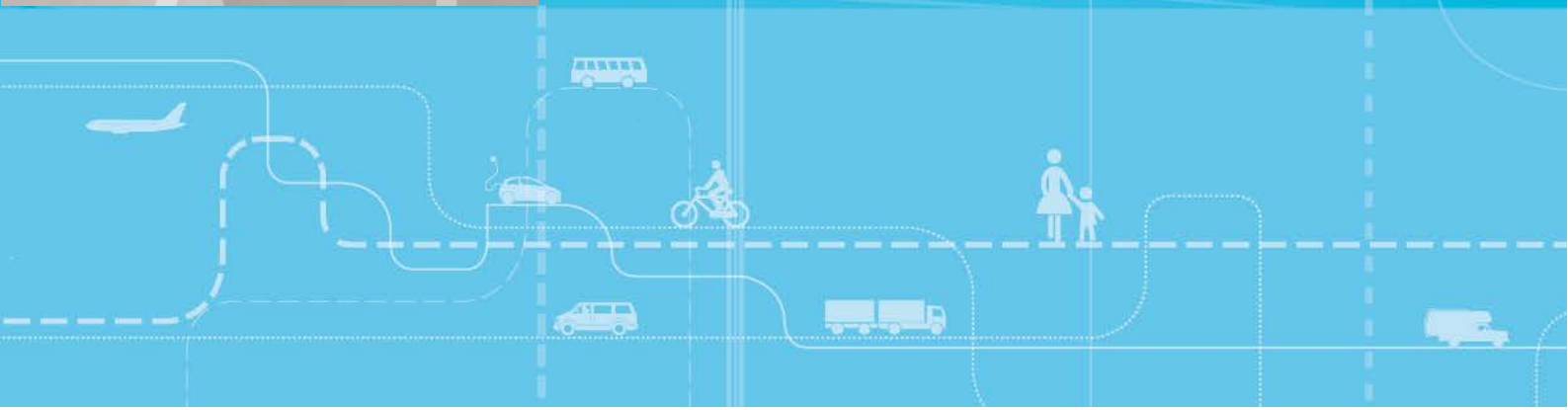


The development of organised car sharing in Norway: 1995-2018



The development of organised car sharing in Norway: 1995-2018

Historical trends and potential impacts

George Cyriac

Tom Erik Julsrud

Forsidebilde: Shutterstock

Transportøkonomisk institutt (TØI) har opphavsrett til hele rapporten og dens enkelte deler. Innholdet kan brukes som underlagsmateriale. Når rapporten siteres eller omtales, skal TØI oppgis som kilde med navn og rapportnummer. Rapporten kan ikke endres. Ved eventuell annen bruk må forhåndssamtykke fra TØI innhentes. For øvrig gjelder [åndsverklovens](#) bestemmelser.

ISSN 0808-1190 Paper

ISSN 2535-5104 Electronic

ISBN 978-82-480-2207-7 Paper

ISBN 978-82-480-2184-1 Electronic

Oslo, December 2018

Tittel: Utviklingen av organisert bildeling i Norge: 1995-2018

Title: The development of organised car sharing in Norway: 1995-2018

Forfattere: Cyriac George
Tom Erik Julsrud

Dato: 12.2018

TØI-rapport: 1663/2018

Sider: 29

ISSN papir: 0808-1190

ISSN elektronisk: 2535-5104

ISBN papir: 978-82-480-2207-7

ISBN elektronisk: 978-82-480-2184-1

Finansieringskilder: Forskningsrådet
Nordisk energiforskning

Authors: Cyriac George
Tom Erik Julsrud

Date: 12.2018

TØI Report: 1663/2018

Pages: 29

ISSN Paper: 0808-1190

ISSN Electronic: 2535-5104

ISBN Paper: 978-82-480-2207-7

ISBN Electronic: 978-82-480-2184-1

Financed by: Research Council of Norway
Nordic Energy Research

Prosjekt: 4307 – TEMPEST

Prosjektleder: Tom Erik Julsrud

Kvalitetsansvarlig: Ove Langeland

Fagfelt: Reisevaner og mobilitet

Emneord: Bildeling
Bytransport
Delingsmobilitet
Organisasjonsmodeller
Teknologi

Project: 4307 – TEMPEST

Project Manager: Tom Erik Julsrud

Quality Manager: Ove Langeland

Research Area: Travel Behaviour and Mobility

Keyword(s): Car sharing
Organizational models
Shared mobility
Technology
Urban mobility

Sammendrag:

Bildeling er en fremvoksende teknologisk og organisatorisk innovasjon som antas å kunne bidra til omstilling til et mer bærekraftig mobilitetssystem. De fleste empiriske studier viser at bildelingsordninger har en netto positiv innvirkning på miljøet. Denne rapporten beskriver historien om bildeling i Norge gjennom fire perioder der vi ser på forretningsmodeller, operasjonsmodeller og brukerprofiler for ulike formene for bildeling. Den raske økningen i bruken av bildeling og antall forretningsmodeller i Norge tyder på at det er et marked grunnlag for dette og at nye aktører trolig vil søke å etablere seg fremover. Vi kan forventet at markedet vil fortsette å være i endring. Antallet elektriske kjøretøy er i rask vekst, og det er behov for mer forskning om miljøbelastning knyttet til bruk av el-bildeling.

Summary:

Car sharing is an emerging innovation that may contribute to a transition to a more sustainable mobility system. Most research shows that car sharing programs have a net positive impact on the environment. This report describes the history of car sharing in Norway over the course of four periods that characterize the business models, operational models and user profiles of the various platforms. The rapid increase in the use of car sharing and number of platforms in Norway suggests that the market has proven itself as being viable and that we are entering a period of competition and further change. As the popularity of electric vehicles increases, more research is needed on the non-carbon environmental impacts of car sharing.

Language of report: English

*Transportøkonomisk Institutt
Gaustadalleen 21, 0349 Oslo
Telefon 22 57 38 00 - www.toi.no*

*Institute of Transport Economics
Gaustadalleen 21, N-0349 Oslo, Norway
Telephone +47 22 57 38 00 - www.toi.no*

Preface

This report has been written as part of two projects: (1) Transforming household mobility practices through shared consumption: Low-carbon transport and sustainable energy solutions in urban areas (TEMPEST); and (2) Sustainable Horizons in Future Transport (SHIFT). The Institute of Transport Economics (TØI) is the project leader of the TEMPEST project, which is funded by the Research Council of Norway through the Large-scale programme for energy research (ENERGIX). The SHIFT project is funded by Nordic Energy Research.

The report provides an introduction to the Norwegian car sharing sector, which has undergone significant growth over the last two decades. It is a follow-up to a prior TØI report entitled “Innovative collective mobility solutions – carsharing as a case” (TØI report 1218/2012), published in 2012.

Oslo, December 2018

Institute of Transport Economics

Gunnar Lindberg
Managing Director

Silvia J. Olsen
Research Director

Content

Summary

Sammendrag

1	Introduction	1
1.1	What is car sharing?	1
1.2	Types of car sharing	3
2	History of car sharing	6
2.1	Origins.....	6
2.2	Car sharing in Norway.....	8
3	Users.....	14
3.1	General characteristics of car sharing users.....	14
3.2	Demography.....	15
3.3	Patterns of use	16
3.4	Car ownership and history	17
4	Impacts.....	18
4.1	Indicators.....	18
4.2	Net VKT and induced demand.....	18
4.3	Reduced vehicle holdings.....	19
4.4	Broader studies on the impact of car sharing.....	20
5	Discussion and Conclusion	23
5.1	New players.....	23
5.2	Incentives and promotion.....	23
5.3	Decoupling car sharing and carbon impact.....	24
5.4	Further Research	25
6	References	26

Summary

The development of organised car sharing in Norway: 1995-2018

TØI Report 1663/2019

Authors: Cyriac George and Tom Erik Julsrud

Oslo 2018 29 pages Language: English

Car sharing is an emerging innovation that may contribute to a transition to a more sustainable mobility system. As it is used in this report, car sharing refers to the practice whereby registered members of an organization or platform can rent and operate vehicles on a self-access basis for short- and medium-term use. Although it does not represent a radically new technology, car sharing challenges the foundations of the current mobility system, which is, to a large extent, dominated by private ownership of vehicles. There is increased recognition that a mobility system based on privately owned fossil fuel driven cars is unsustainable. There is, furthermore, evidence showing that by providing access to cars without necessitating ownership, car sharing can reduce the number of vehicles on the road as well as the total amount of driving among users. In recent years, car sharing has undergone significant growth in Norway, both in terms of usage and number of platforms available. Although the market has matured, car sharing in Norway still needs support and/or time to become a mainstream part of the mobility system.

This report examines car sharing in terms of conceptualization, its historical development in Norway, user profile, environmental impact and research frontiers. In order to differentiate types of car sharing, scholars have used a variety of criteria, focusing mostly on business model and operational model. Business models can be differentiated based on organizational form, the three most prominent of which are for-profit, non-profit and cooperative. A more common business model typology focuses on the relationship between the service provider and customer, yielding categories such as business-to-consumer (B2C), business-to-business (B2B) and peer-to-peer (P2P) car sharing. The most common way to classify car sharing platforms is according to how it is used, or operational model; the most cited of such models are roundtrip (station-based), one-way (free floating, or point-to-point), and fractional ownership.

The history of car sharing in Norway can be broken up into four periods that characterize the business models, operational models and user profiles of the various platforms. During the first period, which lasted from 1995 to about 2004, local member-based car sharing cooperatives were established in Oslo, Bergen and Trondheim, inspired in large part, by the Swiss and German cooperatives that preceded them by at least a decade. The second period, which lasted from about 2004 to 2014, was characterized by the entry of corporate platforms both in terms of the service provider and the primary intended customer(s). The third period, which began in 2015 and is still underway, is marked by the rise of P2P platforms and the expansion of geographic coverage beyond the largest metropolitan areas.

In the most recent period, which is currently in its inception, there has been a blurring of the boundaries that distinguished the preceding periods as well as the different types of car sharing available in Norway. Most importantly, platforms have adopted hybrid business models that incorporate aspects of the P2P, B2B, B2C and cooperative models. There are also signs that car sharing may increasingly be linked with residential organizations, harkening back to the residential cooperative roots of world's first formal car sharing organizations in Switzerland and Germany. Additionally, the first free floating car sharing scheme in Norway was launched in late 2018.

Most research shows that car sharing programs have a net positive impact on the environment. The first reason is because car sharing tends to lead to a reduction in vehicle holdings, both at a household and corporate level. The second reason is that car sharing leads to a reduction in the total kilometers driven. Although many users who begin car sharing without having previously had access to a car experience an increase in driving, this is more than offset by larger reductions by other users who did have access to a private vehicle prior to using car sharing. This induced demand is also significantly smaller than the amount that the users' presumably would have driven had they owned a private vehicle.

As the popularity of electric vehicles increases, more research is needed on the non-carbon environmental impacts of car sharing, especially as it relates to particulate matter (i.e. local pollution). Further research is also needed concerning the broader impacts of car sharing with respect to land use. The rapid increase in the use of car sharing and number of platforms in Norway suggests that the market has proven itself as being viable and a worthy risk for a variety of enterprises. Furthermore, it is expected that the market is in a period of competition and flux, the results of which can be (1) growth and mainstreaming of car sharing or (2) consolidation of providers whereby some platforms exit the market.

