



Car sharing in the Oxford context: Understanding implications for its role in transportation transition

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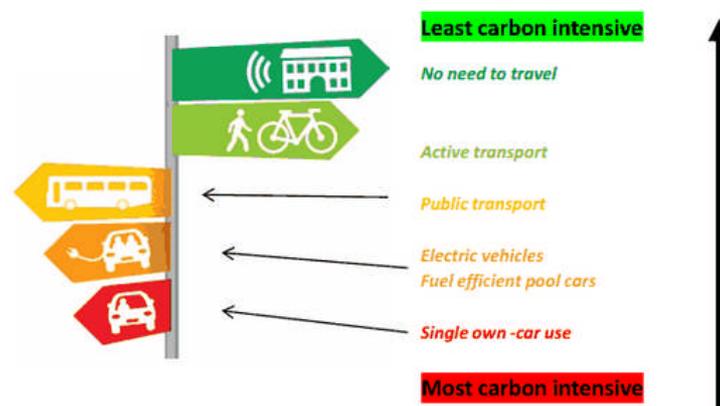
Abstract

This paper examines the state of car sharing in Oxford, a bus-dependent city in the United Kingdom, in order to better understand and relate its current and future role to the socio-technical transition towards low-carbon mobility occurring in urban transport systems across the world. Drawing heavily from the theoretical framework established by previous applications of innovations and transitions thinking in transportation, particularly those featuring the multi-level perspective and related approaches, this paper employs secondary data analysis as well as documentary analysis in order to summarize dominant ‘visions’ of car sharing as a niche innovation in the local discourse and uncover connections between emerging schemes and pre-existing transport infrastructure. The results of this analysis demonstrate the scattered state of expectations surrounding car sharing across a range of key public and private actors. These expectations, a set of commonly understood anticipated effects of that car sharing schemes might have (e.g. emissions reduction, congestion alleviation), often lack definition in how they are imagined and are largely inconsistent between actors. It can therefore be expected that the corresponding visions of car sharing schemes moulded by these expectations are equally lacking in consistency with an imagined presence that remains problematically unarticulated. The paper concludes that a lack of proper visioning in Oxford is responsible for car sharing’s relatively modest presence in the local transport context, even as the city’s progressive ethos continues to foster other innovations in transport. Finally, suggestions are given for further research work to be conducted, particularly in moving toward understanding how imagined linkages between car sharing and incumbent modes are incorporated into visions

1. Introduction

As the rhetoric of sustainability has grown across nearly all facets of society, transportation has emerged as a key venue through which meaningful change toward sustainable living can be explored and implemented (Banister, 2008). Transportation systems represent a foundation fundamental to the functioning of entire global networks, thus approaches to the ‘transition’ towards low-carbon mobility have been highly heterogeneous, complex, and varied based on context and a multitude of volatile external factors (Schwanen, 2013). One potential avenue for regime disruption has come in the form of changing ownership patterns, a rising trend being the shift from traditional product ownership models to the use of products as ‘services’ (Nykvist & Whitmarsh, 2008). Car sharing and car club schemes have widely come to be considered a ‘servicization’ innovation contributing to the socio-technical shift to less carbon-intensive modes of transport, particularly throughout Europe and the United Kingdom. Car sharing schemes are characterized by the renegotiation of user habits, important contextual dependencies, and the incorporation of a wide range of actors, from government entities, to community groups and automotive industry leaders.

Oxford is a city in Southeast England with an established tradition of forward-thinking transport policy (Parkhurst and Dudley, 2004) that has, to the surprise of many, witnessed a rather touch-and-go relationship with the implementation of car sharing measures. In Oxford, the prevailing transport agenda since the mid-20th century has been one uniquely aware of the negative impacts connected to private vehicle domination. This awareness has translated to transformational policy, rendering historic Oxford one of the most bus-oriented cities in the industrialized world (Ibid.). This bus dependency has, in recent decades, been complimented by a radical ‘value hierarchy’ (see Figure 1) that has promoted reducing the need to travel and greater uptake of cycling and the expansion of pedestrian infrastructure in favour of accommodating vehicular travel (Parkhurst, 2004). Taken together, Oxford has been able to ease many of the negative effects associated with increasing car ownership rates felt by similar cities throughout the UK. This innovative ethos has historically accommodated some experimentation in car sharing schemes, but their extent and attention have remained rather limited.



Source: Oxford City Council (2012, no pagination).

Figure 1: Guiding value hierarchy in Oxford transport policy

This is not to say, however, that contemporary Oxford is free of any issues derivative of transportation within the city or throughout the region. While pedestrianization initiatives and street re-allocation measures have effectively catered to alternative modes, private vehicles and high-frequency buses contribute to a host of problems in the city centre and along main corridors in other parts of the city. Further, development in towns adjoining Oxford is occurring at an increasing pace and contributing to a rise in journeys that overwhelmingly favour the private car (Oxfordshire LEP, 2014). As a result congestion, air quality, and parking have become politically charged issues gaining the attention of governing bodies, businesses, residents, and community groups alike. Even with this renewed urgency, the actual application of car sharing measures has substantially lagged behind their rising discursive presence as a possible solution to a range of transport issues. This raises the question: if and to what extent is car sharing perceived or imagined as a partial solution to these issues?

Given the Oxford context and a broader understanding of the larger transportation issues in modern cities being addressed by the transition to more sustainable systems, this paper will aim to understand: how car sharing is being imagined in the city, who is leading the discourse surrounding car sharing schemes, and what characterizes the pervading visions of these schemes in local policy, media, and community action. The paper will begin first with a review of relevant theoretical frameworks necessary for formulating a discussion of car sharing and its place in transition and innovation thinking. Next, the methodology section will outline how frames or visions were analysed. Finally, following the results, the paper will look to answer the questions posed above and conclude with possible implications for the future role of car sharing in Oxford.

