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Inspiring Futures for Zero Carbon Mobility (INFUZE)

Carsharing models and influences – a literature review

Thomas Levermore, Ghaith Nassar

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Executive Summary

The sharing of cars is a concept that has been around in some form for many decades. In the last two decades however, interest has increased due to the combination of digital technologies to manage carsharing services, changing attitudes to car ownership, and a renewed interest in reducing the environmental impact of transport. The INFUZE programme is exploring a future where people do not need to own their own cars. Greater sharing of access to cars could be a key part of that future. This report explores models for carsharing and what factors influence their success as well as models for sharing other assets and this will inform the INFUZE programme's research.

There are many different business and operating models for carsharing, from commercial services for business users, to not-for-profit community car clubs for local people, to peer-to-peer services where a privately owned car can be shared by the owner. The success and sustainability of these models are influenced by the national and local context, the local pool of potential users, and the design and perception of the service.

Two aspects are found to be important, in the literature, to the adoption of a carsharing service: the perception of how compatible the service is with an individual's lifestyle and needs, and the perception of the cost of the service compared to an alternative such as private car ownership. As the total cost of private car ownership is often underestimated by the public this may make carsharing seem less appealing. The costs of both carsharing services and private car ownership are in part impacted by national and local government policies around tax and parking and therefore policymakers play a role in incentivising behaviour, either intentionally or unintentionally. If accessing cars is to be as normal as owning a car then the tax and operational regulations need to treat carsharing as such. This report finds that this has not yet been achieved.

The sharing of assets, particularly high value assets such as cars, has grown in popularity in recent decades. Assets as diverse as private aircraft, vacation property, e-scooters and e-bikes can all now be shared with different operating models evolving. Private aircraft for example are often owned as fractional shares granting a time allocation per year. This fractional ownership model has recently been applied to cars by a company in India. The exploration of these different models of sharing cars as well as other assets provides ideas for new types of services which could be further developed with communities in the INFUZE programme.

This report for the INFUZE programme was developed to explore different models of shared ownership and shared access for cars. It provokes the following questions for further work:

1) How can existing carsharing models evolve and learn from other sharing models to appeal to different communities?
2) What needs to be in place around carsharing services to provide the mix of mobility communities need?
3) What are the wider benefits which reducing the number of cars in communities could offer and how can they be realised?
4) How can the tax and regulatory system be adjusted to reflect the wider benefits that carsharing could offer?

1 Introduction

The sharing of goods in communities has a long history in societies [1]. A relatively recent development related to sharing is the concept of the sharing economy, which is a broad term that in [2] is described as combining three core elements of access to an asset, a platform to mediate the sharing, and a community [2]. Shared mobility is one area of the sharing economy concept that has evolved significantly in the last few decades with the shared asset being the vehicle that enables mobility. Shared mobility covers a broad range of services which can be categorised according to how the sharing occurs in time [3]:

- **Sequential sharing** – where the same vehicle is shared at different times by different users, for example a dockless cycle scheme.
- **Concurrent sharing** – where the same vehicle is shared at the same time by different users, for example a ridesharing scheme.

The INFUZE programme is exploring the future of car ownership with shared access to cars being one important focus area. This report focuses on the sequential sharing of cars (from here on referred to as 'carsharing'). To support the programme, Connected Places Catapult undertook two pieces of related work. Firstly, there is a broad literature review of carsharing focussing on some key questions and sources from industry and academia – summarised in this report. Secondly, a focus group was facilitated by INFUZE programme researchers from which User Stories were written to inform the wider INFUZE programme (see: doi.org/10.48785/100/356).

The literature review provides context for the following questions:

- What are examples of the different shared access models and shared and fractional ownership models for surface transport globally?
- How are they organised commercially and operationally? How are they funded?
- Are there insurance and tax implications and how different are these from private car ownership?

Shared access or shared ownership of a motor vehicle has been around as a concept for many decades with documented examples as far back as 1948 [4]. Various terms are used to describe the sharing of cars, most commonly *carsharing* but *car club* is also used in the UK. Carsharing and related concepts encompass a wide variety of services, business models, and stakeholders. In [5] it is proposed that a carsharing service can be broken down into the following high-level elements:

- The physical assets such as the cars and parking spaces;
- The economic aspects such as the business models and operating models;
- The social aspects such as local demographics and attitudes;
- The technical and regulatory aspects such as local policies and the service platform.

This review is structured similarly, with sections covering business and operating models (section 2), stakeholders (section 3), followed by an exploration of factors affecting carsharing services such as local demographics (section 4). National and local governance

considerations are explored in the subsequent section (section 5) followed by case studies of different carsharing schemes globally (section 6). The final section covers shared ownership and shared access models outside of carsharing (section 7) before a conclusion is provided to complete the report (section 8).

2 Business and operating models

To better explore the different approaches to carsharing, a common framework for describing the business and operating models is helpful. A taxonomy of carsharing business models is presented in [6] which provides a structure for classifying carsharing business models using several dimensions to describe a model. This taxonomy is reproduced in the table below. Note that no connection *between* the characteristics of different dimensions should be derived from the layout of the table – different carsharing schemes can have very different combinations of the characteristics.

Table 1: Taxonomy of carsharing business models reproduced from [6].

Dimension		Characteristics					
Types of service	Destination	Roundtrip		One-way		Roundtrip with option for one-way	
	Minimum duration	At least 1 day or longer		Hourly		By the minute	
	Vehicle types	Identical or very similar vehicles available			Very different vehicles available		
	Additional benefits	Free/discounted parking		Delivery by owner		No additional benefits	
Interface	Vehicle booking	Reservation and fixed return time		Instant access and fixed return time		Instant access and open ended	
	Vehicle access	Manual key handover		Lock box for key		Automatic	
Service platform	Booking platform	Proprietary			Open for other providers		
	Parking infrastructure	Dedicated carsharing stations		Only attached to other transport hubs	Street parking	Private homes	
Organising model	Vehicle ownership	Operator owned			Private customers		
	Vehicle maintenance	Maintained by operator			Maintained by private customer		
	Vehicle refuelling	Refuelled and paid by owner		Refuelled by driver and paid by owner		Refuelled and paid by driver	
Revenue model	Price structure	By duration only			Combination of duration and distance		
	Transaction-based revenues	Service fee (including insurance)			Commission and/or insurance		
	Continuous revenues	Membership fee from drivers	Service fee from car owners	Subsidies	Advertising	Combination of multiple sources	No continuous revenues
	Organisational ownership	Private company		Cooperative		Government owned	

To expand on the terminology used in this taxonomy, for the journey destination dimension the following descriptions are used:

- **Round-trip** requires the journey to begin and end in the same location.
- **One-way** means the journey can end somewhere different from where it started.
- **Roundtrip with option for one-way** means the service allows both journey types.

In addition to the type of journey destination, the operational models for how journeys are ended can be classified according to [3] as:

- **Free-floating model**;
- **Station-based model**;
- **Hybrid model**.

A *station-based model* has designated parking spaces for the shared vehicles to be picked up and returned to, this is also referred to as a back to base model [7]. A *free-floating model* allows vehicles to be returned to anywhere legal within a designated area, and is also known as a back to area model [7]. A *hybrid model* has both operating models each in different parts of the operating area with designated parking spaces in some locations and designated areas in others. Operational models also consider whether only return journeys are allowed or whether one-way journeys are allowed [8]. One-way journeys would still require dropping the vehicle in designated spaces or areas – that space just does not have to be the *same* space or area that the vehicle came from. Some one-way journey services include relocation of vehicles by the operator [9] to balance supply and demand across the service area.

Another important aspect for describing a carsharing service is the business model that is applied. Business models for carsharing include [10]:

- **Business-to-consumer** – a business owns the vehicle fleet, and individuals access the vehicles for a fee, subscription or combined pricing model.
- **Business-to-business** – a business pays for access to a vehicle fleet usually for their employees to use for business purposes.
- **Business-to-government** – similar to business-to-business, but the users are government employees such as local council employees.
- **Peer-to-peer** or **personal vehicle sharing** [3] – private vehicles are shared for a fee with other service users via a platform that connects owners with users, with the platform taking a portion of the fee. The platform could make a vehicle fleet open to all members or have closed groups that are only for approved members. Informal peer-to-peer sharing can also occur, for example between friends without an intermediary platform involved.
- **Combination** – for example, London's Tower Hamlets Council make their council-owned vehicles available on a car-sharing platform outside of core working hours for members of the public to use [11]. Other examples include platform providers that offer both peer-to-peer and business-to-business services on their platform [12].
- **Non-commercial** carsharing – for example, community car clubs where local people come together to setup, run and/or use a common vehicle fleet [13]. Several different legal structures are available for non-commercial carsharing schemes as outlined in [13].

