

# Shared Mobility Research: Looking Through a Paradox Lens

## Abstract

Cities' high traffic concentration, fast technological change, resource scarcity and growing environmental concerns accentuate competing tensions between stakeholders, transport modes and policies [in the mobility sector](#). Tensions become even more salient in shared mobility – a complex yet relatively new phenomenon at the intersection [between](#) sharing economy [and the transport sector](#) – and raise numerous concerns for meeting sustainability objectives. The purpose of this paper is to identify conflicting demands associated with shared mobility by conducting a [systematic literature review](#). Our results reveal several contradictions related to shared mobility and sustainability goals, and relations between those constantly evolving in a dynamic fashion. Thus, although shared mobility represents a step forward in achieving sustainability in theory, in practice, this task is only partially completed due to existing inherent contradictions. A paradox perspective on shared mobility, proposed in this paper, provides grounds for revisiting policy actions and finding workable solutions [for practitioners](#).

**Key words:** shared mobility, sustainability, triple bottom line, paradox, transport policy, [systematic review](#)

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## 19 1. Introduction

### 20 1.1. Sustainability and the case of shared mobility

21 Transport holds tremendous benefits for our societies, allowing the movement of goods and people, and access to key amenities (Di  
22 Ciommo and Shiftan, 2017). Yet, cities' high traffic concentration, limited parking, restricted urban space, and growing environmental  
23 issues accentuate the need for a new transport paradigm (Mattia et al., 2019). If the global increase of greenhouse gas (GHG)  
24 emissions halted for the energy and industrial sectors (respectively reducing from 2.3% to 1% and from 3.4% to 1.4%) for this decade  
25 compared to last, growth in the transport sector has maintained a constant rise of 2% (IPCC, 2022). Following the energy supply  
26 (34%) and industry (22%) sectors, transport accounts for less than 15% of the GHG burden yet remains a top sustainability priority  
27 for policymakers given the relentless concentration of emissions, and consequent damaging effects (e.g., local air pollution, noise,  
28 accidents, visual disruptions, etc.) in urban areas.

29 If mobility focuses on the (political) desire to access a particular location, transportation is the (technical) tool that orchestrates  
30 movement, with vehicles, infrastructures, and traffic rules designed to “realise” mobility; and to make it a concrete experience in a  
31 context of a spatial separation of activities (Handy, 2002). Then within the mobility spectrum<sup>1</sup>, shared mobility refers to the potentiality  
32 of “trip alternatives that aim to maximise the utilisation of mobility resources that a society can pragmatically afford, disconnecting  
33 their usage from ownership” (Machado et al., 2018:1). It is often included in the broader term, ‘the sharing economy’, i.e., extensive  
34 (common) usage of information and communications technology which in our context implies that physical assets such as bicycles

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<sup>1</sup> Despite the nuance in their definitions and for the sake of simplicity, the terms of ‘mobility’ and ‘transport’ are used interchangeably throughout the paper.

35 and cars, are to be used by multiple users, rather than singly owned by individuals (Le Vine and Pollak, 2015). Shared mobility options  
36 include vehicle sharing (e.g., car, scooter, bike), ride-sharing (e.g., carpooling platform), delivery sharing (e.g., cargo shipping) and  
37 demand-responsive transport modes (e.g., minibus) as categorised by Shaheen et al. (2020). Additionally, for added fluidity to the  
38 system, Mobility-as-a-Service (MaaS) embodies digitalisation, integrating multiple transport alternatives into a same platform, thereby  
39 providing a tailored itinerary to the trip planner with payment options and related ancillary services (Durand et al., 2017). Thus, by  
40 design, shared mobility tilts in favour of the environmental, social, and economic domains of transport policy (Mardsen et al., 2019)  
41 or so it seems.

42

#### 43 1.2. Investigating Triple Bottom Line (TBL) tensions within shared mobility

44 Meeting respective TBL goals is particularly challenging because of inherent conflicting tensions associated with them. For instance,  
45 economic growth is generally seen as conflicting with environmental protection - e.g. investing in the road network is prioritised before  
46 increasing the safety and accessibility of pedestrian and cyclist pathways (Laird et al., 2013). Interestingly, this is not the case in  
47 Northern Europe (Jussila-Hammes, 2021). Equally, in the digitalised economy versus social equity controversy – e.g. the digital  
48 divide, trust and reliability issues experienced with crowdsourced passenger information sometimes outweigh the increased  
49 accessibility from virtual transport technologies in remote areas (Velaga et al., 2012). Further, the popularity of shared e-scooters  
50 may increase road equity on the one hand, as it facilitates accessibility to all; yet developing these services, and frequently rebalancing  
51 the system, could create other externalities such as road accidents or air pollution (Reck and Axhausen, 2021).

52 Attempts to address such inherent contradictions laying at the intersection of the TBL, have been suggested in the literature. For  
53 example, Sopjani (2019) emphasises the critical role of involving all users with contrasting motivations, preferences, and contributions  
54 from the start of a new transport service implementation, as a solution to managing sustainable mobility transitions. Yet, the lack of

55 knowledge about hidden conflicting tensions within TBL objectives (Martin et al., 2018), as well as ways through which they could be  
56 managed, creates obstacles for developing workable synergies in meeting those objectives. To address this, we introduce a paradox  
57 perspective to the shared mobility literature to demonstrate ways in which the conflicting tensions associated with social, economic,  
58 and environmental considerations, could be approached.

59

### 60 1.3. Using a paradox lens

61 A paradox is defined as “*persistent contradiction between interdependent elements*” (Schad et al., 2016, p. 6). It’s often used  
62 synonymously with the terms ‘conflict’, ‘tension’ or ‘competing demand’. However, unlike these terms, the notion of paradox goes  
63 beyond a simple acknowledgment of contradiction, and accentuates complementarity between alternative poles, as well as their  
64 dynamic interactions (Smith and Lewis, 2011). In other words, a paradox denotes a relationship between competing elements, rather  
65 than a static opposition (Schad et al., 2019). This theoretical perspective is particularly valuable for shared mobility research because  
66 it provides a more in-depth understanding of conflicting tensions’ nature and emphasises their complementarity. This offers a unique  
67 opportunity to generate original solutions to competing demands within shared mobility often overlooked by mainstream policymaking  
68 approaches influenced primarily by economics and cost-benefit analyses.

69 Our paper aims to address the following research questions:

70 - *How conflicting tensions associated with shared mobility are presented in the research literature?*

71 - *Among them, how do different types of tensions within TBL relate to each other?*

72 - *What methods to manage such tensions are proposed in practice?*

73 To respond to these questions, we conduct a systematic literature review (Pittway, 2008) of existing studies on shared mobility. Due  
74 to the significant impact of the COVID-19 pandemic on transport systems in general and shared mobility, we focus our research on  
75 the studies published before 2020<sup>2</sup>.

76

## 77 **2. Background**

### 78 2.1. Shared mobility and its inherent contradictions

79 Diverging externalities<sup>3</sup>, generally observed in the transport sector and specifically at the scale of urban mobility (Hammadou and  
80 Papaix, 2015), illustrate forms of self-reinforcing inherent conflicts. For example, the reduction of one external cost, namely the  
81 mitigation of local air pollutants when using a particle matter filter, may mechanically increase another external cost, such as induced  
82 additional fuel consumption due to technological features of the filter (Liu et al., 2003). Other frequently cited examples in transport  
83 include increased injustice (e.g., led by a rise in property price) when transport accessibility is improved through investing in public  
84 transit (Preston et al., 2007); as well as seeking improved quality and/or performance of a transport system vs. the issue of data  
85 privacy incurred by automation technologies to ensure it (Xu et al., 2014).

86 Transport research is familiar with the concept of paradox. The textbook example of the ‘Braess paradox’ displays the suboptimal  
87 use of new road infrastructure, aiming to minimise travel time between two points onto the transport network, resulting from  
88 uncoordinated drivers’ choices and behaviours. Indeed, as most drivers would tend to use the new (short cut) road at the same time,

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<sup>2</sup> Our decision is based on the desire to explore existing conflicting demands related to the TBL objectives in shared mobility, and major disruptions caused by the pandemic could camouflage findings and create a distorted picture.