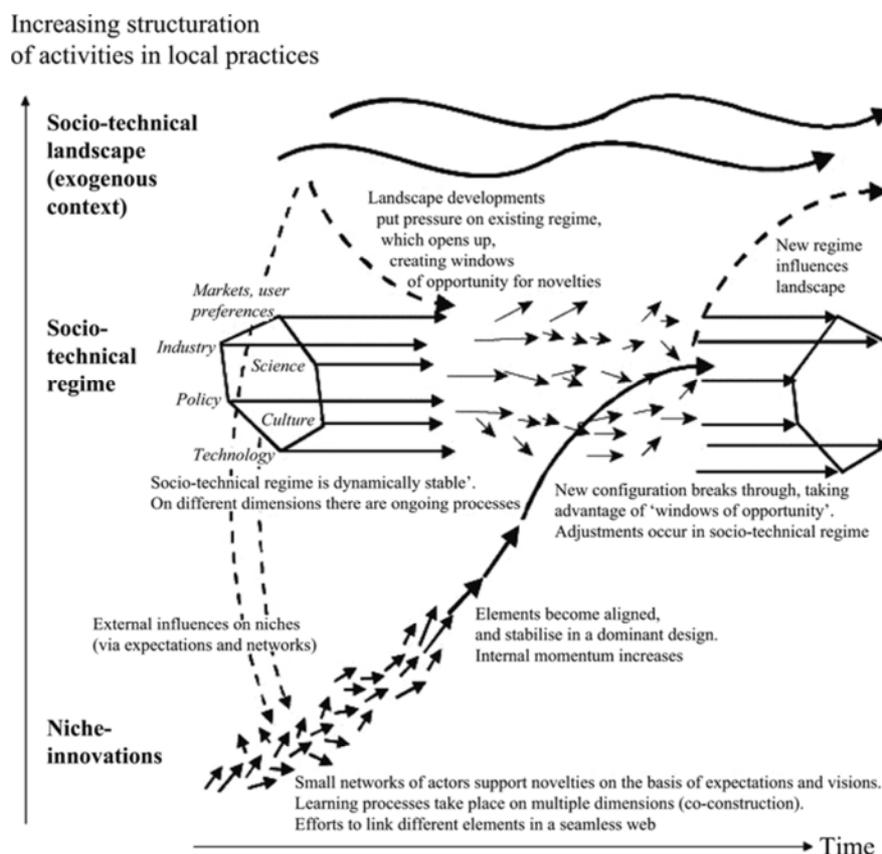
2. Theoretical Lens

The paper implements and was inspired by a sociotechnical transitions approach to the study of transport innovations. In this application, transitions are viewed as collection of co-evolutionary processes that move towards displacing or reconfiguring an established system, incorporating a wide range of actors, social groups, and interdependent interactions (Schwanen, 2013). Socio-technical thinking further highlights the multi-dimensional character of systemic linkages between industry, new and established technologies, financial markets, government, and culture (Geels, 2012). Thus, this framework complements the analysis of car sharing as a perturbation that propagates through the complex and dynamic structure of transportation systems. The applicability of this framework to the larger socio-technical transition of entire transport systems towards low carbon mobility has been elaborated in the sustainable transport literature (see: Schwanen, 2013).

The lens offered by socio-technical transition thinking changes depending upon the variety mobilized; this paper will utilize the multi-level perspective and its affiliated approaches (Ibid). Geels (2012) outlines the central tenets of the multi-level perspective (MLP) as follows:

- Co-evolutionary: changes within a system are not driven by single factors, but instead rely on interactions and developments among multiple dimensions.
- Actor based: the strategies, perceptions, and actions of a range of actors are central.
- Interplay of stability and change: systems encompass mechanisms whereby stability or change is promoted or resisted.
- Dynamic complexity: change within a system is not the result of linear cause-and-effect relationships; developments are mutually reinforcing and interconnected.

The most commonly discussed form of the MLP incorporates a three-pronged hierarchy of niche, regime, and landscape. The core ideology of the MLP states that systemic change away from the incumbent regime of automobility can only come about through dynamic processes linking landscape, regime, and niches (Geels, 2012). At the macro level the landscape represents the context within which regimes are stabilized and niches come to exist, exerting exterior pressures of which actors have little control. The meso level is composed of the dominant regime, a term relaying the full range of incumbent practices and associated rules of an established system (Nykvist & Whitmarsh, 2008). Finally, the micro level of the MLP hierarchy is made of up niches, or protected spaces where niche actors implement and test new innovations that counter trends of the dominant regime (Schwanen, 2013). A visualization of the multi-dimensional regime-disrupting interactions across levels can be found in Figure 2.



Source: Geels & Schot (2007, page 401).

Figure 2: Dynamic interactions across the multi-level perspective

Protected spaces are a defining characteristic or niches, as they afford technologies the ability to develop and configure in ways that are path breaking and disruptive to the regime (Smith & Raven, 2012). Protected spaces are created, sustained, and eventually dissolved by three interrelated processes. The first, 'shielding', deflects mainstream selection pressures away from the niche that would otherwise stifle development or squander opportunities for further innovation. While being shielded from the selection environment, niches in protected spaces can then be 'nurtured'. Nurturing consists of processes that promote the development and refinement of path breaking innovation, often coming in the form of governmental intervention or support. Finally, 'empowerment' is a process resulting from sustained nurturing and support that allows the niche to dissolve protected space and move into the mainstream environment. Empowered niches are capable of further development either in their ability to better compete against unchanged selection pressures, or through influence which alters selection pressures in their favour (Ibid.). Processes related to protected spaces are vital to healthy niche development and incorporate a complex network of actors.

Niches are of great interest in the analysis of car sharing, as they represent the seeds of transformational change and can be both technological and socio-cultural in nature. Successful niches require the construction of social networks of heterogeneous actors who need to learn about design, technology, user preferences and regulations. They also need to articulate, adjust and readjust shared expectations and visions (Geels, 2012). 'Visioning' is a social process that provides guidance and direction to the innovative activities occurring within niches. Visions are achieved through the refinement of niche expectations in order to make them attention grabbing and appealing to mainstream actors. Thus, successful visioning is vital to creating momentum behind niche development as it affords the recruitment of actors and the formation of actor networks (Ibid.). Visioning is useful in the analysis of car sharing frames, as frames are in many ways derivative of coherent visions and established expectations surrounding a given innovation. Frames are understood as the way niche innovations are described or interpreted by relevant actors, particularly based on the emphasis of specific elements or aspects (Dijk, 2011). Additionally, visions and frames are highly transferrable to government discourse and are functional in such practices as transition management and strategic niche management. These two approaches to the governance of transitions shape the objectives of long term policies and aid in realizing how a specific transition, its innovations and its visions, may work towards improving an existing system (Rotmans et al., 2001).

Having established this paper's theoretical framework and its view of car sharing as a niche innovation, it is useful to clarify what is considered innovative in this particular case. Some have discussed car sharing in the context of innovative ownership styles or business models, while others have considered the implications of radical socio-cultural changes with regard to consumption (Geels, 2012; Akyelken, Anderton, Plepys & Mont, 2013). In order to best focus the variety of insights that can be drawn from an examination of car sharing frames, this paper employs the concept of 'servicizing.' Servicizing can be defined as: 'a transaction where value is provided through a combination of products and services where satisfaction of

customer needs is achieved by selling function of the product rather than the product per se and/or by increasing the service component of the offer' (Akyelken et al., 2013). Stated more plainly, servicizing represents a shift from product to service motivated by a combination of environmental, economic, and socio-political values. Thus, approaching car sharing as an innovation characterized by servicizing allows the analysis to better represent a range of motives and actors who are participating in, impacting, or are impacted by niche development.