Across the different business and operating models, there are also a range of objectives and motivations for carsharing schemes. Some of the objectives include making profit, reducing car ownership, reducing public space taken up by cars, reducing carbon emissions, improving mobility for specific groups, building community cohesion and reducing the idle time of a vehicle fleet.

2.1 Vehicles and ownership

A fundamental aspect of the business and operating models of carsharing is the number and types of vehicles in the fleet. For commercial carsharing services, the service provider owns the fleet and decides on its composition. For peer-to-peer carsharing, private individuals own the vehicles, so the fleet depends on who is willing to share their vehicle. Fractional ownership is a less common model for carsharing where a small number of private individuals own a fraction of a vehicle and have proportional access rights. Prorata in India is an example of a commercial service that facilitates fractional car ownership [14] and is described in more detail later in the case study section 6.6 titled Fractional Ownership – Prorata, India.

The types of vehicles that make up a given carsharing fleet can range from small city cars designed for urban journeys to vans and people carriers, and even luxury vehicles [15] and classic cars. Fleet sizes range from one vehicle in small community car clubs to thousands of vehicles in country wide carsharing schemes such as the Mobility Carsharing service in Switzerland [16].

2.2 Funding and procurement

Along with the business and operating models, funding and procurement options for a carsharing scheme also vary. Generally, there is significant capital cost outlay to start or expand a carsharing service due to the cost of vehicles and any infrastructure required. Operational costs are then generally lower. This is also true of private car ownership.

CoMoUK have guidance for the public sector on this topic which highlights two approaches to procuring carsharing services [17]:

- **Concession arrangements** – where a local authority allow an organisation to operate a carsharing service without necessarily providing any funding.
- **Traditional service arrangements** – where a local authority pays an organisation to operate a carsharing scheme in the area.

Public funding of carsharing schemes has evolved since 1999 when public funds were first used in the UK. This funding supported the establishment of a car club in Edinburgh [18] and came from both local and national government sources.

Indirect funding encompasses the allocation of parking spaces for use by carsharing vehicles. In London, Transport for London (TfL) guidance for boroughs that are creating Local Delivery Plans allows funding to be requested for parking-related changes as part of a car club scheme (EVs only) but also notes: ‘Ideally funding for implementation of bays and charge points should

be sought from the car club operator or revenue generated from permits or profit share agreements' [19].

Guidance for local authorities notes that new housing developments present an opportunity for introducing carsharing schemes. Property developers can be required by local authorities (in England) to contribute to a carsharing scheme under section 106 obligations [20] which are used to mitigate the impact of new developments including aspects such as parking.

Different carsharing services employ various funding models to establish and sustain operations. These are outlined in the table below:

Table 2: Carsharing funding models, characteristics and examples.

Funding Model	Description	Key Characteristics	Examples
Private Investment	Commercial operations funded by private investment	Profit-driven, scale-focused, technology-oriented	Most free-floating services (e.g., SHARE NOW)
Cooperative	Member-owned and democratically controlled	Democratic governance, profit reinvestment, community-focused	Mobility Cooperative (Switzerland)
Public Ownership	Public sector funded and operated	Public service orientation, integration with transport policy	Flinkster (Deutsche Bahn, Germany), Corrente (Trasporto Passeggeri Emilia-Romagna, Italy)
Public-Private Partnership	Joint ventures between public authorities and private companies	Risk sharing, complementary expertise, policy alignment	Autolib' Paris (initially)
Social Enterprise	Business with primarily social objectives	Reinvestment of profits for community benefit, addressing transport inequality	Co-wheels (UK)
Corporate Subsidy	Funded by employers for employee use	Employee benefit, reduced parking demand, Corporate Social Responsibility element	Enterprise CarClub for National Health Service Trusts (UK)
Mixed Revenue	Combination of commercial activity, grants, and subsidies	Diversified income streams, balance of commercial and social aims	BlueLA (USA)

Funding approaches significantly impact service priorities, pricing structures, and long-term sustainability. For example, private investment will come with expected return on investment rates which will influences pricing structures and scaling.

2.3 Alternative ownership models

While the focus of this document is carsharing, the context of the INFUZE programme is understanding the future of car ownership, so it is worth briefly mentioning some key aspects in the evolving landscape of vehicle ownership. One conventional model of car ownership sees the vehicle bought outright and the owner is also what is known as the registered keeper – a person or company who is responsible for the vehicle as registered with the Driver and Vehicle Licensing Agency (DVLA). Nowadays, a variety of financing arrangements are possible that mean a vehicle does not need to be bought outright immediately, or at all, and the registered keeper may not then be the official owner. In 2022 84 % of new cars and 22 %

of used cars were bought on finance [21]. As used cars sales per year are higher than new car sales the total annual financing for used cars actually exceeds the total annual financing for new cars [21].

Financing arrangements include hire-purchase, personal contract purchase, and lease-hire. Hire-purchase involves a deposit and loan to cover the total cost of a vehicle, with fixed regular payments and ownership at the conclusion of the term. Personal contract purchase generally involves lower regular payments (to cover depreciation) but at the end of the term a large payment is required to finalise ownership. Lease-hire is effectively a long-term rental with no ownership at the end of the term.

More recently, car subscription models have become available, where a user pays a subscription fee for sole use of a vehicle for the duration of their subscription. Jaguar Land Rover, for example, has invested in two car subscription services, The Out, and Pivotal, which both provide monthly subscriptions to a Jaguar Land Rover vehicle, including insurance [22]. The subscription company is generally the registered keeper of the vehicle and will pass on enforcement notices such as parking and speeding to the subscriber.

3 Stakeholders

Carsharing introduces a different set of organisations and actors than traditional private car ownership. Some of these are described below:

- ***Service providers*** provide the service by which cars can be shared – note they may also be the asset owners. Types of service providers include:
    - organisations that are solely carsharing service providers either private companies or cooperatives [6] such as Zipcar;
    - traditional car rental companies who enter the carsharing market through acquisitions or internal development such as Enterprise CarClub;
    - vehicle manufacturers such as the Stellantis group with Free2Move, or
    - public sector organisations such as transport authorities or local authorities [23], an example being Flinkster by Deutsche Bahn the German railway company. There may be multiple service providers in a given area [7].
- ***Users*** are the individuals who use the carsharing service, for example someone booking a car through a carsharing service to move an item of furniture.
- ***Asset owners*** can either be single private owners sharing their vehicle with other service users, private owners with a share in a car club vehicle, or service providers who also own the vehicles such as Zipcar or Enterprise CarClub.
- ***Local authorities*** can play a direct role in the carsharing by procuring services [20] but can also play a broader role in setting local regulation, incentives, and communicating the opportunities and potential for carsharing in the local area.

4 Factors affecting carsharing

There are many factors identified as affecting carsharing which will be explored in this section. First, it is important to highlight that these factors evolve and have an effect over different timeframes. When designing a carsharing service for an area, these factors and their timeframes should be considered in decision-making. In [24] decisions about designing a carsharing system are categorised according to timeframe (longer to shorter) as *strategic decisions* such as the business model and number and location of carsharing stations, *tactical decisions* such as how many vehicles to have in the fleet and the pricing structure, and *operational decisions* such as moving vehicles around to satisfy hourly changes in demand. Factors affecting carsharing are grouped into three categories in [25]:

- Local context in which the carsharing is being considered.
- Characteristics of adopters who are potential or actual users of a service – which can then be looked at on a location population level through demographics.
- Attributes of innovation that influence the uptake of a service - based on an often-used framework for innovation and in this case applied to carsharing.

These three categories are explored in the following sections.

4.1 Local context

The local context of a carsharing service includes the physical environment and infrastructure as well as the political and societal context in which the service operates. Since current carsharing vehicles are generally not located at or right by a user's home as a privately owned vehicle might be, the user's journey is broken down in [24] into two segments:

- an ***access trip*** to first reach the carsharing vehicle, followed by
- an ***in-vehicle trip*** where the carsharing vehicle is being used.

The access trip distance was identified as a key factor in the uptake of a carsharing service, although different values are proposed for acceptable access distances in literature with the authors of [26] identifying 500 m, 800 m, 1 km or 10 minutes of walking as proposed acceptable access distances, based on either transport planning models or user surveys. The layout and historic planning of space impacts carsharing take-up, with densely populated cities more likely to serve users with shared cars nearby [27]. It is important to note that these are distances people may be prepared to walk, it does not reflect their preference for a convenient system.

The availability of, and integration with, other modes of transport has a positive impact on carsharing [28]. In [29] collaboration between public transport and carsharing operators is also seen to influence carsharing with more than twice as many carsharing vehicles in cities with collaboration between transport and carsharing operators than in cities without such collaboration. Collaboration in this context included shared marketing and package deals [29]. Such findings are intuitive. If a person uses a car frequently and has to access shared cars to do all of the journeys they would have done by their own car then the system will offer little, if any, benefit over private ownership. What is less clear is how good that balance of supporting

services needs to be in order to enable the car sharing service to form an appropriate part of the transport mix for the user.

