



## Succeeding without success: Demonstrating a residential bicycle sharing system in Sweden

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### ABSTRACT

Various services based on sharing have recently emerged in cities across the globe. They entail promises of a more sustainable mode of transportation. Through an in-depth case study, this paper follows the undertakings within a recent demonstration project aimed at implementing a residential bike-sharing service. The involved actors succeeded in presenting a functional service but failed to make the service commercially viable. Consequently, the configuration did not spread beyond the niche level. Based on this finding, the paper identifies a risk in enforcing progressive solutions to becoming commercialised, and urges public actors to play a greater role in steering the transition towards a more sustainable future transport system. By shedding light on the process of failing, the paper contributes important lessons concerning the setup of future bike-sharing systems that can challenge the automobility regime.

### 1. Introduction

The transport system accounts for a large part of the growing greenhouse gas emissions, and the sector generates problems in terms of land use, congestion and environmental problems in urban areas. Despite these alarming matters, the [World Bank \(2018\)](#) estimates that by the year 2050 the number of road vehicles will have doubled on a global scale, with subsequently increased negative impacts. Along with these developments, there is an evolving trend of digitally supported and shared services that challenge the dominant model of personal mobility. A vast number of city districts across the globe have recently seen an increased amount of shared mobility services providing, for example, shared electric scooters, bikes and cars. These emerging “smart” mobility services that enhance the possibility to share vehicles with others are regarded as among the more promising solutions for achieving a modal shift of the transport system ([Marsden and Reardon, 2018](#)). Shared mobility is a broad concept that encompasses a variety of conceptualisations, but in general terms it can be understood as the “short-term access to shared vehicles according to the user’s needs and convenience, instead of requiring vehicle ownership” ([Machado et al., 2018:2](#)). These solutions build on the assumption that increased amounts of sharing have the potential to drive a sustainable societal development ([Agyeman et al., 2013](#); [Boyko et al., 2017](#); [Heinrichs, 2013](#)). Systems that encourage sharing not only enable

the circulation of goods; they also have the potential to foster a caring view of resources and common space ([Bradley, 2018](#)). The sharing of bicycles, in particular, has been associated with a great deal of hope of achieving a more sustainable transport system. These hopes involve the bicycle’s potential to offer a convenient way to make spontaneous and flexible trips while benefitting the health of the user and not causing environmental harm. Despite this potential, new shared bicycle solutions only account for a marginal portion of personal mobility.

Previous studies have suggested that for bike-sharing systems to be considered as an attractive alternative to cars, behavioural aspects such as convenience, travel time and value for money need to be taken into account ([Berg et al., 2019](#); [Fishman et al., 2013](#)), as well as more technical and organisational issues such as the location of docking stations ([Bachand-Marleau et al., 2013](#)). Furthermore, equity issues concerning the design and implementation of bike-sharing systems have also been raised ([Zademach and Musch, 2018](#); [Duarte, 2016](#)). Inequalities in regard to where people live ([Hamidi et al., 2019](#)), their socio-economic background, gender ([Uteng et al., 2020](#); [Singh, 2019](#)) as well as body size ([Nixon and Schwanen, 2019](#); [Christensen, 2019](#)) are issues that need to be considered for bike-sharing to become a sustainable option for all. Another important factor, raised by previous studies in a Swedish context, that influences the likelihood of development of widespread usage of shared bicycles is that even though there is generally high societal support for these services, they are not used

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to a particularly large extent, primarily because potential users already have their own bicycles (Berg et al., 2019; Nikitas et al., 2016; Nikitas, 2019). This issue casts doubt on whether people will abandon the custom of having exclusive access to their own vehicles in favour of sharing them with others. Due to curiosity, people can try shared vehicles, but long-lasting usage requires the services to be convenient and cost-effective (Sochor, et al., 2014).

Previous studies have had a central focus on assessing operating bike-sharing systems. However, Nikitas (2019) is an exception and presents an overview of the state of the art, including a Swedish and Greek case study, in which bike-sharing systems became fiascos and the businesses failed. The overview includes examples of failures that have raised concerns that there is not enough demand for all available low-priced bikes, and competition with other more established companies appears to be a recurring reason for bankruptcy. Nikitas (2019) also shows that vandalism, theft, and misplaced bicycles are reasons behind failed bike-sharing services, along with reasons such as mismanagement, unrealistic revenue expectations and dysfunctional devices. These stories of bankruptcy have caused concerns about whether bike-sharing services as a concept might be failing. However, Nikitas note that there is evidence that schemes can be successful when they have support from local authorities, complement existing transport infrastructure such as public transport and keep inexpensive prices. (Nikitas, 2019).

