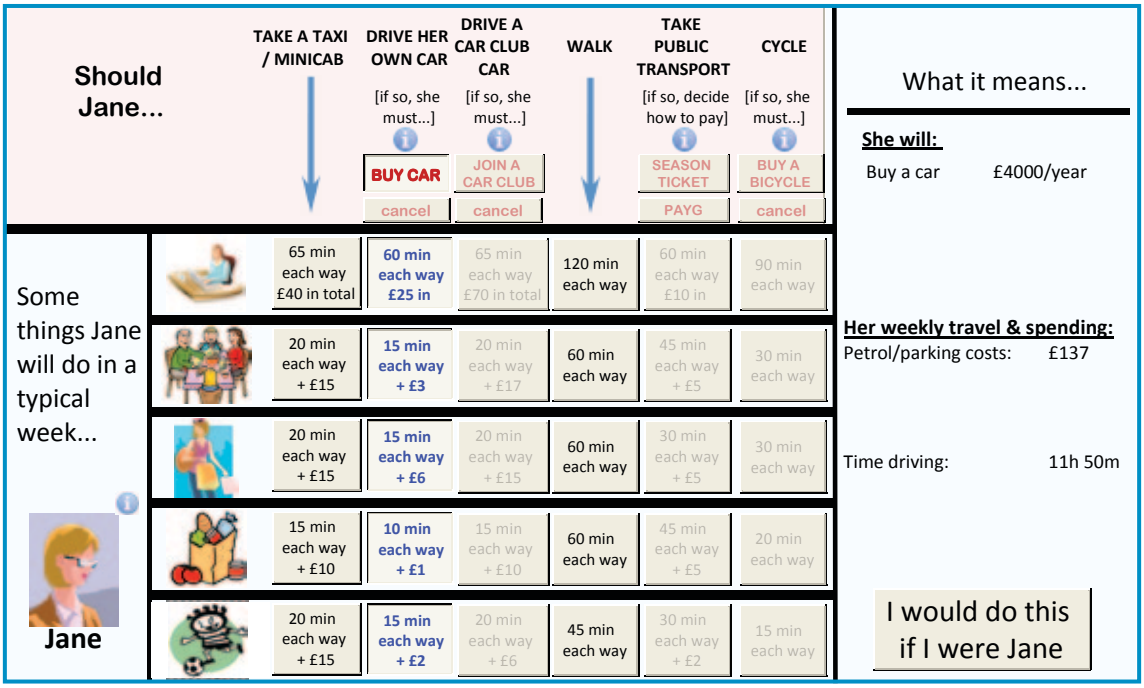
In order to collect information about people's tastes for the features of both types of car clubs (traditional and one-way), it was, however, necessary to augment the NTS data with a dataset from a purpose-developed survey.

The survey instrument is shown in the two figures below. Respondents were tasked with sorting out how to access a set of activities. As they consider how to get around, they decide whether or not to purchase the various resources that facilitate mobility. Figure 3 shows an example of a respondent who has chosen to buy a car and to drive it to access all of her activities. Figure 4 shows, in the same situation, an example of a different set of choices that includes subscribing to and using a car club. Five distinct activities were presented, but given that many subscribers use a car club vehicle less than once a week, it would in principle have been desirable (though impractical) to ask respondents to sort out how to access to a substantially larger set of activities.

Survey fieldwork was performed in spring 2011 with 72 respondents taking part; the forecasts should thus be viewed as indicative with this modest sample size in mind. It should be noted that no explicit assumption was made about fleet size: survey respondents were told that "other members use the cars at different times, so there is a 1 in 20 chance that a car isn't available when [you] want." The size and availability of real-world car club fleets would limit the extent of usage; these forecasts thus indicate the demand for car club services where fleet availability was approximated very roughly. It should be noted, however, that the forecasted level of car club activity would imply a fleet much larger than at present.

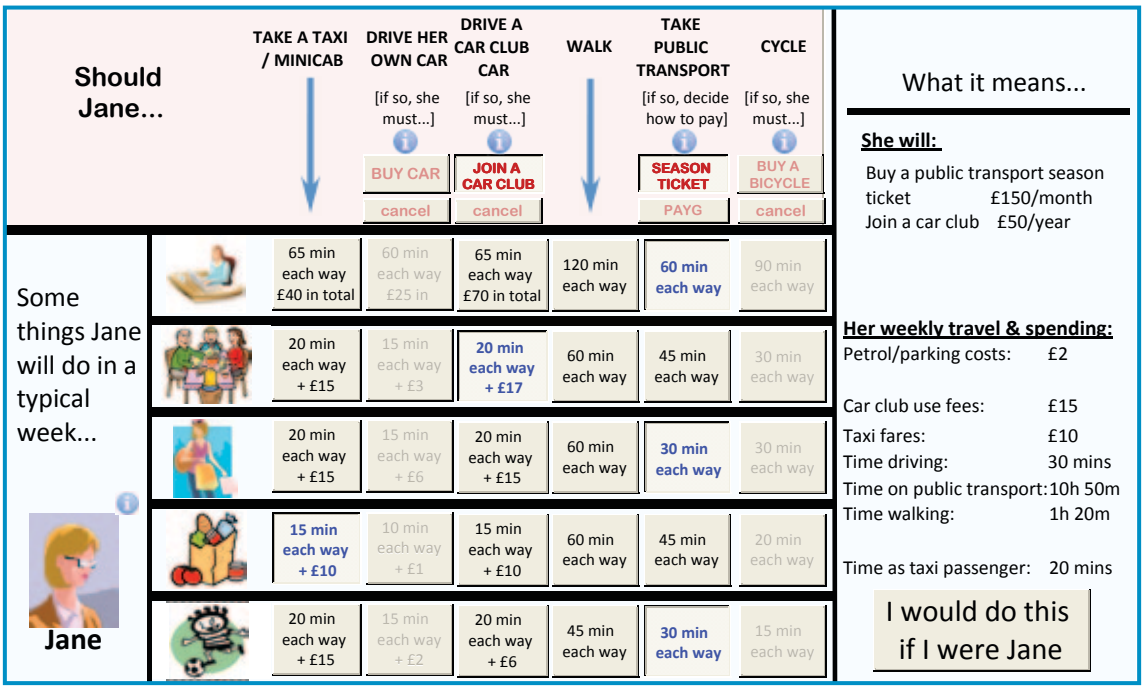
Further detail on the methodology can be found in Le Vine (2011).

Figure 3: Example screen from the survey instrument – this respondent has chosen to buy a car and drive to all of her activities



Source: Le Vine (2011)

Figure 4: Example screen from the survey instrument – this respondent has chosen to subscribe to a car club and buy a public transport season ticket, and to use different methods of transport for different journeys



Source: Le Vine (2011)

