The orchestration of sustainable mobility service innovations: understanding the manifold agency of car sharing operators

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Service-based alternatives to private vehicles and public transport are increasing. These innovations are hoped to boost the transition to sustainable mobility, addressing challenges such as congestion, air quality and the large share of CO\textsubscript{2} resulting from traffic. To achieve this transition, there is an urgent need for collaboration between private companies and public authorities, especially locally. We claim that insufficient attention is paid to the agencies of the practical actors, such as car sharing operators, which is the key to understanding what this collaboration requires. Orchestrating the collaboration successfully is also a prerequisite for the sustainability of the services. We use interview data from car sharing operators and public authorities in Finnish cities to analyze the local-level implementation of shared mobility services. Our results show how the local public authorities play a crucial role in allowing the services to flourish but also ensure the services’ environmental and social sustainability.

\textbf{Keywords:} shared mobility; local government; capability; governance; technological innovation systems

\textbf{Highlights}
- Analyzing novel service innovations calls for combining systemic and micro-level analysis
- We analyze the agency of sustainable shared urban mobility operators and local policymakers in the case of Finland
- We stress the role of local policymakers in providing examples, enabling coordination and harnessing innovative actors
- Local-level collaborating is crucial for the sustainability of mobility innovations

1. Introduction
Organizing transportation is a key issue in present-day cities with the increasing flows of people and goods shaping the cities (Hajer and Dassen 2014). These flows continue to accumulate negative side effects – such as urban congestion, air quality problems and their significant share in CO\textsubscript{2} emissions – and therefore call for urgent action.
These demands have not gone unnoticed. There are several supranational, national and city-level policy targets especially for improving the environmental sustainability of mobility (e.g. European Commission 2020; City of Helsinki 2017). The development of technologies – such as the electrification of vehicles, digitalization and better-organized distribution of mobility services – along with the policies supporting these, have been suggested responses to the sustainability challenges (Givoni and Banister 2013; Terama et al. 2018). One crucial part of this is shared mobility, which is seen to result in better urban structure, less congestion and a reduction in both particle and CO₂ emissions (Baptista, Melo, and Rolim 2014). At the same time, challenges – such as service providers generating as much transport as possible in order to maximize returns on their investment – and wide market entry or equity and inclusion issues (as new services will not occur at the same pace or degree across different areas) are acknowledged (Docherty, Marsden, and Anable 2018).

The task of integrating these developments in a sustainable manner is not easy. Introducing services that aim to change mobility practices requires orchestrating the efforts of various actors – such as private companies, public authorities and policymakers – at different levels of governance. Should cities, for instance, take the lead and harness niches for private shared mobility operators or should they wait for operators to take the lead and wait for the market to form (Fenton, Chimenti, and Kanda 2020)? Either way, to ensure the sustainability of these services, there is a need for mutual learning regarding what kinds of solutions and policies suit the particular contexts (Boon and Bakker 2016).

The role of public authorities has shifted from providing services to managing services, and recently, to ensuring public value, such as the sustainability of public service provision (Docherty, Marsden, and Anable 2018). This also reflects the longer-term trend of emphasizing market-driven solutions for societal issues and, on the other hand, the decentralization of capacities, such as the skills and resources required for policy implementation (Painter and Pierre 2005). From the local public administration perspective, these developments require individual, organizational and systemic abilities and reflexivity in order to assess and operationalize the service provision (Wu, Ramesh, and Howlett 2015). In the context of shared mobility, this is especially important as the environmental and social sustainability of the services depend on how they are organized (Tuominen et al. 2019; Pangbourne et al. 2020). In this, the orchestration of these innovations at the local level plays a crucial role (Spåth, Rohracher, and von Radecki 2016; Vagnoni and Moradi 2018).

Finland is among the forerunner countries in Europe in promoting digital mobility services. In particular, the concept of Mobility as a Service (MaaS) – the concept of providing the end user with a single service for discovering, accessing and paying for a wide variety of transport options – has gained prominence. One of the reasons for this is the enthusiastic and supportive role of the national government, despite factors such as the geographically scattered population and small volumes of users (Akyelken et al. 2018). Even though the importance of national regulation in advancing novel mobility solutions has been recognized (Fenton, Chimenti, and Kanda 2020), it might not be enough to merely offer a permissive policy environment. There is a need for the practical collaboration and experimentation of commercial operators and local authorities to make the mobility innovations robust and viable (Borghei and Magnusson 2018).

The success of these innovations depends on both the actors’ everyday practices and also on the structural elements enabling them (Terama et al. 2018). This means that advancing sustainable mobility is both individual and collective in nature (Hekkert
et al. 2007; Abbott et al. 2016). There have been calls to emphasize the role of agency in change processes (Grin, Rotmans, and Schot 2011; Farla et al. 2012; Boon and Bakker 2016) and efforts to answer this (cf. Köhler et al. 2019). However, we claim that these efforts could benefit from a more in-depth analysis of what agency means in practice and, moreover, assessing the interplay of the agency of the shared mobility actors and the structural elements, such as the policy environment.