Furthermore, a growing body of research focus on business models for sharing in relation to socio-technical transitions (Mont et al., 2020). Here, what role different actors such as governance stakeholders (Edge et al., 2020), entrepreneurs (Meijer et al., 2019) and a fusion of different stakeholders can play in mobility transitions are investigated, typically through in-depth studies of local cases. In a Dutch context, van Waes et al. (2018) discuss what potential for upscaling different bike sharing business model have. They conclude that while all studied bike sharing models are highly dependent on spatial network effects such as large investments in bicycle infrastructures, new commercial actors are dependent on large initial monetary investments. Public operators can to a greater extent rely on the existing urban mobility regime. They also point to that innovative cycling services require entrepreneurial skills, such as knowledge about local regulations and user behaviour (ibid., p. 1309). Edge et al. (2020) discuss government actor's role in mobility transition in the context of e-bikes in Toronto, Canada. They highlight the potential for local stakeholders to optimize niche benefits while controlling for undesirable disruptions, see also Yang et al. (2020). In sum, previous studies focusing on business models points to difficulties in developing business models that are attractive for consumers in terms of pricing, and stress the importance of public actors' active involvement in order for bike-sharing services to succeed.

Based on this line of research, future transition research should pay greater attention to the role of governance actors at different phases of sustainability transition processes. This include visioning, investment, implementation, monitoring and evaluation stages (Edge et al., 2020). van Waes et al. (2018) calls for more studies with an actor-perspective, focusing on entrepreneurship. Mont et al. (2020) request more studies on participants in the sharing economy, focusing on the everyday practices of resource owners and resource users, as well as research focusing on context sensitive in-depth analysis of how municipalities may govern the sharing economy. Following this, our analysis focuses on various of stakeholders and include analysis of visioning, investment, and implementation.

In this paper we contribute to the discussion on what might hamper the widespread increase of bike-sharing systems. In contrast to many other studies, we do not assess an already established system; rather we look into the dynamics in play when the system is under construction. This study complements existing literature by exploring how the process of assembling a bike-sharing system is performed in practice. Through this investigation we analyse this process from a micro

in-depth perspective that acknowledges different actors' viewpoints. We investigate this process from the perspective of the actors involved in setting up a bike-sharing system in a middle-sized municipality in Sweden. Furthermore, this study also adds to existing literature by shedding light on an often-neglected perspective since we do not follow a successful bike-sharing system; we follow a pilot study with shared bicycles that never diffused on the market. We follow how ideas and visions about future personal mobility were defined and realised in a recent pilot project aiming to achieve a modal shift of the transport system. We describe the various stakeholders that were enrolled in the demonstration project, their interdependent roles and contributions, as well as the tensions they encountered in the process of assembling a socio-technical configuration intended to alter the prevailing regime of personal mobility through introducing a sharing service. In this way, the paper contributes to knowledge about the processes that preceded many previous studies, and it can thereby contribute to knowledge about what characterises configurations that do not reach a larger group of users, and can spotlight difficulties involved in the process of creating and spreading a functioning bike-sharing system. Thus, the paper provides insights into different views on how a configuration based on sharing might look, and the lock-ins that ultimately can prevent promising solutions from contributing to a regime shift.

This work is situated in a wider discussion concerning how motorised mobility can be replaced with more sustainable alternatives. The paper therefore begins with a discussion of the literature on transitions. Thereafter we describe the methodology and the demonstration project under study. In the subsequent sections the process of assembling a new sharing configuration that could challenge the current regime of personal mobility is analysed in depth. In the last section we discuss the results and present our conclusions.

## 2. Niches as a central arena in transition processes

Socio-technical configurations consist of a variety of mutually dependent components such as artefacts, users, policies, social norms and practices. Taking on such a conceptualisation, sustainability transitions can then be understood as the long-term processes that operate on a multidimensional scale to fundamentally alter prevailing socio-technical configurations (Markard, Raven and Truffer, 2012). There are a variety of different conceptual frameworks that have been developed to analyse such transition processes. One of the most frequently used is the multi-level perspective on socio-technical transitions, which has suggested a model for analysing the factors that drive systemic change and stability (Geels, 2011). This model is based around three interdependent dimensions, the *landscape* that operates on a macro-level and provides a structuring context, the *regimes* that "constitute the mainstream, and highly institutionalised, way of currently realising societal functions", that in turn "exert a structuring force upon novel alternatives, which arise in *niche* spaces" (Smith et al., 2010:40f).

The framework of Strategic Niche Management especially stresses the importance of niches, and defines them as protected spaces where ground-breaking configurations can be developed without the selection pressure from the prevailing regime (Kemp et al., 1998). The idea is that if niche innovations are protected during their development they can challenge and eventually change entrenched socio-technical regimes (Hoogma et al., 2005; Smith and Raven, 2012). Within this strand of thinking, niches thus play a pivotal role in the transition process since they provide a tolerant arena for the development of radical innovations that can introduce new ideas, practices and artefacts. Niches are framed as sources of systemic change with the potential to provide essential contributions to transition processes. These conceptualisations suggest that entrenched regimes can be challenged and replaced by altered configurations as these new socio-technical

configurations break through and disseminate. This view of transitions has influenced governance initiatives aimed at achieving a sustainable transport system and can be seen in state authorities' initiatives to develop policy measures, and to provide arenas for undertaking and investing in experiments such as large-scale demonstration projects, test-beds and living labs (Bulkeley and Castán Broto, 2012; Hendry et al., 2010; Hoogma et al., 2002; Brown and Vergragt, 2008).