<sup>3</sup> Externalities or external costs from transport usually include Greenhouse gas (GHG) emissions, local pollution, accidents, congestion, and road noise. Their “internalisation” or correction often passes through regulation (standards and norms), monetary incentives (taxes and subsidies), or a mix of both measures, with different acceptability features in each case (Santos, 2017).

89 congestion would peak and conduce additional drivers to start using parallel routes instead, and this increasingly so. Cheng et al.  
90 (2020) add to this point that, the largely investigated value of time, that of air pollution, and the anticipated health risk in the driver's  
91 choice equation, was found to further affect travellers' route preferences more than travel time. More Automated and Connected  
92 Vehicles (ACVs) on the roads may also paradoxically mean more congestion in a mixed traffic environment in the short term (Seo  
93 and Hasakura, 2017). The authors explain this paradox by the fact that ACVs are sharing the roads with conventional cars, and that  
94 more vigilance and safety costs would therefore be added to the experience of manual drivers, creating more traffic disturbance  
95 overall. Yet, if the congestion level increases with the introduction of ACVs, congestion severity, or perceived congestion, is lessened  
96 by the improved in-vehicle experience provided to ACVs users, proportionally with travel time.

97 As a part of the transport sector, the sub-segment of shared mobility has dramatically increased with the rise of complexities  
98 associated with urban motorised transport: congestion, land use, and notably, the battle for parking space, to name a few (Mattia et  
99 al., 2019). Beyond conventional and electric vehicles, shared mobility modes include self-driving taxis, and more recently urban air  
100 transport alternatives, and is already exceeding a net worth of \$60 billion in China, Europe, and the United States (McKinsey and  
101 Company, 2019). Seamless options, with an integration with public transport, are also more commonly employed (Ma et al., 2019).  
102 For example, since July 2020 Uber in London has extended its shared mobility services to river transport (The Guardian, 2020),  
103 collaborating with Thames Clipper MBNA. Yet, if the popularity of shared transport resources is usually highlighted in the literature,  
104 there is little consensus on what is strictly included and even less on the tensions between them. The work of Acquier et al. (2017)  
105 emphasises the complexity of shared mobility and its controverted nature and identifies tensions at different stages – relating to the  
106 'Access economy' (when giving a new outlet to, e.g., underutilised transport assets), 'Platform economy' (when connecting users'  
107 need through peer-to-peer interfaces), and 'Community-based economy' (when encouraging e.g., non-monetary, non-contractual or  
108 non-hierarchical exchanges). The authors question for instance whether shared mobility provides a profound alternative to capitalistic

109 mobility markets as they currently are, or whether they simply displace social injustices to digital platforms; or else whether the social  
110 exchange of transport service is genuine, or whether is it led by a money saving goal and non-reciprocal intentions.

111 In addition to the close (and often complex) relationships with public transport (PT) (Ma et al., 2019), shared mobility resources are  
112 also strongly linked with technological developments. If most impacts of the shared transport technologies are expected to be positive  
113 in terms of accessibility, traffic ease and societal costs. The attractiveness of such web 2.0 features might as well induce additional  
114 use of transport resources and infrastructures, and therefore lead to conflicts regarding their allocation and sharing among users –  
115 illustrating the well-known Downs-Thomson paradox (Burnewicz, 2017). Another example is that of shared e-scooters providing an  
116 excellent alternative to PT options when the latter are insufficient and for non-car holders, but they might lead to safety concerns  
117 when put on the road with heavier vehicles (Hardt et al., 2019). Lastly, the irrational competition effect observed in bike sharing  
118 schemes management (BBC, 2022), describes the fallacious effect of having high operational costs due to a scarce demand for the  
119 bikes at the introduction of the scheme, leading to low effort on maintenance, more carelessness of users, and bike graves on roads  
120 pavements, despite their benefits to relieve congestion and improve transport health in general.

121 Thus, the relative novelty, complexity and 'dark side' of shared mobility defines its contradicting nature and creates challenges in  
122 practical implementation. This becomes even more explicit when looking at the relationship between shared mobility and sustainability  
123 in terms of the TBL dimensions (Mardsen et al., 2019). Indeed, the term of shared mobility holds:

- 124 ● an economic dimension, ensuring a function of transport provision, having an impact on congestion, travel choices and  
125 economic incentives; as long as the 'detour penalty' from trip pooling (Young et al., 2020) is minimised,
- 126 ● a social dimension, with the community building aspect of the peer-to-peer system as well as its attractive 'techy' side,  
127 especially when combined with electric and ACVs technology (Burghard and Dutschke, 2019), and

128 • an environmental dimension, promoting less noisy, less polluting and visually disrupting options in most cases (Whittle et al.,  
129 2019; Hjorteset and Bocker, 2017)

130 Thus, despite significant progress, it is still difficult to make sense of shared mobility's impacts on different areas of human activity,  
131 and to evaluate its role in achieving [sustainability](#) goals. It might be argued that part of this challenge is caused by the inherent  
132 contradictions of the concept which deserve further investigation, [as we attempt it in what follows](#).

133

## 134 2.2. [Insights from the](#) paradox theory

135 Dealing with conflicting tensions presents an ongoing challenge for decision makers (Lewis, 2000). Contradictions become more  
136 salient in a situation of uncertainty, dynamism, resource scarcity, and complexity (Smith and Lewis, 2011). The increasing need to  
137 meet social, economic, and environmental objectives represent such a situation. Previously discussed conflicting tensions at the  
138 intersection of the TBL became the center of attention of paradox scholars. A paradox perspective has [recently](#) been applied to  
139 studying environmental, economic, and social concerns in corporate social responsibility (Hahn et al., 2015, 2018), supply chains  
140 (Brix-Asala et al., 2018), and sustainability management (Ozanne et al., 2016). However, it is a new [perspective](#) for transport research  
141 and shared mobility literature. Although the words 'paradox' and 'tensions' often appear in this body of literature, there is no clear  
142 consensus on the ways such phenomena should be approached and managed.

143 Paradox scholars report several approaches to manage conflicting tensions. Two main strategies [dominate](#); resolution and  
144 acceptance (Hahn et al., 2015). Resolution involves separating the poles of a contradiction spatially and temporally, or prioritising  
145 one over another after weighing up pros and cons. In contrast, acceptance accentuates the opposing elements and emphasises their  
146 dynamic interplay through the processes of differentiating and integrating (Smith and Lewis, 2011).

147 According to paradox scholars, the acceptance strategy leads to better outcomes in a long term when dealing with paradoxes. As  
148 Schad et al. (2016, p. 7) explain, “even as paradox involves a dynamic and constantly shifting relationship between alternative poles,  
149 the core elements remain impervious to resolution”. These characteristics make a paradox different from related concepts such as  
150 dilemma, unanticipated outcomes, and trade-off (Matos et al., 2020) that present competing alternatives where each has advantages  
151 and disadvantages, but where decision makers are required to weigh pros and cons to make a choice (Lewis et al., 2014; Smith and  
152 Lewis, 2011). Similarly, paradox should be distinguished from compromise and synthesis, where competing poles are linked through  
153 finding a common ground (Hahn et al., 2015; Lewis et al., 2014).

154 In a transport context (see box 1 appendix 2 page 17 for a more generic illustration), a paradoxical response to manage conflicting  
155 tensions would correspond to a setting in which people would freely and conveniently share PT and private transport options (self-  
156 managed) but where an ad hoc MaaS platform would be used to regulate and orchestrate such trips (introducing a hierarchy).  
157 Besides, the harmony of such a self-regulated system and a hierarchical system coexisting is found to be one of the key success  
158 factors to MaaS adoption according to Kayikci and Kabadurmus (2022).

159 Regarding the TBL, Hahn et al. (2015) distinguish between instrumental and integrative views on sustainability tensions. The former  
160 “focuses exclusively on situations where there is a consistency between financial, environmental and social dimensions; tensions  
161 between different sustainability aspects are dismissed”, whereas the latter acknowledges tensions, accepts them, and encourages  
162 decision makers to “seek ways to live with this situation, thus keeping the paradox open” (Hahn et al., 2015, p. 300). The framework  
163 proposed by the aforementioned authors allows to analyse sustainability tensions across individual, organisational, and systematic  
164 levels. Their conceptualisation integrates environmental, economic, and social dimensions, and offers a basis for better understanding  
165 and managing sustainability tensions. However, the framework is not suitable for identifying sustainability tensions in shared mobility.