Sammendrag

Utviklingen av organisert bildeling i Norge: 1995-2018

TØI rapport 1663/2019
Forfattere: Cyriac George og Tom Erik Julsrud
Oslo 2018 29 sider

Bildeling er en fremvoksende teknologisk og organisatorisk innovasjon som antas å kunne kan bidra til omstilling til et mer bærekraftig mobilitetsystem. Slik begrepet brukes i denne rapporten, viser det til en praksis der registrerte medlemmer av en organisasjon eller et nettsamfunn kan benytte biler på selvbetjent basis for kort og mellomlang bruk. Selv om det ikke representerer en radikalt ny innovasjon, utfordrer bildeling grunnlaget for dagens mobilitetsystem, som i stor grad domineres av privatbiler. Det er i stor grad enighet om at et mobilitetsystem basert på privatbiler som bruker fossilt drivstoff ikke er bærekraftig. Samtidig er det gjennom empiriske studier vist at bildeling kan redusere antall kjøretøy på veien, samt den total kjørelengden. I løpet av de siste årene har bildeling i Norge hatt en betydelig vekst både når det gjelder omfang og antall plattformer i landet. Selv om markedet har vokst, trenger fortsatt bildeling i Norge tid eller støtte for å bli en vesentlig del av mobilitetsystemet.

Denne rapporten beskriver bildeling med tanke på konseptualisering, historisk utvikling i Norge, brukerprofil, miljøpåvirkninger og forskningsmuligheter. For å skille mellom forskjellige typer bildeling blir det i hovedsak benyttet kriterier som fokuserer på forretningsmodeller og/eller driftsmodeller. En inndeling basert på forretningsmodeller brukes for å skille mellom tre sentrale organisasjonsformer; profit, non-profit og kooperativ. En mer vanlig typologi fokuserer på forholdet mellom tjenesteleverandører og kunder, med kategoriene: business-to-consumer (B2C), business-to-business (B2B) and peer-to-peer (P2P). Den vanligste måten å klassifisere bildelingsplattformer gjøres imidlertid med utgangspunkt i driftsmodell, det vil si hvordan dette brukes. Den mest vanlige klassifiseringen her er stasjonsbasert (station-based), ènveis (free floating eller point-to-point), P2P, og delt eierskap (fractional ownership).

Bildeling i Norge kan inndeles i fire utviklingsperioder der vi ser på forretningsmodeller, operasjonsmodeller og brukerprofiler for ulike formene for bildeling. I løpet av den første perioden, som varte fra 1995 til 2004, ble det etablert lokale medlemsbaserte bildelingskooperativer i Oslo, Bergen og Trondheim, i stor grad inspirert av de sveitsiske og tyske kooperativene som hadde vokst frem om lag 10 år tidligere. Den andre perioden, som varte fra 2004 til 2014, var preget av fremvekst av nye forretningsmodeller og internasjonale aktører i markedet, både når det gjelder tjenesteleverandøren og den primære kunden. Den tredje perioden, som startet i 2015 og fortsatt er under utvikling, er preget av rask fremvekst av P2P-tjenester og utvidelsen av bildelingens geografisk nedslagsfelt.

I den inneværende perioden har grensene mellom de ulike typene bildeling blitt mer uklare og flere nye former har blitt introdusert. Et viktig trekk er utvikling av hybride

forretningsmodeller som inneholder kombinasjoner av P2P, B2B, B2C og kooperative former. Det er også indikasjoner på at bildeling i økende grad integreres med boligutvikling, slik det har blitt gjort blant boligkooperativene i Sveits og Tyskland. I tillegg ble den første énveis bildelingsordningen i Norge lansert på slutten av 2018.

De fleste empiriske studier viser at bildelingsordninger har en netto positiv innvirkning på miljøet. En viktig årsak er at bildeling fører til en reduksjon i antallet kjøretøy, både på husstand og bedriftsnivå. En annen årsak er at bildeling som oftest fører til en reduksjon i det totale antall kjørte kilometer. Selv om mange av de som ikke hadde tilgang til bil før de startet med bildeling kjører mer enn før, blir dette mer enn oppveiet av reduksjoner i kjøring blant brukere som hadde tilgang til et privat kjøretøy før de tok i bruk bildeling. Bruken av bil blant dem som tidligere ikke var bileiere er også betydelig mindre enn det den ville ha vært dersom de hadde kjøpt en bil.

Antallet elektriske kjøretøy er i rask vekst, og det er behov for mer forskning om miljøbelastning knyttet til bruk av el-bildeling, særlig når det gjelder svevestøv (dvs. lokal forurensning). Det er også behov for videre forskning om langsiktige konsekvenser av bildeling med hensyn til arealbruk. Den raske økningen i bruken av bildeling og antall forretningsmodeller i Norge tyder på at det er et markedsgrunnlag for dette og at nye aktører trolig vil søke å etablere seg fremover. Vi kan forventet at markedet vil fortsette å være i endring, og det er grunn til å tro at en vil se fortsatt vekst og «mainstreaming» av bildeling, men også en konsolidering av leverandører der enkelte plattformer forlater markedet.

1 Introduction

Car sharing is an emerging innovation that may contribute to a transition to a more sustainable mobility system. Although it does not represent a radically new technology, car sharing challenges the foundations of the current mobility system, which is, to a large extent, dominated by private ownership. There is increased recognition that a mobility system based on privately owned fossil fuel driven cars is unsustainable (Kemp, Geels & Dudley, 2012, p. 8; Schippl, et al., 2016; Hodson, Geels & McMeekin, 2017). There is evidence showing that by providing access to cars without necessitating ownership, car sharing can reduce the number of vehicles on the road as well as the total amount of driving among users.

This report reviews the academic literature on the emergence, conceptualization, environmental impact and market for organized car sharing services with a focus on the Norwegian national context. It is a follow-up to the 2012 Report from the Institute of Transport Economics (TØI) (1218/2012) entitled “Innovative collective mobility solutions – carsharing as a case”. Since 2012, the Norwegian car sharing market has undergone significant changes, many of which will be discussed in this report.

Car sharing in Norway emerged in the mid-1990s and was largely inspired by similar endeavors in Switzerland and Germany that preceded the Norwegian counterparts by at least a decade. Since then, the sector has grown to include nearly a dozen car sharing platforms that represent a broad range of business models and growth strategies. The vast majority of these organizations are either available in or focused on the Oslo metropolitan area, making it home to the lion’s share of car sharing activity in the country across platforms.

The development of car sharing in Norway is divided in this report into four general periods: (1) the emergence of car sharing and the prevalence of the cooperative model; (2) the entry of corporate and international players into the market; (3) the rise of peer-to-peer (P2P) organizations and expansion beyond the large metros; and (4) hybrid service provision and the blurring of boundaries. These periods are not exclusively bounded from one another – when new types of car sharing emerge, they do not necessarily supplant already existing ones. Furthermore, as is evidenced in the fourth and current period, there is a significant amount of overlap among some of the platforms in terms of service provision and business model.

The report then provides a general review of the literature concerning the impacts of car sharing on the environment, as measured by vehicles holdings, vehicle kilometers travelled (VMT) and greenhouse gas (GHG) emissions. Although not consistent across geographic areas, car sharing is generally shown to lead to reductions in all three measures. The report concludes with a section on the relationship between car sharing and the broader mobility system and implications for the future.

1.1 What is car sharing?

Considering that private vehicles stand idle for 95 percent of the time, car sharing has the potential to increase the overall efficiency of automobile use (Frenken & Schor, 2017).

“The principle of carsharing is simple: individuals gain the benefits of private cars without the costs and responsibilities of ownership.” (Shaheen, Sperling & Wagner, 1998, p. 35). Definitions, however, are more difficult to arrive at than such principles. Private access without the costs and responsibilities of ownership can be used to describe many forms of automobile use, such as car sharing, carpooling, ridesharing, ride sourcing and car clubs. These terms are not mutually exclusive, and in some instances, they mean the same thing depending on one’s geographic context.

Sometimes, researchers use broad language, as when Frenken (2013, p. 9) defines car sharing as “a system that allows people to rent locally available cars at any time and for any duration”. Others prefer more specific criteria – when describing car sharing in North America in the 1990s and early 2000s, Millard-Ball, et al. (2005, p 2-1) provided the following list of characteristics:

- “An organized group of participants
- One or more shared vehicles
- A decentralized network of parking locations (“pods”) stationed close to homes, workplaces and/or transit stations
- Usage booked in advance
- Rentals for short time periods (increments of one hour or less)
- Self-accessing vehicles”

The authors follow this up by citing the State of Washington’s definition of car sharing as being the most concise and comprehensive:

“A membership program intended to offer an alternative to car ownership under which persons or entities that become members are permitted to use vehicles from a fleet on an hourly basis.” (Washington State Legislature, 2005)

Over time though, such definitions may seem dated. For example, recent technological advances, particularly those related to smartphones with broadband connectivity, have enabled the rise of P2P and free-floating car sharing services have called into question what is meant by terms such as station and fleet. Furthermore, framing car sharing as an alternative to ownership emphasizes the extent to which private vehicle ownership is the default mobility option for potential car users. It is worthwhile, however, to consider car sharing in relation to not just vehicle ownership, but all other possible modes of transportation, i.e. walking, biking and public transit.

There are indeed several ways to access a vehicle without owning one, and they, along with car sharing, are part of a growing trend in consumer behavior commonly referred to as the sharing economy. It is important to distinguish car sharing from other new forms of mobility that can be considered part of the sharing economy. Most notably, car sharing is not to be confused with ride sharing or carpooling, whereby additional passengers are added to a pre-existing trip on a non-commercial basis (Harms & Truffer, 1998, p. 9), and ride sourcing services, which “connect passengers with drivers who use personal, noncommercial, vehicles” (Parzen et al., 2015, p. 5-8). The key distinction between car sharing and these other forms of automobile ‘access without ownership’ is that in the case of the former, the vehicle is operated by the user.

A further source of confusion is that in the UK, car sharing, as it is referred to in this report, is known as car clubs, whereas the term car sharing is used to describe ride sharing, carpooling and ride sourcing (Millard-Ball, et al. 2005, p 2-1; Shaheen, Chan & Micheaux, 2015).

Although car sharing is a form of car renting, it is distinct from traditional rental services in terms of duration of use, pricing and mode of access (Millard-Ball, et al. 2005, p 2-16).

Traditional car rental services typically provide cars on a daily basis, whereas car sharing services offer hourly access in addition to longer periods. Car sharing services typically bundle the cost of fuel, toll and insurance into the cost of use, which is determined by duration of use as well as distance traveled. “Carsharing fundamentally changes the cost structure of driving from a fixed cost to a variable cost” (Shaheen, Chan, Bansal & Cohen 2015). Furthermore, car sharing services require membership, which involves prior screening of users’ driving record or confirmation of identity for liability purposes. This allows for self-access of vehicles, which is to say, the ability to order and pick up a vehicle without needing to interact with staff from the service provider.

The literature on car sharing focuses on formal or organized car sharing as opposed to informal or private car sharing. “The distinctive criterion is whether a central service structure exists that co-ordinates the activities of multiple users of a car and whether any legal form of association exists that own the cars. In private car sharing, it is usual for one person to hold legal ownership rights to the car, and access to the car is organized in an informal way” (Truffer, 2003, p. 154). Informal car sharing can be as simple as lending one’s own car to a family member or friend and has existed for as long as automobiles have existed. Car sharing in the formal sense is a more recent phenomenon that has been buoyed by advances in information and communication technology (ICT), most notably smartphones and GPS systems (Shaheen, Chan & Micheaux, 2015, p. 520; Firnkorn & Muller, 2011, p. 1526).

In conclusion, this report defines car sharing as a practice whereby registered members of an organization or platform can rent and operate vehicles on a self-access basis for short- and medium-term use.

1.2 Types of car sharing

In order to differentiate types of car sharing, scholars have used a variety of criteria, focusing mostly on business model and operational model.

Millard-Ball et al. (2005) identified three main **organizational forms** that car sharing service providers can have: for-profit, non-profit, and cooperative. Then and now, the largest operators in the world are for-profit companies such as Zipcar and Car2go. These for-profit companies have access to venture capital and the greatest incentive to expand, but non-profit service providers often have better access to funding from governments and foundations (2005, p. 2-10). Furthermore, given that non-profit organizations have founding missions that are not driven by profit maximization, they may engender more trust from public actors and institutions and be better placed to achieve environmental targets such as vehicle trip reductions (Brook, 2004). The boundaries between these categories are somewhat fluid. In Oslo, for example, the most established car sharing service provider, Bilkollektivet, is both a member-owned cooperative as well as a non-profit organization.