3. The Oxford Transport Context

Over the last six years, transportation in Oxford has witnessed a dynamic swell of innovations ranging from the expansion and 'greening' of the city's popular high frequency buses, the re-allocation of street space in favour of bicycle and pedestrian infrastructure, and the rolling out of numerous car and cycle sharing schemes. In terms of car sharing initiatives specifically, the city has seen the introduction of four formal car sharing schemes along with the creation of an online trip-sharing platform that pairs participants on similar journeys together (Oxford Liftshare). A summary of Oxford's current car sharing schemes is found in Table 1.

Table 1: Summary of pre-existing Oxford car sharing schemes

Operator	Number of cars	Area served	History
Co-Wheels	18	South and East Oxford	Originally founded in 2008 as 'Commonwheels'; serves as the central operator to a conglomeration of neighbourhood-led schemes
Zipcar	9	Central, West, North and East Oxford	Originally known as 'Streetcar' but renamed after take-over by Zipcar; came to Oxford in 2008, originally with four vehicles
eCar Club	1	Summertown, North Oxford	Founded in 2013 by community group, Low Carbon Oxford North. Currently operates one electric vehicle with charging station at Diamond Place Car Park, Summertown.
Oxford Brookes Car Club	8	Headington, East Oxford	Founded in 2013 through the partnership of Oxford Brookes University and national car club operator Hertz 24/7. Serves campus locations throughout East Oxford.

While car sharing schemes have been on the radar of transport innovations in Oxford over the past six years, their current role in a shift towards low-energy, energy efficient transport in the city should not be exaggerated. Their presence has been dwarfed by the continued financial and policy commitments made to buses, cycling, and rail. Especially in terms of financial support, government attention has largely remained elsewhere. For example, in the period 2008-2014, over £25 million has been committed to improving the bus

network and £80 million has been allocated to improving the Oxford Railway Station. In fact, the only initiative related to car sharing to have received government funds during this period was Oxford Liftshare, which was awarded £35,000 for the development of an online platform allowing individuals to more easily share journeys across the city (Oxford County Council, 2011). This figure represents less than one-third of the £150,000 County Council commitment made to the relatively modest Oxonbike cycle sharing scheme in East Oxford (Oxford County Council, 2013). It is clear that car sharing in Oxford is receiving substantially less financial support than is offered to other recent initiatives aimed at making transport more environmentally sustainable.

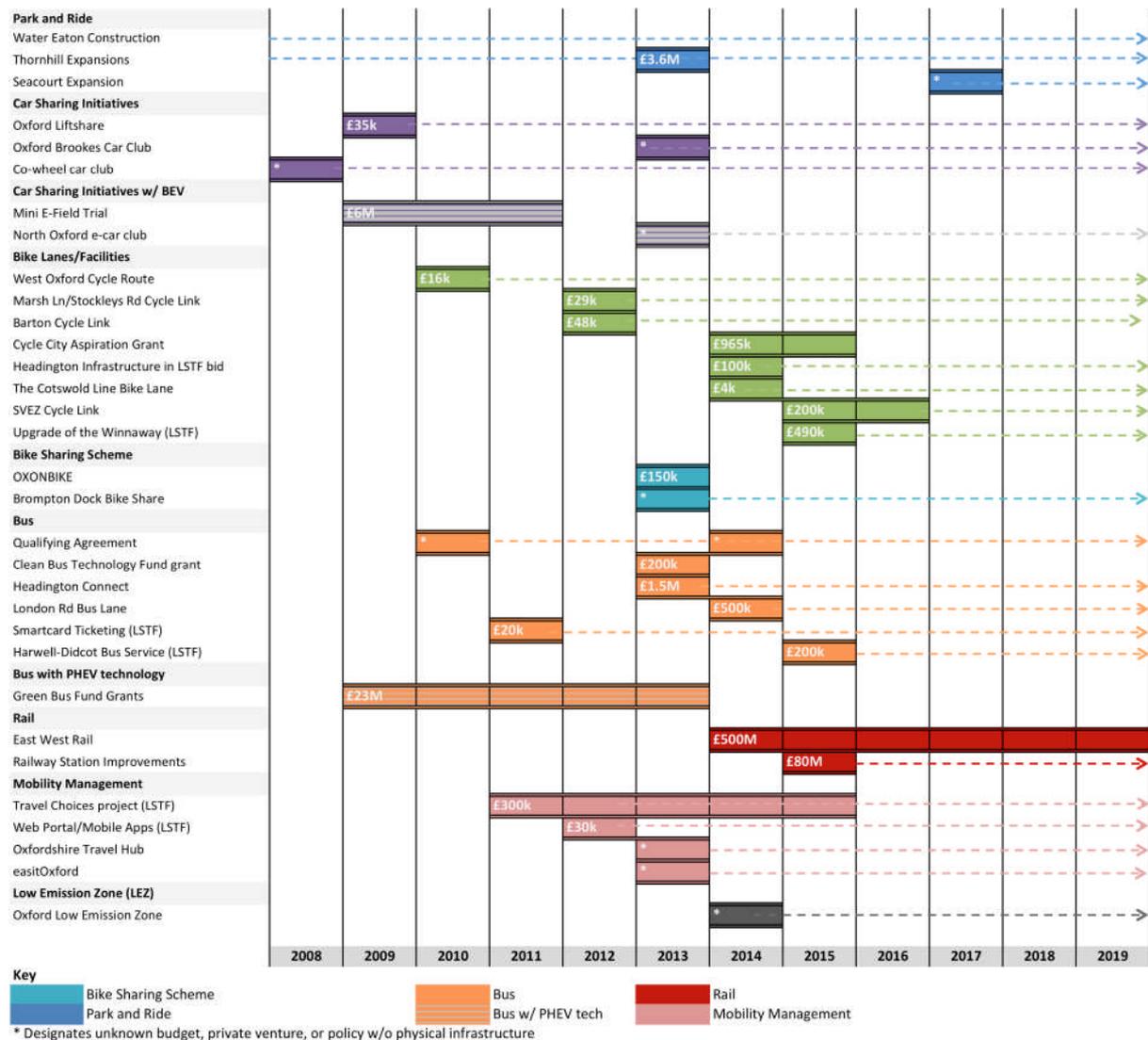


Figure 3: Timeline of Oxford transport innovations since 2008

In some sense, car sharing schemes are being ‘crowded out’ by alternative modes that continue to dominate transport policy and thus secure the majority of funding. In Oxford, the overwhelming beneficiary of local government expenditure continues to be the well-established bus network. Figure 3 illustrates the timeline of transport innovation and initiatives in the city since 2008. While there is a diverse range of transport options being

pursued over this period, it is evident that the focus of government actors remains heavily on buses, cycling, rail, and mobility management.