4.2 Traditional car clubs

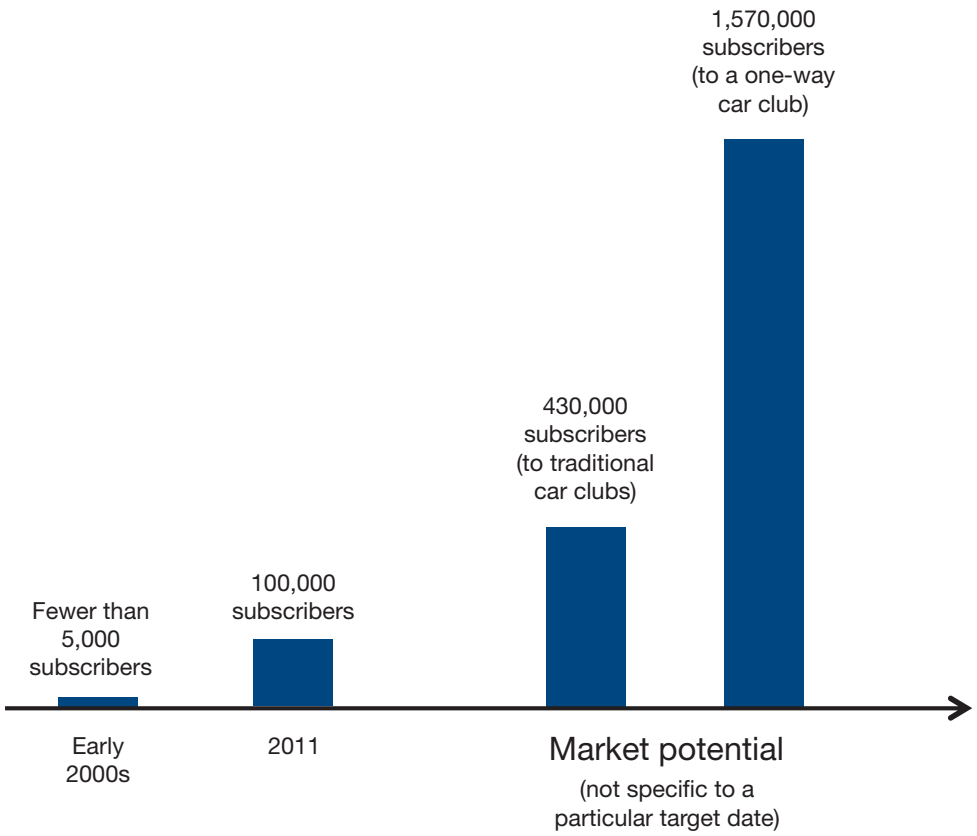
The results of this study (see Figure 5 and Table 1) show that even in London, traditional car clubs have substantial room to grow – up to more than 400,000 members from the current 100,000 – if the services are made widely available in neighbourhoods across the capital. Not surprisingly, projected membership levels in Outer London, at 8% of licensed drivers, are forecast to be much lower than the predicted rate of 17% in Inner London.

The analysis turned up several interesting points regarding travel patterns: introducing car club services into just Inner London was found to have a very weak overall effect on the number of car driving trips (including both private cars and car club cars). There were projected to be only 0.2% fewer driving journeys in London – but this masked large differences in how people use car clubs.

This analysis predicted that people who would trade in a personal car for a car club subscription would on average drive considerably less (making 11 fewer journeys per week), while those who would otherwise not own a car would only drive a modest amount more (making three more journeys per week). But the latter group is predicted to be several times as large (74% of subscribers vs 26% of subscribers) – thus the effects roughly cancelled each other out, resulting in a net impact of very little change in the overall number of driving journeys.

At the potential market size of about 430,000 subscribers to car clubs across all of London, the analysis projects that just over 1% of all journeys in Greater London would be made in a car club's fleet of cars. But whilst the effect of car club services in Inner London on the number of driving journeys was found to be ambiguous, introducing them in Outer London as well was forecast to lead to substantially fewer driving trips: a drop of nearly 4%. This confirms a somewhat intuitive expectation that the environmental benefits of car clubs are greatest in car-oriented areas which already have high car ownership levels, whereas wider access to the benefits of car-based mobility is more important in inner-urban districts where car ownership is less prevalent.

Figure 5: Projected growth in car club subscribers in London



Source: Author's own

Table 1: Summary of forecast impacts from three scenarios of introducing car clubs into London

Statistic	Scenario – which type of clubs are introduced and where		
	Traditional car clubs, Inner London only	Traditional car clubs, all of London	Traditional car clubs *and* a one-way system, all of London
No. of car club subscribers	170,000	430,000	Traditional: 430,000 One-way: 1.57 million
Modal share of car clubs	0.6%	1.3%	Traditional: 1.0% One-way: 3.8%
	Net changes		
No. of personal cars owned	-1.7%	-3.5%	-4.0%
No. of car driving journeys (personal cars + car club cars)	-0.2%	-4.5%	+1.6%
Car vehicle-miles travelled (personal cars + car club cars)	+0.0%	-3.6%	-1.0%
No. of public transport journeys	+1.5%	+3.6%	-0.8%

Source: Author's own

4.3 Prospective one-way car clubs

The discussion up to this point has focused on the traditional car club operating model. But the most striking finding to emerge from this analysis was how sensitive the market is to particular service features.

When the introduction of a one-way car club system across the whole of London was simulated, it was forecast to attract 1.5 million Londoners – over ten times as many active subscribers as traditional car clubs have today, and several times larger than the potential market for the prevailing traditional round-trip car club business model. Given that a real-world scheme is unlikely to initially cover all of Greater London, this forecast should be interpreted as an upper bound on the level of take-up.

1.5 million Londoners are predicted to subscribe to a prospective one-way-usage car club.

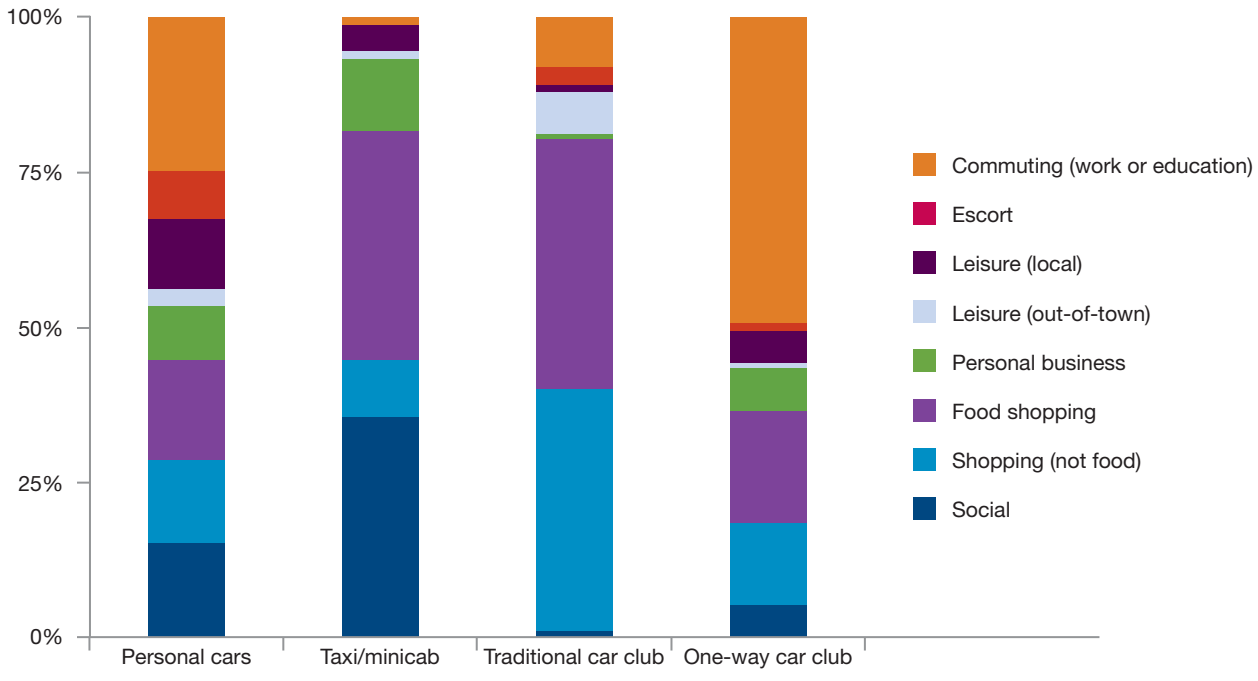
This study looked at just one innovation in car club services – car clubs that operate a one-way business model. The key point is that consumers are very sensitive to the service features of car clubs, and that as services evolve – presumably

in ways that are more attractive to consumers – it is reasonable to expect the potential market to continue to expand.

One important result from this study was that the usage patterns of the one-way operating model are predicted to be somewhat different from those of traditional car clubs. A one-way system would account for approximately 4% of journeys in London, compared to 1% for car clubs. The model was not designed to investigate journey purposes in detail; Figure 6 therefore shows the distribution of journey purposes for the two types of car clubs in the stated-choice survey. Respondents' use of personal cars and taxi/minicab travel in the survey are shown for comparison. It can be seen that respondents selected the one-way car club for commuting much more intensively than the traditional car club, which respondents predominantly selected for shopping journeys. This arises from the cost structures: the pay-per-hour traditional car club business model (which is similar to a parking charge) is less conducive to long-duration activities such as a day at work.