Even though this conceptual framework for understanding transitions can be regarded as influential, the process through which niches alter regimes, and how larger societal transitions occur still require further clarification (Smith, 2007). Regimes are made up of mutually reinforcing entities that provide robust systems that are not easily subject to change. These mutual interdependencies generate lock-ins and path dependency that put ground-breaking innovations at a disadvantage in relation to prevailing configurations (Smith and Raven, 2012). In this way, new configurations that support the prevailing regime are probably more successful in spreading than those that entail more progressive alternatives (Smith, 2007). This suggests that even though niches might be protected from certain forms of regime pressure, they are not excluded from all forms of pressure. For example, grassroots organisations might experience the pressure to become more commercial. This pressure can take different forms and may come from different actors, both within and outside the niche organisations (Smith, 2000; Martin et al., 2015).

Finally, critical environmental theory points to how ideas about ecological modernisation dominate environmental policy, and this thinking can also be applied to the role of niches in the transition process. Ecological modernisation assumes that climate and environmental issues can be solved within current institutions and without contesting the current economic growth paradigm (Hajer, 1995). In this way, eco-modernism assumes that newly emerging configurations can fit into the structures that make up prevailing regimes, an assumption that is based on the idea that regime pressures do not hinder new configurations from breaking through and achieving modal shifts. Eco-modernism is strongly associated with the prevailing idea that innovations will lead the way towards a sustainable future. Thus innovations, and consequently niches, can be conceptualised as the cornerstones of eco-modernism.

With this backdrop, demonstration and pilot projects can be conceptualised as niche arenas that are assigned a key role of achieving fundamental alterations of prevailing regimes. Simultaneously the regimes constituted of entrenching discourses, structures, conducts, already established configurations etc. put pressure on the niche activities.

In this article we follow the processes that took place within a niche targeting cycling as a means to transform personal mobility. We use a recent demonstration project testing a vehicle-sharing system in residential areas as an example of how mobility transitions are imagined, and a socio-technical configuration set up. In the demo, a bike-sharing system and a separate car-sharing system were set up in a residential area in a middle-sized municipality in eastern Sweden. The municipality is known for its geographical conditions, which make bicycling and walking difficult. It is located on the southern coast of Sweden's second largest lake, and another lake is located in the middle of the city. Furthermore, several hilly slopes and a highway that runs through the city, affect everyday mobility. However, public transport is well developed, and the municipality has far-reaching goals to support sustainable mobility. Introducing residential bike-sharing systems offering electric bikes is one aspect of this agenda.

### 3. Methodology and research design

To study a single case is an established methodological approach in the social sciences. A case study methodology is appropriate for in-depth explorations of complex phenomena within their contexts

(Baxter and Jack, 2008). When relating the new knowledge to theoretical claims and to previous research, a case study offers robust new knowledge that sheds light on complex issues (Yin, 2009). A key step in case study methodology is to carefully decide which case to choose. We were first introduced to the case, as one of the authors was invited to participate in the study as a researcher. Initially, we knew that the case had potential to shed light on the role of niche arenas in transition processes and included a number of actors with different roles. However, as the demonstration project played out, it was clear to us that it turned into an interesting case of failure and hence it is from that perspective the paper is framed and presented. Failed projects are shown to contribute to important experiences and can for instance be helpful when constructing supporting environments for sustainability projects (Köhler, 2018).

Despite the potential in case study methodology it has received critic due to the difficulty to produce generalizable results based on a single case study (e.g. Firestone, 1993). But even though case studies cannot provide statistical generalizations, in the sense that the knowledge cannot be transferable to a whole population (Yin, 2009) it can still provide context dependent in-depth knowledge. Flyvbjerg (2006:228) declares that the "force of example" is often underestimated as a source to develop scientific knowledge, while traditional generalization tends to be overvalued. Donmoyer's (2009) adds that knowledge of what happens at a particular time in a particular context is highly valuable for understanding complexities of real-world situations where the atypical or the exception is often commonplace and argues that traditional generalizability should reconceptualize what useful knowledge can be. In this study we have tried to provide as many details as possible of the given case since this is a way to increase generalizability (Baxter and Eyles, 1997; Myers, 2000). The generalizability we are aiming for with this study is naturalistic generalizability which means that others can recognize essential similarities in cases similar to the one analyzed in this paper (Myers, 2000).

As is standard in the case study method, the analysis is based on different forms of empirical material. Here the main material consists of written material about the bike-sharing project and qualitative interviews with key actors. The main author has also participated in project meetings and carried out on-site visits. The interview respondents were chosen to represent key individuals involved in designing and setting up the demonstration project under study. Five persons were interviewed: two representatives from a local bicycle entrepreneur which during the project converted the business related to the bike-sharing demo into a start-up company (a member of the board of the start-up company, bicycle entrepreneur 1), an employed CEO that worked practically with setting up the bike-sharing system (bicycle entrepreneur 2), a manager from the local housing developing company (1 person), the two project leaders, the first an official from a regional energy agency (1 person), and the second a research manager from a transport research institute (1 person). The interviews were semi-structured and included questions about visions about the project, the process of setting up the demo, and their learning throughout the project. In the analytical phase, the verbatim-transcribed interviews were closely read and then coded thematically in line with a content analysis approach (Patton, 2002). The themes were chosen to depict the process of setting up the bike-sharing system, including the initial ambitions and visions as well as important steps taken to implement it, and the constraints that arose.