The local context generally evolves over a longer timeframe than other factors and so ensuring that strategic decisions about the carsharing service design are given sufficient consideration is important.

4.2 Characteristics of adopters and non-adopters

To better understand the reasons for some people using current carsharing services while others do not, there is a developing body of research on the characteristics of carsharing service users and non-users to identify patterns. By increasing the understanding of the characteristics of potential adopters and non-adopters as well the local context, services can be tailored for specific locations and the inhabitants of those areas.

The characteristics explored in carsharing research have included gender, age, household composition, income, education level, and some of these are considered in the following section.

A rapid assessment of evidence on car clubs commissioned by the UK Department for Transport identified that car club users are more likely to 'be male, be based in urban areas, have higher than average education and income, and use public transport and active travel modes more frequently than the general population' [30].

Work in the US has also found that carsharing service users are generally from higher income groups [31]. However, survey findings in the UK showed that users on lower incomes were more likely to say they would not have been able to make their last trip without access to a car club vehicle [32]. Carsharing for low-income populations is a specific focus of a US report [33] noting that making driving inexpensive has not been the aim of carsharing but making mobility cost less overall would help low-income populations, and carsharing can play a role in this.

Age and gender have also been explored as factors influencing carsharing adoption. A review of existing literature in [34] highlighted that the majority of references identified men as overrepresented in carsharing membership. However, a small number of studies from Canada and the US reported women as the majority gender of users for the services studied [21]. The review also highlighted that people with higher education qualifications were overrepresented in carsharing membership [34]. Most research related to the characteristics of carsharing users focuses on the correlation between carsharing use and characteristics without delving into why certain groups are more (or less) likely to use carsharing. Understanding what causes particular groups of characteristics to be more (or less) present in carsharing user populations could inform the design of services to maximise their use.

In [27] factors affecting the supply or use of carsharing include household makeup, with one-person households found to be more likely to adopt carsharing. The link between parenthood and the use of carsharing schemes was found to have limited attention in the literature but some qualitative work has taken place looking at this topic [35] based on interviews with 28 car-free parents of young children. The parents were car-free by choice and lived in areas that had good access to public transport, amenities within walking distance, and "plentiful

commercial car sharing cars" [35]. This highlights the role carsharing can play in supporting citizens reduce their reliance on privately-owned cars, even parents of young children.

Two clusters were identified from a Dublin station-based service using 2017/2018 data, with clustering primarily based on car ownership [36]. One cluster was composed of users who owned a car, who were more likely to have lived in their current residence for more than 10 years and live in a suburban area. The other cluster being users who did not own a car, and were more likely to have lived in their current residence for 1-2 years and live in a city centre location. The latter cluster was more likely than the former to use the carsharing service for grocery shopping, buying bulky items and trips outside of the city. The majority in both clusters said they have used taxis less since joining the carsharing scheme.

An analysis from 2022 on the potential for carsharing in UK cities identified car ownership and annual car mileage as two factors that could be used to assess the potential for reduction in car ownership [37]. Leeds was identified as the UK city or region (excluding London) with the third highest number of potential 'switchable households', i.e. households that could switch one of their cars for carsharing. However, the decision to switch from car owning is not just a utilitarian decision, with [38] finding that participants who are less likely to feel as if particular items are 'theirs' were more likely to use carsharing services.

Specifically for peer-to-peer carsharing, users encompass both drivers who book vehicles and owners who make their vehicles available. The authors of [39] found gender, age, income, household composition, vehicle ownership, living location with respect to a grocery store, and participation in other shared mobility schemes (such as shared bikes) were all associated with whether someone was likely or not to rent their car out to others. Respondents to the survey who were less likely to share their vehicles were more likely to be female, over 40, or from households with high annual income. The characteristics of peer-to-peer carsharing vehicle owners and vehicle users were explored in [40] with younger people, those living in city centres, or those who identify with environmentalism most likely to both use and provide vehicles on a peer-to-peer platform.

The experience a user has with a carsharing service will influence the likelihood of both their future use of the service and the use by other members of their community due to positive or negative sentiments being shared. The user experience starts with the initial activities of registering for the service and setting up any digital applications needed. This is referred to as the pre-use phase of the user experience in [41], which investigates user experience in peer-to-peer carsharing. During the use of a shared vehicle, cleanliness is a big influence on user experience. Cleanliness is also an influence on people's willingness to share their own vehicle via peer-to-peer carsharing services [42]. Cleanliness is even the focus of research on technologies to monitor interior cleanliness of shared vehicles [43].

4.2.1 Understanding journeys

Along with *who* the users are, *how* they use the service or *how likely* they are to use the service is of interest to researchers and service planners – this includes the journey duration, time when journeys take place and the purpose of the journeys. This matters because it will impact on the extent to which the demand for car use is more or less concentrated at different times of the day, which is related to when different activities occur.

To understand carsharing usage patterns, data from a German station-based service was used with clustering methods in [44] to identify five types of user and usage: regular users (often weekly), irregular short-journey users, users classed as second car replacement based on their patten of use, infrequent long distance users and a small group classed as commercial users.

When journeys occur is of interest to researchers and service planners. Researchers using data from two carsharing services in Turin showed peaks of use during the week around 08:00 and 17:00, and at weekends there was a gradual build-up of bookings from 08:00 to a peak at around 19:00 [45].

While journey duration and when they occur can be extracted from carsharing data, the purpose of the journey is harder to assess [46]. Data from London on car club members' most recent journey purpose uses some of the same categories, and found that personal business, visiting friends or family, and leisure were the most common recent journey purpose [47].

4.3 Attributes of innovation

While carsharing as a concept is not new, with the various operating models, limited geographical coverage, and constant evolution, carsharing continues to be an innovation.

From the diffusion of innovation theory, the perceived characteristics of an innovation that impact its successful take-up include [48]:

- **Complexity** – the perception of how difficult an innovation is to understand.
- **Trialability** – whether the innovation can be tried on a limited basis.
- **Observability** – whether the innovation or the benefits of the innovation are visible to potential adopters.
- **Relative advantage** – whether the innovation is perceived to have advantages over existing alternatives.
- **Compatibility** – whether the innovation is compatible with potential adopter's experience, needs, and values.

Relative advantage in relation to carsharing is noted in [25] as being generally only considered for private car owners but this could also be considered for those who do not own a car, in which case the relative advantages will be very different.

In UK specific research on carsharing, perceived incompatibility with existing patterns of behaviour and failure to see how it could benefit them are two of the main barriers to using shared transport options [49]. Such comparisons highlight the challenge of comparing one part of the mobility system (carsharing) to the functionality of the private car. Carsharing is only a small part of people's weekly mobility patterns, with most UK users only using carsharing between 1 and 5 times per year [32]. Carsharing needs to be developed to be part of a system offering. This system view of car use is explored in [50] with daily vehicle needs considered alongside the infrequent vehicle needs of car owners. Carsharing is then proposed as a way to meet occasional vehicle needs such as larger storage space and longer driving

range, while daily vehicle needs could be met by a cheaper, smaller, more environmentally friendly vehicle.

Observability or visibility was noted in [51] as being raised by non-users of carsharing who questioned if people knew where to find shared mobility options, knew about the different options, or understood how they worked. The positive influence of observability is also seen in [32] with the vast majority of survey respondents saying they had joined a car club because they had either seen the car club vehicles on the street or heard about them from a friend or family member.

The total cost of using a carsharing services compared to the total cost of car ownership is explored in [52] and is a topic that spans the observability and complexity attributes (is the *total* cost of car ownership and carsharing usership directly observable and understood), the relative advantage attribute (is carsharing *seen* as cheaper), and compatibility (does an overall cost reduction from carsharing occur for the annual distances and vehicle type a particular user wants). One of the conclusions from the work on total costs [52] is that in the German context across a range of user profiles, the total cost of carsharing was lower than the total cost of ownership and the difference was greater for medium and large vehicles than for small vehicles. The key drivers of carsharing adoption in London are mapped in [53] and include 'comparison between the cost of ownership and membership' as one of the drivers with purchase cost, insurance costs and maintenance costs for private car ownership considered. Of course, the choice is more than just an economic matter.

4.4 Supply and demand management

A critical challenge in carsharing is ensuring access to vehicles while also maintaining sufficient users to ensure the model is financially viable. Managing this challenge happens on two levels, the strategic decisions such as how many vehicles to have in the fleet and the operational decisions such as where to move vehicles to pre-empt short term changes in demand.