4. Methodology

If visions are important in the nurturing and empowering of socio-technical niches and car sharing can be considered one such niche, it makes sense to analyse how car sharing is envisaged by a range of stakeholders in Oxford and beyond. Visions can be articulated using multiple media. Visual representations are imbued with specific affective means that make them powerful means of galvanising support; however, visioning through text is more common and performed by a wider range of stakeholders. The emphasis in this paper is therefore in discursive articulations of expectations and imaginings of car sharing.

Table 2 Qualitative coding of groups and attributes

Groups	Attributes
(1) Organizational Arrangement	<i>Institutional arrangement and definition</i> <i>Lead actor</i> <i>Geographic scale</i> <i>Modal linkages</i>
(2) Imagined Users	<i>Imagined users</i>
(3) Anticipated Impacts	<i>Congestion</i> <i>Parking</i> <i>Other Modes</i> <i>Greenhouse gas emissions</i> <i>Air quality</i> <i>Energy use and efficiency</i>
(4) Role of Government	<i>Financial support</i> <i>Nature of action</i>

Drawing on the literature outlined above, four key areas for the discursive analysis of car sharing schemes were defined as follows: organizational arrangement, imagined users, expected impacts, and role of government. For each key area a number of attributes can be identified, and these are central to the analysis below (Table 2). The attributes investigated have been derived from an extensive review of relevant literature, government documents and initiatives, and various policy measures. The organizational, imagined users and governmental sets of attributes (groups 1, 2, and 4 in Table 2) represent the key structural mechanisms through which actor networks are formed and visions are strengthened (Geels, 2012). These particular attributes allow for an understanding of how car sharing schemes are defined, who is moulding their discursive presence, the extent to which their scale and user base is imagined, and how they are supported by governing entities. The impacts incorporated here (group 3) exist on a variety of scales, both local and global, and have been deemed relevant by a plurality of actors. Congestion and parking are especially ubiquitous terms in the transport literature and are addressed in almost all practical approaches to transportation planning. As this paper examines innovations towards low-carbon mobility, impacts on energy use and its related terminology (efficiency, as defined by fuel consumption

or mileage) are valuable. Given Oxford's historic commitment to public transportation and multi-modal transport schemes, analysing the discussion of impacts on other modes is particularly important in this context. This discussion is further important as it reflects the systemic view that animates MLP thinking, particularly relating to existing regimes. Finally, mentions of air quality and greenhouse gas emissions are increasingly relevant given their presence in influential local and national policy discourse (see: Oxford City Council, 2013; Parliament, 2008). Taken together, the attributes related to the impacts of car sharing schemes further exhibit how visions and expectations are being formed by actor networks (Smith and Raven, 2012).

The analysis mobilizes documentary data and secondary data analysis to investigate the full range of innovations being discussed and to place the framing of car sharing schemes within this discussion. Documents were selected from a diverse database¹ that included innovation-related policy and media coverage across all modes of transport within city regions, from electric bike schemes to rail. The first round of selection incorporated secondary data from actors in Oxford, London, and at the national level of the UK—all discussing transport innovations within the last ten years. This hierarchy of actor group was reasoned to be most central in shaping the larger discourse on transport innovation. Upon refining the sample, there remained eleven documents from Oxford-centric actors and one from the national government's Department for Transport (DfT), resulting in a total of twelve documents spanning eight years. These twelve documents all mention car sharing (or car clubs, as the two terms were considered interchangeable) in some capacity. In order to create a pool of documents representing the 'whole picture' of car sharing in Oxford, the final sample:

- incorporates the full range of the public-private spectrum (from governing bodies to privately held businesses);
- includes documents of varying scope in terms of geographic area, size of imagined user pool, etc.; and
- focuses on actors most relevant, directly or indirectly, in the Oxford context.

While there were undoubtedly documents omitted that had aligned well with these goals, this methodology allows for the confident qualitative analysis of secondary data with respect to the questions being pursued. A summary of the documents that compose the final sample can be found in Table 3.

The twelve selected documents were then qualitatively coded based on the four areas and attributes in Table 2. Attributes were essentially treated as keywords, whereby each document was searched for the explicit presence of a given keyword or a combination of terms that relays information consistent with the keyword (for example in the case of geographic scale, documents were searched for words or phrases that described a defined focus or area at which a particular innovation, initiative, or policy is aimed). The context of this 'mention' was also taken into consideration, specifically with regard to whether or not

¹ This database has been compiled in the context of 'Innovation in Urban Transport' project of the Transport Studies Unit at the University of Oxford (www.cied.ac.uk/research/emergence/innovationsurbantransport).

car sharing was discussed in relation to a given attribute. Following this search, each document-attribute relationship was classified. The classification scheme was as follows:

- Documents were classified as ‘Yes’ for a given attribute if that attribute was present in the document and discussed with relation to car sharing or car club schemes.
- Documents were classified as ‘Yes, with limited specificity’ for a given attribute if that attribute was discussed within the broader context of the document, but not in direct relation to car sharing or car club schemes.
- Documents were classified as ‘No’ for a given attribute if that attribute was not discussed or mentioned in the document whatsoever.