The same analytical approach was used when analysing the written documents that were produced during the project. The documents included the initial research application to the Swedish Energy Agency, annual reports to the same agency, a final report and working material such as memos from meetings etc. Using the identified themes from the interview material, the documents were coded in the program "QDA Miner". Finally, the field notes were analysed to detect information that could add details or provide alternative perspectives. Thus, they were treated as a way to solidify findings found

in the other materials (cf. Creswell and Miller, 2000). The analysis of the written material gave us an overall understanding of the case study and contributed to our interpretation of the bike-sharing demo. The overall themes and different interpretations of the material have been thoroughly discussed and analysed by the authors. The presentation of the findings reflects the sequential process of the project, highlighting visions, implementation and constraints.

As mentioned, one of the authors acted as a researcher in the project. In this role she has participated in project meetings and conducted interviews with users of the vehicle sharing system. These interviews are not subject to analysis in this study but have contributed to a general understanding of the bicycle sharing system and its design. The analysis of the user's experiences of the vehicle sharing system is presented separately (see Berg et al., 2019).

#### 4. Assembling a socio-technical configuration within the bike-sharing demo

In the following we will present how the demo was set up, with particular focus on the different choices the partners made during this process and highlighting consequences for the socio-technical configuration. Our account starts off with the initial visions of the demo and shed light on how these visions were transformed into a functioning bike-sharing service.

##### 4.1. Formulating a vision of an altered mode of personal mobility

How do we go from a car-based transport system to a system where we do not have one vehicle that fulfils all our needs, but a variety of vehicles? How will that work? (Interview, research manager)

What a dream to live in a building where you have access to different kind of bicycles. (Interview, bicycle entrepreneur 2)

In 2015 in a middle-sized municipality in eastern Sweden, a group of local actors had a vision about a city where the car was not the dominant mode of transport. A project manager specialising in sustainable transport at a regional energy agency (REA) initiated dialogue with local stakeholders about how to promote bicycling and how to challenge the dominance of cars in the municipality. A local housing developer was interested in promoting sustainable transport in their newly developed buildings. Together, the housing developer and REA discussed different concepts for bicycle sharing. They knew of a local bicycle entrepreneur that arranged different kinds of bicycle meet ups and camps. The entrepreneur joined the team. In order to gain a research perspective, a research institute was invited to the project. The idea of setting up a residential vehicle-sharing system in order to realise the visions about challenging car dependency started to take shape.

Together, they wanted to make it possible for citizens to get rid of their second, or even first, car and instead bicycle to their everyday activities. These ambitions entailed ideas of a future with fewer emissions from traffic but also a city with less congestion and more space for other kinds of activities, such as bicycling, and there was a wish to make everyday mobility "fun instead of boring" (interview, bicycle entrepreneur 1). The group had resources in terms of local knowledge and professional experience and regarded themselves as "doers".

When reasoning about the vehicle-sharing system, two ideas were central: the bicycle as a technical artefact and sharing as a central practice. Based on their experiences, the group identified some problems with the current configuration of the bicycle. They recognised that a majority of people find it hard to bicycle long distances in various physical environments and tend to discard cycling as an option for everyday commuting. To add electricity to the bicycle was seen as a viable solution to this problem, "you increase the distance it is possible to bicycle" (interview, research manager). An e-bike designed for everyday mobility including commuting to work is expensive, and

users with no inherent interest in bicycling might not make such investments. Also, to keep the bicycle in good repair and to fix flat tyres are viewed as obstacles by many. Considering these obstacles, sharing as a practice was regarded as an opportunity for the user to always have access to high quality bicycles.

We can make it as easy as possible and remove all these [obstacles], "now I have to go to the bicycle shop, now I have to repair it and it is oily and messy, I have to change my flat tyre". Take away all these problems and make the bicycles ready to use, then you will get more people to bicycle. (Interview, bicycle entrepreneur 1)

The business opportunity comprised two visions, first the vision about a mobility that is not based around private motor cars and where the bicycle plays a central role, and secondly, the vision about future shared mobility. The guiding principle is that mobility is one of many services that the individual can consume. For the bicycle entrepreneurs the bike demo offered a way to promote bicycles in general, and their service specifically, as a sustainable and fun way to solve everyday mobility needs. They emphasised how future mobility will be presented as a service, just like any other kind of service, that users can consume.

In ten years', I hope we will see mobility as a function, mobility as a service. Car, bicycle, train, taxi, or whatever it can be, for 999 [Swedish] kronor a month (Interview, CEO, bicycle entrepreneur)

These ideas are aligned with notions of a consumer society built on various services. This goes in line with how the housing developer describes the bike-sharing system as one of many services he would like to see in the residential area: "we want to offer services near the residential area: a grocery store, a pharmacy, a care centre and a restaurant. The bike-sharing system is one part of this".