4.4.1 Supply and demand – strategic and tactical decisions

An example of strategic decisions impacting on supply and demand is provided in [23] with the Autolib' service in Paris, which started in 2011 and after initial success experienced growth in registered users, but a stable number of vehicles resulted in a decline in frequency of use. This was attributed by the authors of [23] to demand outstripping supply with users not being able to access the vehicles when they wished, which eroded confidence in the service, so previous users stopped considering it when planning journeys. Autolib' closed in 2018. Managing supply and demand is challenging for carsharing service providers, however this issue is compounded by how much the user experience is negatively impacted when demand is not met [54].

Supply of vehicles in a peer-to-peer carsharing service is dictated by the willingness of car owners to make their vehicles available, which is explored in [39] and their awareness of such a service. Potential demand forecasting at a strategic level, i.e. how likely people are to join and use a service, has been explored by several authors, some of which are summarised in

[55]. This research (from 2014) focused on London and proposed that the potential market for round-trip carsharing was 430,000 subscribers and for free-floating carsharing was 1,570,000 subscribers [55]. According to the 2023 CoMoUK Annual Car Club Report, London had 258,570 active carsharing scheme members [32].

People want to know that a service will be available when they need it. One way of assessing this is utilisation rate. In [56] a Scottish community car club had utilisation rates of 14 % (equivalent to four hours a day) with room to increase this. However the authors of [56] also note that utilisation rates above 25 % are undesirable as users will struggle to access vehicles when they need them. For context, private cars in the UK are only moving 4 % of the time on average [57]. So, whilst there is considerable scope to use vehicles more than 4% of the time, the upper levels of shared utilisation are less well understood.

To help manage supply and demand, and support the sustainability of a carsharing scheme, local 'anchor organisations' can be identified that can commit to employees using the carsharing service for work trips and thus providing a reliable base demand [7]. These vehicles are then available in the evenings and weekends for general use.

4.4.2 Supply and demand – operational decisions

To manage short term supply and demand changes, operational decisions need to be made, such as whether vehicles should be moved by the service provider and if so to where should they be moved, as well as operational decisions such as short time price adjustments. For operational decisions, the considerations are different depending on whether the service is a one-way service, roundtrip service, or peer-to-peer. For one-way services the relocation of vehicles is a key operational decision – to ensure that vehicles are in the right locations to meet the local demand. This *Vehicle Relocation Problem* is reviewed in [9]. Vehicle relocation can either be completed by the service provider or by users when incentivised by the service provider [58].

A roundtrip service does not need to consider vehicle relocations in the same way as a one-way service, however operational decisions still include what to do when a vehicle is not returned on time and other users have booked the vehicle, and which vehicles to take out of service for maintenance or cleaning and when to do this.

Operational decisions in a peer-to-peer service are mostly transferred from the central entity (a carsharing *platform* provider rather than a carsharing *service* provider) to the individual car owners in the peer-to-peer network. These individuals can decide when to make their vehicle available and whether to accept particular reservation requests. Optimisation of these operational decisions in a peer-to-peer service are explored in [59].

4.5 Carsharing business costs

Cost is often cited as an advantage for car club members compared to private car ownership, but also by non-members as a barrier to using car clubs. The cost of using a carsharing service is driven by the costs to run the service and how they are split between users. This subsection

explores the costs involved in a carsharing scheme in order that such schemes can be compared to private car ownership in the future.

The costs of a business (but also any organisation providing goods or services) are often broken down into capital costs and operating costs. *Capital costs* for a carsharing service would include the cost of the vehicles, for example. *Operating costs*, also known as running costs, can be broken down even further into:

- ***fixed operating costs*** which are recurring costs but are fixed in value and
- ***variable operating costs*** which are linked to how much the service is used.

Insurance, breakdown cover, maintenance, servicing and annual MOT tests are some of the costs that a carsharing scheme incurs, as they are in private car ownership. Insurance, breakdown cover, and annual MOT test costs are generally fixed operating costs. Currently an MOT test is needed annually for all private cars 3 years or older, and the literature indicates this applies equally to carsharing – taxis and private hire vehicles have different requirements. Maintenance and servicing are generally variable operating costs linked to the amount of use the vehicle fleet has. For example, servicing is often required at distance intervals so the more the vehicle is used the more frequent the servicing.

Maintenance and insurance costs will vary depending on the types of vehicles in the fleet. In a corporate white paper focused on the Leo&Go service in Lyon, lessons learned by the service provider included that some vehicles models were too expensive to repair and maintain [60]. Depending on whether or not the user pays for fuel, the cost of fuelling or recharging fleet vehicles may need to be considered.

Staff costs for a carsharing service are operating costs, which are generally fixed. Where volunteers are involved, as is often the case with community carsharing schemes, their time commitment may not have a direct cost but could be included in the operating cost models.

Prior to the availability of digital platforms, the management of carsharing services was time-consuming and had many challenges. While the administrative burden for staff or volunteers has reduced, there is a cost associated with either developing and maintaining, or buying in, a digital platform for managing the carsharing operations [61]. The costs for the digital platform will vary depending on the approach taken, so could involve capital, fixed operating, and variable operating costs.

Cleaning can be a *fixed operating cost* and/or *variable operating cost* that is factored into a carsharing model, either as an explicit cost for an in-house team or outsourced to a cleaning firm, or as less explicit costs such as the time of volunteers in a community car club. For example, Enterprise CarClub clean their vehicles every 7 to 14 days [62], as a fixed operating cost. If a customer reports the vehicle to be in unacceptable condition, then additional cleaning may be necessary which can be considered as a *variable operating cost*.

In addition to costs related to the vehicle directly, permits to park are another cost to consider. These vary depending on the local authority responsible and often depend on whether the permit is for a free-floating or station-based service, and what type of vehicle is used.

Examples of the cost for car club parking permits include a flat rate of £800 per vehicle per year in Ealing borough, and between £0 and £2,290 per vehicle per year in the Royal Borough of Kensington and Chelsea, depending on the vehicle type and emissions. These parking costs are generally *fixed operating costs*. Private individuals may also be faced with residential parking permit costs. The extent to which the charges levied to commercial providers exceed those of residents is a signal of how the scheme is viewed by the local authority, intentionally or otherwise.

Capital costs for a carsharing scheme include the cost of the vehicles and the cost of any infrastructure owned by the scheme. The value of a vehicle will depreciate over time and the timely management of selling and replacing vehicles in the fleet has an impact on the sustainability of the service long term. For a carsharing scheme to be fully accredited by CoMoUK all vehicles in the scheme have to be less than 5 years old throughout their time in the fleet [63]. For context the average age of a car in the UK is almost 9 years old [64], which presents challenges for comparing the costs associated with private ownership of an average car and the cost of a carsharing scheme where the vehicles are newer on average. 2.3

The costs that are borne by the operator ultimately must be passed on to the users or subsidised to ensure the service is sustainable. To compare the total cost of using a carsharing scheme and the cost of private car ownership, the specific usage patterns of users will make a big difference, but the foundations of such a comparison can be found in the table below which considers how and where capital and operating costs are borne by users and operators in both ownership models.

Table 3: Comparing cost allocation for carsharing schemes and private car ownership.

	Carsharing scheme costs are borne by:	**Private car ownership** costs are borne by:
Capital costs		
Vehicle(s)	Operator – although cost could be reduced if bulk buying.	Owner – although cost could be reduced by company car tax or buying used.
Infrastructure	Operator - as necessary.	N/A unless home charging for EV.
Operating costs		
Insurance	Operator and then recouped either uniformly amongst users or according to a user's risk profile.	Owner – insurance to cover all times unless vehicle officially declared 'off the road'.
Breakdown cover	Operator.	Owner.
Maintenance	Operator.	Owner.
Servicing	Operator.	Owner.
MOT	Operator.	Owner.
Cleaning	Operator (routine cleaning). User (exceptional cleaning).	Owner.
Staff	Operator.	N/A.
Digital platform costs	Operator.	N/A.
Parking (at home / base location)	Operator.	Owner – either explicitly via permits or implicitly via cost of a driveway / garage.
Fuelling / recharging	Operator (up to limit).	Owner.

Exactly how the costs are divided and passed on to users is a fundamental business decision for a carsharing service operator. However, the price a user pays for carsharing is more easily

understood and communicated than the total cost for private car ownership [65] and this could be considered when communicating the benefits of a carsharing scheme. The applicable costs for both carsharing and private car ownership are both impacted by national and local governance and regulation and these are explored in the following section.

5 National and local governance considerations

A carsharing scheme is subject to a range of national policies such as insurance requirements, to taxation, and local policies such as parking permit charging.

5.1 Insurance

The insurance implications for carsharing vary depending on the business and operating model, primarily who owns the vehicle(s) and their relationship with the users of the vehicle(s). Peer-to-peer, community car clubs and commercial carsharing services are briefly explored below.