166 In this case, one might consider the influence of multiple stakeholders (users, policymakers, public, transport operators, platforms  
167 etc.), and their levels of involvement in sustainability tensions. This is what the present paper aims to achieve.

168

### 169 3. Methodology

#### 170 3.1. Systematic literature review

171 To identify sustainability tensions in shared mobility, a systematic literature review method has been adopted. This method is used  
172 for “making sense of large volumes of information” with the purpose “to bring together the evidence base on a particular theme in  
173 order to make credible policy, research or practical recommendations” (Pittway, 2008: 216). Systematic literature review has been  
174 adopted in transport research (Bretones and Marquet, 2022; Mandják et al., 2019; Salesi et al., 2022). This well-established research  
175 practice was considered the most suitable method for this study, as it enables to cover a large variety of publications, evaluate  
176 scholars’ approaches, and synthesise previous findings regarding conflicting tensions in shared mobility.

177 The research process included the following stages and corresponding analytical procedures:

- 178 ● Stage 1, data collection: searching and selecting appropriate academic articles.
- 179 ● Stage 2, preliminary analysis: descriptive analysis of the collected data.
- 180 ● Stage 3, developing categories: conducting a more in-depth analysis of underlying meaning structures to identify analytical  
181 categories.
- 182 ● Stage 4, evaluation: synthesising the findings.

183 The subsequent sections provide details regarding each stage of the research process.

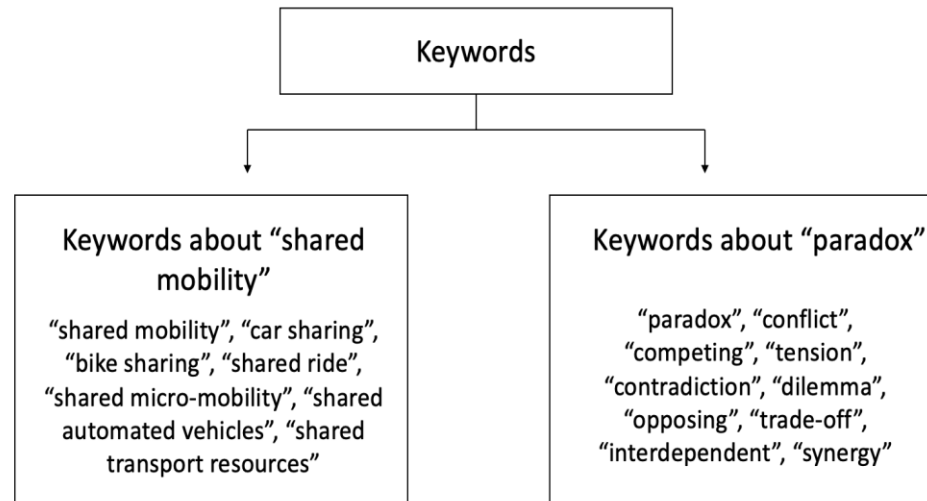
184

### 185 3.2. Data collection

186 To collect the main material, Web of Science – the largest database of academic research – was used, based on the selected  
187 keywords, and defined timeline. As our main goal was to discover conflicting tensions in shared mobility, we used a combination of  
188 the keywords extracted from shared mobility research and paradox literature. Reviewing these areas of literature specifically, enabled  
189 to develop two groups of keywords: “shared mobility” and “paradox” (Figure 1). The choice of keywords was guided by consideration  
190 of the words most associated with each term, which, however, were not necessarily synonymous. Thus, the “shared mobility” group  
191 included words representing generic understanding of shared mobility (“shared transport resources”), main shared modes (“bike  
192 sharing”, “car sharing”, “ride sharing”), but also novel ones (“shared automated vehicles”, “shared micro-mobility”). In terms of paradox  
193 research, apart from the words commonly included in the definition of the concept (“paradox”, “conflict”, “contradiction”, “competing”,  
194 “opposing”, “interdependent”, “tensions”), we also considered those words that were often taken to label paradoxical tensions,  
195 although strictly, they refer to distinct concepts (“synergy”, “dilemma”, “trade-off”) (Smith and Lewis, 2011; Schad et al., 2016).

196 In terms of the timeline, we considered 1992 until 2019. 1992 marked The United Nations Conference on Environment and  
197 Development summit and the introduction of the Rio Declaration on Environment and Development (UN, 1992). We considered this  
198 a starting point of bringing wider attention to sustainability issues and establishing a reference point for their further analysis and  
199 evaluation. Even though the term ‘shared mobility’ started appearing in the literature much later, it was important to make sure the  
200 early signs of this phenomenon were included.

201



202

203

Fig.1. Selection of keywords

204 The systematic paper selection process is shown in Figure 2. The initial search generated 575 papers. However, after verifying overall  
205 relevance, we refined our search criteria through refining the subject area and retained only 19 categories that might be relevant to  
206 transport. Furthermore, consistent with previous studies that used a systematic literature review method (Luo et al., 2022; Mandják  
207 et al., 2019; Salesi et al., 2022; Zhu and Sarkis, 2016), we considered only peer-reviewed publications. Although conference  
208 proceedings often provide important insights and are highly relevant for the academic community in general, we intended to pursue  
209 a rigorous approach in data collection to enable us to focus on studies of a comparable level of quality, and hence increase the value  
210 of our findings. Following this logic, only academic articles published in Q1 SJR journals were kept. This reduced the number to 310  
211 papers.

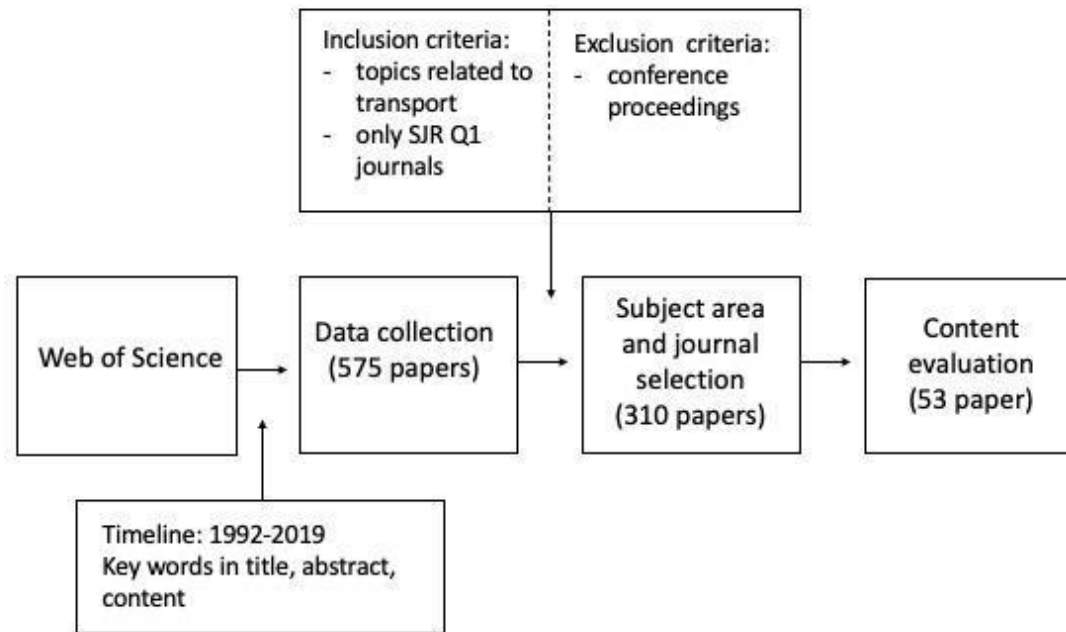


Fig.2. Paper selection process

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213

214 The next step **involved screening the papers' abstract, introduction and conclusion** to only include the most relevant studies. Papers  
 215 using the term “shared mobility” casually or focussing on other areas of knowledge rather than transport research (i.e., medical  
 216 sciences, accounting, engineering etc.) were discarded. After critical evaluation of each paper’s content, only 61 papers remained.  
 217 Next, we undertook a more in-depth analysis of the remaining articles’ content. At this stage, we looked closely at the shared mode  
 218 being studied. 17 papers discussed shared space (e.g., paths, streets, environment) and resources (e.g., shared data, control), rather  
 219 than referring to a particular transport mode. These papers were touching on interesting problems related to mobility and  
 220 transportation in general, although there were no indications strictly of shared mobility, i.e., situations in which mobility resource usage

221 was “disconnected from their ownership” (Machado et al., 2018, p.1). Keeping in mind that the problems they discuss might still be  
222 relevant for shared mobility research, it was worth considering this body of literature for our research. Therefore, these papers were  
223 included in the following in-depth analysis. Lastly, analysing the content of all the papers, we found 8 more of them that would not be  
224 relevant for our investigation, as the keywords implied a different meaning and were used just once (e.g., as a part of a title in the list  
225 of references). In the end, 53 papers were retained for the review and analysis.