Visions about a city with fewer cars, more bicycles and more commercial sharing services constituted the basis for the subsequent process in which a shared bicycle system was configured.

##### 4.2. Motivating the bike demo as an important arena in which future solutions are tested

The next phase after identifying a problem, and formulating a solution and a vision for the future was to find finance and start setting up the service. The project group added a municipal housing company, and a larger housing developer with dwellings all over Sweden and finally the Swedish Transport Agency (STA) as partners. Now, the key actors were pleased with the constellation. Reflecting upon the project group, key actors found the line-up to be successful, "it is attractive to have a project where the whole value-chain is included, we have research, and it is based on scientific considerations" (Project leader, REA). They applied for funding for a three-year demonstration project from the Swedish Energy Agency, which at this time had a special programme for demonstrations of electric vehicles. In October 2016 the application was accepted and was granted close to 350 000 EUR. Later, STA decided to co-finance the project with 95 000 EUR. Now, the vehicle-sharing demo had financial support and in late 2016 could start working on setting up the demo and assigning different roles to the partners.

The key actors involved in the project all articulated various ideas of what they found to be the most important aspect of the demonstration project, and what kind of outcome they imagined. A central theme for the partners was the focus on learning that was partly a result of the financial support from the Swedish Energy Agency. The operative bicycle entrepreneur argued that "what the bike demo contributes is really an environment for testing how it [bike-sharing] works". The learning processes initiated by the bike demo involved several actors. For the bicycle entrepreneurs, to get a chance to design and test a service was very important. During the demo they were able to test differ-

ent kinds of technical and administrative solutions for the bike-sharing service. Several of the key actors also mentioned that a vital part of the learning was to let the users, the residents, try out not only the electric bicycles but also the practice of sharing. If the service was so good that it actually could help users carry out everyday errands there was a chance that they would sign up for this service, or a similar one, after the demo. It was deemed important that the users should get a lot of time to try the service. Finally, societal learning was also put forward as an important output of the demo. One of the bicycle entrepreneurs said:

The benefit is that when it is spread outside, later, the next person that does bike demo 2 will benefit from what we have done. (Interview, bicycle entrepreneur 2)

The project manager from REA argued similarly, and mentioned that they aimed to spread the solutions assembled within the bike demo to others beyond the project:

Control copy, control paste, it is such an important thing for the transition, that it should not be unique for me. We have to get what works verified. (Interview, project leader REA)

When relating to the bike demo as part of a transition, the involved actors also legitimised why public funds should be used for demonstrations like these. They seemed to motivate the demonstration project with arguments that stressed the importance of creating niches so that solutions that would be on the market later were of such high quality that they would work and would be attractive, for example to housing developers or housing companies, but that they also would contribute to a green transition. This is an argument that the research manager from the transport research institute also put forward as vital.

The idea is also to demonstrate, to test something before [market introduction], where you acquire knowledge or experience that can form the basis for whether you decide to move on or not, to make a business permanent, that is what a demonstration project does. And this demonstration project for electric vehicles, aims to identify obstacles and opportunities to introduce electric vehicles in society. So, there it is, you are contributing to this knowledge then. What you contribute can be useful for others, or to society in general in different ways. (Interview, research manager)

When taking the first step towards translating the visions about challenging the automobile regime, the demonstration project was conceptualised as a playful arena for testing out different innovative ideas. This aligns with the perception of niches and what niche activities entail. The partners understand demos, and thus niches, as essential in the transition towards sustainable mobility. As we shall see, in the process of assembling the bike-sharing system, the involved actors made choices that reformed the idea of what kind of learning could be beneficial for society, and in what ways the demonstration project could contribute to disrupting the dominant regime of personal mobility.

#### 4.3. Setting up the bike demo: Encountering problems

To set up the bike demo was difficult, and several problems occurred during the process. The obstacles that arose during the demo point to the difficulty of disrupting the present automobile regime. The problems overall concern three themes: the lack of technological components, the lack of space for the service, and finally the different levels of commitment and experience in the project group

Before the material components of the sharing system could be assembled, an initial tension regarding how the funding from the Swedish Energy Agency could be used developed. When drawing up contracts between the different partners it became apparent that there was some confusion about the rules concerning state funding and pri-

vate business. In the end, the partners came to a mutual understanding where everyone agreed on how the funding should and could be used. However, the process was time-consuming and meant plenty of time was spent on communicating the prerequisites of the funding to the different partners. For the research manager, this points to the difficulty of working with small, new enterprises that are not used to working on projects like the bike demo. Small enterprises normally lack the financial strength to try new things for extensive periods of time and have to be careful in regard to how they use the allocated time and resources. They literally cannot afford failure. The research manager relates the problems in the bike demo to the conditions of research and innovation activities today:

If you look at the research and innovation politics of today, then you become aware of the role of small and medium-sized enterprises, that they have an important role in the development of new services and products. You know that it is harder for them financially to take part in this kind of activity. But the solution is complex. Well, how much money should they be able to have, really? [...] everyone is supposed to compete on the same terms, so you can't spend a lot of state-funded money on start-ups. But on the other hand, there is a need for small enterprises; maybe we should not always be dependent on big business. (Interview, research manager)

After the initial tensions, the first step of setting up the bike-sharing system included identifying the right kind of bicycles for sharing. It was more difficult than predicted to find a contractor that could deliver bicycles that met the bicycle entrepreneur's demands. When the bicycles were finally ordered, the first contractor filed for bankruptcy. This led to a general delay where the bicycles were not delivered according to the plan. Also, it took longer to get the cargo bikes in place which in practice meant that during the demo, the users did not have access to them until very late and several of them were not able to try them at all. When deciding on the docking stations they ran into the same problems. It was difficult to get a contractor that could deliver docking stations that lived up to the set requirements. This led to the bicycles being delivered before the docking stations and in order to get the demo going, they were used without docking stations.