In this paper, we explore one specific set of actors operating within mobility innovations – namely car sharing operators, and car sharing platform and aggregator service (MaaS) providers – and also consider their counterparts in the local administration. To comprehend the uptake and mainstreaming of these innovations, we approach the phenomena via a Technological Innovation System (TIS) framework in conceptualizing the different functions needed at the system level (Hekkert et al. 2007). However, to fully understand the dynamics of systemic change and the role of the different actors in it, we need to also consider the micro level (Markard, Hekkert, and Jacobsson 2015). To operationalize this, we use the concept of strategic capabilities offered by Lévesque and Murray (2010) in analyzing agency. The benefits of our approach lie in bringing together the meso- and micro-level perspectives of a TIS and agency in considering the orchestrating of urban mobility innovations while also contributing to the quest for a more nuanced understanding of the actors in a TIS (Köhler et al. 2019).

Building on interviews with operators and civil servants at the local level in Finland, we propose the following research questions:

- What kinds of capabilities do the car sharing operators utilize in setting up new mobility services?
- How do these capabilities steer the agencies of the actors?
- How the different agencies in orchestrating urban mobility innovations be utilized in a sustainable way?

The task of this paper is twofold. Firstly, we want to broaden understanding of agency in the context of governing sustainable urban mobility by integrating system-level (TIS) analysis with micro-level analysis (agency). Secondly, as a more practical effort, we offer insights that help to introduce urban car sharing, especially in similar contexts of lower population density that are similar to our Finnish context. By showing the critical points for success, the results help in designing national and local policy measures and incentives in the quest for sustainable shared urban mobility.

In the following, we first give an overview of the recent topics in car sharing literature and present our approach, which combines a TIS and agency via strategic capabilities. Next, we present our interview data and results. In the latter part of the article, we assess what aspects the different actors emphasize and lack when aiming to advance shared mobility innovations in cities. Finally, we elaborate the critical points in the collaboration between the different actors and reflect on our findings in the light of current and future policies for sustainable shared urban mobility.

2. Analyzing car sharing as a technological innovation

Shared mobility, and car sharing in particular, have not gone unnoticed in scientific literature. These discussions can be characterized into three streams: (1) studies on car
sharing user groups and usage patterns (e.g. Schmöller et al. 2015; Becker, Ciari, and Axhausen 2017), (2) the mobility, environmental and car-ownership impacts of car sharing (e.g. Ciari, Bock, and Balmer 2014; Nijland and van Meerkerk 2017) and (3) the market characteristics and operator perspectives of car sharing (e.g. Ballus-Armet et al. 2014; Steininger and Bachner 2014). Focusing on user uptake, the benefits and the advancing of car sharing has left the policy setting with less attention (Akyelken et al. 2018) with some recent exceptions concerning the MaaS concept (Docherty, Marsden, and Anable 2018; Fenton, Chimenti, and Kanda 2020).

Methodologically the literature often utilizes quantitative data in the form of surveys, for example, surveys among the service users (see, e.g. Baptista, Melo, and Rolim 2014; Becker, Ciari, and Axhausen 2017), statistical analyses of car sharing operators’ user data (e.g. Klinevicius, Morency, and Trepanier 2014; Schmöller et al. 2015) or car sharing simulations (e.g. Ciari, Bock, and Balmer 2014; Le Vine et al. 2014). We continue the stream of operator perspectives, but broaden the focus to include the interplay between the operators and the wider systemic elements.

When analyzing the uptake and conditions for novel technological solutions, such as car sharing, one popular and useful approach is to contextualize the phenomena as a Technological Innovation System (TIS) (Hekkert et al. 2007). Such a system can be defined as “a network of agents interacting in the economic/industrial area under a particular institutional infrastructure”, aiming to generate, diffuse and utilize a certain technology (Carlsson and Stankiewicz 1991, 111). The advantage of this approach is the focus on the interplay of several interconnected factors, including governance.

Literature often categorizes the processes within a TIS into seven functions affecting the performance of the system (Bergek et al. 2008). 1. Knowledge development and diffusion means how the different kinds of knowledge are developed, combined and exchanged. 2. Influence on the direction of search means the guidance of resources and incentives toward certain pathways for adopting certain technologies. 3. Entrepreneurial experimentation is the testing of new solutions or markets by, for example, piloting. 4. Market formation means creating markets and aiming to create demand for the new solutions. 5. Resource mobilization is about the practical allocation of resources that can be, for example, financial or human resources. 6. Legitimation means the efforts to overcome resistance, establish practices and develop acceptance. 7. The development of positive externalities is about how the activities create spillovers that can benefit, for example, new actors and benefit the renewal and development of the system (Bergek et al. 2008; Lukkarinen et al. 2018).