226

### 227 3.3. Data analysis

#### 228 3.3.1. Descriptive statistics

229 The discussion on shared mobility and conflicting tensions began in 2007. Since then, attention to these topics has been growing  
230 gradually reaching 14 papers in 2019. This provides enough evidence to justify the increasing importance of shared mobility, as well  
231 as the rising number of challenges associated with it. Figure 3 demonstrates the overall trend of publications and [Table 3](#) shows a  
232 detailed distribution of publications per journal.

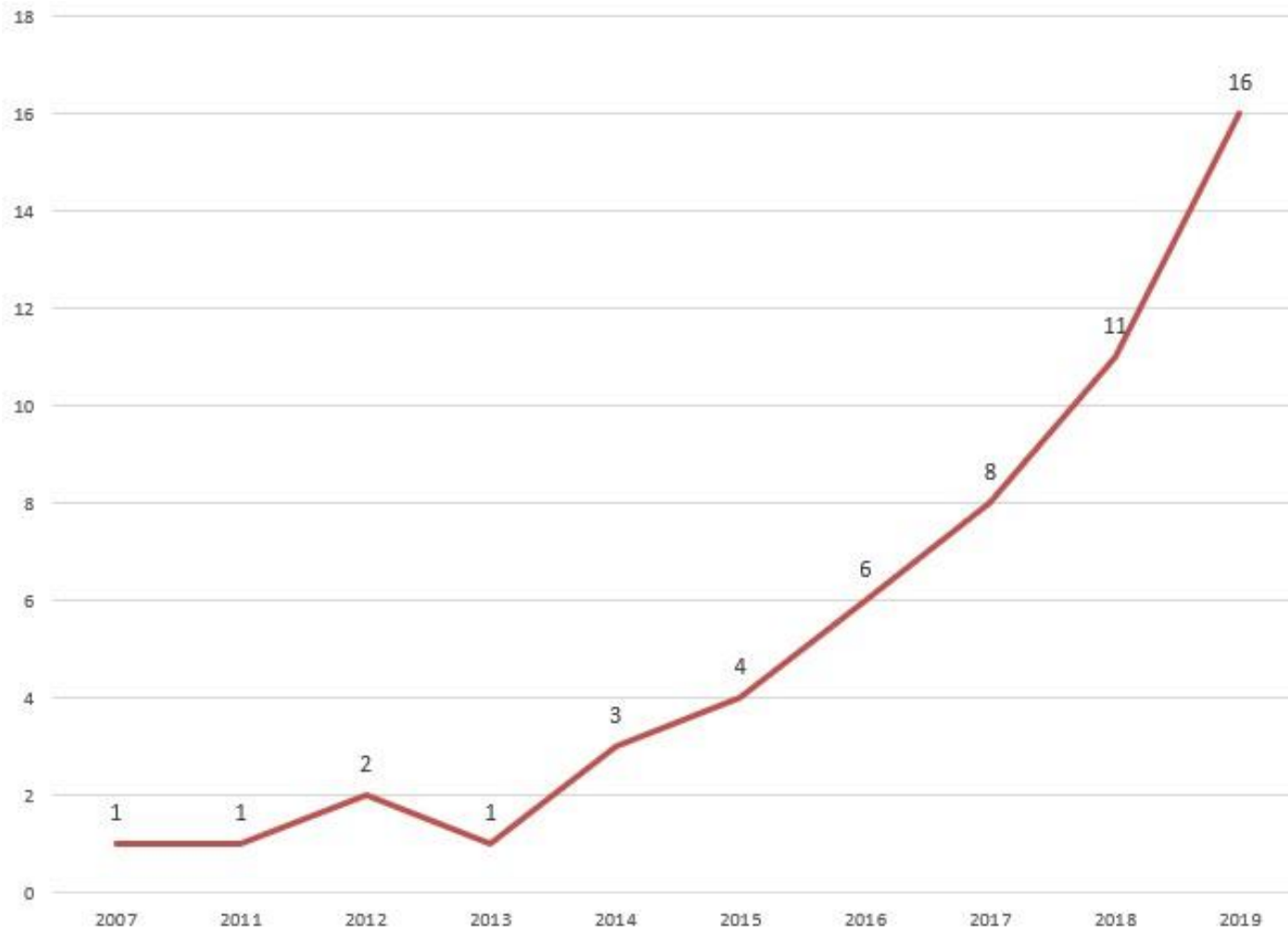


Fig.3. The trend of shared mobility papers

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Journals	Years											Total
	2007	2011	2012	2013	2014	2015	2016	2017	2018	2019		
Cities									1			1
Ecological Economics		1									1	2
Energies									1			1
Environmental Innovation and Societal											1	1
European Journal of Operational Research						1					2	3
IEEE Transactions on Intelligent Transportation Systems					1				1			2
International Journal of Sustainable Transportation								1				1
Journal of Advanced Transportation					1				1			2
Journal of Cleaner Production									2	1		3
Journal of Transport Geography							1					1
Land Use Policy									1			1
Manufacturing and Service Operations Management									1			1
Mobilities										1		1
Network and Spatial Economics								1				1
Organization & Environment					1							1
Research in Transportation Business & Management						1						1
Transport Policy											1	1
Transport Research part A			1				1	1	1		4	8
Transport Research part B			1	1				2				4
Transport Research part C						2	1		1	1		5
Transport Research part D	1								2	1		4
Transport Research part F							2	1		1		4
Transport Reviews											1	1
Transportation											1	1
Travel Behaviour and Society								1		1		2
<b>Total</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>11</b>	<b>16</b>		<b>53</b>

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Table.3. Distribution of papers by journals