The smart locks presented a very important feature of the sharing system for the bicycle entrepreneurs. The electric cars that were also included in the service that were demonstrated, already had a booking system in place, which was operated through an already established car-sharing service. The bicycle entrepreneur however envisioned a system that was designed specifically for their service, which made it possible to "scale up" and offer a commercial service after the demo. They did not want to share the system with another commercial actor. As with the docking stations and the bicycles it was time-consuming to identify the right kind of locks for the intended use. Consequently, two sharing systems had to be used, where the car-sharing system was separate from the bike-sharing. According to the housing developer it would have been more effective if the bicycle entrepreneur had used the car-sharing system because then the service would have been up and running "in a week" (Interview, housing developer).

To identify a space in the residential area for the bike-sharing system also presented a challenge. For the bike-sharing system to succeed, it was important that the space was visible and easily accessible for all the residents. Furthermore, the bicycles needed access to electricity and had to be protected from the weather and from break-ins. It turned out to be difficult to find such spaces since they were not identified in the plans for the residential area or in the building permit. Instead, the bicycles was located in the parking garage, in a parking space previously reserved for one car. It was difficult to fit all the bicycles into this space, especially the cargo bikes. In practice this meant that the service was not as accessible as desired.

Due to organisational, communicational and technical problems, the bike demo was launched a year later than expected. In all, the users had access to the bicycles for four months. This was substantially less time than planned, and according to the project group this was less than ideal. For example, in the interview the research manager referred to previous research about changing mobility behaviour and said that to try to get users to accept a new service, the demo should have been in place for one to two years.

The housing developer and the bicycle entrepreneur interpreted the delays differently. They both wanted to develop a bike-sharing system. But while the housing developer wanted to offer the residents a functioning service quickly, the bicycle entrepreneur wanted to design, test and evaluate a service which they could use to develop a business model of their own when the project was over. The housing developer described the process as follows:

The implementation phase was too focused on the bicycles, it was delays, delays, delays. There has been a change of enterprise, of people, of structure. The focus on this led to delays. It was only admin. Everything took time. We wanted it to be “start and test, up and roll, learn, test and evaluate” (...) If we had known how long time everything would take, then we would have gone for another actor. (Interview, housing developer)

The different perspectives of the housing developer and the bicycle entrepreneur reflect conflicting ideas about what it means to develop a new service. The housing developer’s view of the process as too slow can be interpreted as indicating he is used to and expects “business as usual”, and that the emerging niche solution in this sense is already compliant with the present regime.

When the demo was finalised, the bike-sharing system included 12 robust premium electric bicycles and three electric cargo bikes that were offered to 275 residents. The bicycles had smart locks attached to them and docking stations were identified but not in place. The bicycles was placed in an allocated space in the parking house of the residential area. Other components of the bike-sharing system were a service agreement with a local bicycle shop and an insurance agreement.

At the time of the demonstration, the idea of residential vehicle systems in Sweden was new and the technical components that were needed for the service were not available on the market. In parallel, the intended users had little or no experience of either bicycling as an everyday transport mode, or of sharing. In this sense, the bike-sharing system was disruptive, and the difficulties that occurred reflected this.

To assemble the different components of the bike-sharing system was difficult and time-consuming. However, it was possible to resolve the encountered problems, and a functioning sharing system was produced. In the end, a final tension remained, a tension that prevented the bike-sharing system from succeeding even though the service was in place and functioning. In the next session we will discuss the implications of the idea that the bike demo would lead to a commercial service after the project.

#### 4.4. Commercialisation pressure challenges the bike demo

The project partners framed the bike-sharing system from the start as a business opportunity. The bicycle entrepreneur, a commercial actor, was constructed as the main provider of the service. In the project, the partners aimed for a solution where the users paid to gain access to the service. In this way, the users were constructed as the target group for the service. The partners’ experiences of the demo challenged this idea. For the bicycle entrepreneur it was made clear that it was not residents that were their main target group, but rather housing developers, property owners and tenant-owners associations. For them to offer an attractive solution for the users and run the service in a

business-like manner, they needed subventions from another actor. For the bicycle entrepreneur, it was not evident that the residents saw the value of paying for mobility sharing today:

In the future, I think that consumers will be willing to put their money on this. We are not there yet today. We will be dependent on the property owners. To get to “you will not own, you will rent and share”, it takes time. (Interview, bicycle entrepreneur 2)