Another way to differentiate business models would be to focus on the relationship between the service provider and customer. The most common categories used are business-to-consumer (B2C), business-to-business (B2B) and peer-to-peer (P2P) car sharing. The advantage of this typology is that it takes into consideration technological advances that have introduced newer forms of car sharing, namely P2P. In theory, it is also possible to have a P2B model whereby individuals make their privately owned vehicles available to institutional users, but there are no signs of such services taking off in Norway. Furthermore, it is worth noting that these categories are not mutually exclusive. Several firms in Norway offer a mix of B2C, B2B and services.

A more common way to classify car sharing platforms is according to how the vehicles are used. Martin and Shaheen (2016) identify four **operational models** of formal car sharing services – roundtrip, one-way, peer-to-peer (P2P), and fractional ownership. *Roundtrip* services, also known as station-based services, require users to pick up and drop off cars at the same location. They were the earliest of the four varieties and the one for which we have the greatest amount of empirical research. Roundtrip car sharing services tend to be located in mixed-use, residential urban neighborhoods (Shaheen & Cohen, 2013, p. 14).

With *one-way* services, generally known as a “free-floating” car sharing, users can pick up and deliver vehicles at any legal parking spot within a predetermined geographic territory, often a densely populated residential or commercial area. Early attempts at one-way services, like Procotip in Montpelier, France, and Witkar in Amsterdam, were plagued by technical and operational problems – the technology required to support such services simply did not exist at the time. ICT advances, most notably smartphones and GPS systems, made it much easier to access vehicles that do not have a fixed location (Shaheen, Chan & Micheaux, 2015, p. 520; Firnkorn & Muller, 2011, p. 1526). Nevertheless, maintaining geographic balance between demand and supply of vehicles remains a challenge. Although most one-way services in the world operate with a free floating fleet of vehicles, as Shaheen, Chan & Micheaux (2015, p. 525) point out, one way services can also be from station to station.

The same technological innovations that paved the way for one-way car sharing also allowed for P2P car sharing. The emergence of P2P car sharing has complicated matters by providing criteria for organizational as well as operational differentiation.

P2P service models can be divided into three sub-categories: (1) hybrid P2P-traditional car sharing; (2) “traditional” P2P car sharing; and (3) P2P marketplace (Stocker & Shaheen, 2017, p. 10). In the hybrid model, a car sharing organization supplements its own fleet of cars with privately owned vehicles in order to increase supply without having to own the entire fleet. Traditional P2P car sharing allows individual car owners to rent out their vehicles on a short-term basis with a service facilitator keeping a share of the rental transaction. Although such practices have existed on an informal basis since the advent of the automobile age, new technology and the presence of third party intermediaries that facilitate transactions make contemporary P2P car sharing a new and rapidly growing form of mobility. P2P marketplaces function much like P2P car sharing with the exception that terms (e.g. cost, drop-off point) and disputes are often resolved privately.

Fractional ownership, as it is referred to in the literature is perhaps the newest and least common type of formal car sharing. It is a misnomer in that it doesn’t refer to formal ownership arrangements, but rather lease agreements involving multiple users or subscriptions to a fleet of vehicles owned by third parties. It would be more accurate to refer to it as fractional leasing. An example of the former is Audi Unite program, which offered shared lease agreements for up to six users. The pilot project was launched in 2014 in Stockholm and ceased operation in early 2017. A similar project, known as the Ford Credit Link pilot, was launched in 2016 by the Ford Motor Company in Austin, Texas. In 2018, the first fractional ownership, or shared lease car sharing platform in Norway, called Hayk, launched in Oslo and currently operates two vehicles, each of which is leased by members of housing cooperatives.

In some publications, fractional ownership is grouped together with P2P car sharing to form a broader category of personal vehicle sharing (PSV) (Shaheen & Cohen, 2013; Shaheen, Chan, Bansal & Cohen (2015); Stocker & Shaheen, 2017).

Shaheen and Cohen (2012, p. 14-15) list several other types of car sharing that are less common or receive less scholarly attention within the context of the car sharing literature:

- College and university car sharing services, whereby “vehicles can either be dedicated to the campus or shared in a neighborhood residential and or business context”. Enterprise Carshare, for example, currently offers shared vehicles at 120 colleges and universities in the United States (Enterprise Carshare, 2017).
- Institutional fleets can include shared vehicles for employees of a business or government body. Examples of municipalities that have either launched or expanded car sharing services for its staff include Koprivnica, Croatia (Hleb, M. and M. Perković 2015), and Bremen, Germany (Clean-fleets, 2015). As of 2014, Zipcar for Business had a presence in 63 North American cities and accounted for 25 percent of total membership (Shaheen & Stocker, 2015).
- Public transit car sharing: park and ride services targeting ‘first and last mile’ problem.
- Vacation/resort: short term rentals targeting tourists at popular destinations.
- Research pilots, which often have scheduled completion dates – some, like the Bremen program mentioned earlier, get fully implemented.

2 History of car sharing

2.1 Origins

The earliest formal car sharing services were launched in Europe in the 1940s. Harms & Truffer (1998), Shaheen, Sperling & Wagner (1998), Shaheen, Sperling & Wagner (1999), Millard-Ball, et al. (2005) and Shaheen & Cohen (2007) have all chronicled of the early car sharing era. For all intents and purposes, the world's first formal car sharing service was the Sefage (Selbstfahrgemeinschaft) program, which was launched in 1948 in Switzerland by about a dozen members of a housing cooperative in Zürich. The following decades saw several failed attempts at car sharing services throughout Europe, including Procotip in Montpellier, France (started in 1971), Witkar in Amsterdam (1973), Bilpoolen in Lund, Sweden (1976), and Vivalla bil in Örebro, Sweden (1983). Most of these were cooperatives made up of several to dozens of household members and failed as a result of technical as well as organizational problems (Harms & Truffer, 1998, p. 40).

After decades of experimenting, a more viable car sharing industry began to emerge in Switzerland and Germany in the late 1980s. The Swiss car sharing cooperatives, Auto Teilet Genossenschaft (ATG) and ShareCom were founded in 1987 and would later merge in 1997 to form Mobility, currently the largest car sharing service in the country, with approximately 3,000 vehicles serving more than 177,000 members (Mobility, 2018). In neighboring Germany, StattAuto Berlin was founded by Markus Peterson in 1988 as an extension of his PhD thesis, which was inspired by an informal car sharing arrangement he had with his brothers. Like the earlier attempts at car sharing, the founders of the first successful car sharing organizations in Europe were motivated by economic concerns – put simply, sharing cars was the best alternative for those who could not afford to own their own private vehicles (Harms & Truffer, 1998, p. 40-41; Shaheen, 1998). This is not to say that those involved with the early European car sharing sector was not concerned with environmental or social matters, but that household economy was the chief driver.

In 1991, ATG, Sharecom and StattAuto Berlin joined forces to create the European Carsharing Organization (ECS), an umbrella organization that promoted industry standards and advocated for car sharing providers. By the time the organization was dissolved in 2007, car sharing in Europe had grown so much that most of the work carried out by ECS was picked up by similar bodies that had emerged at the national levels (Groß & Stengel, 2010, p. 24).

An important distinction can be made between the development of car sharing in Europe and in North America. “In contrast to Europe’s early members, American first adopters appeared more concerned with personal utility...they were motivated more by convenience and less by affordability, possibly because of much lower costs of driving in the United States” (Lane, 2005, p. 158). A further distinction is that unlike the development of car sharing in Europe, which was driven, in large part, by the economic concerns at the grassroots level, car sharing in North America emerged primarily from a top-down research environment (Shaheen, 1998, p. 40).

The first such pilot project, Mobility Enterprise, operated by Purdue University from 1983 to 1986, took a hybrid approach by providing each participating household a small personal vehicle for day-to-day use and access to a common fleet of larger vehicles for use when

needed (Sparrow et al., 1982). The second pilot was the Short-Term Auto Rental (STAR) demonstration in San Francisco, which was established in 1983 by a private firm with funding from the Urban Mass Transportation Administration and the California Department of Transportation and was discontinued half-way into the project owing to difficulties with collecting user payments (Shaheen, Sperling & Wagner, 1999, p. 25). The first car sharing service in North America that was not part of a research project was Auto-Com, which launched in 1994 in Quebec City as a non-profit organization and would later change to a commercial enterprise in 1997 under the moniker CommunAuto. The first car sharing organization in the United States was CarSharing Portland Inc., which was launched in 1998 (Brook 2004).

The mid-1990s and early 2000s witnessed an expansion and maturation of car sharing markets in both Europe and North America. In particular, the number of commercial car sharing service providers increased dramatically. This represented a marked transition from the earlier experiences with car sharing, which was driven mostly by member-driven cooperatives and fixed-period research projects. Prominent examples of commercial car sharing services include Zipcar, Car2go, DriveNow and Sunfleet. With the exception of Zipcar, which was a startup modeled after Swiss and German car sharing organizations, the others were all established as subsidiaries of established multi-national automobile manufacturers and rental car companies¹. In 2013 Zipcar itself was eventually acquired by, and currently operates as a subsidiary of, the multinational rental company Avis Budget Group, for approximately USD 500 million (Kell, 2013).

Although there was a general trend of commercialization in the 2000s, the case of StattAuto Berlin was less straight forward and spans a much longer time period. Following its establishment as an extension of an informal car sharing arrangement, StattAuto Berlin experienced nearly two decades of expansion and increased formalization. It was then acquired in 2005 by Greenwheels AG, the largest car sharing service provider in The Netherlands, which was in turn taken over by Volkswagen in 2013. A closer look at StattAuto Berlin highlights the innovative origins of European car sharing, its emergence as a viable mobility service, and the entry of multinational corporations into the sector².

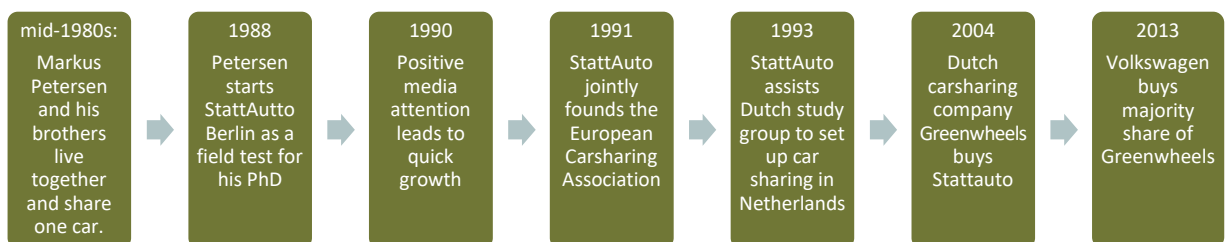


Figure 2.1: Summary of relevant literature on the environmental impacts of car sharing.

¹ Car2go is a fully owned subsidiary of Daimler AG. DriveNow is a joint venture between BMW and the European car rental company Sixt. Sunfleet was launched as a joint venture between Volvo, the Swedish municipality of Gothenburg, the construction company Sanska and the rental car company, Hertz.

² This is not to suggest that the innovation process concluded in the initial stages of the development of StattAuto Berlin. The incorporation of the company into Greenwheels and Volkswagen can certainly be viewed as examples of innovation through acquisition.

2.2 Car sharing in Norway

Car sharing has existed in Norway for a little over two decades. As of late 2018, there are 11 car sharing service providers or platforms in Norway that provide access to over 7,000 vehicles to more than 200,000 reported registered members.³ These two decades of growth can be broken up into four periods, which can be characterized, respectively, by the: (1) emergence and growth of cooperative providers; (2) entry of corporate and international actors; (3) arrival and rapid growth of P2P platforms; and (4) blurring of boundaries between platforms and types of service. The following is an overview of these four periods.