To place the potential market for drive-it-yourself car access in perspective, the 5% of journeys that could be performed in traditional or one-way car club cars compares to the roughly 1% of journeys in London that are at present made in taxis or private-hire minicabs.

Figure 6: Survey respondents' stated usage of cars by type of car access (share of trips by purpose)



Source: Author's own

Introducing both types of car club would also lead to more driving trips overall. This would come from a combination of a 3% drop in private car driving journeys and a smaller drop in journeys by public transport and non-motorised modes – with the fall in private car journeys being outweighed by the number of one-way car club journeys. But despite the increase in the number of driving journeys, the one-way car club is projected to be used for shorter-distance journeys than private cars, with the result that overall car traffic levels (measured as vehicle-kilometres of travel) would still be lower than when no car clubs are in service, by approximately 1%.

4.4 The relationship between car clubs and public transport patronage

This research also looked at the relationship between car clubs and public transport systems. The prevailing view is that in economic terms car clubs tend to be more of a complement to public transport than a substitute for it, as in combination the two are thought to offer a stronger alternative to private car ownership than either mode does on its own.

The research found 'traditional' car clubs – as they exist in the UK today – to indeed be complementary to public transport: the transport model shows them to lead to about 3.6% more public transport journeys as a result of people who had previously owned a car switching to a lifestyle of public transport and occasional car club usage.

The findings, however, were that a prospective one-way system in London (like car2go or DriveNow) would lead to a modest decrease (roughly 1%) in the number of journeys made on public transport. This is because the service features and cost structure of a one-way car club are closer to that of public transport services.

5. Challenges and Opportunities

The potential benefits of car clubs can be categorised as:

- A rationalisation of car use: wider access to cars, while at the same time fewer 'low-value' car journeys (as the higher usage costs result in subscribers being more deliberate in their car use), fewer parking spaces needed in urban areas and greater efficiency in the resource-intensive automotive sector
- A smaller environmental footprint, principally in the form of reduced pollutant and greenhouse gas emissions
- Commercial opportunities for system operators, managers and suppliers
- Tighter social links and a greater sense of community cohesion, which some proponents suggest arise from sharing a common fleet of cars rather than people owning cars privately

This section investigates current issues regarding the development of car clubs. It discusses the challenges to achieving the benefits that car clubs can offer, and the opportunities for doing so.

5.1 Reduced inequality in access to cars

Several of the potential benefits are ambiguous; as the case study of the London market (Section 4) shows, the environmental impacts (which are closely related to aggregate driving levels) vary widely, and depend strongly on the particular service features of the car club, and both the mix of subscribers and the types of places in which they live.

Reduced inequality in access to cars is a more certain outcome of the growth of car clubs. The majority of subscribers would not otherwise own a car – for these people the principal benefit takes the form of increased mobility options. The analysis of the London market showed that car clubs lead to a small increase in the number of adults driving at least once a week (from 54% to 56%), with much more widening of car use predicted from a one-way system (to 64% of adults). This widening in access to car use should be viewed in the light of public debate over rising car insurance rates and the broader public discussion about 'transport poverty'. It is important to note, however, that car club subscribers tend to have middle-to-upper incomes and be well-educated – they are generally a different group of people from those discussed in the context of transport poverty and social exclusion.

Percentage of London adults forecast to drive at least once a week:

- Without car clubs: 54%
- With 'traditional' car clubs: 56%
- With 'traditional' car clubs and a one-way-usage car club: 64%

Source: Author's own

Interestingly, the transport model predicted that a one-way car club system would be somewhat more attractive to men than women. While there is some evidence for this sort of gender split from research into the car2go system (see Firnkorn & Müller, 2011), it is not clear why this finding arose in London, and a deeper understanding is required regarding this apparent effect.

5.2 Impacts on use of other methods of travel

Another complex issue is whether car clubs constitute a complement to or substitute for public transport and other 'non-car' methods of travel. In Paris, for instance, Green Party officials have expressed support for traditional car clubs, whilst opposing the recently inaugurated one-way Autolib' system on these grounds (*Le Parisien*, 2009).

As noted above, the analysis of the London market (see Section 4) found traditional car clubs to be complementary to public transport: introducing 'traditional' car club services led to more public transport journeys. But, conversely, the transport model predicted a complicated set of impacts from a one-way system: fewer walking and public transport journeys, more car driving journeys, but nevertheless an overall reduction in car driving mileage.

> The Green Party in Paris opposed the Autolib' one-way-usage car club system, on the grounds that it could "encourage unnecessary [car] journeys" (*Le Parisien*, 2009.)

As any such system, whether in London or elsewhere in the UK, will require public sector buy-in, policymakers have an opportunity for input in the development of tariff structures that support broader policy goals. Naturally, such charging schedules will also have to take into account consumer preferences for simple, fair and readily understandable fees.

5.3 Car clubs and neighbourhood design

The UK's experience has been largely with traditional car clubs, which have proven most successful in London, and specifically Inner London. The evidence shows that the traditional business model fares best in places where parking is limited and which have good walking accessibility and public transport links. This is not to say that car clubs do not work outside of city centres, but that their greatest commercial successes have been in this type of environment.

It is worth noting that the two types of innovative services considered in this report (one-way and P2P car clubs) have markedly different spatial characteristics from each other as well as traditional car clubs.

The one-way systems seen to date have all operated within a rigidly defined geographic area from which cars may be picked up or dropped off, and which

have included city centres and some adjacent suburban areas. The requirement for 'fluidity' in one-way systems means that the geographic coverage must be limited to areas where the operator can expect a relatively high level of demand.

Peer-to-peer systems have precisely the opposite features: their geographic coverage extends well beyond that of traditional car clubs. As any car owner in the UK can offer their car, the fleet of a P2P car club can cover rural areas and other low-density environments.

5.4 Serving the corporate market

Car club operators generally have low utilisation rates during midday periods on weekdays, and hence see the business-to-business market as a way to increase utilisation of their fleet without expanding it. From their perspective, firms and institutions are under growing pressure to show tangible commitments to corporate social responsibility; managing their corporate fleet more efficiently can be a cost-effective way of doing so.

But car clubs will have to adjust their operations in order to make substantial inroads into this market segment. Corporate customers will be looking for trusted brands with which to form long-term partnerships, and the evidence from other forms of corporate travel is that businesses are generally willing to pay premium prices (over the personal travel segment) for services of a very high quality.

It is therefore operators with highly reliable services and strong brands, possibly including new entrants with established names from other industries, who are likely to be best positioned to attract corporate customers. This may mean that operators who are successful in this market segment choose to operate at lower customer-to-vehicle ratios (to maintain high availability) and offer services which provide a corporate customer with priority access to some vehicles, or which resemble a hybrid between running a private corporate fleet and relying solely on an open-to-the-public car club.

5.5 Insurance: managing risks and responsibility

As with personal cars, issues of responsibility and liability when controlling an expensive, powerful and potentially dangerous machine are of prime importance.

Insurance products have previously emerged to meet the unique needs of car clubs, and new types of cover will continue to be needed as service features evolve. As mentioned in section 2.1, there is a role for technology to play: operators will have the ability (and incentive) to charge differential insurance rates based on each user's observed driving style, and, in the longer term, new sensing and monitoring technologies may reduce the uncertainty as to where, when and how vehicle damage occurs, thus lowering the general costs to be covered by insurance. There is also particular scope for further development of insurance products to serve the P2P car club market, as at present the first P2P operator in the UK (WhipCar) has a bespoke insurance arrangement.

5.6 Car clubs and electric vehicles

Car clubs have been experimenting with adding electric cars to their fleets, as in principle there is a match between the strengths of electric vehicles and the services that car clubs offer: a very recent review of how car club operators are incorporating electric vehicles into their fleets is included in Cairns and Harmer (2011). The authors show that many car club operators are now augmenting their existing petrol-powered fleet with electric vehicles, typically with up to several dozen electric vehicles.