A TIS looks at change processes primarily from a meso level. For this reason, the approach has been criticized for lacking an elaborate understanding of the actors involved and their practical activities (Kern 2015; Köhler et al. 2019). The same criticism has been voiced for the literature on the transition process in general, where the tendency to emphasize structural components over agency has also caused the actor types to be diminished into archetypes and neglects how their roles can change over time (Avelino and Wittmayer 2016; Fischer and Newig 2016). Similarly, focusing on technologies and enabling structures in transitions can leave crucial factors, such as power positions, to receive less attention (Grin, Rotmans, and Schot 2011; Scoones, Leach, and Newell 2015). Albeit some of these aspects have been addressed recently (cf. Köhler et al. 2019), applications combining the TIS approach with more agency-centred analysis, especially at the sub-national level, remain lacking.
As we understand it, *agency* is the possibility for an individual or entity to act in a specific operational environment (Parag and Janda 2014; Fischer and Newig 2016). Agency is thus about both the qualities of the actor and also about the dynamic relationship with the systemic elements (Laamanen 2017). To analyze the actors and their agency, we assess the *capabilities* the actors utilize in pursuing their objectives (Parag and Janda 2014; Huikkola and Kohtamäki 2017). In the context of shared mobility, the operators’ objective can be defined as offering services in order to advance the change from the use of personal vehicles toward more shared and efficient use of these resources (e.g. Ballús-Armet *et al*. 2014). This obviously goes along with the business actors’ general targets of staying in business, making profit and prospering, and cities’ targets of, for example, providing services to their citizens and advancing sustainability.

There is a vast amount of empirical literature analyzing capabilities from the actor perspective (cf. Huikkola and Kohtamäki 2017). We find the categorization of strategic capabilities offered by Lévesque and Murray (2010) a useful tool in conceptualizing the makings of the agency of the car sharing operators, as this categorization also resonates with the TIS functions. These categories (capability attributes) are intermediation, framing, articulation and learning. Even though the original context in which the categorisations of Lévesque and Murray were applied (the characterization of the success factors of trade unions) is different to our context, it is analogous with our approach, where the actors have to be agile in crossing boundaries between policymakers, customers and other operators with the same goals.

*Intermediation* (a) refers to the ability to mediate between actors with common and conflicting interests, foster collaborative action and manage various networks. As intermediaries, these actors must build networks, and translate and create knowledge among different actors and realities (Lukkarinen *et al*. 2018). In the context of mobility innovations, policymakers, and local administration in particular, are prime examples of the actor groups with whom the operators are intermediating.

Second, *framing* (b) means “the ability to put forward an agenda that can be more or less inclusive and can be part of a broader social project” (Lévesque and Murray 2010, 343). It is often a linguistic device in the public realm that suggests what the issue is about (Brewer and Gross 2010). It thus manages to narrate the objectives in a manner that resonates with societal goals such as climate change mitigation. Framing is also called for when introducing novel solutions for end users in order to link the applications to the users’ current practices.

*Articulation* (c) is “constant arbitration between actions as regards time and space” (Lévesque and Murray 2010, 343). This means operating as a practical linking mechanism between the different actors. For emergent actors it is crucial to be part of and act in the processes that might challenge the state of play, offering possibilities to advance their objectives (Ingram 2015, 61). As we understand it, intermediation is often interpreted as acting for the common good, whereas articulation might have less altruistic motives. For car sharing operators, it is often used in connection with the other actors, such as public transport, that call for the practical articulation of activities, technologies or data interfaces.

Finally, *learning* (d) is the “ability to foster, reflect on and learn from past and current change in contexts and organizations” practices and routines in order to anticipate and act upon change” (Lévesque and Murray 2010, 344). For actors implementing innovations, continuous learning and re-adjusting activities is crucial (Borghei and
Magnusson 2018). This is especially the case in situations where technologies, policies and user preferences are evolving and successful examples from other locations and operational environments can be harnessed and unsuccessful ones avoided.

3. Data and methods
Traditionally, TISs have been utilized on the national scale (Markard, Hekkert, and Jacobsson 2015), but recently the approach has also been found useful in local contexts (Lukkarinen et al. 2018). In TIS studies, the makings of a system are often divided into actors, networks and institutions (Bergek et al. 2008). The actors can be categorized according to their economic activity (Wieczorek and Hekkert 2012). In the context of car sharing, the local level is one of the most important levels, and there, the most crucial actors can be categorized into companies (car sharing operators), the government (its city-level policymakers and administration) and civil society (the users of the services). Our empirical focus is on the first two.

Our data consist of car sharing operator and local government interviews. We interviewed all the key operators who were offering car sharing and aggregator services in Finland in 2017 and 2018 (see Table 1). These operators are not a homogeneous group of actors but differ in several aspects, such as in their financial assets, future orientation and history. They are part of a technological system wherein they must simultaneously provide a supply for fragile and emerging demand, and more crucially, they must simultaneously develop and foster this demand. The operators interviewed (8 interviews, 10 people) can be divided into four different categories: (1) peer-to-peer operators who offer a platform for individuals to share their vehicles, (2) car sharing companies who offer their fleet either from designated parking facilities or as a floating fleet in which the vehicles are more freely distributed, (3) large incumbent companies also offering car sharing types of services or vehicles based on demand and (4) operators offering MaaS-type aggregator services, where customers can use several mobility services under one solution.

In the analysis, when we use the term operator, we refer to all four types, but especially to the types detailed in points 2 and 3. When necessary, we define the type in more detail, such as peer-to-peer operator or MaaS operator.