The early years and the cooperative period

The emergence of car sharing in Norway bore a striking resemblance to the experiences of providers in other countries at the time. The most obvious similarity was timing – the first car sharing organizations in Norway were established in the mid-1990s – a little less than a decade after the establishment of the first successful Swiss and German providers and approximately the same time as the establishment of the first North American providers. Further similarities, especially when comparing with European counterparts, had to do with operational and business models.

The first formal car sharing service provider in Norway was Bilkollektivet, which was established in 1995 in the country's capital and largest city, Oslo. The name Bilkollektivet literally translates to 'the car collective' and like Sefage and many of its European successors, it was a member-owned cooperative. In 1996 similar car sharing organizations were established in the second and third most populous cities in Norway – Bildelingen in Bergen and Trondheim bilkollektivet. These service providers were also member-owned cooperatives and represent a prime example of user-driven innovation in the urban mobility field.

The primary customer base for the early Norwegian car sharing sector were households that wanted access to a car without having to own one. A smaller but also relevant segment of the market was businesses and government agencies, whose employees use car sharing service when needed rather than owning and maintaining a fleet of dedicated company vehicles.

Besides being based in the three largest cities in Norway, the car sharing stations were almost always located in central areas with a high enough residential or business density to sustain a viable customer base. Bilkollektivet is the only provider of the three cooperatives that has branched out into other Norwegian cities. In addition to having over 150 stations in Oslo, Bilkollektivet currently operates six stations in Stavanger and two in Tromsø. Interviews with the companies indicate that as of late 2018, Bilkollektivet had a fleet of over 300 vehicles, as compared with Bildelingen and Trondheim Bilkollektivet which have approximately 200 and 100 vehicles, respectively.

The three original cooperative service providers each have a distinct geographic focus. This insulation from competition enables cooperate with one another; for example, members of any one of the organizations – Bilkollektivet, Bildelingen and Trondheim bilkollektivet – have access to the vehicles in all three of the platforms.

³ Determining the number of actual users is challenging at the moment; it is most certainly lower than this reported figure. See the sub-section on "Peer-to-peer and car sharing 2.0" for an explanation.

Corporate and international players enter the market

These three cooperatives represented the totality of Norway's car sharing sector for nearly a decade. In 2004, a fourth service provider, Oslo bilpool, entered the Norwegian car sharing market. Oslo bilpool was created at the behest of a consortium of actors, most notably, the Norwegian real estate developers Selvaag Forvaltning and Avantor (Hertz bilpool, 2018). The entry of private corporate interests marked an important shift in the Norwegian car sharing market, which until then had been dominated by member driven cooperatives. In 2010 Oslo bilpool was acquired by the international car rental company Hertz and was renamed Hertz bilpool. The company currently has a fleet of over 150 vehicles, most of which are located in the Oslo metropolitan area, but which are also available in many of the larger cities in the country.

Outside of Oslo, Hertz bilpool stations are often located in the parking lots of large shopping centers, most notably ones with an Ikea, which is the case in and around Ålesund, Stavanger, Tromsø and Hamar. This marks another important shift in the Norwegian car sharing market, which had previously been available almost exclusively in densely populated urban cores of large metropolitan areas.

A second for-profit car sharing service provider, Move About, was established in 2007 and began offering services in late 2008. The company, which is located mostly in and around the Oslo metropolitan area was unique with respect to the types of vehicles they offered and the types of customers they served. Move About was the first service provider in Norway to offer a fleet of 100 percent battery electric vehicles. Although Norway is currently a leading country in the world in terms of electric vehicle support mechanisms, infrastructure and user adoption, the electric vehicle market was still in its infancy when Move About launched.

Furthermore, the company was the first in Norway to focus on corporate rather than household customers. Move About's agreement with its first client, the Norwegian company Den Norske Veritas (DNV), provided for five electric vehicles to be used by approximately 150 employees. By 2012, approximately 40 percent of Move About's fleet of 70 vehicles was reserved for exclusive use by corporate clients; the other 60 percent were available for all members. Despite representing less than half of the vehicle fleet, the exclusive corporate car sharing agreements accounted for nearly 80 percent of the company's revenues.

There is, however, reason to question whether Move About's provision of services to corporate clients is indeed car sharing – the exclusive nature of the agreements blurs certain boundaries of the term. While it is true that companies like DNV no longer need to own and maintain a fleet of vehicles for their employees, the amount of sharing does not necessarily change with membership in Move About. Employees who shared company owned vehicles now share vehicles that are provided as a service, from Move About. There was already a type of sharing taking place and the number of vehicles being used does not necessarily change under the new arrangement. In some respects, Move About's corporate offerings is more akin to leasing a corporate fleet than car sharing. It is also indicative of the increased attention given to mobility as a service, which is related to car sharing in important ways, but is not the same.

Peer-to-peer and car sharing 2.0

In 2015, the number of for-profit car sharing companies in Norway doubled with the entry of Nabobil and GoMore, bringing the total number of providers to seven. Together, these two new companies offered Norway's first large scale formal P2P car sharing platforms,

whereby members rent out their private vehicles to other members on a short term basis. The term platform is used rather than service provider because under such a business model, companies like Nabobil and GoMore can be viewed as facilitators of car sharing whereas the individual owner of the vehicle is technically the provider.

Nabobil, which in Norwegian means ‘neighbor car’, is often compared in Norway to AirBnB, but for cars instead of homes. Unlike the incumbent car sharing services in Norway, companies that operate P2P platforms do not need to own or maintain any vehicles. Nabobil’s website shows a prominent banner that encourages members to rent out their vehicles and earn up to NOK 80,000 (approx. USD 10,000) per year; the real amount that a member can earn may be higher or lower. Like AirBnB, which rents out rooms and apartments on a short term basis, P2P car sharing attracts members that are seeking to rent vehicles for use as well as members that are looking to earn extra income from the excess capacity of a capital good. In order for the platform to work, the company needs to recruit a sufficient and balanced number of member users as well as member providers.

P2P car sharing allows for rapid upscaling, both geographically and in terms of size of vehicle stock. Within three years of launching, Nabobil has more than 170,000 registered users and 5,500 vehicles in over 200 municipalities throughout Norway. In terms of users and vehicles, Nabobil alone can be seen as being an order of magnitude larger than the entire non-P2P Norwegian car sharing sector.

Such figures may be misleading, however, as it is possible to register as a member but never use the service as either a vehicle user or provider. The prospect of earning extra income by just registering a private vehicle may result in thousands of vehicles being added to the platform but never used. Since its founding Nabobil has facilitated more than 100,000 car rental transactions (Nabobil, 2018a), which is to say that over the course of three years of operation, the company has approximately 1.65 users per actual transaction. This suggests that a significant number of Nabobil’s registered users do not use the service. As such, it is challenging to carry out quantitative comparisons between the newer P2P platforms and the incumbent service providers. Furthermore, while it may be technically true that there are more than 200,000 registered car sharing members in Norway, this figure is most certainly inflated by the large number of registered members who are not active users.

The other P2P platform in Norway, GoMore, was started a decade earlier by two philosophy students in Germany and had experienced growth, particularly in Denmark leading up to its launch in Norway⁴. GoMore was distinct from its competitors in that car sharing was just one of multiple mobility offerings provided by the company.

GoMore’s business strategy, which can be seen as a multipronged approach that incorporates elements of the sharing economy as well as mobility as a service, offers ride sharing, P2P car sharing and leasing arrangements. The leasing service is conventional in most respects except in that it focuses mostly on battery electric and plug-in hybrid vehicles. The ride sharing services, also known as carpooling, pair passengers and drivers travelling on similar routes by matching their preregistered journeys, whether planned or desired. Although ride sharing facilitates the sharing of a vehicle by multiple users, it is generally excluded from the category of formal car sharing services, which focus on user operated vehicles. GoMore’s P2P services do, however, fall within the rubric of car sharing because the vehicle is operated by the user. Additionally, the company’s website even

⁴ GoMore was launched in Norway in 2014 but offered only ride sharing services. P2P car sharing was added in 2015.

encouraged members who lease to make their vehicles available to other members for P2P car sharing.

As compared with the B2C and B2B platforms, P2P car sharing platforms rely, to a much greater extent, on technological innovations, particularly those having to do with smartphones, mobile applications and internet access. Although a car sharing company that owns its own fleet of vehicles has and could still exist without a web presence, all of them do currently have websites through which members can book vehicles. The P2P platforms, however, go beyond having a mere website but embody the logic of Web 2.0, which is to say, they allow users to create their own content and, in the cases of GoMore and Nabobil, actually provide the service (Bertheussen and Arnestad, 2016). For example, Bilkollektivet, the oldest and largest of Norway's 'traditional' car sharing services, allows for booking of vehicles through a web browser interface and over the telephone, and only as recently as late 2018, by smartphone app. GoMore, on the other hand, already has more than 100,000 downloads in the Google Play store for Android apps. Coupled with the absence of membership fees, the Web 2.0 interface has allowed the P2P platforms to rapidly expand their membership base – much faster than the incremental growth of the traditional providers. Whether this larger customer base will translate to corresponding increases in the use of car sharing remains to be seen. It should be noted that GoMore's car sharing platform and Nabobil have existed in Oslo for only three years.

Blurring the boundaries

The emergence of P2P car sharing platforms also foreshadows even further innovations and changes in the car sharing market. Nabobil has recently introduced a feature called *uten nøkkel* (without key), wherein the company installs remote key lock mechanism in the vehicles of participating member providers such that member users can avoid having to pick up a physical car key and can access the vehicle by using the Nabobil smartphone app⁵. Although installation is free to the member, the member provider must pay a monthly fee of 299 kroner (approx. USD 36) to use the service (Nabobil, 2018b). This fee, coupled with the company's claim that providers can rent out their vehicles twice as often, suggests that the *uten nøkkel* service is targeting users who wish to use their vehicles as a more substantial source of income.

One could take this one step further and surmise that, like AirBnB did with lodging and accommodation, P2P car sharing platforms like Nabobil and GoMore can encourage third party companies to enter the car sharing market, by using the app, thus blurring the boundaries of business model and organizational structure. This would be very similar to the B2C business model, the only difference being the presence of the P2P platform as a middleman that facilitates transactions.

Another example of blurred boundaries in the Norwegian context is the entry of Avis, whose parent company, the Avis Budget Group, operates one of the largest rental car fleets in the world. In 2016, Avis, which had already been offering traditional rental car services in Norway for decades, partnered with OBOS, Norway's largest housing cooperative to provide a car sharing service, exclusively to OBOS members. The service, known as Avis Now, and later *Avis selvbetjent billete* (self-service car rental) blurs the boundaries between commercial and cooperative enterprises as well as those between car sharing and traditional rental car services.

⁵ The *uten nøkkel* service is not available to all users. Vehicles must be no older than 10 years old, have been driven no more than 150,000 km and already have functioning power door locks.

Avis launched its car sharing service through Avis Preferred, the company's loyalty program, which offers registered members a number of benefits, chief among them, faster pickup and delivery of vehicles. One of the key distinctions between traditional rental cars and car sharing is that the latter offers self-access of vehicles. Although Avis Preferred still requires users to engage with an Avis employee at a physical office or counter, certain other services, such as pre-signing of the contract and switching vehicles can be done through the Avis smartphone app. Avis selvbetjent billette, as the name suggests, took this one step further by allowing for self-access. It is worth repeating that car sharing is, in fact, a form of car rental; Avis selvbetjent was merely one option among a range of rental options offered by Avis.