Table 3: Summary of documents analysed

Oxford City Council (2006) - <i>Sustainability Appraisal of the Oxford West End Area Action Plan (1)</i>	<ul style="list-style-type: none"> • Assessment of sustainability measures incorporated into development of the city’s West End
Oxford City Council (2007) - <i>Parking Standards, Transport Assessments and Travel Plans (2)</i>	<ul style="list-style-type: none"> • Supplemental planning document that establishes review process for transport measures in development packages
Oxford City Council (2008) - <i>West End Area Action Plan 2007 -2016 (3)</i>	<ul style="list-style-type: none"> • Plan to guide future development and change in the West End, the southwest corner of City centre
DfT (2011) - <i>Creating Growth, Cutting Carbon: Making Sustainable Local Transport Happen (4)</i>	<ul style="list-style-type: none"> • White Paper discussing government commitments to promoting sustainable growth at the local level
Oxford County Council (2011) - <i>Oxfordshire Local Transport Plan 2011-2030 (5)</i>	<ul style="list-style-type: none"> • Countywide transport plan including specific goals, budget allocations, and future developments
Oxford County Council (2011) - <i>Local Sustainable Transport Fund Bid - The Oxfordshire Arc (6)</i>	<ul style="list-style-type: none"> • Document outlining the county’s bid for national-level funding from the Local Sustainable Transport Fund for the period 2011-2014. This successful bid sought to support employment growth and promote access to higher education and health care by improving transport options in East Oxford.
Oxford City Council (2012) - <i>Workplace Travel Plan (7)</i>	<ul style="list-style-type: none"> • Plan to improve workplace travel of City Council employees in order to meet sustainability goals
easitOxford Initiative (2013) (8)	<ul style="list-style-type: none"> • Scheme funded through a grant from the Local Sustainable Transport Fund that brings Headington based businesses together to form a network that provides tailored travel initiatives for staff by helping employees identify and use travel options
eCar Club (2013) - (9)	<ul style="list-style-type: none"> • Electric car club based in Summertown, North Oxford initiated by a community group and run by national car sharing provider eCar
Oxford Mail (2013) - Fantato – <i>Drivers Urged to use Electric Car Club (10)</i>	<ul style="list-style-type: none"> • Article by a local media provider covering the establishment of the electric car club in North Oxford
Oxford City Council (2013) - <i>Air Quality Action Plan (11)</i>	<ul style="list-style-type: none"> • A local government plan to meet air quality standards and objectives in the city’s designated Air Quality Management Area
Oxford County Council (2014) - <i>Local Sustainable Transport Fund Bid - Access to Science Vale Enterprise Zone (12)</i>	<ul style="list-style-type: none"> • Document outlining the county’s bid for national-level funding from the Local Sustainable Transport Fund for 2015-2016. This successful bid seeks to support economic growth and provide sustainable transport connections to and across ‘Science Vale’, the area in East Oxfordshire from Bicester in the north via Oxford to Didcot in the south where science and knowledge-intensive economic activity is concentrated.

5. Results

The results section following is outlined in accordance with the analysis groups relayed in Table 2.

5.1 Organizational arrangement

Within the documents analysed, definitions of car sharing schemes or explicit mention of how schemes are institutionally organized are inconsistent and varied among actors. Wide scoping government documents, notably the DfT's White Paper '*Creating Growth, Cutting Carbon*' (number 4 in Table 3) and the Oxford County Council's local transport plan (5), offer some semblance of definition in the discussion of car sharing schemes. These examples distinguish between what are considered 'peer-to-peer' car sharing programs, those most closely related to 'liftsharing' or 'carpooling', and what are more formal pay-as-you-go car clubs. Slightly more specific government documents, the city council's workplace travel plan and the easitOxford initiative for example, outline 'software' measures to promote shared journeys but fail to define this arrangement as a formal car sharing scheme. Documents with the finest scope, like those covering the North Oxford eCar club (9 & 10), describe more commercialized arrangements of car sharing, explicitly outlining the costs associated with membership.

Lead actors are more rigidly defined among the documents analysed, especially those outlining discrete government initiatives like the two Local Sustainable Transport Fund (LSTF)² bids (6 & 12) or the West End Area Action Plan (WEAAP) (3). In these examples public leadership is tied directly to private partnerships and community organizations. On the whole, government entities are overwhelmingly incorporated as 'leading' or 'delivering' authorities, with slight variations based on the source of the document. Examples like the easitOxford initiative (8) or the North Oxford eCar club (9 & 10) explicitly mention government support, but are largely led by more private interests.

Nearly all of the documents encapsulate some geographic focus, although there is significant variation in scale and the extent to which car sharing schemes particularly are spatially imagined. Broadly, wide scoping government documents incorporate larger areas than more targeted measures. For example, the city council's Air Quality Action Plan (11) describes an Air Quality Management Area that includes the entire city centre while the WEAAP (3) has an implied extent on the scale of a specific neighbourhood. Among all the documents, there is limited placement of car sharing schemes within defined geographic boundaries. While examples like the North Oxford eCar club (9 & 10) have a clear service

² The Local Sustainable Transport Fund (LSTF) was introduced by the Cameron led coalition government in the 2011 White Paper *Creating Growth, Cutting Carbon*. Local authorities could bid for funding from this fund in two rounds (in 2011 for the period 2011-2014, and in 2014 for the years 2015-2016) provided they provided matched funding from other, local sources. £600 million of national funding was made available in 2012 to 77 local authorities, meaning that in total over £1 billion is invested in local sustainable travel. An additional £65 million of national funding was awarded to 44 local authorities in 2014. As the local contribution was much greater this time (£375 million), a further £440 million is expected to be invested in 2015-2016 (DfT, 2014). Oxfordshire County Council has received £5 million in 2012 and £1 million in 2014 from the LSTF, matching this with £2.8 million and £1.1 million, respectively (OCC, 2011; DfT, 2014).

area, this level of clarity is relatively uncommon. The geographic scale of car sharing remains largely unarticulated amongst the broad government-originated documents that mention the implementation of schemes.

Similar to geographic scale, a substantial majority of documents analysed discuss modal linkages within the transport system as it relates to a given project or initiative. However, this discussion is especially broad and heavily favours the incorporation of more mainstream modes like buses, cycling, or walking. In terms of car sharing specifically, the extent to which linkages with existing or planned offerings are imagined is very limited. The question whether car sharing is competing with, or rather complementary to, modes of transport that are widely considered sustainable, such as buses or cycling, are largely unaddressed. Exceptions to this trend include the city council’s parking standards document (2), which offers some sense of complementarity in discussing the importance of public transport links when formulating a successful car sharing scheme.

5.2 Imagined Users

Discussions of imagined users were often vague or simply implied; few documents lent any specificity to understanding who would actually be patronizing or participating in a given initiative or scheme. The implied user base was heavily derived from the document’s context, especially in a geographical sense. For example, while the Science Vale LSTF bid (12) has a broad geographic component that indirectly ‘captures’ some sense of potential users, a discussion explicitly targeting specific groups or journeys is absent. A similar situation arises in the WEAAP (3) and the Oxfordshire Arc LSTF bid (6). Apart from geographic context, other baseline contextual elements influence the imagined set of users. As a more explicit example, the city council’s workplace travel plan (7) emphasizes ‘office based staff’ as imagined users in terms of commuting and travel during work hours. Overall, users are very roughly imagined or implied based on the geographic context or scope of a project, particularly in the case of car sharing schemes. Other considerations, like demographic factors or pre-existing commuting patterns, are completely absent.