5.1.1 Peer-to-peer

For peer-to-peer carsharing in the UK with an intermediary platform used, generally the vehicle is insured with the owner's private motor insurance but when used by others through the peer-to-peer service, the journey is covered by the service provider's commercial insurance policy [66]. The cost per booking generally includes an insurance component which varies depending on the vehicle being used and location, but also on the driver's age and driving history amongst other factors. Peer-to-peer service provider Hiyacar notes in [67] that several peer-to-peer carsharing service providers have closed in the UK due to insurance challenges and that '[e]ntering this market [peer-to-peer carsharing] is difficult as the insurance regulations in the UK are much tougher than in most other countries'.

In the event of damage during a hire session, most peer-to-peer service providers have a claims process involving damage assessment, cost estimate and payment for repair. The vehicle owner generally has to organise the actual repair local to them. Some peer-to-peer carsharing services offer a courtesy car if significant repairs are required to a vehicle that was hired out [68].

5.1.2 Community car club

Community car clubs, often run by volunteers face challenges with insurance due to the diversity of potential users and the implications for insurance companies then assessing the overall risk.

Insurance has been highlighted as a particular challenge for community car clubs in the UK [69], worsening in recent years. A spokesperson for the Association of British Insurers was quoted in [69]: 'While insurers are supportive of different modes of transport and vehicle ownership, car clubs present a unique challenge wherein driver risk is difficult to measure'.

Individual insurance per member is one option for car clubs, facilitated through short-term insurance services such as Cuvva [70]. The individual's insurance then only applies for the duration of their booking. Recently some community car clubs have moved to using a closed-loop peer-to-peer platform which provides individualised insurance for the duration of a members booking [71]. Whilst it is clear that the risks which are being insured under a shared access model are different to a private car, the current market approach is pushing the cost of shared access insurance up relative to private cars and this would need to be addressed if sharing were to be considered the norm.

5.1.3 Commercial carsharing service

For commercial carsharing services, the service provider arranges insurance cover for members who are covered for their journeys using the service. Generally, the cost of insurance is included in the booking price and does not vary by user. A damage excess waiver is often available to users for an additional cost.

Most commercial carsharing services have age-related restrictions. Zipcar in the UK require members to be 25 or older and Enterprise CarClub have a specific under-22 plan for members aged from 19 to 22.

5.2 Tax

There are several aspects of taxation that are relevant to carsharing in the UK:

- **Vehicle excise duty** – paid annually by owners of vehicles used or parked on public roads.
- **Personal income tax implications** – how much an individual pays in income tax can be connected to private car ownership, for example if a company car is provided.
- **Value added tax** – paid by consumers on goods and service from commercial organisation.

For a user of a carsharing scheme, vehicle excise duty ('car tax') is generally the responsibility of the vehicle owner and this is often put forward as one of the benefits of using carsharing compared to car ownership – avoiding the annual costs of car ownership.

It is worth noting however that some models of private car ownership attract tax benefits in the UK such as company car schemes [72], where carsharing users do not have equivalent benefits. If an employer provides a company car for an employee to use for business and personal journeys, then benefit-in-kind tax is applicable as the employee is benefiting from using the car for personal journeys. The amount of tax payable depends on the vehicle model and employee salary but in some circumstances a company car reduces the overall cost of private car-ownership for individuals. For example, an electric vehicle with a book value of £40,000 and a benefit-in-kind tax rate of 2 % would have a taxable benefit value of £800, which for a 40 % rate taxpayer equates to £320 per year [73].

Government data shows that in the tax year 2022/23 760,000 people received company car benefit-in-kind – down from 960,000 in 2015/16 [74]. A 2012 report identified a decline in company car ownership compared to an increase in private car ownership between 1995 and 2005 [75].

A personal income tax incentive for shared access to transport to be aware of, while not carsharing, is the access to shared e-bike services. In the UK, a subscription to services such as Beryl, Lime, and Forest, can be purchased in conjunction with schemes to reduce an employee's tax burden [76]. Salary sacrifice, where the cost is taken from an employee's salary prior to tax being applied, is the mechanism by which these savings are made. A similar scheme is available for purchasing private electric vehicles through salary sacrifice [77] but no equivalents exist currently for membership or use of a carsharing scheme – highlighting the incentives for owning cars that are not replicated for users of carsharing schemes. Changes to the UK tax system have previously incentivised changes in car ownership, with company car tax adjusted to encourage the uptake of electric vehicles.

For peer-to-peer carsharing services, car owners that generate income from sharing their vehicle in this way may be liable for income tax.

The peer-to-peer carsharing service provider Hiyacar notes that value added tax (VAT) is not charged for their peer-to-peer bookings when the vehicle is owned by a private owner [78] but is charged when the Hiyacar accredited car club scheme is used. The accredited car club scheme is for commercial owners of vehicles rather than private car owners but the Hiyacar platform still provides the interface for booking and managing access to the vehicles [79]. The British Vehicle Rental and Leasing Association (BVRLA) note that peer-to-peer carsharing platforms that do not generate VAT revenue for the treasury produces an 'uncompetitive landscape' for traditional car rental providers (which are represented by BVRLA) [80].

The Vehicle Emissions Trading Schemes [81] indirectly impact carsharing schemes in the UK as additional credits are acquired by a vehicle manufacturer for selling new zero-emission vehicles to car clubs for their exclusive use - this is on top of the credit acquired for selling a new zero-emission vehicle to the public. The Vehicle Emissions Trading Schemes incentivises vehicle manufacturers to increase the percentage of zero-emission vehicles they sell by allocating credits for zero-emission vehicles. These credits are used against each non-zero-emission vehicle that is sold to avoid paying a charge per such vehicle. The additional credits gained from selling new zero-emission vehicles to car clubs should theoretically have a value to vehicle manufacturers that result in lower purchase prices for car clubs.

5.3 Local authorities

The approach that a local authority takes to carsharing has a big impact on the service. A local authority may agree for a carsharing service provider to operate locally under a concession contract without providing any funding [7]. The service provider would generate their income from the customers only. Alternatively, a local authority may provide funding by procuring a specific service for either their own use or for public use, or both [7].

Parking is an area where local authorities have a significant role to play in the success of carsharing locally. This could be by dedicating car parking spaces for carsharing use only in a

station-based operational model, or providing parking permits for carsharing vehicles in a free-floating operational model [20]. As carsharing vehicle fleet and the car fleet generally becomes electrified, electric charging infrastructure is similarly an area where local authorities can play a role [20]. Several carsharing scheme operators have highlighted what they perceive as local authorities using parking permits for carsharing as a revenue generating opportunity [82], [83]. In setting the cost of both residential parking permits and parking permits for carsharing schemes, a local authority has the power to support or even incentivise the use of carsharing schemes locally.

Local authority engagement with carsharing organisations can include having a single operator agreement, having a multi operator agreement, or using a permit-based system where there is no ongoing contract. Where a commercial agreement is in place between a local authority and a service provider, it is recommended in [20] that local authorities 'should consider whether to include accreditation as a requirement for a successful bidder'. CoMoUK run an accreditation scheme for car clubs in the UK. However, as noted above, accreditation currently requires vehicles to beless than five years old which may price some potential users out of the market, given the age profile of the wider car fleet.

Local authorities can support carsharing locally by becoming a corporate member of a car club [17] This provides a base demand for the service from local authority employees. There are also other incentives local authorities can use to encourage carsharing, for example in the London Borough of Camden, a free 2-year car club membership is available for residents who cancel their resident parking permit [84].

5.4 Regulation

The key area of regulation for carsharing in the UK is that of parking regulations, generally specific to each local authority. Dealing with parking tickets is a topic for carsharing services to have a policy on outlining responsibilities and process for handling such tickets, likewise with speeding violations. Guidance on the assignment of parking fines (or Penalty Charge Notices) and actions for local authorities to support carsharing are provided in [85].
Examples of carsharing related regulation or legislation from outside of the UK include Germany with the Car Sharing Act of 2017 [86]. Part of this act allows parking fees to be reduced or removed for carsharing vehicles, whereas previously all road user groups had to be treated equally.

Regulations related to the type of organisation that provides the carsharing will vary. For example there are several different structures that non-commercial carsharing schemes can adopt each with different regulatory requirements [13], such as Community Interest Companies (CIC) which need to report annually to Companies House and the CIC register, and Cooperative Societies which are regulated by the Financial Conduct Authority (FCA) [13]. The profits of a CIC have to be reinvested for the benefit of the community, while the profits of a Cooperative Society can be shared with members. The time and cost of fulfilling the regulatory requirements of different organisational structures are part of a carsharing schemes overheads.

6 Case studies

Case studies are presented below of different carsharing service examples, ranging from an initially promising but ultimately unsuccessful service in Paris, to a long-running profitable service in Switzerland, to a service launched in Lyon that quickly became profitable. Examples of a community car club and a fractional ownership model are also presented.