Even if the bicycle entrepreneur believes in the idea of bike-sharing, he also acknowledges that the present regime still prescribes not only car-based mobility but also owning as a practice. To challenge these ideas, the entrepreneur need support. This raises questions about the idea that start-up companies and small-scale green entrepreneurs can act as drivers of change on their own. Based on the experiences from the bike-sharing demo, this is not likely. The question is whether other actors, such as housing developers, see the value of integrating new sharing systems in their present residential service, or if they perceive that the responsibility lies somewhere else. The research manager acknowledged that while housing developers can play an important part, public actors also have a potentially equally important role as facilitators. Furthermore, she saw dangers related to equity with leaving the development of mobility sharing services to profit-seeking initiatives:

The public should not give in to this, or we’ll get more ‘cherry picking’, we’ll get services where there are the most people (...) even though the public transport supply is very good there and so on. You get that kind of “where can we reach the most customers in the shortest time?”, that kind of [service]. But if you want any other type of change where it would actually contribute to a sustainable transport system and also contribute to social and economic sustainability, then maybe you get to take on other roles as a public actor. (Interview, research manager)

To conclude, the experiences from the bike demo show that it was difficult to develop a traditional business model where an entrepreneur offers a service that consumers are willing to pay for. To make money out of a residential bike-sharing system and at the same time challenge the automobile regime was not viable after a three-year demonstration project. When the demonstration project ended, the housing developer decided not to continue to offer the bike-sharing system to the residents, and the collaboration with the bicycle entrepreneur ended when the financial and organisational support from the Swedish Energy Agency terminated. This development can be read as indicating that the bike demo could not live up to the commercialisation pressure.

In the end, when the visions of the bike-sharing system were assembled into a socio-technical configuration it materialised as quite a standard sharing solution that worked in a limited context where it was supported by the infrastructure in terms of financial and organisational support that the demonstration project offered. The procedure for how the demonstration project was initiated, set up and funded, including enrolling partners, defining the problem (car dependency) and the solution (a bike-sharing system), shed light upon the difficulties of configuring mobility transitions in practice. In the final section of the paper we will, based on our findings, discuss some of the challenges that this study highlights on achieving mobility transitions through bike-sharing systems.

## 5. Discussion and conclusions

In this paper we have analysed the process of assembling a configuration with potential to challenge the dominant regime of automobilism. We have described the various steps throughout this process including the tensions that recurrently occurred. The project started out with a common vision of an altered regime for personal mobility.

But as the project proceeded this long-term vision was marginalised and reduced. We have shown that urgent issues, such as keeping within a tight time schedule, presenting a commercialised solution and adjusting the configuration to altered conditions, put pressure on the project and made key actors focus on just getting the configuration to work while putting the long-term vision aside. However, to change the entrenched regime of personal mobility that has been prevalent for more than 50 years is not an easy fix; rather, it will take time and patience, which was lacking in the project under study. Despite various challenges, the project succeeded in assembling a functional bike-sharing system. Nevertheless, key actors did not regard the project to be a success as it failed to deliver a profitable service provided by a commercial operator. Through this in-depth case study, we have highlighted complexities that can be of value for similar demonstration projects, or sites where bike sharing schemes are set up (c.f. Myers, 2000). The findings also contribute to the wider understanding of niches as arenas for sustainability transition, and pose some challenges that must be addressed for this transition to occur. Specifically, we would like to point to three key issues that the analysis highlights.

1. Disruptive services are not likely to succeed within a 'business as usual' framework.

The idea that a disruptive service can be delivered fast and without additional tensions reflects a 'business as usual' aligned conceptualisation of technological progress in an ecological modernisation framework. The analysis shows that in the demonstration project under study, eco-modernism set limits for the niche activities as it influenced what kinds of actors engaged in the innovation process, their interdependent relations, and what kinds of socio-technical configurations they aimed to achieve within the project. One of the difficulties that arose in the pilot project was the different perspectives and expectations among the key stakeholders, which also have been noted in previous literature as an obstacle for bike-sharing systems to succeed (Bachand-Marleau et al., 2013; Nikitas, 2019). The housing developer's view of the process as too slow is an example of a "business as usual" approach. On the other hand, the bicycle entrepreneur's notion that you need time and flexibility is more in line with the idea that niche innovations need protected spaces to try out different technical and organisational solutions. That it was difficult to get access to different technical solutions is one example of how the present automobile regime does not offer easy solutions for new niches to adopt. Rather than viewing different partners as difficult and ineffective to work with, problems like these should be expected when niches that challenge a dominant regime are configured. Experiences from the bike demo challenge the notion of demonstration projects as protected spaces.