5.3 Expected Impacts

A graphical summary of results drawn from the coding mobilized in the analysis of impacts can be found in Figure 4. Here, individual documents are arranged with respect to private or public character and time, which allows for the visualization of trends that will be expanded upon in the text. The numbers used in each graph correspond to a specific document as outlined in Table 3 above. Table 4 breaks down the frequency of each classification type as described above and as depicted in Figure 2.

Table 4: Frequencies of classification types

Classification	Frequency
Attribute discussed in relation to car sharing	25
Attribute discussed in broader context of the document	20
Not discussed whatsoever	27
<i>Total</i>	72

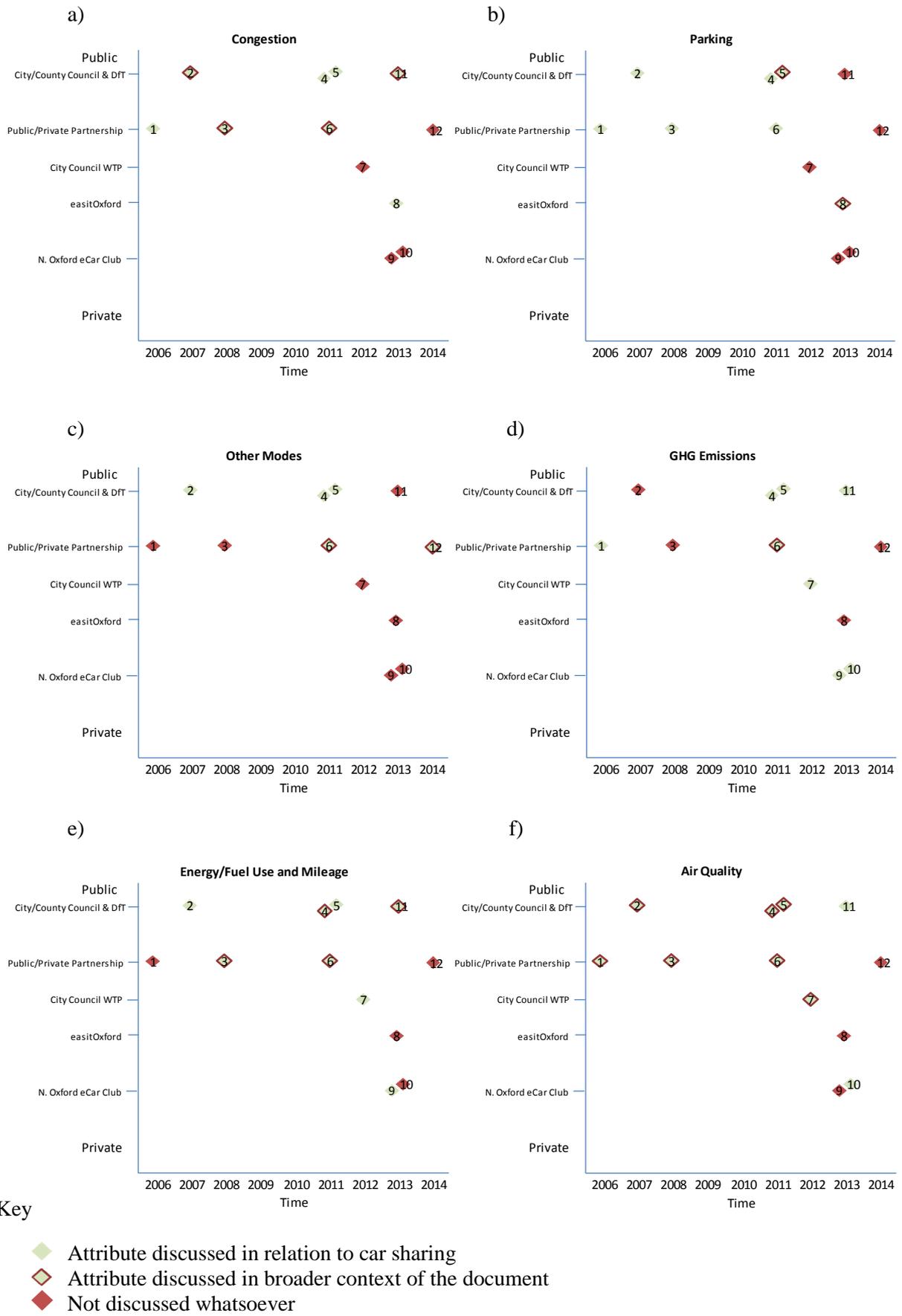


Figure 4: Visualization of impact coding with respect to time and public-private character

Government plans, regulations and initiatives are more likely to address congestion in some capacity and are substantially more likely to link congestion reduction to car sharing schemes. Examples of explicit linkages between car sharing and congestion reduction include the broadest documents, i.e. the DfT's White Paper (4) and the Oxford County Council's local transport plan (5), and a selection of those with an intermediary level of geographic focus (i.e., the easitOxford initiative (5) and the sustainability appraisal of the West End redevelopment project (1)). Private sector documents as well as documents that include elaborate public-private partnerships tend to loosely discuss congestion impacts in other contexts or omit this discussion altogether.

Issues and impacts related to parking are notably discussed among government documents dated before 2012, with a majority of this selection directly linking car sharing to the discussion. Documents dated after 2012 very rarely mention parking issues or requirements in any capacity and none draw a connection between parking and car sharing initiatives. Documents that lack parking impacts include the City Council's workplace travel plan (7), those related to the North Oxford eCar club (9 & 10), the city council's Air Quality Action Plan (11), and the Science Vale LSTF bid (12).

Discussion of the impacts of car sharing on the use of other modes of transport is uncommon across all actors, although there are some notable exceptions. Documents that draw a direct linkage between car sharing schemes or car clubs and the use of public transport, cycling, or walking are solely coming from the public sector. This connection is elaborated in those documents with the widest scope; specifically the city's parking standards (2), the DfT White Paper (4), and the county council's local transport plan (5). While the LSTF bids (6 & 12) do consider parking impacts and requirements outside of car sharing schemes, the remaining documents make no mention of parking whatsoever.

Greenhouse gas emissions are discussed widely across public-private actors, especially among documents dated after 2011. Documents addressing sustainability measures most broad in scope largely discuss greenhouse gas emission reduction in relation to car sharing; these include the city's Air Quality Action Plan (11), the DfT paper (4), the local transport plan (5), and the West End development sustainability appraisal (1). However, more specific measures that target smaller imagined user pools, the North Oxford eCar club (9) and the county's workplace travel (7) plan, also incorporate the impacts of car sharing schemes or car clubs on lowering vehicular emissions.