The partnership between Avis and OBOS is also blurring the boundaries of business model. On the one hand, Avis is a commercial enterprise, on par with Hertz as a car sharing service provider, but the membership consists entirely of those already belonging to a housing cooperative. An important distinction must be made here between OBOS and the smaller housing cooperatives that spawned many of the early European car sharing schemes. Unlike its predecessors, which were small local organizations, OBOS is a national organization that consists of approximately 400,000 household members, which corresponds to approximately ten percent of the adult population in Norway (OBOS, 2016; SSB, 2018). Given its size, OBOS is categorically different from the other cooperatives mentioned in this report – it may be fair to consider it to be a cooperative that, because of size and scale, behaves like a corporation. As with the potential for third party operators to use Nabobil uten nøkkel, Avis selvbetjent marked a concrete departure from the traditional model of a singular service provider as a one-stop-shop.

In 2018, OBOS and Avis announced a reorganization of their partnership whereby the car sharing platform for OBOS members would be operated by Zipcar, an Avis subsidiary and one of the largest car sharing companies in the world. Despite its large global presence, Zipcar has launched with a small fleet of eight vehicles in Oslo. Given that car sharing is more in line with the experience and core competence of Zipcar as compared with its parent company, it would come as no surprise that Zipcar would be able rapidly upscale if and when the opportunity presents itself.

Another recent entrant into the Norwegian market is Hyre, which is a car sharing startup whose primary investor is Møller Mobility Group, one of the leading companies in Northern Europe that deals in automobile import, sale, repair and leasing. Hyre operates on a hybrid model that combines elements of P2P and B2P with over 200 vehicles in Oslo. Unlike Nabobil uten nøkkel, which is an optional service for members, all vehicles in the Hyre fleet are available to members through mobile phone app. Furthermore, Hyre has partnered with BankID⁶, Norway's leading electronic identification authentication platform, to facilitate vehicle bookings, pickup, use and drop-off by mobile phone app. Nabobil has also begun using BankID for membership verification.

Another recent startup Hayk, offers shared vehicles not to individuals, but to residential cooperatives and condominiums. In its first year (2018), Hayk has delivered two electric vehicles in Oslo and arranges for the establishment of a charging station at a dedicated parking space at the residential complex. In addition to the utilization of idle capacity that traditional car sharing offers, the company hopes to facilitate ride sharing among neighbors, especially among those commuting to work.

⁶ BankID is a public key infrastructure which was developed by the Norwegian Financial Services Association (Finansnæringens Hovedorganisasjon) and the Norwegian Savings Banks Association (Sparebankforeningen) and is used primarily to access online services with Norwegian banks, public sector organizations (e.g. tax authorities) and third party actors such as Hyre.

In late 2018, the Norwegian State Railways (NSB) announced, in partnership with the Danish company GreenMobility, launched the first free floating car sharing platform in Norway. The platform includes 250 fully electric free floating cars that can be parked for free, with some exceptions, in any public parking space within Ring 3 of Oslo, which contains most of the high density areas on the city. Users are offered the option to be charged by the minute, or day; alternatively users can subscribe to a monthly plan that will allow for 20 hours of driving/access during the period. NSB claims this is parts of its efforts to invest in mobility and door-to-door services in the Nordic region (NSB, 2018).

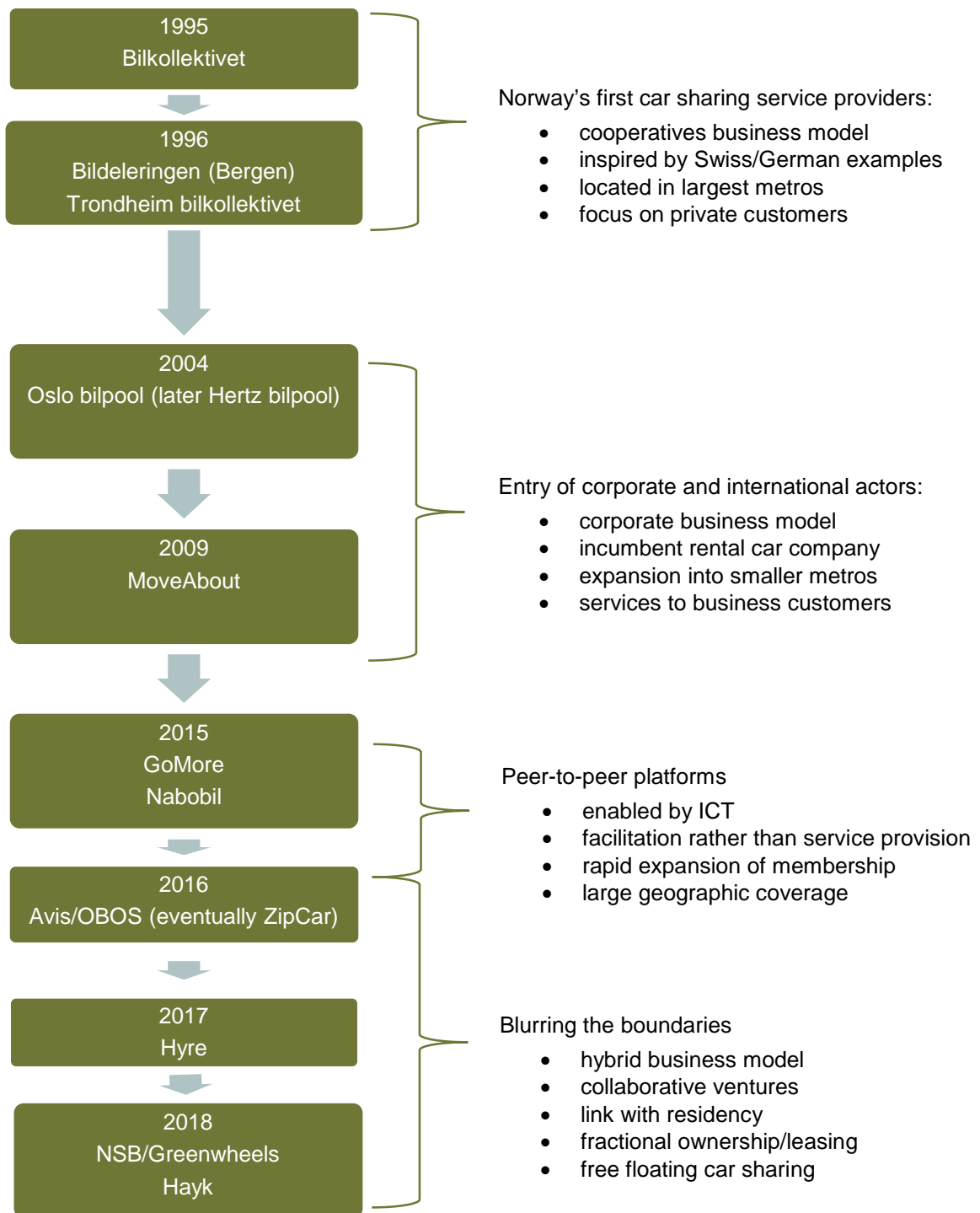


Figure 2.2: The emergence of the Norwegian formal car sharing sector from 1995 to 2018.

3 Users

Car sharing remains a niche practice in most markets. In order to reap the full societal benefits of car sharing, which is to say reductions in congestion, pollution and green-house gasses, car sharing must not only use cleaner cars than are common today, but also scale up to become a mainstream practice, while at the same time leading to a reduction in overall driving among users. “Improvements in engine efficiency and other related technological advances are great but for car sharing to have an impact, it must be adopted at a mass scale by users”. (Firnborn & Muller, 2011, p. 1527). Understanding who these users are is an important component of upscaling car sharing.

3.1 General characteristics of car sharing users

There is evidence that users of car sharing are often distinct from the general population and from other users of private automobiles. Although there are no standard demographic indicators that apply to car sharing users across geographic contexts, there are some patterns that begin to emerge upon examination. For example, car sharing users generally tend to be more urban, wealthy, educated and younger than the general population. Still, the profile of the early users is heavily dependent on the particular socio-technical environment that it takes place within, and comparative research suggest that car sharing may develop as very different practices in different national markets.

According to most former studies, car sharing users disproportionately come from households that did not previously own an automobile. For example, Cervero and Tsai found that San Francisco’s Cityshare users were “drawn disproportionately from professional-class residents who do not own cars and who live alone or in nontraditional households” (2004, p. 121). Similarly, Sioui, et al. (2013, p. 63) found that, among users of Montreal’s Commonauto service, 88 percent did not own a vehicle, as compared with 34 percent of the general population. Lane (2005) also found that car sharing users tend to not own cars, but furthermore, that their most significant demographic characteristic is that they are highly educated and that they disproportionately live in small or non-traditional households.

Car sharing is often associated with environmental awareness and efforts to curb the negative effects of automobile use. Many of the early experiments with car sharing were partly inspired by environmental concerns. As car sharing grows in popularity, however, users are less and less concerned with the environmental effects (Loose, 2010, p. 66). Although environmental concerns are not absent among users, the most important factors are consistently convenience and affordability (Katzev, 1999, p. 31; Lane, 2005, p. 158)

To give an understanding of the profile of Norwegian car sharers, we will in this chapter present some key results from a survey of car sharers in the Oslo region, conducted by TØI. A questionnaire was distributed to members of Nabobil, Bilkollektivet and Hertz bilpool in collaboration with the providers. In total, information from 3,130 users of was registered, giving unique insight into these three groups of car sharers.

The target area for the survey was car sharing users in the greater Oslo region. The sample is not necessarily representative with respect to other cities in Norway. There are also users

of these three platforms who are not included in our sample. Yet, the sample size of the survey renders it probable that the sample gives a reliable picture of the users of these three platforms in Oslo.

3.2 Demography

There is a significant majority of men in the customer base of all three car sharing platforms, but in particular for Nabobil and Hertz. In total, there are twice as many male car sharers. There are also other differences between the users of these three schemes: members of Bilkollektivet are in general older, and have a higher level of education than users of Nabobil, and to some extent Hertz as well (table 6.1). The novel P2P concept offered by Nabobil, seems to be particularly popular for the youngest group of users – 20 percent of its customer base consists of users between 18 and 30 years old.

For Nabobil and Hertz, the average age is 41, whereas it is 43 for Bilkollektivet. However, if we exclude the passive members in the sample (those that have not used the platform for the last six months), the average age of Nabobil users decreases to 38 years.

Table 3.1: Gender distribution of Nabobil, Bilkollektivet and Hertz users. Percent.

	Gender***		Total	N
	Female	Male		
Nabobil	31,0 %	69,0 %	100,0 %	1737
Bilkollektivet	41,1 %	58,9 %	100,0 %	1119
Hertz	23,7 %	76,3 %	100,0 %	274
All	34,0 %	66,0 %	100,0 %	3130

*** $p < .000$

Table 3.2: Age of Nabobil, Bilkollektivet and Hertz users. Percent.

	Age***			Total	N
	<30	30-50	50<		
Nabobil	21,7%	54,3%	24,0%	100,0 %	1737
Bilkollektivet	9,5%	68,5%	22,1%	100,0 %	1119
Hertz	18,6%	60,9%	20,4%	100,0 %	274
All	17,1%	59,9%	23,0%	100,0 %	3130

*** $p < .000$

Table 3.3: Education level for users of Nabobil and Bilkollektivet and Hertz. Percent.

	Education***				Total	N
	Primary and lower secondary	Upper secondary	University/high school (3 years)	University/high school (5 years)		
Nabobil	1,8%	17,0%	34,5%	46,6%	100,0%	1737
Bilkollektivet	0,6%	7,4%	25,0%	66,9%	100,0%	1119
Hertz	0,7%	12,8%	36,5%	50,0%	100,0%	274
All	1,3%	13,2%	31,3%	54,2%	100,0%	3130

*** $p < .000$

3.3 Patterns of use

As described earlier in the report, Bilkollektivet, Hertz and Nabobil rely on different models for sharing. The P2P scheme offered by the latter opens for different types of engagement, as renter, users, or both (table 6.3). In the survey, we found that about 50 percent of the respondents were active renters, and 20 percent were only renting out their car. A small share of 3.5 percent were both renting and hiring, and approximately 30 percent had not yet used the system. Thus, it is not surprising that Bilkollektivet is used more frequent than Nabobil. For Bilkollektivet, 37 percent use the service more than once a month compared to 5 percent of the Nabobil users. The Hertz users are in the middle range, where one in four rent cars more than once a month.