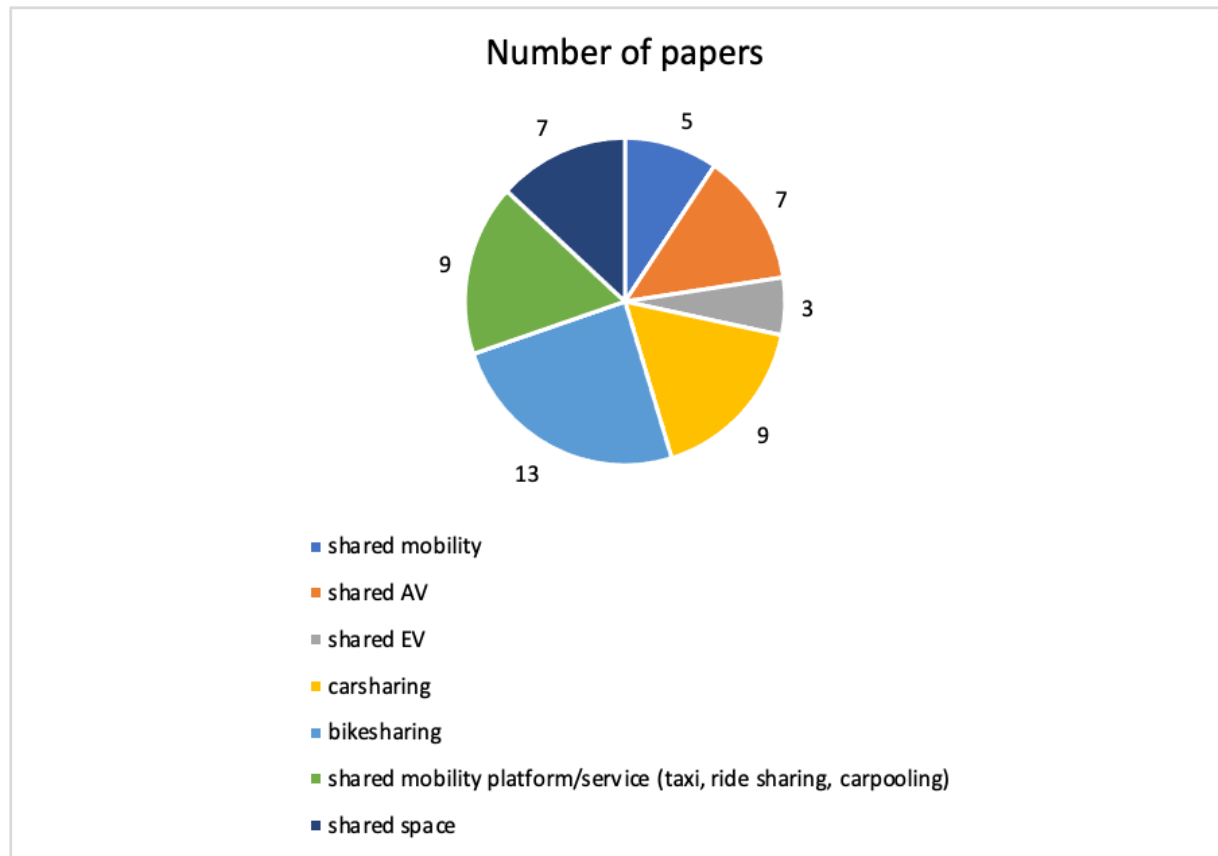


Fig.4. Distribution of papers by shared modes

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239 In terms of shared modes, we identified six different categories (Figure 4). Bicycle-based shared mobility most commonly referred to  
 240 as bike share or bicycle sharing systems (BSS) in the literature (respectively in Zuo and Wei, 2019; Chardon, 2019). However, for  
 241 car-based shared mobility systems or car sharing, distinguishing between modes was more challenging. The concept was  
 242 alternatively referred to as “Peer to peer car sharing business” in Meijer et al. (2019); “car sharing platform” alluding to taxis (Sun et

243 al., 2019) and to “social taxis” in Amar and Basir (2018); “ride sharing” in Jones and Leibowicz (2012); “ride sharing or carpooling” in  
244 Wang and Chen (2019); “free-floating vs. Station-based” car sharing systems in Becker et al. (2018); “shared mobility services” or  
245 “shared taxis” in Bridgelall (2018).

246 Distinguishing between the modes was even less straightforward considering electric vehicles (e.g., in Fan et al. 2019), autonomous  
247 vehicles (e.g., Dandl et al., 2019) or both (Iacobucci et al., 2018). In fact, electric, autonomous, and mixed (both) car sharing systems  
248 hold very specific features rendering their classification as car sharing ‘subsets’ too narrow. These modes result indeed from four  
249 distinct recent innovations in the sector: “automation (automated vehicles: AVs), connectivity and digitalisation (connected vehicles  
250 or CVs), electrification (electric vehicles: EVs), and shared ownership (shared vehicles: SVs)” (Adler et al., 2019).

251 Such attention to BSS and AEVs (automated electric vehicles) in research literature shows that academics set their hopes on these  
252 modes in achieving sustainability goals. Yet, these appear to be most controversial due to complex tensions, which will be discussed  
253 later in this paper.

254

### 255 3.3.2 Content analysis

256 The content analysis approach suggested by Mayring (2015) was selected as main technique to analyse the selected studies. At this  
257 stage deductive and inductive category formation procedures were taken as main analytical techniques. The former is directed by  
258 theoretical considerations in identifying categories, and the latter develops categories out of the material by summarising the material  
259 and moving to another level of abstraction (Mayring, 2015).

260 In applying the deductive procedure we specifically focused on the pairs of contradictions that would refer to each dimension of  
261 sustainability – economic, social, and environmental. Following Elkington and Zeitz (2014), broadly, these dimensions point at the

262 concerns associated with the profit, people, or planet. To ensure accuracy in our coding, we obtained more insights in relevant  
263 transport literature (Marsden et al., 2019) adding to the TBL examples provided in the introduction. For additional guidance, we added:

264 • Economic: 'economics of public transport provision', 'congestion', 'mechanism for capturing some of the commercial value',  
265 'economics of travel', 'economics of travel choices', 'incentives', 'transport modes'.

266 • Social: 'community of users', relevant 'forms of activities', travel 'purposes', 'attitudes', 'concerns' and behaviour of 'public' and  
267 'different groups' of users.

268 • Environmental: 'environmentally friendliness', 'noise', 'pollution', 'visual disruption', 'emissions'.

269 This was useful to identify conflicting tensions in each pair within the TBL (e.g., economic vs. environmental, environmental vs. social,  
270 economic vs. social).

271 At the inductive categorisation stage, a more in-depth analysis of scholars' attitudes to conflicting tension was conducted. This helped  
272 to identify how conflicting tensions were approached, as well as to detect the relationships between them. The final stage of the data  
273 analysis consisted in mixing results from the deductive categorisation (applying the TBL tensions scheme) with findings from the  
274 inductive categorisation, to identify linkages between conflicting tensions.

275

## 276 **4. Results**

### 277 4.1. Identifying tensions

278 The task of identifying conflicting tensions in shared mobility was quite straightforward in some cases. In some articles the  
279 contradictions were already implied in the title (e.g., Cardon, 2019 and Faghih-Imani et al., 2019). Furthermore, two papers by Bagloee  
280 et al. (2016; 2019) contained the word 'paradox' in their title and referred to e.g., the 'Braess paradox' specifically. However, through  
281 in-depth content analysis, we found that most articles have a very implicit indication of conflicting tensions. For example, Kabak et al.

282 (2018) mentioned ‘conflicting criteria’, but the discussion also pointed at the tensions within the bike sharing system, although those  
283 were not explicitly called ‘tensions’ or ‘contradictions’. Similarly, Jensen et al. (2017) referred to ‘competition’ of bicycles and cars in  
284 terms of speed, which was an indication of the tension between the two transport modes.

285 Consistent with the view stated in the research literature, shared mobility in the reviewed papers was presented as an alternative to  
286 traditional transport that enables meeting objectives at all three dimensions of sustainability. Specifically, Ma et al. (2019) referred to  
287 sharing mobility in this sense. Chardon (2019) took the same view on bike sharing. Similarly autonomous vehicles were also  
288 presented as a new mode of transport that helps to achieve sustainability goals (Legacy et al., 2019; Kolarova et al., 2019). Finally,  
289 several papers considered ride sourcing and shared taxis as an enabler to attain sustainability goals (Cohen and Kietzmann, 2014;  
290 Firnkorn and Muller, 2011; Jin et al., 2018; Jokinen et al., 2019; Wand and Chen, 2012). These papers demonstrated a certain level  
291 of acknowledgment of inherent contradictions, and those were discussed in a more explicit manner. At the same time, even though  
292 the shared modes were presented as an adequate response to address these tensions, the articles still argued that other competing  
293 demands also needed attention, which we discuss in the section here-after.

294

#### 295 4.1.1 Bidimensional tensions

296 At the next stage of the analysis, the tensions related to each dimension of sustainability were identified. First order categorisation  
297 process revealed conflicting tensions between the different sustainability dimensions, such as those between economic and  
298 environmental aspects (e.g., Becker et al., 2018). Similarly, other studies (e.g., Marletto and Sillig, 2019) investigated contradictions  
299 between social and environmental elements, and, between economic and social (Aïvodji et al., 2016). This group of conflicting  
300 tensions we categorised as bidimensional tensions. To some extent, this is an expected finding, as contradictions between the  
301 elements of the TBL have been discussed by scholars in different areas of research (e.g., Hahn et al., 2015, 2018; Ozanne et al.,

302 2016; Reck and Axhausen, 2021). Nevertheless, this enabled us to acknowledge specific pairs of bidimensional tensions in shared  
 303 mobility. The pairs of competing demands are summarised in Table 2a.