6.1 Public-private partnership - Autolib', Paris

The Autolib' service was launched in Paris in 2011 [23] following a public tender by the City of Paris through which Bolloré were selected. Paris is noted as a good candidate for carsharing based on the high population density [87] however what was an initially popular service faced significant economic challenges.

Autolib' was initially popular with the number of users growing [87]. However, the number of journeys per user started to decrease. Between 2014 and 2016 the ratio of registered users per car had increased from 22 to 28, while the number of trips per user per week had decreased from 1.4 to 0.8 [23]. The projected timeframe to reach profitability was extended several times but ultimately was never achieved, and the Autolib' service closed in June 2018 [23].

The Autolib' service used just one vehicle type – a small, electric, city car. This vehicle was produced by the Bolloré company that also ran the service, and it was the first vehicle they had produced. Maintenance and repairs were noted as challenging due to the vehicle not being a mass-produced model [88].

The taxonomy from [6] is applied to the Autolib' case in the table below:

Table 4: Autolib' Paris model characteristics.

Dimension	Autolib' Paris
Destination	One-way – can return vehicle to any station.
Minimum duration	Hourly
Vehicle types	Identical or very similar vehicles available
Additional benefits	No additional benefits
Vehicle booking	Instant access and fixed return time
Vehicle access	Automatic
Booking platform	Proprietary
Parking infrastructure	Dedicated carsharing stations
Vehicle ownership	Operator owned
Vehicle maintenance	Maintained by operator
Vehicle refueling	Refueled by driver and paid by owner
Price structure	By duration only
Transaction-based revenues	Not applicable
Continuous revenues	Membership fee from drivers
Organisational ownership	Private company

Paris still has other carsharing services operating which implies either that different operating and business models can be successful in Paris and/or that carsharing continues to attract investment for new services.

6.2 Cooperative carsharing service provider - Mobility Carsharing, Switzerland

Mobility Cooperative was created in 1997 from a merger of two carsharing organisations that both began in 1987 [16]. At the time of writing the most recent annual report (2023) states there were more than 3,000 vehicles available, 1,600 stations and 277,000 customers. The service operates in locations all over Switzerland from cities to villages.

The cooperative operates on a business-to-consumer model and has made a profit in each of the last 5 years - a profit of 1.4 million Swiss francs in 2023 from a turnover of 84.2 million Swiss francs [89].
There are currently three membership options [90]:

- A **monthly subscription** (9.90 Swiss francs approximately £9.10 at time of writing) that gives a reduced rate per hour.
- A **pay as you go service** with the standard rate per hour but no monthly charge.
- A **membership** of the cooperative which has a significant one-off charge (1,250 Swiss francs approximately £1150 at time of writing) that gives access to a reduced rate with no monthly charge.

The core of the service is a roundtrip or station-based service, although other service types have been tried by the cooperative in parallel to this. In 2023, the option of one-way journeys was removed after seven years due to a lack of demand and high operating costs. The free-floating service was discontinued in 2022 [16]. In 2014 it was reported that Mobility operated 1,400 vehicle locations covering 65 % of Swiss municipalities, with 16 % of locations not covering their costs while the overall organisation was in profit. The loss-making locations were maintained as part of the organisation’s social commitment [54].

There is a range of vehicles available through the service from small city cars to vans with electric, hybrid, petrol and diesel vehicles. Rates vary based on the vehicle type being used. The taxonomy from [6] is applied to the Mobility Cooperative case in the table below:

Table 5: Mobility Cooperative Switzerland model characteristics.

Dimension	Mobility Cooperative Switzerland
Destination	Roundtrip – must return vehicle to same station.
Minimum duration	Hourly
Vehicle types	Very different vehicles available – from small city cars to vans
Additional benefits	No additional benefits
Vehicle booking	Reservation and fixed return time
Vehicle access	Automatic
Booking platform	Proprietary
Parking infrastructure	Dedicated carsharing stations
Vehicle ownership	Operator owned
Vehicle maintenance	Maintained by operator
Vehicle refueling	Refueled by driver and paid by owner
Price structure	Combination of duration and distance
Transaction-based revenues	Not applicable
Continuous revenues	Membership fee from drivers
Organisational ownership	Cooperative

6.3 Private carsharing service provider – Leo&Go, Lyon

The Leo&Go service launched in Lyon in 2021 with 300 hybrid and electric vehicles [60]. The service has expanded to more than 400 vehicles with 30,000 registered users. The service achieved profitability (based on earnings before interest and taxes) in 2023 and continues to grow [60]. A corporate white paper produced on Leo&Go identified some lessons learned by the service provider including that some vehicles models were too expensive to repair and maintain [60].

Leo&Go started with a free-floating model before expanding to include other services such as a station-based model for premium vehicles and business-to-business services [60].

There is a range of vehicles available through the service from small city cars to vans with a focus on electric and hybrid vehicles. The cost of using a vehicle depends on the duration, from 1 minute up to 30 days and the type of vehicle. An unlocking fee of 1 EUR is charged for each use and additional kilometre charges are applied if the vehicle is used beyond the included kilometres. Registration is free and there are no ongoing costs, only the cost per each use. Additional protection can be purchased to reduce the excess paid in the event of damage. Accessories such as baby car seats, ski carriers, and winter chains can also be included in the rental. Whilst these wider ‘add-ons’ have not been discussed in the literature, they are clearly important to carsharing being open to multiple users and journey types. Discounts are available for students and recipients of various social welfare benefits.

The taxonomy from [6] is applied to the Leo&Go service in the table below:

Table 6: Leo&Go model characteristics.

Dimension	Leo&Go Lyon
Destination	One-way
Minimum duration	By the minute
Vehicle types	Very different vehicles available – from small city cars to vans
Additional benefits	No additional benefits
Vehicle booking	Instant access and open ended
Vehicle access	Automatic
Booking platform	Proprietary
Parking infrastructure	Street parking
Vehicle ownership	Operator owned
Vehicle maintenance	Maintained by operator
Vehicle refueling	Refueled by driver and paid by owner
Price structure	Combination of duration and distance
Transaction-based revenues	Excess reduction fees
Continuous revenues	Combination of multiple sources
Organisational ownership	Private company

6.4 Peer-to-peer carsharing – Hiyacar, UK

Hiyacar operate a peer-to-peer carsharing platform in the UK bringing together car owners who want to share their vehicles with others (for a fee) and carshare service users who want to use a shared vehicle. Started in 2016, the company has grown in user base and diversified into serving businesses as well as consumers. Hiyacar publicise that more than 175,000 bookings have been made on their platform so far and they are attracting continued investment, most recently in 2024.

The Hiyacar platform enables several different models including:

- Local **closed-loop schemes** where only local members can access the vehicles.
- Company **pool cars shared** between employees within an organisation.
- Public **peer-to-peer carsharing** where owners make their cars available for users of the platform to use.

For renters wanting to use a vehicle on the public peer-to-peer platform, an application fee is payable (£9.49 at time of writing). Renters must be aged between 21 and 75. The duration of a booking can be between 1 hour and 24 hours (or up to 10 days for members with more than 4 years driving experience). The minimum and maximum durations are set by the vehicle owner.

Prices vary by vehicle type, location, and time of day. Prices are set by the owner of the vehicle and are typically between £2 and £8 per hour. In addition to the hourly rates advertised, a user-specific insurance cost makes up the final cost for the booking and this is based on the risk profile of the user.

For owners offering their vehicle on the platform, the vehicle must be less than 15 years old, lower than insurance group 31, current value less than £40,000 and have a maximum of seven seats. On signing-up, owners will have an onboarding call or video guidance from Hiyacar. Owners can set a calendar showing when their car would be available and it is then only visible

to users who wish to book during those times. Hiyacar can provide QuickStart keyless technology which allows users to access vehicles without having to receive a physical key from the owner, which adds convenience for both the owner and user. The technology can be fitted for a one-off installation fee and then a recurring monthly fee.

When a user requests a booking, the owner receives a notification via the Hiyacar app or via text message and they can accept or reject the booking. If the owner has not responded within one hour, then Hiyacar automatically searches for similar vehicles nearby and suggests those to the user who made the original request. Owners are able to list their vehicles as 'instant book', in which case the owner does not have to approve each booking and as long as the vehicle has QuickStart keyless technology, and the booking meets the owners pre-defined criteria, then the booking is instantly approved.

The taxonomy from [6] is applied to Hiyacar as a public peer-to-peer carsharing service in the table below.

Table 7: Hiyacar model characteristics.