Table 3.4: Frequency of use the last 6 months for users of Nabobil and Bilkollektivet. Percent.

	Frequency of use the last 6 months***				Total
	More than once a week	More than once a month	Between 3-6 times	Less often	
Nabobil	0,8%	4,9%	31,3%	63,0%	100,0%
Bilkollektivet	4,9%	37,2%	37,3%	20,6%	100,0%
Hertz	3,3%	23,0%	32,5%	41,2%	100,0%
All	3,1%	22,7%	34,3%	39,9%	100,0%

*** $p < .000$

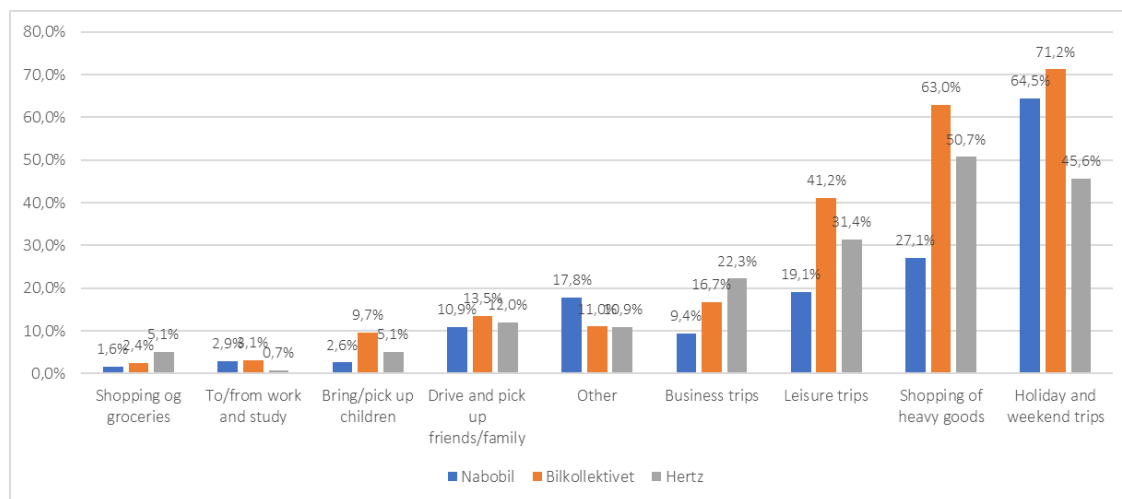


Figure 3.1: Main purpose for using cars from Bilkollektivet, Nabobil and Hertz. Percent. (Respondents could indicate 1-3 predefined purposes). Only users that have used the service more than 3 times the last 6 months are included.

The purpose of the car sharing trips is largely similar for all three schemes: It is primarily used for holiday and leisure trips as well as for shopping of heavy goods (Figure 3.1). Thus, the shared cars are rarely used for everyday travel. As indicated above, Bilkollektivet’s cars are, in general, used more frequently and the additional use mainly involves leisure, shopping and holiday/weekend trips. Nabobil users have a particular high number of holiday trips. Hertz users have a relatively higher share of business trips than the others, although this scheme is also dominated by shopping and holiday trips.

3.4 Car ownership and history

As discussed earlier, ownership history among users is important in terms of how car sharing influences the total amount of driving and emissions, as well as the number of additional vehicles in the households. Looking at the users in this sample, 63.1 percent had owned car before becoming a member of a car sharing scheme (Table 6.4). However, at 41.1 percent, the share of previous non-owners were significantly higher for Bilkollektivet's members than the two other.

Our data shows that, in some cases, but not always, car sharing seemed to have replaced a private car. More than one third of households had access to at least one additional car, either leased or owned ones. For the Nabobil users, more than 50 percent had access to other cars, while this was the case for only 16 percent of Bilkollektivet's members. Among the group of Hertz users, one third had access to other cars in the household.

In sum, the survey indicates that there are clear similarities in the use of car sharing across all three types. Yet, the users of Bilkollektivet are more dedicated sharers, with more active use of the cars and with less reliance on additional vehicles in the households.

Table 3.5: Present and previous access to car in households. Percent.

	Nabobil	Bilkollektivet	Hertz	Total
<i>Previous car ownership***</i>				
Have owned car before	66,5%	58,9%	71,0%	63,1%
Have never owned a car	33,5%	41,1%	29,0%	36,9%
	100,0%	100,0%	100,0%	100,0%
<i>Additional cars in household***</i>				
Access to owned or leased cars	53,6%	16,4%	32,1%	37,3%
No other cars in household	46,4%	83,6%	67,9%	62,7%
	100,0%	100,0%	100,0%	100,0%

*** $p < .000$

4 Impacts

The first scholarly analyses of car sharing were pilot projects in the 1980s, such as Mobility Enterprise at Purdue University and STAR in San Francisco, that were testing the feasibility and potential impact of such services. As the number of car sharing services in Europe and North American increased over the next decade, especially economically viable ones, broader analyses of commercial offerings, public response, and overall impact became possible. Whereas the initial studies focused on individual service providers and case cities, as the car sharing industry matured, subsequent studies began to take into consideration industry-wide effects and lifecycle impacts of car sharing.

The impacts of car sharing are often measured by a multitude of environmental, economic and social indicators. Environmental impact, especially as it relates to GHG emissions and climate change, are the most studied and written about. The most common indicators used for determining the environmental impacts of car sharing are:

- Vehicle holding at the household level
- Vehicle miles travelled/Vehicle km traveled (VMT/VKT)
- GHG emissions
- Modal splits/relationship between car sharing and other modes of mobility

4.1 Indicators

The most common of these are vehicle holdings and VKT, the latter of which is combined with GHG emissions as one category in this report insofar as the total amount of CO₂ emitted is strongly related to how much driving is done. This does not include other GHGs, such as nitrous oxides (NO_x) and carbon monoxide (CO), the emissions for which depend on a lot more than VKT. As such the potential GHG emission impacts included in this report relate more to climate change and less with local environmental pollution.

Whereas VKT focuses on what comes out of the tailpipe, the other commonly used indicator, vehicle holdings at the household level, is important because it takes into consideration the entire lifecycle impact of automobile use. If car sharing can lead to reductions in VKT and related GHG emissions, but does not reduce the total number of vehicles in society, the carbon footprint of automobile production and disposal, not to mention related land use planning an practices, would remain on its current trajectory. Furthermore, early research indicates that the relationship between vehicle holdings and VKT is complex and varied across regions.

4.2 Net VKT and induced demand

In most studies, car sharing is associated with a decrease in VKT (Steininger et al., 1996; Meijkamp, 1998; Cervero, Golub & Nee, 2007; Loose, 2010; Martin & Shaheen, 2011). More recent studies tend to support these findings as well, as with the study of Dutch car

sharing users, carried out by Nijland and Meerkerk (2017), in which they reported that users drove 15-20 percent fewer km than they did prior to becoming car sharing members. It has been noted however that by providing access to a car to individuals who did not previously have such access, car sharing can induce driving demand and lead to more carbon emissions. For example, an evaluation of the STAR program in San Francisco indicates that although vehicle holdings among members went down, overall car usage went up (Walb & Loudon 1986). A similar study conducted nearly two decades later found that members experienced a net increase in VKT of 19.5-54.3 percent as compared with non-members (Cervero, 2003).

Although such instances of induced automobile usage may seem counterproductive, it is worthwhile to differentiate members according to their vehicle holding status prior to joining the program. In a study of 350 car sharing user households in Austria, Steininger et al. (1996) found that users who owned a car prior to using car sharing saw a VKT reduction of 62 percent, whereas users who did not own a car saw an increase of 118 percent. "In absolute per person terms the increase of the latter group is only one sixth the reduction of the former group. The aggregate net effect...was a reduction of 53%" (*Ibid*). There were similar results in a study of Philadelphia's PhillyCarShare, in which Lane (2005) found an even more pronounced disparity in the magnitude of change among users who did or did not have access to a car prior to becoming car sharing members. Users who gained access to a car increased their VMT by up to 48. km/month whereas members who gave up ownership of a car reduced their VMT by approximately 840 km/month (*Ibid*, p.165).

In short, it matters whether you owned a car before becoming a car sharing user. It should come as no surprise that gaining access to a car will lead the user to use the car. The environmental impact is a net positive as long as (1) the availability of car sharing is able to offset a greater amount of VKT of former car owners; and/or (2) the "induced" demand among users who gained access to a car is lower than what their usage presumably would have been, had s/he purchased an automobile.

4.3 Reduced vehicle holdings

Car sharing's impact on vehicle holding is not as clear as yes or no – sometimes membership and use can delay the purchase of a car. In a review and analysis of carsharing Portland, a small organization with 110 active members and 9 vehicles, Katzev (1999) found that 26 percent of members sold a personal vehicle within one year of joining the program and 53 percent of users postponed the purchase of a vehicle as a result of their membership. Although a majority of the members planned to or eventually did buy a vehicle, their use of car sharing was able to keep a car off the roads, if only for a limited period. The overall impact of this delay would depend on its duration. This is to say that car sharing has potential environmental benefits even if users go on to abandon their membership and drive their own personal vehicles.

Cervero and Tsai (2004) found that reductions in VKT were most likely directly linked to vehicle holding; 73.3 percent of San Francisco's City CarShare members reduced or postponed car ownership as compared with 42.9 percent of non-members. A follow-up study (Cervero, Golub & Nee, 2007) found similar effects of car sharing on household vehicle holdings, although less pronounced.

In a study of car sharing among businesses, Shaheen and Stocker (2015) found that approximately two out of five corporate members sold or postponed the purchase of a

vehicle as a result of being a member of Zipcar. At the time of the study, nearly a quarter of Zipcar’s total users consisted of business members, which corresponds to a reduction of about 33,000 vehicles from the road.

In a survey carried out with car sharing users in Switzerland, Becker, Ciari and Axhausen (2018) found that 8 percent of free floating users and 19 percent of station-based users would have purchased a car if they were not members of the car sharing scheme.

4.4 Broader studies on the impact of car sharing

By the early 2000s, the car sharing market in North America and Europe underwent a period of maturation. There was a marked increase in the number of national and international commercial enterprises, as opposed to local cooperatives. The most notable of these were Zipcar, Car2go, DriveNow and Sunfleet, all of which were either spearheaded by or eventually acquired by an incumbent automobile manufacturer or traditional car rental company.

During this time, scholarly analysis of car sharing began to expand beyond individual programs and cities. Martin, Shaheen & Lidicker (2010) carried out one of the first studies of car sharing that used survey data from a broad set of user participants (N=6,281) in the United States and Canada. Among the participant sample, the study found that carsharing removed between 9 to 13 vehicles from the road for each shared vehicle deployed – a total reduction of 90,000-130,000 vehicles.

Concurrently, a similarly broad study of car sharing in Europe, co-financed by the European Union and entitled “Momo car sharing”, was carried out using survey data from 84 car sharing service providers that operated a fleet of over 3,500 vehicles, mostly in Germany. The study found that car sharing generally reduced the CO₂ emissions footprint of vehicles 15-20 percent (Loose, 2010).

As the popularity of car sharing increased, and newer forms of car sharing (i.e. free floating and P2P platforms) emerged, larger studies supported the claim that even these new types of car sharing reduce carbon emissions. According to Firnkorn and Muller (2011) who studied the free floating service car2go in Germany, 13.5 percent of a total 17,000 members are expected to reduce their car ownership, which corresponds to a net reduction of almost 2,000 vehicles. The same study indicates that car sharing users emitted 53-60 percent less CO₂ and that even when assuming the highest level of fuel consumption, car2go users could increase their VMT by 167 percent and maintain an overall reduction in CO₂ emissions.