Electric vehicles have very particular operational requirements that imply an extra commitment of management resources from the operator's point of view – there is a tension to be managed between recharging requirements and the utilisation levels required for them to be economic to operate. The wear and tear on electric vehicle batteries from frequent charge–discharge cycles, particularly if coupled with fast charging, present another challenge.

An interesting development is that some new-generation systems (car2go in San Diego and Amsterdam, and Autolib' in Paris) are coming on stream with all-electric-vehicle fleets ranging in size from a few hundred to several thousand cars – in other words, on a much larger scale than the electric-vehicle projects of major existing car clubs. These systems are purpose-designed for managing a large number of electric vehicles, and in particular in the case of Autolib' the fact that the system would be all-electric was important to generating support from both the public sector and the public at large.

Besides electric vehicles being incorporated into car club fleets, another point of interface between the two is also being explored by vehicle manufacturers. Peugeot is the most prominent car brand to have proposed a car-club-style solution to the limited range of its electric vehicles: its 'Mu' scheme supports

the launch of its iOn electric car. Whilst the programme is open to the public, the concept is that it will allow iOn owners to access a petrol car on driving holidays, or other long trips where its 60-mile range is inadequate.

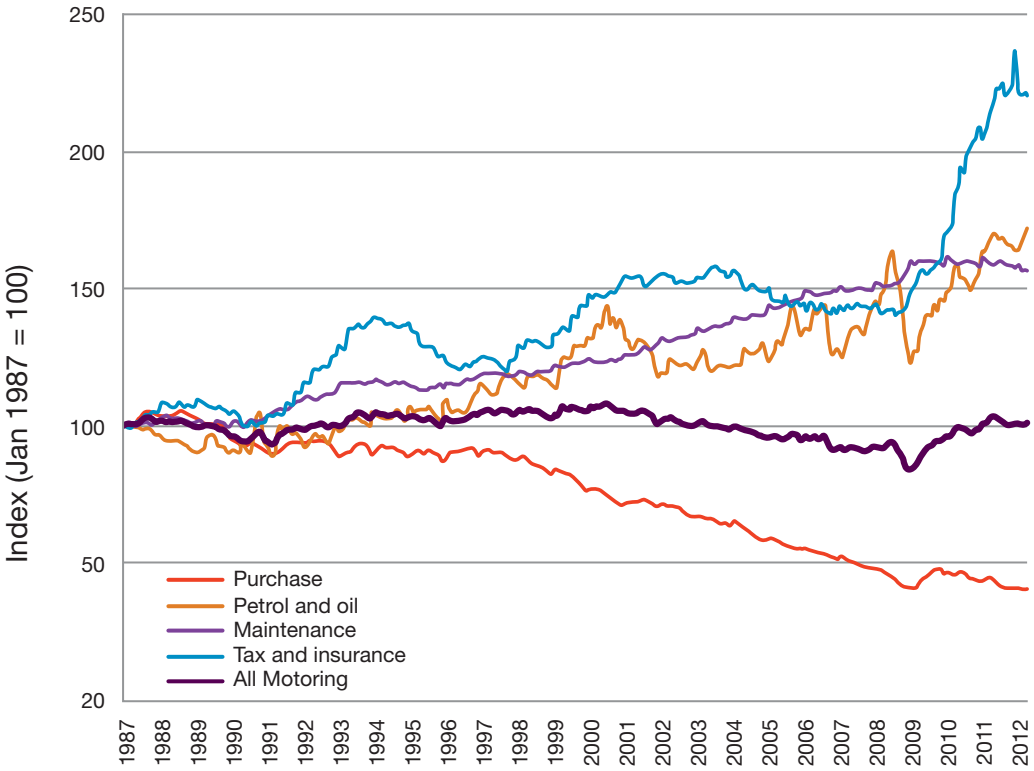
In summary, from the point of view of car clubs, electric vehicles place heavy demands on limited resources in the short term, but also – when considered on a medium-term timescale – are a logical complementary technology for developing a new class of mobility options.

5.7 Structural shifts in the costs of motoring

A largely overlooked aspect of car clubs is that they fall within a broader trend whereby the cost burden of motoring is shifting away from fixed ownership costs and onto the pay-as-you-go elements (principally the cost of petrol) – this can be seen in Figure 7. This phenomenon is not universally true – consider the rising costs of insurance, for example – but vehicle purchase and fuel costs account between them for nearly 80 pence in the pound of motoring expenditure, and they are trending in opposite directions.

In real terms, fuel prices in 2010 were 10% dearer than at the time of the fuel price protests a decade earlier (and fully 50% higher than a quarter of a century ago). Marginal-cost road-user charging has also made its way onto the public agenda in recent years. But what is not often recognised is that at the same time the cost of purchasing a car has decreased, and it is now in real terms 40% less expensive to buy a car than even a decade ago.

Figure 7: Trends in the components of the overall cost of motoring relative to all prices, 1987–2012



Source: ONS (2012)

Thus the pay-as-you-go nature inherent in car club systems fits firmly within wider developments in motoring. But if these cost trends continue, then a large part of the economic rationale for car clubs – the ability to sidestep the fixed costs of car ownership – will over time be undermined, as these costs are on a long and slow downward trend.

A noteworthy point in this regard is that the cost structure of electric cars is precisely the opposite of that of car clubs: they have high purchase costs coupled with low running costs. Widespread electrification of personal cars could thus reverse this shift in the cost burden of motoring from fixed towards usage costs.

5.8 Resource efficiency

What access to a shared fleet offers is an approximate optimisation of fleet usage: rather than private cars sitting idle for an average of 23 hours a day, a shared fleet is used much more intensively. ‘Optimisation’ is an accurate description to the extent that cars are a limited resource, though the key point here is that cars must be viewed as only one of the resources required for motoring – just as necessary is a driver, and there are others as well.

Car ownership implies the existence of a personal car which is controlled by and constantly waiting for instructions from its driver – and hence an inevitable amount of 'slack' in how the vehicle is used. But a car club subscription offers less control over when and where a car can be accessed: rather than the vehicle having 'slack' time, the driver does. If a car is not available when a driver wants one, they must somehow adjust their own plans.

This simple two-resource example shows that a system can in principle deliver optimal results for either cars or drivers – but not for both simultaneously. This theoretical result shows up in the real world, as would-be car club subscribers must consider how much spontaneity and control of their plans they are willing to forgo in exchange for the financial savings (and freedom from responsibility for maintenance and upkeep) which they enjoy by not owning a car.

6. The Appropriate Role for the Public Sector

As car club services develop, finding the appropriate role for the public sector is an issue that policymakers will clearly have to face. Indeed, car clubs have since their infancy required interaction between the private-sector operators and the public sector – in the early days this took the form of direct subsidy, and to the present day this is still seen in the issue of access to street space for parking bays.

A range of possible postures exist for the public sector: at one extreme is an entirely hands-off approach, whilst at the other it is quite conceivable for a car club system to be funded and operated publicly. It would also be possible to use legislation or regulatory power to effectively preclude certain types of car club services if policymakers so desired.

6.1 Considerations

Although no one can say for certain how car clubs will evolve, the relevant factors from a public sector perspective would seem to be the following:

- There is clearly a robust market for various types of car clubs, which under certain conditions and in some places seems to be well in excess of 10% of adults.
- The long-term financial viability of car clubs remains an open question, though Zipcar posted operating profits in Quarters 3 and 4 of 2011 (Zipcar, 2012a), and Daimler says that it expects its car2go subsidiary to be profitable by 2014 (Brook, 2011). It is clear, on the evidence of Zipcar's recent public offering, the success of P2P networks in raising venture capital, and the interest of major firms in the automotive sector, that the industry is able to attract private capital.
- Car clubs appear to bring positive net effects, including reductions both in the demand for parking spaces in urban neighbourhoods (allowing freed-up space to be beautified or put to better use) and in tailpipe emissions. Moreover, the environmental benefits of wider car access can be expected to be particularly large at the modest car-use-per-subscriber levels that characterise the car club market.
- There is a general lack of clarity about how the industry will develop if left to its own devices. Key unknowns are the impacts of new technologies, how consumer tastes may develop, the outcomes of public sector decisions, and the strategies of prospective new entrants to the industry.