The data allows us to understand how the operators perceive the constraints and enabling factors of the operational environment. They thus explain what capability attributes the operators emphasize. They are therefore simultaneously attributes of the operators themselves and also indicative of their dynamics with the system level. To assess the interlinkages between the operators and the crucial actors in the operational

| Actor group # | Actor                           |
|---------------|---------------------------------|
| 1             | RIDEnRENT                       |
| 1             | ShareIt Bloxcar                 |
| 2             | City Car Club                   |
| 2             | 24Rent                          |
| 3             | Herz Car Sharing                |
| 3             | OP Kulkku                       |
| 4             | TUUP (present Kyyti Group)      |
| 4             | WHIM - MaaS Global              |
environment, we also interviewed key civil servants responsible for mobility and transport planning in the two main metropolitan areas of Helsinki and Tampere, the two regional center cities of Lappeenranta and Kotka, and two fringe cities of Lohja and Ii (6 interviews, 11 people).

The total number of operator and city interviews was 14, included 22 people, and lasted 58 min each on average. The interviews were conducted in person except for three city interviews, which were conducted over the telephone. The interviews were recorded and transcribed. In the semi-structured operator interviews, we inquired how their service had started and what had been the main barriers or enabling factors regarding the design, use and operational environment of the service. In the civil servant interviews we discussed the local mobility planning principles and development of shared mobility services, and then focused on the internal and external collaboration and outlook of sustainable shared mobility services.

When analyzing the interview transcriptions, we utilized a qualitative content analytical methodology (Elo and Kyngä 2008). We first analyzed the ways in which the operators discuss (1) their position and objectives in the operational environment, (2) their operations when aiming to reach these objectives and (3) the advantages and assets they possess and utilize, and further, the problems and barriers they face.

From these results, we differentiated the capability attributes of intermediation, framing, articulation and learning. By scrutinizing the attributes, we then assessed their contribution to the agencies of the operators’ and how they serve different TIS functions.

After this, we used the civil servant interviews to scrutinize and reflect how the agencies of the operators appear from the policy perspective, which allowed us to further elaborate the four attributes. Finally, we assessed the crucial points for success and the pitfalls in light of the TIS functions that advance or hinder the uptake of these mobility innovations from the system perspective and what kind of suggestions this brings about for local and national policymaking.

4. Results
In the following we present, through illustrative examples, how the agency manifests in the TIS functions via capability attributes and what implications this has for advancing the sustainability of these solutions in the studied contexts. Table 2 summarizes which TIS functions each capability serves from the operator and local administration viewpoints.

4.1. Knowledge development and diffusion (intermediating + articulating + learning)
From the operator perspective, learning is crucial. This applies to the operators learning themselves, users learning to use the services and also to the cities learning how to deal with these kinds of innovations. Knowledge of the available services and how they can be used among potential users or promoted by decision makers was one of the key issues the operators had to tackle. This means learning what the users of these services want and need, and what can be learned from other actors. There are similar services increasingly available and used elsewhere, but the trick is to implement them in the local contexts with local administrations providing the enabling environment for
Table 2. Examples of practical applications of the different TIS functions of the car sharing operators and local administration, and which of the capability attributes they consist of.

| Structural TIS functions that are served | Practical realization in the daily operations - operators | Practical realization in the daily operations - civil servants | Capabilities as building blocks of agency |
|------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------|------------------------------------------|
| **1. Knowledge development and diffusion** | Taking part in the essential societal discussions by promoting the sharing and platform economies as viable pathways. Exploit past successes and user data. | Scoping applicable experiences from other cities. Market dialogue. | A) Intermediation, C) Articulation, D) Learning |
| **2. Influence on the direction of the search** | Networking with policymakers and administration for mutual understanding and ambition for change. | Networking with operators for mutual understanding and ambition for change. | A) Intermediation, D) Learning |
| **3. Entrepreneurial experimentation** | Connecting practices and interfaces between actors. Developing and testing applications and services via user feedback. Developing new concepts (i.e. sharing a municipal fleet). | Developing local policies according to local experiences in, e.g. parking. | C) Articulation, D) Learning |
| **4. Market formation** | Gaining public acceptance among users and policymakers. Collaborating with crucial actors (e.g. public transport, insurance companies). Agile and reflexive changing of operative practices. | Gaining acceptance among citizens and local councils. Collaborating with peer cities. Increasing public knowledge on car sharing as part of sustainable mobility. | A) Intermediation, B) Framing, C) Articulation |
| **5. Resource mobilization** | Applying public R&D funding successfully. | Enabling local piloting and informing about public funding possibilities. | A) Intermediation, C) Articulation |
| **6. Legitimation** | Ensuring users’ trust in the service. Highlighting the sustainability aspects of the services. | Ensuring continuity and/or explicating clear guidelines for piloting. Highlighting sustainable mobility. | A) Intermediation, B) Framing |
| **7. Development of positive externalities** | Changing large companies’ personnel’s work-related travel and commuting. Developing municipal car sharing. | Changing municipal personnel commuting practices. Exploring the sharing of a municipal vehicle fleet. | C) Articulation, D) Learning |
the action. Besides the user needs, operators also need the ability to intermediate, inform and affect relevant stakeholders, not only in cities but also nationally.