Table 4.1: Summary of relevant literature on the environmental impacts of car sharing.

Article	Location	vehicle holding	VKT/GHG
Walb & Loudon 1986	San Francisco	<ul style="list-style-type: none"> ownership down but car usage up 	
Steininger et al. 1996	Austria		<ul style="list-style-type: none"> users who previously owned a car saw a reduction in VKT by 62% whereas those that did not own a car previously saw an increase of 118%
Meijkamp 1998	Netherlands		<ul style="list-style-type: none"> 33% reduction in VKT for members
Katzev 1999	Portland	<ul style="list-style-type: none"> 26% sold after joining. 53% postponed. 	

Article	Location	vehicle holding	VKT/GHG
Doka & Ziegler 2001			<ul style="list-style-type: none"> As cars become more efficient, the share of carbon footprint derived from land use and material consumption increases.
Cervero 2003	San Francisco		<ul style="list-style-type: none"> members' net VMT was 19.5%-54.3% higher than non-members
Cervero and Tsai 2004	San Francisco	<ul style="list-style-type: none"> 73.3% of members reduced or postponed car ownership as compared with 42.9% of non-members 	<ul style="list-style-type: none"> Mean VMT fell by 47% for members, yet increased by nearly 73% for nonmembers. Over the 2 years, members' average daily transportation-related CO₂ emissions fell by an estimated 0.75 lb/day compared with an estimated increase of 0.25 lb/day among non-members
Lane 2005	Philadelphia	<ul style="list-style-type: none"> Each PhillyCarShare vehicle replaced an average of 23 private vehicles 	<ul style="list-style-type: none"> Users who gained access to a car increased their VMT by up to 48 km/month whereas members who gave up ownership of a car reduced their VMT by up to 840 km/month
Birceno et al 2005	Norway		<ul style="list-style-type: none"> if money saved from CS is used on a distributed set of consumables, the carbon impact is marginal, but if spent on, e.g. air travel, carbon impact of car sharing diminishes.
Hertwich 2005			<ul style="list-style-type: none"> Rebound effect: changed behavior may offset part of the environmental gain
Cervero, Golub & Nee 2007	San Francisco	<ul style="list-style-type: none"> City CarShare members were 12% more likely to shed a vehicle than non members. 	<ul style="list-style-type: none"> 67% decrease for members, 24% increase for non-members 2001-5
Martin, Shaheen & Lidicker 2010	North America	<ul style="list-style-type: none"> carsharing removed between 9 to 13 vehicles from the road for each shared vehicle deployed 	
Loose (MOMO) 2010			<ul style="list-style-type: none"> Generally a 15-20% reduction in CO₂.
Martin & Shaheen 2011	North America		<ul style="list-style-type: none"> 27-43% reductions in VMT 34-41% reduction in GHG emissions (average of 0.58-0.84 metric tons/household)
Firnkorn & Muller 2011	Ulm, Germany	<ul style="list-style-type: none"> 13.5% of the 17,000 car2go-members expected to reduce their car ownership (net reduction of 1,995 cars) 	<ul style="list-style-type: none"> Car2go users could drive up to 167-190% more kilometres and maintain an overall CO₂-reduction. 53-60% reductions in CO₂ emissions
Sioui et al. 2013	Montreal	<ul style="list-style-type: none"> 88% of users did not own a car whereas 34% of the general population did 	
Baptista, melo & Rolim 2014	Lisbon		<ul style="list-style-type: none"> Well to wheel (WTW) emission reduction of hybrid 35% in hybrid cars and 65% in BEV
Shaheen & Stocker 2015	NA	<ul style="list-style-type: none"> 1 in 5 corporate members sold a vehicle and 1 in 5 postponed the purchase of vehicle due to joining Zipcar - 	

Article	Location	vehicle holding	VKT/GHG
		total reduction of approx. 33,000 vehicles	
Chen 2016			<ul style="list-style-type: none"> individual reduction in energy use and GHG emission by 51% and net savings expected to be 3% across all U.S. households
Carplus 2017		<ul style="list-style-type: none"> 53% reduction in long-term members who owned at least 1 vehicle (station based) and a 17% reduction for long-term FF members. 	
Trivector, 2014	Gothenburg, Malmoe and Stockholm	<ul style="list-style-type: none"> Number of households without cars increased from 60-90 percent 	<ul style="list-style-type: none"> Average reduction per person was 150 – 170 VKT Total reduction in CO₂ per year was 3 200 tons (for all cities) or 420 kg per active members per year.
Nijland & Meerkerk 2017		<ul style="list-style-type: none"> 30 % less car ownership amongst car sharers and 15-20% less driving than prior to car sharing 	<ul style="list-style-type: none"> Due to reduced car ownership car sharers emitted 240-390 fewer kg of CO₂ per person per year.
Becker, Ciari, Axhausen, 2018	Basel, Switzerland	<ul style="list-style-type: none"> 6 % of free-floating car sharing customers reduced their car ownership, compared to a group of non-users 	

5 Discussion and Conclusion

5.1 New players

Car sharing has grown steadily in Norway over the past two decades. Although it may be difficult to calculate the number of actual users due to the prevalence of passive members, one could broadly, but conservatively, state that there are tens of thousands of car sharing users in Norway. Furthermore, there are now almost a dozen firms offering a wide variety of car sharing options. Whereas the station based cooperative model is the most established model, newer types of platforms, both in terms of organizational model and operational model, have entered the market.

The most significant developments in recent years have been (1) the growth of P2P car sharing platforms, namely Nabobil, MoveAbout, and Hyre, and (2) the entry of established multinational incumbent mobility stakeholders such as Zipcar and GreenMobility into the market, (3) the coupling of car sharing to residential organizations and practices as is seen with the latest platforms offered by Zipcar/OBOS and Hayk, and (4) the introduction of the first free floating car sharing platform in Norway.

Despite these developments, there still exists an important link between car sharing and cooperatives. Firstly, the three oldest platforms in Norway – Bilkollektivet, Bergen bildelingen and Trondheim Bilkollektivet – are all member owned cooperatives that have all expanded and become established or dominant actors within their local markets. Secondly, new firms entering the market are focusing on housing cooperatives as they key pathway to a customer base. This is the case both for large international actors like the Avis/Budget Group as well as new small startups like Hayk.

The arrival of incumbent mobility stakeholders and multiple startups in Oslo suggests that it is now a proven market. What remains to be seen is who the dominant players and what the dominant platforms will be.

5.2 Incentives and promotion

Car sharing in Norway remains geographically concentrated in the Oslo metropolitan area. With the exception of the established cooperative platforms in Bergen and Trondheim, every single other service provider in the country is focused on Oslo. This confirms previous research that shows that car sharing is more likely to succeed in urban areas, and furthermore, that the successful neighborhoods tend to be densely populated, walkable, and transit oriented (Dowling & Kent, 2013). If car sharing is to contribute to a transition to a more sustainable mobility system in Norway, policymakers and service providers must lay the groundwork to upscale the practice beyond Oslo; at the very least in other large urban areas. Otherwise, car sharing will remain a niche practice for the foreseeable future. The implications for Oslo, on the other hand, are more far reaching if current growth trends persist. The same can be said of international cities of comparable size to Oslo.

Until now, car sharing has grown with little to no support, either financially or in terms of regulation, from public authorities. A recent example of municipal efforts to support car

sharing is the Oslo Municipality's proposal to dedicate up to 600 public parking spaces exclusively for shared cars (Sørgjerd, 2018). A challenge with such a proposal is that some shared vehicles are used much more frequently than others, and thereby more "deserving" of a dedicated parking space. There would obviously have to be adequate criteria and/or countermeasures to avoid pro forma P2P users providers – those who would (presumably) register their private cars as a shared vehicle with the primary intention of obtaining a desirable parking space rather than renting it out to other users. Despite the complexities of carrying out such a proposal, other Norwegian cities should consider ways of offering such incentives to car sharing users and service providers if they hope to curtail the increases use of private vehicles.

If policymakers aim to increase the use of car sharing, they should incorporate it into the regulations for residential parking in such a way that allows users to park shared vehicles throughout the city. If not, municipalities would effectively be hampering the uptake of car sharing at an early stage.

5.3 Decoupling car sharing and carbon impact

By decoupling carbon impact and car sharing, we mean that the traditional way of assessing the environmental footprint of a mode of transportation, i.e. CO₂ emissions, will be increasingly irrelevant in the coming years.

As cars become more efficient, and even emission free, the share of carbon footprint that is related to land use and material consumption increases (Doka & Ziegler, 2000, pp. 6-7). Since the middle of the Twentieth Century, most Western countries have had a land use pattern that was built around the logic of the private automobile (Urry, 2004). Car sharing, as opposed to private automobile use, has the potential to alleviate the environmental costs of sprawl (Firnkorn & Muller 2011, p. 1527; Camagni, Gibelli & Rigamonti, 2002).

Although it has been shown to lead to a reduction in vehicle holdings, VKT and carbon emissions, it is still a niche practice. If user practices and technological capabilities change as the market matures, car sharing could still have a net negative carbon footprint if it encourages a land use regime that is not dense, walkable and transit oriented.

Furthermore, there are GHG issues specific to car sharing. Automobile emissions vary according to start temperature – starting a warm engine, which is more common with cars that are used more frequently "could be responsible for a multiplication of several gaseous emissions other than CO₂" (Firnkorn & Muller 2011, p1526). If car sharing becomes a mainstream mode of transportation, it will be necessary to carry out more rigorous research on harmful non-CO₂ emissions (e.g. NO_x, CO) that may be more prevalent with shared cars.

Furthermore, it would be worthwhile, going forward, to decouple VKT and GHG emissions when it comes to analyzing car sharing's environmental impact. The primary reason for doing so, especially in a Norwegian context, is the growth in popularity of battery electric vehicles. By the end of 2018, the sale of battery electric and hybrid electric vehicles accounted for nearly half of all personal vehicle sales in Norway. Furthermore, as the proportion of automobiles that use zero-emissions technologies increases, more attention should be given to the impacts of emission in general – not just those that exacerbate the greenhouse effect. Given that much of the efforts to limit automobile use in cities is driven by local environmental concerns, there needs to be more studies of the effects of car sharing on local gas emissions and levels of suspended particulate matter (SPM) that result from, among other thing, the deterioration of road surfaces, tires and brake pads.

5.4 Further Research

Much of the research on the impacts of car sharing depends on survey data with member users, which includes a “large intention-behaviour gap” (Firnkorner & Muller, 2011, p. 1526). As the popularity and geographic availability of car sharing increases, more comprehensive impact analyses that incorporate actual vehicle sales over longer periods of time would offer more concrete evidence as to the effects of car sharing on vehicle holdings. The same can be said of VKT.

A disproportionate amount of the currently available research on car sharing, especially large scale quantitative studies, have a geographic focus in the largest and most developed markets, namely the United States and Germany, and to some extent, Canada, Switzerland and the Netherlands. More work is needed in other European and emerging markets outside of the European and North American cores.

An additional area of research that deserves attention is the implication of automation when it comes to car sharing. It has been claimed that autonomous vehicles can only be environmentally friendly if they are shared (Fagnant & Kockelman, 2014). We know very little about the environmental, economic, social and psychological factors that would inform a future in which shared cars are autonomous.