Impacts on air quality are frequently mentioned among the documents sampled, although this mentioning is rarely specifically related to car sharing measures. Virtually all of the documents dated before 2012, the majority of which come from the place of government, broadly discuss air quality and pollution remediation without this discussion being linked to car sharing. The two documents that do forge this linkage, and happen to exist on opposite ends of the public-private gradient, are the city Air Quality Action Plan (11) and the Oxford Mail article (10) discussing the establishment of the North Oxford eCar club.

The incorporation of energy use analysed as a function of impacts on fuel consumption or mileage travelled, varies substantially among documents from similar actors or within a given year. Purely governmental documents are roughly more likely to incorporate a discussion of reduced energy use to some extent than those originating from private entities or public-private partnerships, although this incorporation is rarely explicit in terms of car sharing impacts. Overall, the distribution of the discussion of energy use impacts over time and across the public-private spectrum is quite random and does not readily illustrate a dominant trend.

5.4 Role of Government

In the documents analysed, financial information of a given project, initiative, or policy is often presented although with limited specificity in terms of identifying actual metrics of funding. Two notable exceptions are the Science Vale and Oxfordshire Arc LSTF bids (6 & 12), which include detailed funding profiles that relay monetary allocations within the project. Of the documents that include some mention of finances but do not disclose actual amounts, it is still common, however, to find information related to the source of funds or an explanation of actors who are financially committed. Those documents that include no mention of financial support are composed entirely of ‘software’ measures that do not have discrete funding necessities, such as the Air Quality Action Plan (11) or the city’s parking standards piece (2). As used here, ‘software’ is defined as measures that do not require direct investment in physical infrastructure. These exist opposite ‘hardware’ measures, which are those that necessitate the construction and managing of physical infrastructure. Nearly all of the documents analysed offer some sense of how financial commitments or outlined goals will be translated into real world action. The language describing this translation varies significantly based on the context of the document, particularly between ‘software’ policy measures and ‘hardware’ or infrastructure. Actors are described as ‘delivering’ certain elements of a document, ‘rolling out’ infrastructure, ‘providing support’ for initiatives, or serving ‘to regulate’ policy requirements. However, documents do not go much further in visioning or configuring the role of government.

6. Discussion

6.1 Shared definitions, actor networks, imagined geographic scale and modal linkages

The results demonstrate that a shared definition or institutional vision of car sharing is generally absent in the current discourse. This can be partly explained by the fact that the servicization of cars consistent with car sharing innovations, that is, the shift from ownership to service, comes in a variety of distinct forms (Akyelken et al., 2013). Nonetheless, given these distinctions, it should still be possible for a policy, project, or proposal to incorporate and define the form most likely to fit a set of external conditions or goals. While a small portion of the documents analysed from government actors did recognize the varying arrangements of car sharing possible, namely the DfT White Paper (4) and the county’s local transport plan (5), this recognition did not translate into targeting a specific arrangement in practice. Further, additional documents allowed for an implicit understanding of the type of

scheme to be expected but otherwise did not offer much clarity; this was the case with the North Oxford eCar club (9) and the City Council's workplace travel plan (7) where schemes were implied to be commercial and peer-to-peer respectively. However, on the whole, the lack of definition and detail in describing the type of scheme being implemented suggests it is too early to identify the niche's dominant design. This lack of dominant design is further underscored by deficiencies in visioning and results in a murky understanding of car sharing with little translatability across actors.

While the institutional arrangement of car sharing schemes lacks definition, lead actors of the various documents analysed were well defined and represent a range of public-private entities with valuable partnerships and collaboration. Thus, actor networks surrounding car sharing are relatively well developed and represent an existing capacity for successful implementation. The strong presence of government entities in the discourse surrounding car sharing schemes especially represents an important subset of actors that could, if drawn to schemes by refined expectations, be more effectively utilized. This presence is unsurprising given historic approaches to transport innovations in the Oxford context discussed in the introduction of this paper. Robust actor networks are a vital prerequisite for the successful visioning of niche innovations, although they do not guarantee the creation of appealing visions (Geels, 2012). This discrepancy between well-developed actor networks and limited niche development suggests that barriers to the uptake of car sharing schemes must be originating elsewhere. As previously touched on, these barriers may be attributed to a lack of dominant design, the force of selection pressures in the mainstream environment that favour other modes, or the scattered nature of niche expectations.

Results relating to geographic scale and modal linkages suggest that the extent to which spatial arrangement and interconnectivity of modes is imagined varies in conjunction with a given document's scope or context. The direction of this relationship, however, is opposite between the two. Broader initiatives or policies have a more coarsely defined imagined geographic scale, while documents with a finer scope have a more specific or explicit geographic focus. In terms of modal linkages, the opposite trend can be witnessed. Here the results relay that large projects tend to be more specific and encompassing when imagining interconnectivity across modes and small projects are rather general or fail to consider modal linkages altogether. Both examples demonstrate, however, the importance of context and scope in considering the extent to which various aspects of transport or car sharing are imagined. As car sharing schemes are generally small scale, it would be expected that their imagined geographic scale would be lost when discussed in the context of a complex and wide scoping document. In a similar vein, it is somewhat unsurprising that documents focused heavily on car sharing would not discuss modal linkages in detail as these interdependencies exist on the scale of entire transport systems. Taken together, both trends reveal the systemic emphasis of Oxford's dominant regime. Actors are more likely to consider transport modes that have a definitive presence at the level of regime or, what could be considered, the set of alternative regimes (buses and cycling specifically).

6.2 The lack of properly imagined users

Findings in the results section concluded that users are very roughly imagined or simply implied based on geographic limitations built into documents, which is similar to the previous discussion on spatial scale and modal linkages. This is rather surprising in the context of transport innovations and limits, to a degree, the creation of attractive car sharing visions (Geels, 2012). The lack of specificity or general absence of a discussion surrounding who will actually participate in car sharing within the majority of these documents suggests a lacklustre commitment to implementing schemes and can be considered a barrier to the growth of car sharing in the Oxford context. While generally small in service area, car sharing schemes are still highly complex and if users are to be properly imagined, discussion should incorporate a range of demographic factors, existing commuting patterns, and other important metrics.