Besides learning, articulating the practices and knowledge to the different actors allows for the operators to develop their processes. Articulating when the other actors are competitors is a delicate task, as one does not want to give out too much information but, at the same time, the need to create a critical mass depends on the quantity of services and how they articulate to each other. This is especially relevant for the operators dealing with the MaaS concept. Currently, at least rhetorically, the actors emphasize networking and connecting with the other novel mobility actors, but also acknowledge that the core innovations and technologies are best kept to themselves.

To be honest, cities organise these seminars and hope that these service providers will come and start their businesses. But when we then say “OK, we will come, but we need parking spaces”, they don’t reply. Or at most they say “Well, it is a bit difficult”. And if we then, despite all this, start operating, they ticket our vehicles and then try to come up with reasons why we should pay the tickets instead of our customers paying for the tickets. (car sharing operator, type 2)

In solving issues regarding the parking of shared vehicles, cities have resorted to external consultants. This is not limited to mobility, as cities often deal with consultants rather than take advice directly from commercial operators. From the operators’ perspective, it looks like the very same knowledge they have been trying to get through is taken seriously when it comes from transport planning consultants. In this sense, it is not only about the knowledge itself but also the legitimacy of who is voicing this knowledge, which highlights the role of intermediation and articulation. Cities’ hands are much more bound, not only in a legislative sense but also in their need to appear as neutral intermediaries. In this way, a consultant without a direct or explicit agenda in relation to the advice given might appear to be a less biased intermediary, whereas the operators might emphasize a more practical articulation of their services in the current systems.

4.2. Influence on the direction of the search (intermediating + learning)

The operators have limited opportunities to affect, for example, funding instruments. However, intermediating in the sense of active networking and being visible in societal discussions was one strategy for trying to affect the piloting of novel mobility solutions. For effective intermediation, the actors need legitimacy. For the new actors, legitimacy was often constructed by operating in alliance with other actors. For the larger incumbent actors, size and history seem to be the sources for legitimacy. Credibility in another field allows them to appear as a neutral intermediary in advancing novel services without necessarily seeming to be dependent on them, whereas the smaller operators have to actively intermediate between the different actors, emphasizing the common good.

If we want these services that need certain infrastructure to start emerging in cities, we must think where to focus resources. Do we just wait here for somebody somewhere to start to do something, or is this something that the public sector should invest in so that the end-user services could emerge, which would then also benefit society in general? (MaaS operator, type 4)
The Transport Services Act that brought together the scattered legislation on transport markets and targets in order to create preconditions for digitalization and new business models took effect in 2018 (the first stage) and 2019 (the second stage) in Finland (Ministry of Transport and Communications 2017). The changes in transport legislation were taken as a positive signal. However public policies’ role in spurring innovation was considered to be overemphasized as, in the end, the change depends on the daring operators. This was a recurrent view, especially in the views of the larger actors such as the MaaS operators. On the other hand, certain infrastructure, such as parking, is in the hands of public actors and the operators have limited opportunities to influence these processes, no matter how bold they are or how many resources they possess.

Besides intermediation, learning from other contexts and showing how these solutions have been taken up elsewhere can be considered as an effort to affect the policy environment in cities. The role of cities as the enablers of sustainable mobility was prominent throughout the interviews. The operators expected the cities to be active in enabling the services to run and take proactive steps in promoting these services. The personnel in the cities, on the other hand, tend to think that their role is to stay in the background and make sure that all interests are equally represented, while acknowledging the pressing need for more sustainable mobility. Intermediation is urgently called for in situations like this, where all actors agree on the goals, but it is highly unclear who should take the lead.

4.3. Entrepreneurial experimentation (articulation + learning)

As most of the services in question have a short history and limited experience in Finnish cities, experimentation is at the heart of the operators’ activities. Estimating how to develop the services requires market analysis and research on trends and data. For some operators, the strategy was to try out something and see whether or not it takes off, and if not, to then try something else. In this kind of approach, the business is based more on a hunch than on a systematic analysis of the market. For emerging needs and markets this might be a credible strategy, as the operators also stated that people tend to be more supportive in discussions and surveys than they actually are in their practical everyday choices.

Novelty makes it harder for the operators to be taken seriously, especially as many of them offer a unique service. For this reason, the incumbent actors now offering these services have an advantage as they often have a customer base and/or a brand that is trusted. For the smaller operators, articulating with other actors (such as local entrepreneurs), offering parking places in their facilities or offering discounted membership fees for public transport card holders is part of this experimentation.

We analysed how people use these [shared] cars. […] Then we realised that there is a change in the use patterns now – people have also started to drive short distances using car sharing. Then we started to get inquiries such as “Can I return the car to a different location?” and “Can we do this and that?” Based on these, we started to think whether some of the global models – such as car2go, DriveNow or the like – could be tailored to work in Finland. (car sharing operator, type 2)

For the actors that have been operating for a longer time, user data and practical experiences serve as valuable tools with which to learn what is wanted from a service.
On the other hand, it requires bold moves as these signals are often weak. The quote above also implies the interesting finding that when people use the services, they are being altered by the users. They use them in ways that the operator has not predicted, and also quite often for uses that the users themselves were not aware of needing. A novel service can also promote novel uses, which then might become feasible in contexts that otherwise would not have seemed worth starting. This co-learning with the users and cities requires cities to be open to the exploratory business models of the operators. This is sometimes difficult when civil servants need to be cautious about not appearing to favor certain actors over others. On the other hand, in recent years, a culture of experimenting and piloting has been one way to tackle these concerns in local administration.