304 Table 2a. Bidimensional conflicting tensions

<b>Economic-Environmental</b>	<b>Social-Environmental</b>
<ul style="list-style-type: none"> <li>- efficiency vs. emissions level</li> <li>- travel time vs. emissions level</li> <li>- energy demand vs. energy supply</li> <li>- mileage vs. energy consumption</li> <li>- financial vs. environmental sustainability</li> <li>- cost vs. emission performance</li> <li>- congestion vs. emissions level</li> <li>- business model vs. environmental regulation</li> </ul>	<ul style="list-style-type: none"> <li>- comfort vs. sustainability concerns</li> <li>- community good vs. emissions reduction</li> </ul>
<b>Economic-Social</b>	
<ul style="list-style-type: none"> <li>- efficiency vs. equity</li> <li>- land use vs. vandalism</li> <li>- bike cost vs. pro-sustainable behaviour</li> </ul>	

305  
 306 Table 1 in Appendix provides a detailed description of identified pairs of tensions. As it shows, even though similar pairs of  
 307 sustainability dimensions were discussed in the literature, they underpinned different issues and situations, and therefore implied  
 308 different types of tensions. For example, the environmental vs. economic tension appeared quite often within each mode; but when  
 309 looking at car sharing only (Table 1d), it was evident that scholars referred to different pairs of contradictions within each dimension:

310 Bellos et al. (2017) discussed the interaction between business model and environmental regulation, while Firnkorn and Muller (2011)  
311 investigated the trade-off between efficiency and emissions levels. Our review did not find papers that would present sharing mobility  
312 as a response to the last pair of dimensions – economic and social. Instead, the reviewed body of research was found to draw  
313 attention to various tensions between these two aspects that often appeared because of adopting shared mobility.

314

#### 315 4.1.2 Unidimensional tensions

316 In addition to bidimensional tensions, our analysis revealed contradictions within each economic and social dimensions; we labeled  
317 this category of contradictions ‘unidimensional’<sup>4</sup>. For example, Lin et al. (2017) highlighted the conflicts between system usage and  
318 sustainable finance (economic vs. economic), or Normark et al. (2018) brought attention to conflicts between experienced and novice  
319 cycles (social vs. social). Understanding how such tensions were presented in relation to shared mobility, is the main purpose of this  
320 literature review. Sampled results are presented in the Appendix Table 1a~g, and specific competing demands are summarised in  
321 Table 2b below.

322 Our analysis revealed that discussing shared mobility in relation to *all three dimensions* of sustainability was quite rare. Only two  
323 pairs came across a ‘solution’ at most to accommodate competing goals: these were the contradictions between environmental and  
324 economic dimensions on one hand, and environmental and social ones on the other hand.

325 Bike sharing was presented as an enabler to attain environmental and economic (Kabak et al., 2018) -, and environmental and social  
326 (Zuo and Wei, 2019) goals. Car sharing was also discussed to meet these two pairs of objectives (Firnkorn and Muller, 2011; Becker  
327 et al., 2018, and Meijer et al., 2019).

---

<sup>4</sup> Through our analysis we did not identify any unidimensional environmental tensions.

328

329 **Table 2b. Unidimensional conflicting tensions**

<b>Economic</b>	<b>Social</b>
tensions between modes: <ul style="list-style-type: none"><li>- old vs. new (car/bicycle vs. AV/EV/AEV)</li><li>- private vs. public (car vs. PT)</li><li>- traditional vs. app-based (PT/taxi vs. on demand service)</li></ul>	tensions between users: <ul style="list-style-type: none"><li>- cyclists vs. drivers</li><li>- drivers vs. pedestrians</li><li>- cyclists vs. pedestrians</li><li>- regular vs. novice cyclists</li></ul>
tensions within modes: <ul style="list-style-type: none"><li>- competition for users</li><li>- competition between users</li><li>- supply vs. demand</li><li>- satisfaction vs. profit</li></ul>	behavioral tensions: <ul style="list-style-type: none"><li>- compliance vs. vandalism</li><li>- equality vs. discrimination</li><li>- enthusiasm vs. skepticism</li></ul>
general: <ul style="list-style-type: none"><li>- cost vs. efficiency</li><li>- cost vs. service</li><li>- cost vs. utilisation</li><li>- usage vs. financing</li><li>- mobility vs. congestion</li></ul>	tension between stakeholders: <ul style="list-style-type: none"><li>- public vs. private interests</li><li>- individual vs. society focus</li><li>- operator vs. provider</li></ul>

330

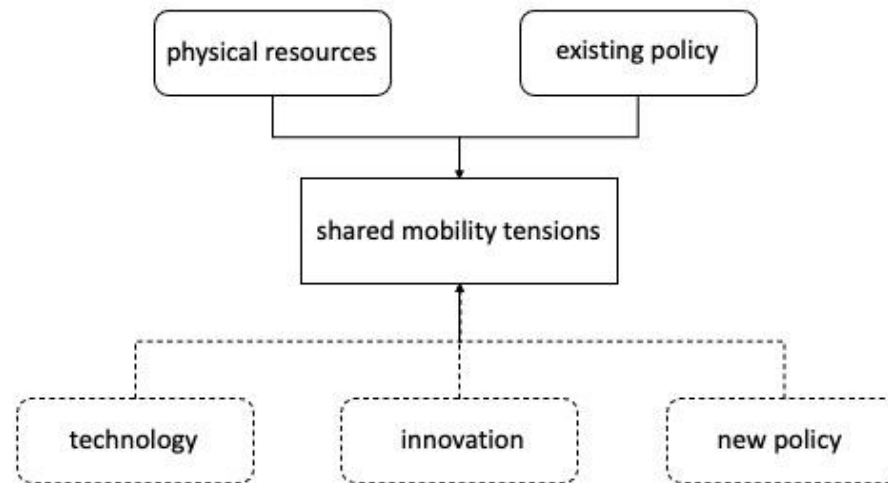
331 In addition, a simultaneous pursuit of environmental and economic objectives was considered in relation to shared mobility in general  
332 (Taiebat and Xu, 2019), shared autonomous vehicles (Jones and Leibowicz, 2019), and AEVs (Iacobucci et al., 2018).

333

#### 334 4.1.3 Factors influencing conflicting tensions

335 Our analysis shows that despite being considered as an advanced way to meet economic, social, and environmental objectives,  
336 shared mobility itself represents the sources of conflicting demands. In other words, conflicting tensions are *inherent* to the shared  
337 mobility mode (Chardon, 2019; Cohen and Kietzmann, 2014; Jin et al., 2018;). Paradox research suggests that any other type of  
338 human agency inevitably involves conflicting demands, they become salient under the influence of triggers, such as the lack of  
339 resources, environmental complexity, or dynamism (Smith and Lewis, 2011). In our review we observed that scarcity of physical  
340 resources (roads, streets, lanes, paths) and imperfections of existing policies were related by the transport scholars to such triggers  
341 that accentuated multiple contradictions. At the same time, the reviewed papers provided suggestions to meet competing demands.  
342 Technology, innovation (new systems, structures, or business model innovation) and proposed new policies were associated with  
343 the factors that allow for accommodating competing goals simultaneously. Figure 5 below illustrates the factors that accentuate and  
344 help manage conflicting tensions.

345 The role of technology in managing conflicting tensions is particularly interesting. Due to the rise of new forms of vehicles (EVs, AVs,  
346 and AEVs) and app-based solutions associated with shared modes, technology often came across as a central topic in many studies.  
347 On one hand, it was presented as an enabler in achieving conflicting objectives simultaneously, but on the other, technology was  
348 found to cause new contradictions (Aïvodji et al., 2016; Iacobucci et al., 2018; Jones & Leibowicz, 2019; Legacy et al., 2019).



349

350

Fig.5. Factors influencing conflicting tensions in shared mobility

351

The next task involved identifying the relationships between tensions, which enabled us [to address our second research question](#).