- There are significant barriers to entry, which include the costs of investing in a fleet of new cars, the current allocation of rights for on-street parking spaces to a small number of firms, and the expense of setting up and maintaining a sophisticated back-office IT system. Zipcar, for instance, asserts that it has "a sustainable first mover advantage with deep competitive moats" (Zipcar, 2012b).
- Under current market conditions in the UK, these barriers to entry are not likely to be high enough to deter well-capitalised large firms in the automotive sector from entering this market. An earlier example was the entry of the car hire firm Hertz into the car club marketplace in 2008. Despite Zipcar's current dominance of the UK market, Daimler is expressing interest in expanding its car2go system into the UK beyond Birmingham, where it has reached an agreement with the council to start a service in late 2012.
- Car club subscribers tend to skew towards middle-to-upper income levels (Carplus, 2010) – in other words, the advantages of wider access to cars are not necessarily getting to those who tend to have the least access to car-based mobility.

6.2 Environmental benefits and the case for subsidy

Issues relating to the environmental benefits of car clubs are complex. On the one hand, they provide a rationale for public subsidy to encourage the industry to expand faster and further than it otherwise would. But on the other, the pace of growth and innovation in the industry is likely to render any large-scale public sector intervention out of date very quickly. It would thus seem prudent to withhold consideration of direct subsidy until both the market stabilises and the scale of environmental benefits can be more reliably quantified.

The need for research regarding the environmental benefits of car clubs is discussed in Section 7; of note is that they have been identified as a mechanism for helping to achieve greenhouse gas emissions targets in the UK, which means that accurately quantifying the scale of environmental benefits is of substantial interest to the public sector. There are an increasing number of policy documents at various levels of government that make explicit links between car clubs and emissions reduction strategies, among which are: Scottish Government (2011), Croydon Environment and Climate Change Partnership (2010), and Transport for London (2008).

6.3 Market structure

The degree of consolidation in the car club sector is a concern, as evidenced by the Competition Commission's enquiry into the Streetcar–Zipcar merger.

In this regard, the Commission concluded that the expected entry of competitors limits the ability of Zipcar, the currently dominant operator in the

UK, to raise prices or otherwise act in an anti-competitive manner (Competition Commission, 2010):

> "[W]e expected that [industry] entry and expansion would prevent a merged Streetcar-Zipcar from exercising market power to the detriment of consumers in the medium to long term. We therefore found that the merger may not be expected to result in an SLC [substantial lessening of competition] in the car club market in London."

Whether Zipcar or any other car club operator could exercise market power depends on how large the barriers to entry will prove to be as the industry matures; some observers believe that they will be substantial, whilst others see the car club sector as offering what is essentially a 'quasi-commodity' service – in other words that barriers to entry will prove to be modest (Agnew, 2011).

6.4 Flexibility in tendering

It is advisable for local authorities to interact with car club operators in ways that allow for as much flexibility as possible, due to the pace of change in the industry. As noted by the Competition Commission, awards of on-street parking spaces should in general be designed to result in multiple operators competing in the same neighbourhoods. A current example is Wandsworth Borough in Inner London: parking spaces have been awarded to three operators, one of which (Greenwheels) is established in continental Europe and is entering the UK market for the first time (Wandsworth Council, 2012).

In addition to introducing competition where possible, contracting should also be relatively short-duration to accommodate new service innovations. Operators

can be expected to press for long-duration contracting to de-risk their business, but the public sector will have to strike a balance. On the one hand, there is a definite possibility that offering short-duration contracts will lead to a delay in welcoming new services. But on the other hand is the risk of signing a contract with a service that becomes outdated during the contract period, and which means that the operator has limited incentives for upgrading their system.

The public sector should also ensure that developments abroad are taken into account: following the success of one-way schemes elsewhere, it is quite plausible to expect that in the very near future, policymakers will be seeking evidence-supported guidance as to the desirable features of such systems in the UK.

6.5 What local authorities can expect to receive

Local authorities are on the front line of car clubs' development, as they control the public space to which car clubs wish to have privileged access. Councils have an opportunity to guide the process of growth with a view to the broader public interest, and it is thus important to ask exactly what can be expected.

The answers to this question will, as with all such matters, differ according to the political philosophy of those in power. The general principle must be, in all cases, to ensure that requests placed on operators are not so burdensome that they tip the balance so as to render car club operations uneconomic within a given area.

Councils that have a strong interest in social inclusion will want to ensure that car clubs assist them in achieving their aims (see the discussion on car clubs and lower-income families in section 6.7 below).

There is also a precedent for car clubs providing 'benefits in kind' that provide direct savings to local authorities. In Austin, Texas, for instance, the contract with car2go provided for free use by city staff on official business.

As car clubs mature, it is also suggested that councils seek to size the on-street footprint of their car club network so as to maximise the net benefits of car clubs. Relevant considerations in making such judgements will include:

- the revenue that will arise from providing car club operators with privileged access to public space, and the foregone revenue that would have come from other use of that space (e.g. revenue from pay-and-display spaces or residents' parking permits);

Councils may pursue any of several objectives: social inclusion, cost-efficiencies for the public purse, competition, or other local priorities.

- the wider costs and benefits of car clubs (accruing to customers and the industry rather than the council's financial bottom line) – these can be assessed roughly by using as a proxy the amount that car club operators are willing to pay for privileged access; and
- external benefits such as reductions in emissions and congestion.

Local priorities will guide each council's negotiations with car club operators. A council will know that its demands are too onerous and in need of recalibration if multiple operators enquire but subsequently decline to provide service. Likewise, short-duration contracting will prevent a council from finding itself laden for an extended period with an overly generous concession.

The telematics systems present in many car club vehicles offer the possibility of providing real-time information about traffic conditions. In the future it may be possible to use the vehicles as a platform for other services, such as mobile monitoring of air pollution levels. It is thus in principle possible for local authorities to negotiate such matters with car club operators. As car clubs are not the only possible 'probe' vehicles for applications of this kind, it will be up to the public sector to determine whether the characteristics of the car club fleet, and how its vehicles are used, make it an ideal candidate for such applications.

Washington DC: Four generations of parking deals

Car clubs have been operating in the Washington DC metro area for over a decade, and Zipcar today counts it as one of its four 'established' markets (alongside New York City, Boston, and San Francisco). The City's experience is instructive, as local authorities have through the years reached various types of arrangements for parking in on-street spaces and at public transport stations.

First generation: In 2001, the local public transport operator signed an exclusive agreement with a car club (Flexcar), that provided it with dedicated access to parking spaces at stations. The parking spaces were awarded for a year initially, with multiple one-year options at the transport agency's discretion on a 'no-cost, no-revenue' basis: no money changed hands. The agency sees car clubs as 'complementary' to its public transport services, and reports that its customers 'highly regard' the programme.

Second generation: From 2005 the District's Department of Transportation (DDOT) has also contracted with car clubs to provide dedicated on-street parking spaces; roughly half were previously meter-controlled spaces. At first there were no charges to car clubs for on-street space; fees of $200 (about £125) began after a year. DDOT specified that only 'ultra-low-emission' vehicles could be kept in on-street parking spaces. DDOT was also careful to ensure that

the tendering for on-street spaces resulted in car club services being brought to several low-income neighbourhoods not previously served.

Third generation: As car clubs began to mature, DDOT found itself with a single car club operator: Zipcar had absorbed Flexcar in a 2007 merger. It decided that it was appropriate to auction the 80+ dedicated on-street parking spaces, with minimum bids for spaces varying between $2,400 and $4,800 per year depending on location.

This auction took place in 2011 and led to two new entrants in the Washington area: Hertz on Demand and Daimler's car2go. A majority of the dedicated spaces went to the new entrants; Zipcar retained a dozen on-street spaces and reports that it subsequently arranged for off-street locations to replace many of its on-street ones. Most of Zipcar's fleet in Washington DC were kept in private off-street spaces anyway.