4.4. Market formation (intermediating + framing + articulating)

As the established mobility patterns and practices were seen as the key hindering obstacles to using shared cars, framing the services as viable alternatives to a private car was at the heart of nourishing an emergent market. There was a strong assumption among the operators that the novel services are what people want if the information, availability and ease of use is provided. To put it bluntly, market formation requires the simultaneous provision of supply by intermediation and articulation and creating demand by framing.

To frame car sharing as a more flexible form of car rental is one example of framing the services. A more substantial framing is needed when framing personal mobility as a need for a service rather than a need for certain public or active transport mode or a private car. In this reframing, the freedom of owning a car is seen as being very expensive and, in some regards, also inflexible, which is one strategy with which to mold the market.

In a sense we are trying to offer these people knowledge and ideas about the different uses they can use this [car sharing] for, in order to broaden their horizons a little; so that people would not perceive this so traditionally – as just car rental. (car sharing operator, type 2)

Framing works on a discursive level but articulation is, in a way, implementing the vision the actors aim for at the practical level. It is about providing hands-on solutions for the customers and linking and connecting the services with established practices, such as public transportation. Connecting means articulating the mobility innovations with the current practices, such as linking travel chains and also trying to bend them. The challenge here is both the inertia of individual mobility behavior and also the rigidity of, for example, transport planning and public transport practices.

4.5. Resource mobilization (intermediating + articulating)

To upscale the services, they need to be connected to current mobility practices. For this reason, the operators need to connect to, and also affect, the actions of other actors. For this, intermediation between the actors is important, but practical articulation is also needed. For some operators, articulation is the core of the business, for example, the MaaS-involved actors who aim to provide the end user with a one-stop
shop for discovering, accessing and paying for a wide variety of transport service options with varying pricing models. For the smaller service providers, articulation can thus happen through joining as a supplier of certain services or joining forces with other smaller operators in order to gain momentum, but it can also happen through being able to provide a set of modal choices for citizens.

The operators need to solve issues that often have no existing conventions. An example of this is insuring privately owned, peer-to-peer shared vehicles. Some operators have managed to resolve the challenge with certain insurance companies, who can then use the novel service in their marketing, representing themselves as a frontrunner in new business models. This creates a win–win situation for the companies, as the smaller operators also benefit from the visibility and customer base of the large companies.

One has to admit that this [car sharing] has started slower than expected. It is because many of the critical actors around Europe and elsewhere are not ready for these kinds of operations where data and interfaces would need to be open so that they could be combined. Instead, they think it’s their customers and their business. But in the long run it won’t work anymore. (peer-to-peer operator, type 1)

The quote illustrates the efforts to mobilize other actors’ resources, such as advancing open data. This also reflects how the actors see the responsibility of advancing sustainable mobility innovations. The operators want the city to be actively involved in mobilizing both public resources and also other actors’ resources. The cities, on the contrary, expect the operators to take the lead in suggesting practical measures and suggesting, for example, solutions for the more seamless connection of public transport to shared vehicles.

4.6. Legitimation (intermediating + framing)

From the operator perspective, acquiring legitimation for their services is crucial and needs to be advanced in several domains. Framing is not only important for market formation but also in representing the services in such a way that it resonates with both the customers and the crucial other actors in, for example, city administration gatekeepers and other gatekeepers. The services must appear legitimate and be seen to address sustainability objectives, but they must also appear trustworthy and reliable from the users’ perspective. Activities supporting legitimacy thus both justify the need and possibilities for the services themselves and also the operators as legitimate actors in advancing sustainable mobility.

The latter is especially important for the domains of policy and administration where enough momentum is needed in order to get a message through. The operators are all acting in an environment where they need to both justify themselves to the general public (i.e. their potential customers) and also shape the systemic level in aiming to affect policies and practices locally and also nationally. Successful intermediation is thus also dependent on the legitimacy of the actors. Representing more than the interests of the actor itself is a strategy that intermediation often calls for.

At this point these issues [about the parking of shared vehicles] are not anyone’s responsibility in the city administration. So, you cannot say, “Hey you, Peter, in the land use department, this is your responsibility.” Instead, it is about avoiding
responsibility. One does not have to take care of it because it is something new, unknown; it is not known what it really is. (car sharing operator, type 2)

Policy and administration are not one but many. The same need for actors with sufficient legitimacy and drive are also needed within city administration for successful framing and advancing of novel mobility services. Quite often, it is to the other departments in the administration, policymakers or pressure from the citizens that the actors within a city have to defend their stances. Often, the case is about the use of city space and vested interests as novel services often take resources from somewhere else, such as from residential parking.

4.7. Development of positive externalities (articulating + learning)

Entrepreneurial experimentation is closely tied to the function of developing positive externalities. The essence of experimentation is in the unexpected. The hope that the operators put in the potential for scaling up lies in weak signals and global megatrends. Learning from practices works as a way to find out how much the global megatrends are actually affecting the operational environment.