Dimension	Hiyacar
Destination	Roundtrip
Minimum duration	Hourly
Vehicle types	Very different vehicles available – from small city cars to people carriers
Additional benefits	
Vehicle booking	Reservation and fixed return time
Vehicle access	Combination
Booking platform	Proprietary
Parking infrastructure	Combination
Vehicle ownership	Private customers
Vehicle maintenance	Maintained by private customer
Vehicle refueling	Refueled and paid by driver
Price structure	By duration only
Transaction-based revenues	
Continuous revenues	Service fee from car owners
Organisational ownership	Private company

6.5 Community car club – Tisbury, UK

The Tisbury Electric Car Club is featured in a case study by CoMoUK [91]. This community car club is part of a European-wide community of car clubs called The Mobility Factory which allows access to a digital platform to manage joining, booking, paying, and accessing the club's vehicles as well as knowledge and shared resources.

This community car club has two electric vehicles and partnered with an electric vehicle charging social enterprise to install two electric vehicle chargers.

Users pay a membership fee to join and are charged by the hour of use or at a day rate. The pricing structure has been adjusted to attract members, after member numbers stagnated at around 30 and subsequently membership rose to 80 members. The case study highlighted that most members were inactive except for occasional trips when they are very grateful to have access to the service. There is also a core group of members who use the service

regularly and rely on it for some of their transport needs, while also volunteering to support the service with tasks as needed. The price for the user is either per hour or per day at either a full rate (£5.50/hour or £30/day), a concession rate, or a rate that is subsidised by a local charity. Broadly speaking the costs are lower than commercial carsharing services in the UK, but depending on user and vehicle numbers, the type and level of service will differ making direct comparisons difficult to interpret.

The CoMoUK case study outlines the upfront costs the club incurred initially, including the cost of joining the wider cooperative community and platform provider, the vehicles and charging infrastructure as well as telematics hardware and branding materials. The annual operational costs include fees for platform use, electricity, insurance (car and liability), maintenance and other costs related to the having volunteers supporting the service.

The insurance was provided by Tradex, through a broker. The terms and conditions set in 2021 stated that members needed to be between 25 and 69, with a full UK driving licence held for more than three years [92].

In 2025, the Tisbury Electric Car Club moved to using the Hiyacar platform as a local closed-loop scheme. Prices are quoted as £3 per hour or £24 for 12 hours, with an additional cost for insurance that depends on the member's risk profile.

The taxonomy from [6] is applied to the Tisbury Electric Car Club in the table below:

Table 8: Tisbury Electric Car Club model characteristics.

Dimension	Tisbury Electric Car Club
Destination	Roundtrip
Minimum duration	Hourly
Vehicle types	Identical or very similar vehicles available – small electric vehicles.
Additional benefits	No additional benefits
Vehicle booking	Reservation and fixed return time
Vehicle access	Automatic
Booking platform	Proprietary
Parking infrastructure	Dedicated carsharing stations
Vehicle ownership	Operator owned
Vehicle maintenance	Maintained by operator
Vehicle refueling	Refueled and paid by owner
Price structure	By duration only
Transaction-based revenues	
Continuous revenues	Membership fee from drivers
Organisational ownership	Cooperative

6.6 Fractional Ownership – Prorata, India

Prorata is a company based in India that enables fractional car ownership by organising groups of people in a 10km radius who all want to own a particular type of car – generally a higher end vehicle. Prorata then charge them each a fraction of the cost of the vehicle, and provide the vehicle as needed along with managing scheduled access, cleaning, maintenance, and insurance.

Co-owners can be between four and twelve individuals who pay a one-off cost that grants them proportional access to the vehicle over a five-year period. A 1/12 fraction, for example, would give a co-owner 30 days of access to the vehicle per year which they book using a scheduling app, and the vehicle is delivered to their home by Prorata [14]. Example users proposed by the company include urban professionals visiting their hometowns, expats who are returning to India once or twice a year, and off-road or sports car enthusiasts. Whilst this model is currently largely targeted at the luxury market, it offers a different route to shared access than the models typically in play across Europe.

The taxonomy from [6] is applied to Prorata in the table below:

Table 9: Prorata model characteristics.

Dimension	Prorata
Destination	Roundtrip
Minimum duration	Daily
Vehicle types	One vehicle available – selected by the factional owners
Additional benefits	
Vehicle booking	Reservation and fixed return time
Vehicle access	Manual key handover
Booking platform	Proprietary
Parking infrastructure	Private homes
Vehicle ownership	Private customers
Vehicle maintenance	Maintained by operator
Vehicle refueling	Refueled and paid by driver
Price structure	By duration only – fixed per year
Transaction-based revenues	
Continuous revenues	Combination of multiple sources
Organisational ownership	Private company

7 Wider shared ownership and access examples

The shared economy concept encompasses a wide variety of assets, business and operational models. A summary of the more relevant aspects of the shared economy landscape is provided below, focusing initially on different transport related shared access before concluding with non-transport shared access that may have relevant models, challenges, benefits, and lessons that could be investigated for shared access to cars.

7.1 Shared access to transport

Shared access in transport is a broad topic covering many decades, the following subsections explore a few examples of different transport modes and some of the shared access and shared ownership models that have developed in these modes.

7.1.1 Micromobility

Micromobility encompasses e-scooters, e-bikes and bicycles amongst other vehicle types. Shared access to e-bikes is common across many UK cities. Similar to carsharing, shared e-bike services can operate on a station-based or free-floating model, there is also a middle ground of preferred parking zones that are designated locations but are not *required* to be used [93]. Some shared e-bike services can be used in conjunction with existing salary sacrifice schemes such as the 'cycle to work' scheme to reduce an employee's tax burden [76]. Payment and unlocking are through phone-based apps with a range of pay as you go, bundles of minutes and season ticket options.

7.1.2 Aircraft

The cost of an aircraft means that to fly for leisure or travel privately, shared ownership is often a more attractive option than sole ownership. Most shared ownership arrangements are based on 800 annual hours of use with 1/16 shares generally the smallest fractional unit. Fixed costs such as regular maintenance and hangar fees are usually shared proportional to the share owned. Operational costs related to actual flights include fuel, and airfield fees would be paid by the shareholder when they access the aircraft [94].

Shared ownership models are used for both private pilot licence holders who want to fly for leisure and also used for access to private jets purely for travel purposes, in which case a pilot and crew has to be factored in to the costs [95]. Agreeing a system for booking access to the aircraft is one challenge to shared ownership, particularly for private pilots for whom weekends and summer days are more popular than other times [96].

To further reduce the cost of flying for leisure, flight-sharing is possible [97] where a private pilot advertises their flight for passengers to join them and share the cost of the flight as is done with car ridesharing. No profit can be made from this otherwise it would become a commercial flight with very different implications.

7.1.3 Boats

With boats being high-value assets, a range of shared ownership and shared access models have developed for individuals to use boats primarily for leisure. Some of the models are outlined in [98] include a private syndicate, a managed syndicate, charter lease-back, boat clubs, chartering, and peer-to-peer boat sharing. A *private syndicate* is a fractional ownership model managed by the owners themselves, a *managed syndicate* is similar, but management is by a company who charge a regular fee. *Charter lease-back* involves one organisation who sell a boat to an individual and then lease it back from them to use as part of a charter fleet, with the owner getting pre-defined access rights but also an income stream from the leasing arrangement. A *boat* or *yacht club* allows members to access boats for a membership fee, but training and events are available to members. *Chartering* gives time-limited access to a boat chosen by the customer from a charter company's fleet, with no ongoing commitment. Chartering is similar to traditional car rental. *Peer-to-peer boat sharing* platforms have developed in recent years, with a platform in Finland studied in [99].

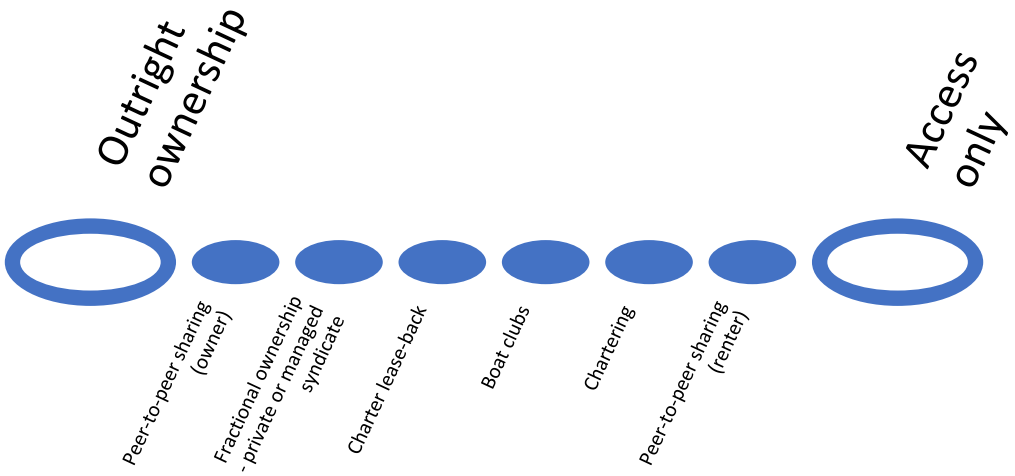

Figure 1: Visual representation of the range of boat ownership and access options, based on [98].