352

353

#### 4.2. Connecting tensions

354

Scholars' attention was mostly directed to economic unidimensional tensions. The second-largest group was considered with social

355

unidimensional tensions. Some of them appeared because of addressing a different pair of contradictions – environmental and

356

economic (e.g., Jokinen et al., 2019), or environmental and social (Marletto and Sillig, 2019) [occurring in stakeholders' decisions](#).

357

These complex relationships were demonstrated in the works of Bagloee et al. (2016, 2018) that showed how attempts to meet

358

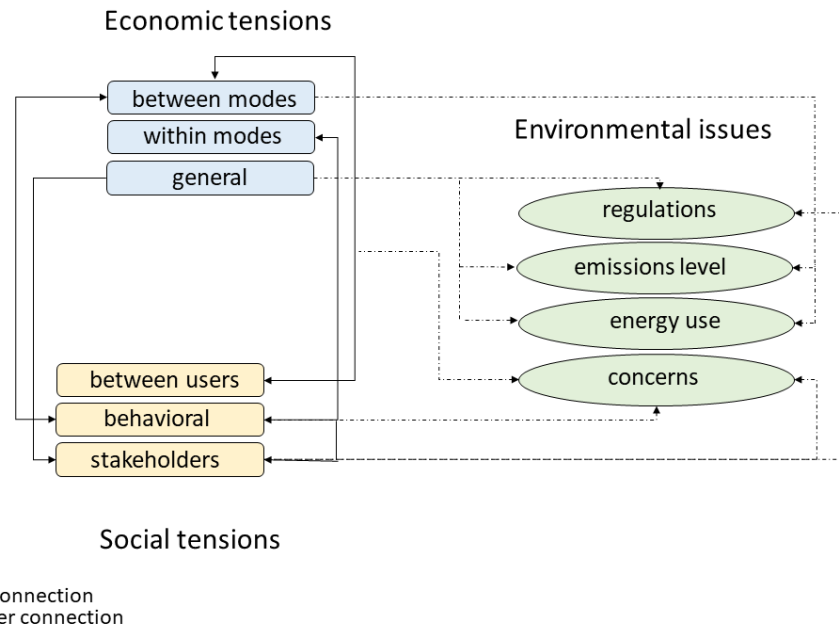
environmental (emission reduction) and economic (congestion) goals resulted in additional social economic tensions. Our consequent

359

task was therefore to gain a more in-depth understanding of the relationships between different contradictions, and to analyse their

360 patterns. A noticeably common type of contradiction was that between different transport modes (e.g., traditional taxis vs. app-based  
361 services, car ownership vs. cycling, bicycles vs. vehicles). Such tensions were often linked with related conflicts between users  
362 (drivers vs. cyclists, cyclist vs. pedestrians). Furthermore, some authors brought attention to other social tensions, such as those  
363 between different stakeholders (public vs. private) and the contradictions associated with behaviour and attitudes (compliance vs.  
364 vandalism, individual vs. social preferences, equality vs. discrimination). Thus, it was possible to observe the connections between  
365 economic unidimensional and social unidimensional contradictions.

366 In addition, the content analysis allowed identification of more emerging tensions that appear between sustainability dimensions. In  
367 particular, the analysis of economic and social tensions revealed emerging conflicts between user privacy and system performance  
368 (Aïvodji et al., 2016). Another common tension that appeared at the intersection of these two dimensions was the contradiction  
369 between comfort of users and efficiency of the transport mode (Martinez et al., 2014; Wang and Chen, 2012). Regarding the economic  
370 and environmental dimensions, the tension between efficiency of the system, or mode, and the need to reduce the level of emissions  
371 was emphasised by several papers (Becker *et al.*, 2018; Firnkorn and Müller, 2011; Iacobucci et al., 2018; Kabak et al., 2018). Our  
372 review exposed that these **rising** tensions remain unaddressed, although scholars offer some suggestions in this respect. Figure 6  
373 below illustrates how shared mobility is linked to various contradictions between sustainability dimensions, as well as unidimensional  
374 ones, and how they relate to each other.



375

376

377

Fig.6. Interrelated tensions within shared mobility

378 Shared mobility attempts to meet sustainability goals. However, it also causes economic unidimensional, social unidimensional and  
 379 socio-economic tensions. For example, the competition between different transport modes for the road space causes tensions  
 380 between the users (first order connection). At the same time, economic unidimensional tensions, such as old vs. new transport modes,  
 381 lead to the contradiction between financial and environmental sustainability, or travel time and emissions level (second order  
 382 connection). Similarly, a social unidimensional pair of contradictions, like enthusiasm vs. scepticism towards new shared modes and  
 383 technologies, will cause conflict between comfort and sustainability concerns, which is a social-environmental one.

384 Hence, as [our findings suggest](#), shared mobility involves numerous hidden tensions that can be understood after analysing shared  
385 mobility research in aggregate. Even though some scholars already point at multiple contradictions (Chardon, 2019; Jin et al., 2018;  
386 Jokinen et al., 2019; Legacy et al., 2019; Marletto and Sillig, 2019), it is important to consider other related tensions that might be  
387 revealed by them, that were highlighted by other scholars.

388

#### 389 4.3. Addressing tensions

390 Lastly, we [analysed](#) the suggested responses to conflicting tensions. This involved identifying larger themes across identified  
391 responses, as well as analysing and relating those to the strategies of managing contradictions suggested by paradox research.

392 Shared mobility modes were considered by scholars as an opportunity to achieve different sustainability goals simultaneously, i.e.,  
393 more [advanced](#), and “green” compared to conventional modes, especially PT and car ownership (Chardon, 2019; Frinkorn and Müller,  
394 2011; Jones and Leibowicz, 2019; Taiebat and Xu, 2019). Nevertheless, as our analysis demonstrates, attempts to address one pair  
395 of sustainability tensions often involves the emergence of another tension either between two other dimensions or within one of them  
396 (e.g., social, and economic aspects) (e.g., Alonso-Almedia, 2019; Chardon et al., 2016; Marletto and Sillig, 2019; Wen et al., 2018).  
397 Furthermore, scholars revealed that shared mobility often involved several tensions that were closely interlinked with each other (Jin  
398 et al., 2019; Shen et al., 2018). Most papers from our review offered ideas towards developing a solution to manage such tensions,  
399 even though it was not always the main purpose of the research, and these conflicting tensions were not always discussed in an  
400 explicit manner. Others tended to focus more on bringing attention to one issue (part of which could be a conflicting tension), rather  
401 than offering specific solutions (e.g., Alonso-Almedia, 2019; Jennings, 2015; Jin et al., 2019).

402 Taking a closer look at the papers that provide solutions to address conflicting tensions, showed that a significant number of studies  
403 suggested resolving strategies. Such strategies involved weighing up pros and cons of each alternative and demonstrated a tendency

404 toward prioritising one over the other (Shen et al., 2018). For example, applying cost benefit analysis (Fan et al., 2019; Brey et al.,  
405 2017) can be a typical response to resolve a conflicting tension. Resolving strategies represent a conventional way to manage them  
406 and can often be seen in many studies across different disciplines (Schad et al., 2019). It is not surprising to see this approach so  
407 common across the reviewed papers, although it has been criticised by transport scholars in the past (Patton, 2007). However, such  
408 an approach tends to be suitable only short term, as resolving contradictions will inevitably lead to new tensions in future.

409 Another group of responses included what paradox scholars call a synthesis approach to resolve tensions. That is, when a third  
410 element is introduced to the contradiction that would satisfy both competing demands. In the shared mobility literature, new policy  
411 (Aïvodji et al., 2016; Wang and Chen, 2012), economic incentives (Bellos et al., 2017; Chardon, 2019; Legacy et al., 2019; Pfrommer  
412 et al., 2014) or technological improvements (Aïvodji et al., 2016; Legacy et al., 2019; Taiebat and Xu, 2019) were presented in this  
413 regard. Such responses are typically associated with achieving a trade-off or a compromise solution [between stakeholders](#). Like cost  
414 benefit analyses, trade-offs and compromises help resolve immediate challenges, but from the perspective of paradox research, they  
415 are not ideal for achieving long-term sustainability (Smith and Lewis, 2011).