Articulating with other mobility practices sometimes causes positive surprises when actors from domains that the operators have not thought of show an active interest in their services. According to the operators, such surprises were, for example, receiving contacts from large companies that want to change their personnel’s work-related travel and commuting. Another such group is formed of municipalities that want to promote car sharing among their employees and promote the shared use of their fleet, but are unsure of how to proceed. The operators then have to adjust their operations if they want to benefit from them.

From the city perspective, the field of novel mobility solutions is moving so fast that it requires constant learning about what works and how it works. One way to manage this is to allow the operators to test out their services in real-life circumstances with less regulation. Cities must consider multiple interests and try to learn how to combine these. For example, so-called local regulatory sandboxes enable a direct testing environment for innovative products, services or business models, pursuant to a specific testing plan. Innovative public procurements may help to tackle the difficulty of scaling up from a pilot project due to traditional procurement rules (European Commission 2021). In the testing approach, cities are learning from the operators and consultants, but also from other cities where similar services are in operation. Sometimes these developments even create opportunities for new actors that, at best, complement each other.

5. Discussion

New mobility service innovations are needed to advance the various sustainability objectives in cities. This transition is a chicken-and-egg situation, where the service supply, demand and policy environment intertwine. As our results show, the mere supply of sufficient services that meet the actual or suspected potential is not enough. On the other hand, national policymakers offering a suitable policy environment in which the operators can offer their services is not enough either. This requires re-thinking the roles of the actors involved and collaboration, especially locally.
Our first two questions concerned the capabilities the car sharing operators utilize in setting up new mobility services and how these affect the related actors. For this, we applied the categorization of strategic capabilities offered by Lévesque and Murray (2010) in order to conceptualize the agency of the car sharing operators and found it to be a useful micro-level supplement to the TIS functions in analyzing service innovations. All four capabilities were identifiable within the TIS of Finnish car sharing services, including car sharing operators, and car sharing platform and aggregator service (MaaS) providers.

The operators need to utilize a varying combination of capabilities, depending on the actors with whom they are collaborating. As the operators vary regarding, for example, size and maturity, their agency is also driven by varying constellations of capabilities. However, the challenges they struggled with were surprisingly unanimous. They were linked to the practical local-level arrangements, siloing local administration and collaboration with local-level public authorities. These challenges are in line with findings from Stockholm, where cooperation and partnership were similarly prominent when analyzing the needs of MaaS operators (Fenton, Chimenti, and Kanda 2020).

Of the four capabilities we analyzed, intermediation is an attribute that all types of actor utilize, but it was especially emphasized by both the car sharing and MaaS operators. For the MaaS operators, intermediation is crucial, as the concept requires changes in several societal spheres and scales, and is thus very much dependent on the legitimacy of the actors. Intermediation also pinpoints how the operational environment consists of very different counterparts. This variation can occur even within one organization, as seen in cities with their sometimes internally conflicting institutional structures.

Successful intermediation requires legitimacy. Framing the solutions as supporting the inevitable need for more sustainable mobility resonates with policymakers, local administrations and the end users. Framing is thus not mere rhetorical play but also helps the stakeholders to understand the functioning logic of these services and has the potential to lead to changes in mobility behavior.

Articulation is about the actual hands-on work that aims to connect the solutions to other practices. Legitimacy is also one key here as the operators need to appear as serious and trustworthy partners so that the established actors do not risk their reputation, reliability or data assets when connecting their operations. Articulation was utilized by all of the actors, but peer-to-peer operators proved especially active in this. Without the articulation with current practices, the novel solutions remain isolated.

Learning can harness other actors’ experiences, but as the solutions are applied in local practices, it also requires learning from the customers. In this, in particular, the car sharing operators were active, which is partially explained by their longer history in the business. While intermediating and framing are more about collaboration with the counterparts in the system, articulating and learning are more about adjusting the actors’ processes. Both aspects are needed, since they are complementary.

The capability attributes do not exist in isolation but are interdependent and affected by other actors and factors. Besides ability, skills and know-how (Lévesque and Murray 2010), agency also depends on the resources to which the actors have access (Farla et al. 2012). These can often be collective and the result of collaboration (Laamanen 2017). With these assets, the actors need to position themselves so that their agency gets expanded on the systemic level (Grin, Rotmans, and Schot 2011).
Looking at how the capabilities served the different systemic-level TIS functions, our analysis revealed that articulation and intermediation have been the capabilities used most by the operators with both serving five of the seven TIS functions. Learning has been utilized nearly as much (in four functions of the seven). A slightly surprising finding is that framing – representing amongst other things, outreach toward the end users – has been the least-utilized capability, utilized in only two of the seven TIS functions. The diverse utilization of intermediation and articulation suggests that, above all, the operators need to be flexible in playing different roles during different phases and need to connect simultaneously in various domains. Farla et al. (2012) have suggested two broad categories for actor strategies in the context of sustainable transitions: associating and networking with other actors and investing in ‘expectations work’. The emphasis on intermediation and articulation suggests that the operators invest in networking rather than in ‘future work’ related to framing and carving out future space. This might indicate that the way the operators utilize the capabilities is not so much strategic and future oriented, but rather responds to the day-to-day challenges encountered in advancing their operations.