Fourth generation: A further development took place in early 2012: car2go has begun service in Washington with a one-way business model. The firm reached an agreement with DDOT that lets customers park car2go vehicles in metered spaces without paying, as well as any other non-time-restricted on-street parking space. The agreement is for one year; the operations and impacts will be reviewed after six months with the possibility for an expansion of the 200-car fleet at that time. DDOT believes that these arrangements give them the flexibility to be 'data-driven' in their decision-making and take public reaction to this pilot project into account.

DDOT elected to receive a fixed annual payment of c.$3,000 per car2go vehicle, which in part accounts for lost revenue from the fleet's cars using meter-controlled on-street spaces. This is easier to administer than the arrangements reached in another new car2go city. In San Diego, California, the agreement stipulates that car2go will use the GPS devices in their fleet to track and then reimburse the city for all time that their fleet uses in parking-meter-controlled spaces. This is in addition to car2go purchasing a residential parking permit for each vehicle in the 300-car fleet and reimbursing the city for the costs to convert 10 existing on-street parking spaces to dedicated spaces for car2go vehicles. The agreement in San Diego is for two years with an extra one-year option at the City's discretion.

6.6 The issue of time-sensitivity

A big question for the public sector is the time-sensitivity of actions relating to car clubs. As discussed throughout this report, events are moving rapidly and the market is growing fast.

Being early-to-market is a critical issue for the private sector: a supplier or operator which fails to capitalise on today's opportunities may indeed find itself left behind. But this is not the case from the perspective of the public sector: neglecting to act now does not preclude any opportunity. There is no evidence that moving at a measured pace does any lasting harm to the public interest, or that councils that are early adopters can benefit from a sustainable advantage over market forces. The history of car clubs in the UK is illustrative: the fact that Edinburgh led the way as the UK's first city with car club services did not stop London from becoming the car club 'capital' soon thereafter.

In several years' time there are likely to be suppliers in the UK offering radically different types of services based on new technologies and management principles: services will only get better over time. This logic argues for fairly short-duration and flexible contracting with the prevailing generation of car clubs, and, where public resources are required, supporting innovative operating models on small-scale systems. (See box 'Bike sharing: a learning process' for a description of the process by which bike sharing, a related type of transport service that is also evolving quickly, is maturing in the UK.)

With respect to car clubs, the main resource that the public sector controls is street space in strategic places. This space is not going to go away: exploiting it methodically and carefully is firmly in the public interest, since it provides the opportunities to benefit from newer technologies as they appear and to learn from making small mistakes rather than big ones.

Bike sharing: a learning process

Bicycle sharing first appeared in the UK in the 1990s as small-scale experiments (involving less than about a hundred bikes) in Cambridge and Portsmouth (Beroud et al., 2010).

Technology moved on from the first-generation systems; by one reckoning, today's state-of-the-art systems are the fourth generation of bike sharing (DeMaio, 2009). Paris' Vélib' system is widely known as the first large-scale bike-sharing system.

A number of small schemes (also all with less than about a hundred bikes) emerged across the UK between 2004 and 2009, in cities such as Bristol, Blackpool, and Cardiff. One London Borough (Hammersmith and Fulham) experimented with bike sharing as well, but dropped it after a few years.

After several years of planning, in 2010 Transport for London (TfL) launched the Barclays Cycle Hire scheme with six thousand bicycles and a service area covering a wide swathe of Inner London (corresponding roughly to Zone 1 on the Tube map). The bicycles,

docking stations, and associated back-office IT systems were delivered by a bike-sharing company that was started to deliver the bike-sharing system in Montréal, Canada. It is reported that when setting specifications for London's system, TfL ordered a total of 43 modifications to the bicycle design then in use in Montréal to accommodate London's specific needs.

The Vélib' system in Paris is operated by a firm whose primary motivation for delivering the system was to obtain advertising space in public places in return. London's system, by contrast, is operated on a service contract by Serco, a large government service and business process outsourcing company with experience in the transport sector.

London's scheme lagged behind Paris' Vélib' scheme, but was able to benefit from the experiences of other cities that were early adopters. London now has newer-generation technology and arguably more rational contractual arrangements to deliver its system. And the 20,000 or so bikes of Paris' Vélib' scheme are today overshadowed by systems in China – several Chinese cities each have over 50,000 bikes in their systems.

6.7 Car clubs and families on lower incomes

The fact is that car club subscribers tend to have above-average incomes, and it is unclear whether this will persist as services grow and further develop. This is a notable development, as car clubs were initially viewed by proponents as a way to provide car access to people for whom ownership was not financially practical.

This is a complicated issue and there is a chicken-and-egg aspect: do people on lower incomes tend not to use car clubs because they live in

neighbourhoods that are not well served, or do other reasons better explain why they are under-represented amongst subscribers? As noted by Transport for London in its most recent (2008) car club strategy document, a reasonable goal for the public sector is to ensure that car-access services are available in a wide variety of types of neighbourhood, and the tendering process for on-street parking spaces is one activity in which the network's development can be influenced by local authorities.

The issue is certainly much more complex than where the cars are parked, however. Serving people who do not have access to electronic payment methods is one such challenge.

Do people on lower incomes tend not to use car clubs because they live in neighbourhoods that are not well served? The issue is certainly much more complex than where the cars are parked.

The Buffalo CarShare (BCS) car club is an example of an operator that targets a low-income community of subscribers (see box 'Buffalo CarShare: an operator targeting social exclusion'). Though BCS is successful by its own reckoning, it shows both the possibility of serving a low-income pool of subscribers and the practical limits to scaling up such a service.

Buffalo CarShare: an operator targeting social exclusion

BCS operates a small car club (with around ten cars) targeted at low-income residents in Buffalo, New York, USA (Randall, 2012).

Half of its 500 subscribers have an annual salary of less than $25,000 (about £16,000).

The not-for-profit car club accepts payment by any electronic payment method – in addition to standard credit cards, this includes pre-paid credit cards, debit cards, and electronically paid benefits from the state. It also reports occasionally accepting money orders on a case-by-case basis.

BCS reports that 15–25% of monthly bills are not settled, and a collection rate of about 50% for major infractions such as fraud and payment of the insurance deductible for vehicle damage.

In addition to revenue from its services, BCS is part-funded by several local and state-level government agencies.

The lesson from BCS experience is that delivering car club services to socially excluded groups on a financially sustainable basis remains a challenge. This important aspect of the car club market remains poorly understood and is thus in need of deeper enquiry.

6.8 Peer-to-peer car clubs

Local authorities do not have the same leverage over P2P car club operators as over traditional car clubs.

In the case of P2P services, the appropriate role for the public sector would appear to be simply an enabling one. This includes ensuring that innovation in insurance products is not hindered by outdated legislation or regulations – an issue in the USA at the moment, where a number of states have very recently passed laws regulating the provision of insurance for P2P car hire.

In principle, local authorities can provide reduced-rate parking or other incentives to a car owner who makes their car available to neighbours on a P2P basis, though there are questions of how to define and enforce participation: is it enough to list a car on a P2P service, or must a listed car be available for use a certain number of hours a month, or must it be actually used through the service beyond a certain threshold level – and if so, how would this be administrated? Further, very little is known at present about the impacts of P2P car club systems on car ownership levels and people's travel patterns; it may be that the different service features lead to quite different impacts from those of traditional car clubs.

6.9 Improved tracking of car club activity

Public agencies in the UK collect and maintain much data about the transport sector, and the time may have come to begin gathering information about car club subscription and use as part of general large-scale travel survey efforts.

The main benefit here would be better understanding and documentation of how car club services are used and of their knock-on impacts, to supplement the annual bespoke car club surveys carried out by Carplus. As noted in section 6.2, if the public sector is to increasingly rely on car clubs to help meet emission reduction targets, it will also be of growing importance to make a convincing case that the environmental benefits are real and will be sustained as car clubs grow and their service features evolve.