6.3 Impacts on pre-existing transport issues and the strength of expectations or visions

The results from the analysis of attributes, particularly as depicted in Figure 2 and outlined in Table 3, demonstrate that imaginations of the impacts car sharing may have remain underdeveloped. Impacts are more likely to be mentioned in the broader context of a document or not mentioned at all than to be tied directly to car sharing schemes. However, the distribution of mentions with relation to car sharing, non-mentions, and mentions with limited specificity is not equal across all attributes. For example, air quality has a much higher concentration of mentions with limited specificity, whereas the impact on other modes category has a significant concentration of non-mentions. This results in some of the attributes analysed being viewed as ‘winners’, wherein the impacts of car sharing schemes on various transport issues are well imagined. Thus, ‘losers’ are dominated by non-mentions or mentions with limited specificity that suggest poorly imagined impacts. The results also relay the existence of a number of intermediaries that are not overwhelmingly ‘winners’ or ‘losers’.

Greenhouse gas emissions and parking are the two ‘best imagined’ attributes in terms of car sharing impacts. This can be explained partly in terms of the selection of documents analysed, as examples like the city’s parking standards and the DfT White Paper (4) clearly offer an appropriate venue for a discussion of this pair of attributes. The well-imagined quality of these impacts is also logical given external factors that suggest car sharing schemes can lessen parking demand by decreasing car ownership rates, and that vehicles utilized in schemes are often newer and include low or zero-emissions technology (Cervero & Tsai, 2003; Martin & Shaheen, 2011). There are, however, a few key documents that fail to incorporate either parking or emissions impacts. For example, the WEAAP (3) does not mention emissions in any capacity, and the Science Vale LSTF bid (12) is missing discussions on both parking and emissions. Nonetheless, expectations surrounding the ability of car sharing to curb emissions and reduce parking needs are well imagined and thus promote successful visions.

The results indicate that impacts on congestion and energy use or efficiency are mixed in terms of being well imagined. These two examples are characterized by high levels of

mentions with limited specificity in the coding, but also include some documents that directly link car sharing to the respective attribute. This could be partially explained on the basis of scale, as both congestion and energy use are favoured to be mentioned in wide scoping government documents. This is reasonable in the sense that both attributes are rather systemic in nature and in part driven by powerful external factors such as development patterns in the case of congestion or technological evolution in the case of energy use or efficiency. However, this logic could also hold for greenhouse gas emissions and in some sense clashes with the results discussed above. One possible explanation could be that relevant actors view car sharing as a remedy to some systemic issues, but not others. In this case, while car sharing is imagined to be useful in reducing emissions, governments and businesses may tend to look towards other innovations when addressing congestion or energy use. Thus, in the Oxford context, car clubs and car sharing schemes are not particularly imagined as effective means of reducing congestion or energy consumption in urban transport.

The impacts of car sharing on other modes and air quality are particularly not well imagined given results that convey either high levels of mentions not specifically related to car sharing schemes or no mention of the attribute whatsoever. This is surprising given that modal impacts and air quality both have some relevancy at the local level, even if they are largely considered system-wide issues that could potentially overlook car sharing schemes as a result of an especially wide scope. Further, no single document includes a discussion that links car sharing impacts to both air quality and use of other modes. This raises questions about car sharing as it relates to these attributes that could perhaps be pursued in further work. The discourse in Oxford does not imagine car sharing schemes as effective measures towards improving air quality nor does it consider the impacts of schemes on other modes.

Overall, considering the streaky if not incomplete extent to which favourable impacts of car sharing schemes on the attributes discussed are imagined, it is clear that the visions and expectations associated with the niche innovation are not ideally unified (Rotmans et al., 2001). This presents a barrier to implementation of schemes in Oxford and links back to the discourse-reality gap touched upon in the introduction.

6.4 The imagined role of government support

The results demonstrate that lead actors are discussing financial support and appropriate courses of action in the context of many of the documents analysed here, although not explicitly. This creates some uncertainty surrounding the role government may play in the development and maturation of the car sharing niche. As government actors are not themselves articulating how they will interact with the car sharing as it evolves, it is difficult to confidently infer an imagined role. While potential actions may be implied based on the use of ‘software’ or ‘hardware’ measures with respect to pre-existing modes and concurrently developing niches, this requires logic grounded in uncertainty. Thus, understanding the role the state may or may not see for itself in encouraging, dissuading, or maintaining the car sharing niche is best left for additional research in contexts with more established schemes.

7. Conclusions

Car sharing schemes and car clubs, as they currently exist in Oxford, do not represent an innovation that will be at the centre of the radical reconfiguration necessary to displace the current sociotechnical regime organized around private vehicle use and ownership. As the niche matures and develops, however, car sharing may eventually come to contribute an important piece of whatever radical realignment lies in the future of socio-technical transitions in transport. For now, the development of car sharing schemes in Oxford is severely limited by a lack of financial support and attention on the part of local government. This lacklustre support is the result of a transport innovations context in Oxford dominated by busses and incumbent schemes, as well as a state of inconsistent visioning and scattered expectations among relevant actors in the discourse.

The potential role of car sharing in Oxford is very likely to be a limited one; however, there certainly are gaps in the city's current transport system that could be addressed by successfully implemented schemes. For example, there is a growing demand for more flexible transport in Oxford in terms of the destinations and timing of specific trips. These emerging and expanding trip patterns do not currently exert a force great enough to warrant public transport provision, but could be well served by the freedom and customizability offered by car clubs. Examples of these journeys include those that navigate between locations along the city's periphery and bypass city centre, that occur specifically in the evenings or on weekend days when public transport provision is generally less robust, or that cover distances perceived to be too long for walking or cycling. In addressing these scenarios, car sharing schemes could improve and more fully assimilate into the current transport system. The issue here preventing car sharing from meeting these demands, however, is again related to visioning, as current visions tend to lack any spatial or habit-based specificity when imagining potential users. Further, the discourse on car sharing fails to establish expectations surrounding the complementarity or competition between introduced schemes and the pre-existing transport system. Refining these expectations and visions could help better market car sharing as a potential solution to the scenarios described above and, more generally, offer a more concrete understanding of the interdependencies and interactions to consider when implementing schemes in a given mobility context.

Future research on car sharing in the Oxford case and beyond could consider the following:

- Service mapping and geographic considerations: How does the spatial arrangement of schemes influence usage patterns?
- User demographic: How are users imagined in a socioeconomic sense? How can existing users be characterized in terms of demographic metrics?
- Complementarity and competition: To what extent does the realized usage of car sharing schemes compliment or compete with Oxford's dominant transport offerings?

- Design and user experience: How established or mature are dominant scheme designs and does variation in user experience among car sharing initiatives correlate with usage or uptake?
- Role of government: Further work could be pursued to better understand how government is imagining its role in promoting or preventing the development of car sharing schemes.

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