6 References

- Baptista, P., et al. (2014). "Energy, environmental and mobility impacts of car-sharing systems. Empirical results from Lisbon, Portugal." *Procedia-Social and Behavioral Sciences* 111: 28-37.
- Becker, H., et al. (2017). "Comparing car-sharing schemes in Switzerland: User groups and usage patterns." *Transportation Research Part A: Policy and Practice* 97: 17-29.
- Bertheussen, R. B. and M. Arnestad (2016). *Bildelerne i Norge: en studie om norske bildelere: hvem er de og hva driver dem?*
- Briceno, T., et al. (2005). "Using life cycle approaches to evaluate sustainable consumption programs: car-sharing."
- Brook, D. (2004). Carsharing—start up issues and new operational models. *Transportation Research Board 83rd Annual Meeting, Washington, DC, Citeseer.*
- Camagni, R., et al. (2002). "Urban mobility and urban form: the social and environmental costs of different patterns of urban expansion." *Ecological Economics* 40(2): 199-216.
- Cervero, R. (2003). "City CarShare: First-year travel demand impacts." *Transportation Research Record: Journal of the Transportation Research Board*(1839): 159-166.
- Cervero, R., et al. (2007). "City CarShare: longer-term travel demand and car ownership impacts." *Transportation Research Record: Journal of the Transportation Research Board*(1992): 70-80.
- Cervero, R. and Y. Tsai (2004). "City CarShare in San Francisco, California: second-year travel demand and car ownership impacts." *Transportation Research Record: Journal of the Transportation Research Board*(1887): 117-127.
- Chen, T. D. and K. M. Kockelman (2016). "Carsharing's life-cycle impacts on energy use and greenhouse gas emissions." *Transportation Research Part D: Transport and Environment* 47: 276-284.
- Clean fleets, Increasing efficiency of administration's fleet management – Car-sharing in Bremen Clean Fleets Case Study, 24.08.2015. Retrieved on 03.09.2018: http://www.clean-fleets.eu/fileadmin/files/documents/Publications/case_studies/Clean_Fleets_case_study_-_Bremen_Car-Sharing_integration.pdf
- Doka, G. and S. Ziegler (2000). "Complete life cycle assessment for vehicle models of the mobility carsharing fleet Switzerland."
- Enterprise Carshare, retrieved 14.10.2018: <https://www.enterprisecarshare.com/us/en/locations.html>
- Fagnant, D. J. and K. M. Kockelman (2014). "The travel and environmental implications of shared autonomous vehicles, using agent-based model scenarios." *Transportation Research Part C: Emerging Technologies* 40: 1-13
- Firnkorn, J. and M. Müller (2011). "What will be the environmental effects of new free-floating car-sharing systems? The case of car2go in Ulm." *Ecological Economics* 70(8): 1519-1528.

- Frenken, K. (2013). Towards a prospective transition framework. A co-evolutionary model of socio-technical transitions and an application to car sharing in The Netherlands. International Workshop on the Sharing Economy. Utrecht.
- Frenken, K. and J. Schor (2017). "Putting the sharing economy into perspective." *Environmental Innovation and Societal Transitions* 23: 3-10.
- Geels, F., et al. (2011). *Automobility in transition?: A socio-technical analysis of sustainable transport*, Routledge.
- Groß, S. and N. Stengel (2011). *Mietfahrzeuge im Tourismus: Grundlagen, Geschäftsprozesse und Marktanalyse*, Oldenbourg Verlag.
- Harms, S. and B. Truffer (1998). "The emergence of a nation-wide carsharing co-operative in Switzerland." A case-study for the EC-supported research project "Strategic Niche Management as a tool for transition to a sustainable transport system", EAWAG: Zürich.
- Hertwich, E. G. (2005). "Consumption and the rebound effect: An industrial ecology perspective." *Journal of industrial ecology* 9(1-2): 85-98.
- Hertz bilpool (2018), company website – about us, retrieved 30.10.2018: <https://www.hertzbilpool.no/om-oss/>
- Hleb, M. and M. Perković (2015). Report on the introduction of electric municipal car-sharing scheme in Koprivnica. Implementation Status Report, CIVITAS.
- Hodson, M., et al. (2017). "Reconfiguring urban sustainability transitions, analysing multiplicity." *Sustainability* 9(2): 299.
- Katzev, R. (1999). *Carsharing Portland: Review and analysis of its first year*, Department of Environmental Quality, Portland, Ore.
- Kell, J. (2013). "Avis to buy car-sharing service Zipcar." *Wall Street Journal* (January 2).
- Kemp, R., et al. (2012). Introduction: Sustainability transitions in the automobility regime and the need for a new perspective, in Geels, F., et al. (2011). *Automobility in transition?: A socio-technical analysis of sustainable transport*, Routledge.
- Kent, J. L. and R. Dowling (2013). "Puncturing automobility? Carsharing practices." *Journal of Transport Geography* 32: 86-92.
- Lane, C. (2005). "PhillyCarShare: First-year social and mobility impacts of carsharing in Philadelphia, Pennsylvania." *Transportation Research Record: Journal of the Transportation Research Board*(1927): 158-166.
- Loose, W. (2010). "The state of European car-sharing." Project Momo Final Report D 2.
- Martin, E. and S. Shaheen (2016). "Impacts of Car2Go on vehicle ownership, modal shift, vehicle miles traveled, and greenhouse gas emissions: an analysis of five North American Cities." *Transportation Sustainability Research Center, UC Berkeley*.
- Martin, E., et al. (2010). "Impact of carsharing on household vehicle holdings: Results from North American shared-use vehicle survey." *Transportation Research Record* 2143(1): 150-158.
- Martin, E., et al. (2010). "Impact of carsharing on household vehicle holdings: Results from North American shared-use vehicle survey." *Transportation Research Record* 2143(1): 150-158.
- Martin, E. W. and S. A. Shaheen (2011). "Greenhouse gas emission impacts of carsharing in North America." *IEEE Transactions on intelligent transportation systems* 12(4): 1074-1086.

- Meijkamp, R. (1998). "Changing consumer behaviour through eco-efficient services: an empirical study of car sharing in the Netherlands." *Business Strategy and the Environment* 7(4): 234-244.
- Millard-Ball, A. (2005). *Car-sharing: Where and how it succeeds*, Transportation Research Board.
- Mobility, About Us, Retrieved 17.12.2018: <https://www.mobility.ch/en/mobility-cooperative/about-us/>
- Nabobil (2018a), Internet homepage, retrieved 11.12.2018: <https://nabobil.no/>
- Nabobil (2018b), Internet website for «uten nøkkel» service, retried 11.12.2018: <https://nabobil.no/nabobil-uten-nokkel>
- Nenseth, V., et al. (2012). "Innovative Collective Mobility Solutions-Carsharing as a Case." TØI Report(1218/2012).
- Nijland, H. and J. van Meerkerk (2017). "Mobility and environmental impacts of car sharing in the Netherlands." *Environmental Innovation and Societal Transitions* 23: 84-91.
- NSB (Norwegian State Railways) (2018), NSB med endelig avtale om elektriske bybiler i Oslo, 15.06.2018, retrieved on 14.10.2018: <https://www.nsb.no/om-nsb/for-presse/pressemeldinger/nsb-med-endelig-avtale-om-elektriske-bybiler-i-oslo>
- OBOS (2016), "Rekordtilstrømning av OBOS-medlemmer" Organization website, retrieved on 12.12.2018: <https://www.obos.no/dette-er-obos/nyheter/rekordtilstromning-av-obos-medlemmer>
- Parzen, J., et al. (2015). "Shared-use mobility reference guide." Chicago (IL): Shared-use Mobility Center.
- Schippl, J., et al. (2016). "Different pathways for achieving cleaner urban areas: A roadmap towards the white paper goal for urban transport." *Transportation Research Procedia* 14: 2604-2613.
- Shaheen, S., et al. (2015). "Definitions, Industry Developments, and Early Understanding." Berkeley, CA: University of California Berkeley Transportation Sustainability Research Center. http://innovativemobility.org/wp-content/uploads/2015/11/SharedMobility_WhitePaper_FINAL.pdf.
- Shaheen, S., et al. (1998). "Carsharing in Europe and North American: past, present, and future."
- Shaheen, S., et al. (1998). "Carsharing in Europe and North American: past, present, and future."
- Shaheen, S. and A. Stocker (2015). "Information Brief." *Carsharing for Business, Zipcar Case Study & Impact Analysis*.
- Shaheen, S. A., et al. (2015). "One-way carsharing's evolution and operator perspectives from the Americas." *Transportation* 42(3): 519-536.
- Shaheen, S. A. and A. P. Cohen (2007). "Growth in worldwide carsharing: An international comparison." *Transportation Research Record* 1992(1): 81-89.
- Shaheen, S. A. and A. P. Cohen (2013). "Carsharing and personal vehicle services: worldwide market developments and emerging trends." *International Journal of Sustainable Transportation* 7(1): 5-34.
- Sioui, L., et al. (2013). "How carsharing affects the travel behavior of households: a case study of Montréal, Canada." *International Journal of Sustainable Transportation* 7(1): 52-69.
- Sparrow, F., et al. (1982). "The Mobility Enterprise-Improving Auto Productivity."

- SSB (Statistics Norway) (2018), Befolkning, Statistiskbanken, retrieved 19.09.2018: <https://www.ssb.no/statbank/table/07459/>
- Steininger, K., et al. (1996). "Car-sharing organizations: The size of the market segment and revealed change in mobility behavior." *Transport Policy* 3(4): 177-185.
- Stocker, A. and S. Shaheen (2017). Shared automated vehicles: Review of business models. International Transport Forum.
- Sørgjerd, C. (2018). "Vil revolusjonere bildeling i Oslo med nytt forslag." *Aftenposten* (January 24).
- Truffer, B. (2003). "User-led innovation processes: the development of professional car sharing by environmentally concerned citizens." *Innovation: The European Journal of Social Science Research* 16(2): 139-154.
- Urry, J. (2004). "The 'system' of automobility." *Theory, Culture & Society* 21(4-5): 25-39.
- Walb, C. and W. Loudon (1986). Evaluation of the Short-Term Auto Rental (STAR) Service in San Francisco, CA, US Department of Transportation, Urban Mass Transportation Administration.
- Washington State Legislature, Revised Code of Washington 87.70.010 Definitions, retrieved 23.09.2018: <https://app.leg.wa.gov/rcw/default.aspx?cite=82.70.010>

Transportøkonomisk institutt (TØI) Stiftelsen Norsk senter for samferdselsforskning

TØI er et anvendt forskningsinstitutt, som mottar basisbevilgning fra Norges forskningsråd og gjennomfører forsknings- og utredningsoppdrag for næringsliv og offentlige etater. TØI ble opprettet i 1964 og er organisert som uavhengig stiftelse.

TØI utvikler og formidler kunnskap om samferdsel med vitenskapelig kvalitet og praktisk anvendelse. Instituttet har et tverrfaglig miljø med rundt 70 høyt spesialiserte forskere.

Instituttet utgir tidsskriftet Samferdsel med 10 nummer i året og driver også forskningsformidling gjennom TØI-rapporter, artikler i vitenskapelige tidsskrifter, samt innlegg og intervjuer i media. TØI-rapportene er gratis tilgjengelige på instituttets hjemmeside www.toi.no.

TØI er partner i CIENS Forskningscenter for miljø og samfunn, lokalisert i Forskningsparken nær Universitetet i Oslo (se www.ciens.no). Instituttet deltar aktivt i internasjonalt forsknings-samarbeid, med særlig vekt på EUs rammeprogrammer.

TØI dekker alle transportmidler og temaområder innen samferdsel, inkludert trafiksikkerhet, kollektivtransport, klima og miljø, reiseliv, reisevaner og reiseetterspørsel, arealplanlegging, offentlige beslutningsprosesser, næringslivets transport og generell transportøkonomi.

Transportøkonomisk institutt krever opphavsrett til egne arbeider og legger vekt på å opptre uavhengig av oppdragsgiverne i alle faglige analyser og vurderinger.

Besøks- og postadresse:

Transportøkonomisk institutt
Gautstadalléen 21
NO-0349 Oslo

22 57 38 00
toi@toi.no
www.toi.no