Turning our attention from the operators toward the policy environment, we find out that, similarly to the operators, a city is not one but many and consists of different actors with differing and often conflicting agencies (Akyelken et al. 2018). Our results indicate that quite often it is indeed these key individuals in the administration who can make a difference. Their agency is built on the same capabilities as the operators, such as intermediating between the administrative units, framing the solutions as legitimate measures that support cities’ strategies, articulating the different actions and functions within the city and learning from other cities. Their capabilities are somewhat dependent on the broader city administration and past policies, but they can also shape the institution of which they are part (Avelino and Wittmayer 2016). Thus, while learning how to tackle the various practical issues concerning shared mobility, they also increase the public authority’s overall capacities to advance sustainable mobility (Wu, Ramesh, and Howlett 2015).

What can then be learnt from this? Our third question addressed the actors’ different roles in orchestrating urban mobility innovations in a sustainable manner. Public authorities’ role can vary from merely regulating the operational environment to setting an example. However, advancing sustainable innovations means that they increasingly need capabilities to orchestrate a multi-faceted set of actors (Wu, Ramesh, and Howlett 2015; Abbott et al. 2016).

The importance of collaboration in designing these services is emphasized as, at worst, the good intentions can create path dependencies that fortify the current unsustainable mobility patterns (Docherty, Marsden, and Anable 2018). Our analysis suggests that neither the operators nor public authorities alone possess all the information and capabilities with which to best advance and implement these solutions sustainably in local contexts – they need to learn this together. The learning process is often based on trial and error rather than on rigorous upfront evaluation (Bennett and Howlett 1992). This is especially the case when introducing and regulating niche solutions, meaning that all parties need to accept a certain ambiguity in the mutual learning in order to eventually achieve a stable operational environment (Boon and Bakker 2016).

National-level legislation is an important enabler in setting the regulatory ground for mobility service innovations (Fenton, Chimenti, and Kanda 2020). However, we argue that the local level is the domain wherein the sustainability of these services
gets defined and implemented. It is also increasingly where the capacity to act is expected to be realized (Painter and Pierre 2005). As one operator stated: “[A]ll these national legislative renewals have never made innovations really surge. It requires courageous operators to make things happen.” Besides these venturesome operators, cities and practical, local decision-making play a crucial role in making the sustainable urban mobility transition happen (Vagnoni and Moradi 2018; Akyelken et al. 2018). Designing and implementing the services together with the operators, public authorities and users ensures that they complement other sustainable modes for low emission travel chains rather than replace the use of more sustainable travel modes (Tuominen et al. 2019). Simultaneously with this, the services need to be economically viable. The details of the practices, such as the parking of shared vehicles, determine both the uptake and also the sustainability of these services.

The sharing and vehicle technologies, active operators and policy environment are in a constant dynamic flux. This is also one caveat of our study. The analysis covers a certain time with particular actors being active at that point. However, it provides a viewpoint of a specific time when operators offer new services and cities aim to incorporate them into the existing operational environment.

In technological innovation, the actors can fulfill multiple roles (Wieczorek and Hekkert 2012). This also holds for novel mobility service solutions. Instead of fixed roles – such as operators being the providers of services, administration acting as the regulator of these services and consumers as the users of the services – all of these actors can have multiple roles. This blurred division between producers and users has been prominent in innovation studies for a long time (Smits and Kuhlmann 2004) but also in the public authorities’ roles with the shift from principal-agent constellations to the indirect orchestration of service provision (Abbott et al. 2016). Local governments’ role is increasingly to ensure public value in these processes (Docherty, Marsden, and Anable 2018) and to take an active role in enabling sustainable innovation (Borghei and Magnusson 2018).

Our results show how the operators often want cities to be more active in advancing these services, but the cities may consider their role to be to ensure that all interests are represented, and they would rather choose to stay in the background. However, in ensuring public value, cities cannot stay in the background as mere spectators. The key for mobility innovations to succeed and be sustainable is co-creating the practices together with public authorities and private operators, using insight from the users. These processes are context bound and also require local implementation with local knowledge.

6. Conclusion

The operational environment of shared mobility innovations is evolving at an increasing speed. Novel mobility service operators are competing in a market where they must simultaneously create demand, guarantee supply and try to influence regulation. The same competition aspects also apply to cities, who compete for the building blocks of vitality and who see fluent and sustainable urban mobility as an asset in this competition for taxpayers. In this paper we analyzed the efforts to advance sustainable, shared urban mobility innovations from both car sharing operator and local administration viewpoints.
The results show how, in particular, the emergent commercial actors play multiple roles across various domains rather than just develop and offer novel services. This multiplicity of roles requires networking with other similar actors, but especially with public authorities. The critical issues revolve around collaboration and shared responsibility in advancing and facilitating these innovations at the local level. For this, cities should take an active role in providing examples, harnessing coordinated action and enabling the potential actors in critical points. By collaborating with the operators, cities can also avoid unintended negative consequences, such as car sharing reducing the use of more sustainable alternatives, such as active modes or public transport.

Note
1. Henceforth, operators.

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