416 Finally, few papers demonstrated a tendency towards integrating conflicting elements without separating or synthesising them. This  
417 represents one of the most interesting findings of our review. Scholars called for searching for alternative solutions, and some stressed  
418 the complementarity between conflicting elements or calling for integrative approaches (Becker et al., 2018; Jokinen et al., 2019).  
419 For example, Normark et al. (2018) pointed out the interdependence of distinct users (pedestrian and cyclists) even though these  
420 were often taken as conflicting elements within a social dimension and associated with competing transport modes. A tendency of  
421 appreciation of synergies between conflicting goals and the need for transformation (Ma et al., 2018; Wen et al., 2018) was also  
422 observed. This third group of responses presented to manage conflicting tensions can be associated with active strategies (Schad et  
423 al., 2019) that enable viewing conflicting tensions as paradoxical and stress complementarity and interdependence between the  
424 opposites.

425 It is important to stress that embracing contradicting tensions can be quite challenging. The acknowledgment of the dialectical nature  
426 of conflicting tensions often involves distancing from mainstream approaches, and leads to ideological and paradigmatic changes  
427 (Pel, 2016). According to paradox research, to manage conflicting tensions successfully, decision makers must have a paradox  
428 mindset (Schad et al., 2019). Developing such a mindset requires stakeholders to revisit core assumptions that block active strategies  
429 in addressing conflicting tensions, such as acknowledging the possibility of multiple perspectives, viewing resources as generative,  
430 and accepting dynamism and change (Smith et al., 2016). The last two assumptions were particularly relevant for our review.

431 Our review has demonstrated that one such assumption (resource scarcity) was often associated with the main challenge in meeting  
432 sustainability goals simultaneously. Indeed, there is limited space to accommodate numerous needs of cyclists (Anvari et al., 2015;  
433 Beitel et al, 2019; Hoye et al., 2016), drivers and pedestrians that can be in conflict even with the wider implementation of 'more  
434 advanced' shared modes (Brey et al., 2017; Normark et al., 2018; Zuo and Wei, 2019). However, it is often a matter of perspective  
435 whether resources are truly limited or abandoned, and possibilities to search beyond conventional solutions, implementing flexible  
436 systems and new technologies, remain forgotten (Smith et al, 2016). It is promising to see that transport scholars draw attention to  
437 such approaches that would eliminate resource scarcity problems (Becker et al., 2017; Meijer et al., 2019; Taiebat and Xu, 2019).  
438 [Indeed, the emblematic GHG emissions abatement cost curve of McKinsey \(McKinsey & Company, 2019\) graphically represents](#)  
439 [candidate solutions for cutting emissions in the transport sector, some of them with a cheap or even negative cost, e.g., fuel-efficient](#)  
440 [driving](#). Matopoulos et al. (2014) add the role of transport mode, routing, and scheduling choices, to minimise the use of resources.  
441 Finally, Nello-Deakin (2019) goes further with a suggestion to specify in this equation, the trip chaining features and travel distances  
442 rather than simply associating people to transport mode to rationalise transport investments. In fact, the authors recommend reporting  
443 the mode to the space effectively occupied on the territory and the travel speed, to rethink transport resources and their allocation.

444 Scholars also expressed the positive impacts of dynamic approaches and change and transformation in achieving sustainability  
445 objectives (Ma et al., 2018). In addition, rebalancing strategies (Chardon et al., 2016; Zheng and Geroliminis, 2013) and proposing

446 new campaigns that would initiate change (Hoye et al., 2016) can be seen as an attempt to revisit mainstream assumptions.  
447 Embracing dynamism and change has lately become a particularly essential prerequisite for decision makers as macro-environmental  
448 changes create additional needs for experimentation and innovation.

449

## 450 **5. Discussions and conclusions**

### 451 5.1. Main messages

452 Rapidly changing landscapes of cities, technological innovation and resource scarcity accentuate conflicting tensions in the field of  
453 sustainable transport. Strategies for successful transitions have been suggested to policymakers, notably by Banister et al. (2008;  
454 2011). Among them, empowering a variety of stakeholders involved in the implementation of a new transport project or policy, ranging  
455 from specialists, researchers, and academics to practitioners through participatory processes and broad coalitions; to rely on  
456 behavioural options targeting demand reduction; more effective ways to use regulatory instruments as well as revisiting transport  
457 governance, have been advised. Holden et al. (2013) also recommend the use of indicators such as the energy consumption per  
458 capita, travelled distances using motorised modes, PT accessibility levels and a glance at the share of renewable energy used in the  
459 transport system in place to monitor such transitions.

460 Specifically, the shared mobility field emerged at the overlap of the two distinct areas of research – sharing economy and sustainable  
461 transport, each of which embeds conflicting demands (Dinev, 2014; Neunhoeffer and Teubner, 2017). This makes shared mobility a  
462 complex phenomenon that is inherently paradoxical. As demonstrated in the paper, multiple tensions can be identified at the  
463 intersections of sustainability goals, that are closely linked to each other. Attempts to resolve these tensions by using conventional  
464 methods often result in repeated emergence of these tensions, due to their persistent nature. It is, therefore, important to consider a

465 different approach to conflicting tensions and to focus on the interdependent relationships between opposing elements. That involves  
466 treating them not just as static alternatives poles or dilemmas, but as interrelated elements that can co-exist in a dynamic relationship.  
467 Our analysis also showed that although shared mobility and its individual modes represent an attempt to meet environmental,  
468 economic, and social goals, it appears to be quite problematic due to multiple existing tensions. Many scholars explicitly point at  
469 numerous contradictions within shared mobility (e.g., Chardon, 2019; Cohen and Kietzmann, 2014; Jennings, 2015; Ma et al., 2018),  
470 while in other works the tensions are presented in a more implicit manner (e.g., Bellos et al., 2017; Taiebat and Xu, 2019). Finally,  
471 our review advocates that attempts to resolve tensions through synthesis or separation often cause additional tensions. Thus, even  
472 though shared mobility represents a step forward in achieving sustainability, it only contributes partially, and resulting issues require  
473 decision makers' attention.

474

## 475 5.2. Theoretical contributions

476 The present review's contribution to transport research is two-fold. First, by identifying multiple tensions at the intersection of the TBL  
477 and indicating their links with shared modes. Our dynamic approach to investigating interrelations of conflicting tensions goes beyond  
478 previous studies praising the role of shared schemes to mitigate management challenges associated with the TBL (Wiengarten et  
479 al., 2017). Second, by introducing a paradox lens (Smith and Lewis, 2011), this review provides a refreshed understanding of these  
480 issues, and sheds light on the possible ways to address them.

481 Future studies could take a more comprehensive approach to shared mobility and include a greater variety of the shared modes. It  
482 would be worthwhile to identify different levels (institutional, societal, and individual) at which tensions occur and investigate their  
483 interlinkages.

484

### 485 5.3. Policy implications

486 Appreciation of the paradoxes' variety presented in the results section can help practitioners (users, urban planners, and  
487 policymakers) in adopting paradoxical frames in dealing with contradictions as opposed to a cost-benefit or contingency approach.  
488 This provides additional incentives to change individual behaviour and guides decision making. For example, instead of thinking  
489 whether to buy a new bike to limit the impact on the environment or save costs, a user might start considering ways in which minimising  
490 costs and pursuing sustainability goals as a whole could complement each other. This might stimulate ideas toward generating  
491 possible solutions, such as negotiating the opportunity to get assistance with covering the costs for implementing a shared e-bike  
492 scheme with an employer. Similarly, for an urban planner or policymaker the question of whether to pedestrianise a road or keep it  
493 for cars might be transformed into a task of finding a synergy between the sustainability agenda and that of accessibility, which can  
494 lead to a myriad of creative urban solutions. Regarding MaaS specifically, as an emblematic figure of shared mobility technology,  
495 balancing the needs of stakeholders in a way to ensure accessibility and affordability for vulnerable travellers (elderly, disable and  
496 low-income groups), would guarantee a greater viability of this solution according to Dadashzadeh, et al. (2022). Furthermore,  
497 understanding the relationships between different paradoxes shows that addressing sustainability challenges requires a greater  
498 involvement of multiple stakeholders and the need for developing collaborative approaches, instead of dealing with them in an isolated  
499 manner.

500

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