7.1.4 Motorhomes

Motorhomes, also known as campervans or recreational vehicles, combine transport and accommodation for leisure travel. As with aircraft and boats, the cost of a motorhome can be significant and so fractional ownership is a model that is used [100] to reduce the cost of ownership and access for users. The access is managed by a schedule dictated by the terms of the ownership contract.

7.2 Shared access to transport enabling infrastructure

Electric vehicle charging infrastructure is an evolving landscape as more electric vehicles are on the road. The cost of installing a charger can be offset by sharing access to the charger with other electric vehicle users. Shared access models like this in the UK include CoCharger [101] and Joosup [102]. Both organisations provide a platform to allow charging infrastructure owners to allow access to charging infrastructure users for a fee. CoCharger specifically focuses on 'base charging', so users are linked with charger owners near their home to reduce

the complexity of managing charger supply and demand. Joosup supports booking charging infrastructure wherever it is available on the system. Both organisations charge the owner of the chargers for making their location available on the service either as a subscription or a percentage of the fee charged to the user.

As mentioned earlier in this document, parking is a key component of carsharing services. Parking space is an example of shared access to transport enabling infrastructure but also shared access to space. Shared access to space and other non-transport assets is explored in the following section.

7.3 Non-transport assets

The sharing economy can also be found outside of the transport domain. These examples may provide inspiration for further variants in sharing access to cars.

7.3.1 Shared space

The sharing of space encompasses many different models and types of space and has a long history. Examples of spaces that are often shared as part of the sharing economy include office space, commercial space, and parking space [103].

The shared economy is a well-established concept in the tourism sector with access to holiday properties being shared for many decades. A continuum of holiday property ownership is presented in [104] ranging from traditional nightly rental where there is no ownership, to vacation ownership products and ultimately to whole home ownership by an individual. This is illustrated in the figure below.

One model for shared access to holiday properties is timeshare where individuals pay for the right to use the timeshare property for a particular week or weeks every year. Crucially, in the right-to-use model the individuals do not own any part of the property – it is access, not ownership. Timesharing has evolved from the fixed week model to give more flexibility and now includes floating options such as a week-float where the specific property or unit within a larger property was fixed but the week of use changed per year. Alternatively, a unit-float model is also possible where the week remains fixed but the exact property or unit changes.

Without the complication of ownership or an ongoing commitment, holiday property rental is a common model for shared access. Traditionally business have provided holiday properties to rent but digital platforms such as Airbnb have been disrupting the sector recently, allowing individuals to rent to other individuals through their platform. This is similar to the platform-mediated peer-to-peer model for carsharing.

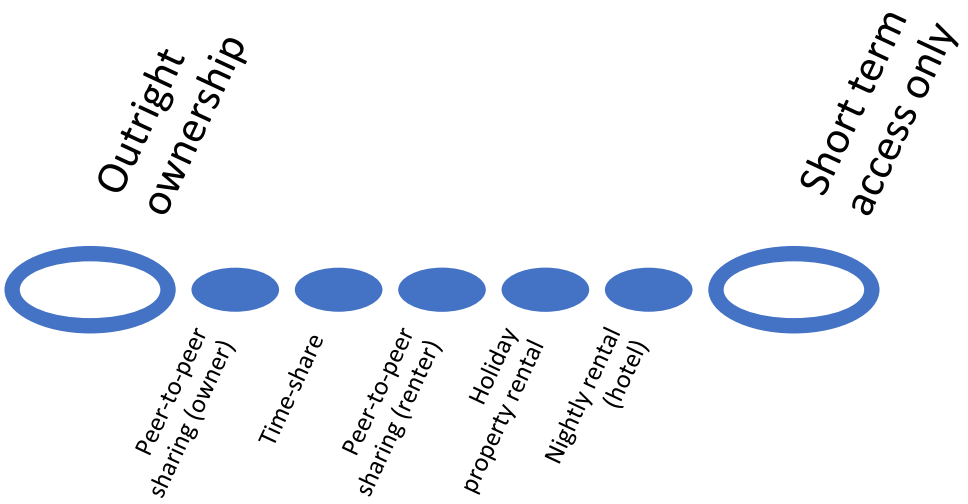

Figure 2: Visual representation of the range of holiday property ownership and access options, based on [104].

7.3.2 Shared items

Shared economy concepts are also being explored for assets that are infrequently used such as power tools [103], household appliances, and garden equipment [105]. This type of sharing is often termed a 'library of things'. Four archetypes for library of things are described in [106] as:

- **Public-to-citizen** – modelled on conventional libraries as publicly funded with paid staff.
- **Community-drive free** – volunteer- or member-run with donated items and space.
- **Community-driven paid** – members pay for the service, but funding is also drawn from a diverse set of sources.
- **Scaling paid** – members pay for service with paid staff and external funding used to start service. An example is the Library of Things Ltd, which is a UK company [107].

These library of things schemes often incorporate skills and knowledge-sharing alongside the physical assets being shared. It is noted in [106] that the inventory of items is often sourced at a discount from suppliers as a promotional opportunity for the supplier but there is sometimes a tension for the library of things organisation between the reduction in their costs and the conflict with their objectives to reduce consumption.

8 Conclusion

Carsharing is a concept that has been around in some form for many decades; however, interest has increased in the last two decades due to the combination of digital technologies to manage carsharing services, changing attitudes to car ownership, and a renewed interest in reducing the environmental impact of transport.

Using desk-based research, a variety of carsharing business models have been identified that are both for-profit and not-for-profit. The success of carsharing schemes to date has been found to depend on a range of factors. The nature of the scheme and the motivation for establishing it matter. Use is also influenced by factors in the local context such as existing transport infrastructure and service levels as well as factors related to the local population, social norms, convenience, cost and the perceptions of carsharing and private car ownership.

Our relationship with car ownership and sharing cars is both very personal and shaped by the way in which ownership and access are normalised in daily life. The suitability of different options also varies with lifestyle constraints such as caring responsibilities or the need to transport large items regularly. In addition, personal characteristics such as mobility impairments, comfort with accessing goods via apps all matter. These issues are explored further in a companion document where a set of detailed user personas and stories drawn from focus group participants are discussed. By paying attention to what people value and how to meet their practical needs there remains scope for growth and evolution of different carsharing models. The user stories together with this literature review that brings together key research topics such as factors affecting carsharing with examples of shared ownership and access in other parts of the sharing economy, provide a foundation for designing new carsharing services and exploring their potential as part of a wider transport system transition,

Sharing access to cars can have many benefits such as reducing transport costs for users, reducing the space taken up by parked cars, and environmental benefits. All of these things offer public value and yet there is little visible evidence to communities that there is a benefit from participating. Indeed, the system of taxation, insurance and regulation were built up around the notion of owning a car as the default. As such, sharing access to a car is made more difficult or, in some respects, more expensive than owning. If sharing access to cars were to be a normal part of everyday life, and at least as normal as car ownership, then these barriers would be designed out and the public value of car sharing recognised and reinforced. There is both the scope to reimagine the role of the car in future transport systems and a need to do so.

9 Glossary

Term	Definition
Carsharing business models	
Business-to-consumer	A carsharing model where a business owns the vehicle fleet, and individuals access the vehicles for a fee, subscription or combined pricing model.
Business-to-business	A carsharing business model where a business pays for access to a vehicle fleet usually for their employees to use for business purposes.
Peer-to-peer carsharing	A model for private car owners to make their vehicles available for users to access them for defined periods. This is usually mediated by a digital platform that changes a fee for that service.
Carsharing operating model components	
Station-based	An operational model for carsharing where vehicles are picked up and returned from specific locations such as designated parking spaces.
Free-floating	An operational model for carsharing where vehicles are picked up and returned from a wide area rather than designated parking spaces.
Hybrid	An operational model for carsharing that combines the station-based and free-floating models, with designated parking spaces in some operating areas and wide areas in other operating areas.
Round-trip carsharing	An operational model for carsharing where the user must pick-up and return the vehicle to the same location.
One-way carsharing	An operational model for carsharing where the user can return the vehicle to a location that is different to the pick-up location.
Carsharing decision-making layers	
Strategic decisions	Long-term decisions such as the number and location of carsharing stations in a service.
Tactical decisions	Medium-term decision such as how many vehicles to have in the fleet.
Operational decisions	Short-term decisions such as when and where to move vehicles to satisfy hourly changes in demand.

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