This recommendation would include the NTS, as well as regional and local household surveys in locations throughout the UK which have a car club service of any meaningful size. An example of an embryonic effort in this regard is the modification to the question on household vehicle availability in the most recent London Travel Demand Survey (LTDS). It is now possible for LTDS respondents to indicate 'car club vehicle' in response to the question of which "vehicles [are] available to drive by members of your household". More direct questions will likely be needed: many car club subscribers, particularly infrequent users, are unlikely to state that they have a car club vehicle 'available to drive' on the day they are surveyed.

Once the most appropriate form/wording of question(s) has been decided, the results relating to car club activity derived from such generic transport surveys would have a higher degree of credibility than the current data on car club impacts for at least two reasons. Firstly, the inferences would be based on standardised travel diary data rather than retrospective questions to recall travel behaviour which took place over an earlier extended time period. Secondly, it would reduce the possibility of statistical bias resulting from car club subscribers knowing that they are being surveyed by the car club they subscribe to. In many cases car clubs have promoted themselves as providing environmental benefits, an association that could introduce bias into people's responses.

Such a change would track not only car club usage, but also people's subscriptions to car clubs, in a similar manner to that whereby existing survey questions identify holdings of personal cars and public transport season tickets. It would make sense to consider such a change as part of a wider effort to better track the alternative ways of accessing cars, which would also include ride sharing, informal car-lending, and so on. The guiding principle would be to track, for any journey made in a car, whether owned by a member of the respondent household or not, the means by which the car was accessed. This is similar to what is already done in the NTS for vehicles owned by a responding household: respondents record which household car is used for each journey and whether a traveller is a driver or passenger.

There is precedent to justify the additional burden of these new questions on respondents: London's travel surveys, for instance, gather and collate information about people's use of both taxis and minicabs, which at a combined 1% of journeys amount to a small fraction of the projected 5% for shared-car services. It is also suggested that in Carplus' annual survey of car club members, a question be added which covers subscription to multiple car clubs, to address the possibility of double-counting people who subscribe to more than one. Along with tracking activity in household travel surveys, this will provide policymakers with better estimates of overall car club subscription levels in the UK.

An interesting question pertains to whether operational data from car clubs should be open source, i.e. publicly available in an anonymised form. Many operators view such data as proprietary business information, whilst others (Canada's Communauto is one example) voluntarily make such data freely accessible. London's bike-sharing scheme makes some information available in real time, which makes possible a variety of third-party applications and research. It should be noted, though, that the bike-sharing system was designed by – and is directly funded by – the public sector, whereas most car clubs are not. The public benefit from making car club operational data freely available will have to be weighed against other public benefits, when various levels of government negotiate with private car club operators.

6.10 Integration with public transport services

A more pressing issue for the public sector relates to integration of car clubs with public transport systems.

There are examples from both North America and Europe of joint ticket offerings, and the technology exists for similar hybrid products to be launched in the UK. Canada's Communauto service, for instance, offers joint ticketing with the region's inter-city rail operator, which comprises the long-haul rail journey leg plus access to a car club car at the destination station. Mobility CarSharing in Switzerland provides an example of an operator offering discounts on a combined car club subscription and public transport season ticket. Though the UK's operators lag behind both continental European and North American peers in this regard, the business and policy logic behind partnerships between car club operators and public transport networks extends to the UK as well.

6.11 Car use by public sector staff

Many public sector agencies manage a fleet of cars that staff use for official business, or rely on the 'grey fleet', where staff use their personal car for official business on a reimbursement basis. There is an opportunity here for the public sector to benefit from car clubs' services – including new offers for closed environments that provide greater control than that afforded by open-to-the-general-public fleets – and at the same time provide benefits of scale to help car club operators reach critical mass in otherwise marginal locations. This is a benefit to both staff and others nearby, who may be able to use the same vehicles at other times for personal business on a commercial basis. Also, in some cases different fleets are maintained by different public agencies located at the same place; replacing these multiple 'mini-fleets' with one larger jointly managed fleet offers further economies of scale.

6.12 Future scrappage schemes

A policy which was quickly enacted by the UK government at the onset of the 2008 recession was to incentivise owners of older cars to trade them in for less-polluting new cars. UK car clubs have at times run similar promotions that provide usage credits to new members who sell their personal car.

The Italian government recently ran a scrappage scheme similar to the UK's, but that provided incentives to people who join a car club when they scrap cars in certain emission bands (Loose, 2009).

Any future UK scrappage scheme should treat car club subscription in a similar way to purchasing a cleaner car.

There is an argument on policy grounds for any future UK scrappage scheme to do the same. Should a future UK government decide to undertake a scrappage scheme, it is suggested that such a scheme recognise car club subscription in a similar way to purchasing a cleaner car, and allow car clubs to administer the programme alongside car dealers as in the 2008–10 scheme.

7. The Important Policy and Research Questions

Up to this point, this report has surveyed the landscape of the car club sector and considered how it might evolve in the coming years. This section looks at the key policy and research questions which will form the agenda from now on.

7.1 Control and responsibility

Differences in the degree of control over the use of a vehicle, and the reliability of accessing one, were identified as a key distinction between car ownership and access to a shared-car fleet. The precise nature of how people value such features of car club services is an unknown at this point, and ripe for research; prospective customers face a range of linked questions, including:

- Will I be able to access a car club car when, where, and for the duration I wish, at short notice if necessary? If I am unable to do so, what are my second-best options likely to be? Is the operator likely to be able to deliver on my reservations once I have made them? And, again, if the answer is "no", what would my options be, given that I would have been planning on the car being available to me?
- To what degree can I expect the operator to be able to resolve unanticipated events (e.g. damage to a vehicle by a third party during my period of usage) to my satisfaction?
- How likely is it that this service will continue with its present features – for instance, is there a risk of the pricing structure changing to my detriment at some point after I have committed to a subscription?
- Can I rely on the car club operator continuing indefinitely as an operating business? Will it continue to provide service in locations that work for me? If I am planning to rely on a car club operator as part of a 'portfolio' of mobility options, to what degree can I count on the complementary products/services remaining operational?

7.2 Users in flux

The latest figures show that roughly two thirds of car club subscribers in the UK are aged under 40 – this compares to about a third of licence-holders in the same age bracket. An important question is whether this presently youthful cohort will continue with shared-car access as they age, or whether such services will continue to be appeal primarily to younger adults.

This question of whether a period of car club subscription serves a particular point in people's lives, or whether the market will gradually extend over time to include more older people, must be considered in the light of broader changes in car access and use. It has, for instance, been recognised for some time now that the current generation of young people in the UK are simply not acquiring driving licences at the same rate as in years past (DfT, 2012). Similar changes have been noticed elsewhere: Kuhnimhof et al. (2012) discuss changes in how young adults access cars in Germany, and report that in recent years young men, particularly those in the lowest income classes, have sharply lower rates of car ownership than was the case in previous years.

Will car clubs continue to appeal primarily to younger adults?

7.3 A prospective real-world pilot project

One suggestion that has been raised is a pilot real-world field trial to investigate synergies between car clubs and other forms of access to cars without owning one: ride-sharing services, taxis, traditional car hire, and so on. Any such undertaking must be designed with great care, as it will be very challenging within the scope of any plausible research budget to deliver services to participants that will be of the quality, scope, and ease-of-use of best-in-class commercial services, due to the inability to benefit from economies of scale in a small pilot project. If not adequately addressed, such concerns could affect the ability to make general inferences on the basis of a field trial.

7.4 Evaluation methods

Further research is also needed to develop robust techniques for predicting the impacts of car clubs, most particularly the new types of operating models (i.e. P2P and one-way car clubs).

The forecasts of market penetration and knock-on effects reported here are based on a purpose-designed analysis, which confirmed that the experimental techniques were feasible. If the newly developed methods are to be useful for practitioners, they will require standardisation, more efficient use of computing resources, and modification to work with widely available datasets. Techniques of this sort are necessary for planning, both for operators and other stakeholders in the private sector, and for public agencies which have responsibility for transport systems' oversight and management.

Analyses of the environmental effects associated with car clubs tend to address the issue in a cross-sectional manner. Tailpipe emissions from people's driving with the car club in place are compared against the hypothetical situation of the car club not providing service. There is a gap in knowledge,

however, as relates to emissions on a life-cycle basis. Car clubs have 'emissions overheads' generated by assets required to deliver the service: staffing, commercial property, vehicle maintenance, advanced information technology systems, and so on. The cars used in car clubs are generally new and well-maintained, and hence emit less than older less fuel-efficient cars: Harmer and Cairns (2011) provide evidence that the average car club vehicle is roughly 25% more efficient in terms of CO_2 emissions per kilometre.

But this also implies frequent purchases of new cars – and incurring the CO_2 emissions of producing and ultimately scrapping them – to keep the service fleet young. On the other hand, car club members report owning fewer cars than they would in the absence of their car club subscription, implying less automotive manufacturing. Further complicating the matter is that these changes will have knock-on effects over a long period of time in the market for second-hand cars – these impacts can be expected to be diffuse and exceedingly difficult to quantify. Though operators can be expected to view many issues pertaining to their fleet as commercially sensitive, the balance struck between putting information into the public domain and guarding it in the interests of business strategy will have important implications on the credibility of the sustainability case for public sector support.

This issue must be recognised as one aspect of the broader discussion about whether the current metric for assessing cars' emissions – tailpipe emissions over a representative drive cycle – needs to be updated with a life-cycle approach. Whilst there is clearly an 'in principle' argument for such a shift, there are many practical hurdles to do with carbon accounting at such a scale. What makes the matter especially difficult is the fact that the environmental impacts of car clubs depend strongly on whether cars are driven more or less, which is a more complex issue than their CO_2 emissions per mile.

Another issue about which little is known is how the costs (and cost savings) of car club activity interact with the rest of people's personal budgets – what economists call an 'income effect' – and how it relates to one's carbon footprint. For instance, a large cost saving from selling one's car and subscribing to a car club instead could lead to spending more on other forms of carbon-intensive consumption. The author is not aware of enquiry into income effects associated with car club usage.

Recognising the challenges raised by these issues, what is needed from the research community is a proper analysis of the life-cycle environmental benefits associated with car clubs, such as has been performed for many other products in the marketplace. At the very least it would serve to establish a starting point with rough figures (and ranges of confidence) that can then be refined and improved upon over time; even the most sophisticated analyses to date of car clubs' environmental effects (e.g. Martin & Shaheen, 2010) have tended to limit their scope to tailpipe emissions from their customers' travel.

7.5 Induced travel

A major issue on both the transport policy and research agendas is to do with 'induced demand', or the tendency of improvements in ease-of-movement to lead to more overall mobility.

In the case of car clubs there are two sides to this issue. For subscribers who, in the absence of a car club, would not own a car, the term 'induced car travel' is apt, as the availability of the shared-car access allows them to drive more than they otherwise would. But the opposite effect occurs for people who otherwise would own a car: their car travel is generally 'suppressed' rather than induced – and this willingly – in exchange for forgoing the fixed costs of owning a car. Further, 'induced' car travel enabled by car clubs is not necessarily a bad thing: it is quite plausible (although this has yet to be shown) that the benefits of this additional car travel outweigh the costs (where the costs in principle include the full social costs of car use).

> It is not well understood how and whether people take advantage of a car club subscription by changing where they travel to and how frequently they do so.

What is also not well understood about induced/suppressed travel associated with car clubs is how people adjust their day-to-day routines in response to subscribing. An exploratory study (Adamou, 2011) recently showed how people who do not own a car would adjust their grocery shopping patterns if a one-way car club system was available: not surprisingly, the results showed that they would travel to more distant food shops, but do their food shopping on a less frequent basis. Research along the lines of this exploratory study is needed to better understand how people's day-to-day travel habits are shaped

by having access to shared cars; this will have the added benefit of providing fundamental insights into induced/suppressed travel dynamics in general.

7.6 Long-term impacts on car ownership

Whilst data for the UK is not publicly available, there is evidence from other countries of a high rate of turnover in car club subscribers: amongst active members of a Canadian car club, annual rates of around 50% have been reported (Martin, 2007). High rates of turnover raise an important question that relates to a long-term form of induced/suppressed car travel: does a period of car club subscription make people likely to drive more or less after they stop being active users?

Some light can be shed on this point by Carplus' most recent annual survey, which showed that existing car club members tend to state that subscribing has made them less likely to buy a car – fewer than one in ten said that joining had increased the likelihood that they would buy a car in the future, whilst fully 60% said that it had made them less likely to do so (Carplus, 2011).

There is some evidence that is apparently to the contrary, however: Zipcar's filings with the Competition Commission state that "exit survey evidence collected by both Zipcar and Streetcar shows that the move to private car ownership is a very common reason for customers to resign their membership of a car sharing club", though the detailed figures from the exit surveys are redacted (Zipcar, 2010).

Other things being equal, people's responses to retrospective questions (as with the exit survey) would be expected to be more accurate than responses to questions about future intentions. These two results are, however, not necessarily contradictory: it is possible both that many people leaving a car club go on to purchase a car *and* that being a member of a car club tends to make people less likely to buy a car afterwards.

Long-term impacts on people's tastes and expectations for car use in the future are unclear.

Thus it is clear that much deeper insights are needed into how car club subscription affects people's tastes and expectations for car use at future points in their lives – reliable answers to such questions are urgently needed if policymakers are to have confidence in the robustness of the apparent environmental benefits of car clubs. A starting point here would be to institutionalise regular exit surveying of people who leave car clubs, in a manner similar to that in which Carplus currently annually surveys both joining and pre-existing subscribers.

8. Conclusions

Car clubs are a form of short-term car hire, and are undergoing rapid change as they grow both in number of customers and in geographic coverage. In addition to start-up car clubs, well-established names in the automotive sector (Daimler, Ford, General Motors, Hertz, Peugeot, etc.) are investing in this market using a variety of business strategies.

Entirely new types of car club services are now emerging in the UK, and in coming years the sector will look very different to how it does today. Two big developments are the growth in peer-to-peer car clubs (already in the UK) and the expected entry of one-way car clubs. Both of these innovations appeal, in different ways, to new and potentially much larger segments of customers.

This report has demonstrated that subscribing to a car club is not a like-for-like substitute for owning a car: the experiences differ in some important ways. Besides differences in the cost structures, the most fundamental distinctions are in the level of control over the use of the car and the degree of responsibility for it. A car club subscriber must accept that they may not always be able to use a car when they wish, but on the other hand their responsibility for it stops at the end of their use. Managing responsibility for a shared-usage vehicle can be difficult, though new technologies will help.

One of the main research questions relating to car clubs is to do with the nature and extent of environmental impacts. Though there is a strong evidence for net emissions reductions, the matter is not closed, particularly with respect to new types of car club systems. There is also a tension between the twin goals of providing wider access to the benefits of car use and reducing emissions from cars. The fact is that most of today's subscribers (to 'traditional' car clubs) are driving a bit more than they did previously, whilst a minority is driving less – on average much less.

It has also been reported that car club subscribers tend to have middle-to-upper incomes. Thus the hoped-for benefits of greater social inclusion brought about by wider access to cars amongst the poorest segments of society have yet to fully materialise, though the reasons are not well understood.

Continuing to monitor shifts in the profile of subscribers is important, as is reaching a better understanding of the long-term impacts of joining a car club on an individual's desire to personally own a car at some point in the future. A key recommendation is that information regarding people's car club activity

(both subscription and usage) be integrated into background large-scale data collection efforts such as the National Travel Survey.

The appropriate role of the public sector has been discussed in depth: the overriding principle is to be methodical and avoid rigid long-term contracts. What the public sector brings to the table is strategically located street space, and this resource is not time-sensitive. There is no need to rush; on the contrary, the pace at which car club services are improving argues for a considered and flexible approach from policymakers.

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89–91 Pall Mall
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