2. Commercialisation pressure conditions the likelihood of success.

The pressure to deliver a commercially viable service was one of the most prevalent challenges to the success of the bike-sharing system. We argue that commercialisation pressure should be understood in the light of capitalism: the system that organises our societies and stresses the need for profit-seeking initiatives. Capitalism is one of the most deeply-rooted structures of Western societies. It influences the workings of socio-technical systems but has so far been largely ignored in the literature on sustainability transitions, and has primarily been regarded as a taken for granted or external parameter (Feola, 2019). This treatment of capitalism is associated with the logics of ecological modernisation that have figured as the key rational in sustainability governance. The bike demo set out to challenge the regime of private mobility, but not the structure of capitalism as such. But since these systems are so aligned it seems impossible to alter one and not the other. The findings of this paper align with Martin et al., (2015)

who showed that non-profit organisations are exposed to commercialisation pressures that come, for example, from innovation funders who have the assumption that "all innovators within the sharing economy would be for-profit organisations seeking to establish a financially sustainable business model" (p. 246). That the bike-sharing system should be commercially viable was indeed treated as a presumed parameter, that could not be adjusted or criticised (c.f. Feola, 2019).

We see a risk in enforcing all initiatives that challenge current regimes to become profitable or perish. When forcing the bicycle into a commercialised system, users are configured as customers expected to build their mobility on commercial relations. Other relations that are based on non-capitalist forms might eventually become excluded. These findings stem from the arguments of Bradley (2018) showing that commercial bike-sharing systems might enhance the attractiveness of bicycling but do not necessarily live up to the potential of the bicycle as a tool that can empower people; rather, such systems tend to lock users into capitalistic relations (see also Zademach and Musch, 2018). Martin (2016) had similar concerns, arguing that a sharing economy based on corporate interests will most likely not push the transition towards a more sustainable future. In this way the inherent potential in shared bicycles systems might unfortunately become incomplete or even vanish. To put it frankly, forcing all regime-challenging initiatives to become commercially viable is like putting the cart before the horse. This needs to be acknowledged since niche innovations are most likely to be successful if they are aligned with the incumbent regime, while more radical innovations are less likely to spread (Smith, 2007).

3. New models beyond capitalism are needed.

Furthermore, the analysis of the bike demo shows that the current roles of private and public actors risk obstructing the transition of the transport system. The demonstration phase is recurrently presented as best performed when partners with different interests, purposes and knowledge bases etc. collaborate in line with the triple helix model (Vergragt and Brown, 2007). The project under study was initiated with this approach, and private and public actors collaborated in a joint process of change. However, the commercial actor involved in the project was ascribed the responsibility to achieve a modal shift through the bike-sharing system. This raises the issue of why collaboration is seen as key to solving societal problems in demonstration processes, but not when the innovation is to be spread beyond the niche. If a public-private partnership works best in the demonstration phase, this model should seriously be considered when establishing future organisation models as well. Previous studies have noted that public actors played an important role as active supporters in successful bike-sharing schemes (van Waes et al., 2018; Nikitas, 2019). Mazzucato (2015) stresses that the idea of the private sector as a driver for innovation is based on myths of how innovations are made. She argues that the state needs to take on a proactive role in driving the transition towards a clearly articulated vision that unfortunately is increasingly lacking (Mazzucato, 2015). These ideas can also be applied to the findings of this study. Could public actors care about providing bike-sharing services for citizens just as they care about providing books through public libraries, or education through schools? However, the current setup suggests that innovations are created by the "fast-moving, risk-loving and pioneering private sector" while the state should take on the role of fixing market failures rather than shaping or creating innovations (Mazzucato, 2015:2). According to this way of reasoning, sustainable innovations are achieved by the profit-seeking private sector, while the public sector should primarily address the obstacles that these market participants may encounter as they achieve sustainability. Our analysis points to the need for new models for organising services and innovations that can alter present regimes. Collaborations between private and public actors are not always easily achieved; rather, there are many barriers that hinder

their joint efforts to achieve a more widespread sharing of vehicles (Karlsson et al., 2016; Smith et al., 2019). Nevertheless, in order to reach sustainability and equity goals, which is often stated as the main goal motivating new mobility services such as bike-sharing systems, there is a need of support from a wide range of public and private actors in collaboration. This paper contributes to this line of research, as it points out how the lack of active support from public actors can result in that solutions that have the potential to challenge the mobility regime, will not diffuse from the niche level.

Demonstration projects are given a key role in testing configurations for a more sustainable society, and they have been assigned the task of setting the direction for the future and establishing paths for future developments. The studied bike-sharing system had the potential to fulfil the mobility needs of the users in a particular residential area in eastern Sweden. In this article we have engaged with demonstration projects as arenas that possess the mandate to influence the future, and conceptualise them as sites that can decide on what kinds of socio-material relations work and what kinds do not work. Our findings illustrate that these niche arenas need to be given reasonable conditions, time and resources to assemble configurations with the potential to alter entrenched regimes. It is often argued that a successful demonstration can send out a message that it can work elsewhere too. We argue that failed demonstrations send out equally important messages. The main message from the bike-sharing demo is that new models beyond a strict capitalistic regime are necessary in order to realise disruptive socio-technical configurations that can be truly sustainable and socially just. This in turn points to the need for new roles for both private and public actors in the innovation and diffusion processes. There is a need for studies of innovative bike-sharing models that challenge “the business as usual” approach, where for example public actors or civic society have a leading role. Important questions for future research include whether public actors would be more capable of achieving equity and sustainability objectives if commercialisation were not the overarching goal of bike-sharing or other sharing services.

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## CRediT authorship contribution statement

**Malin Henriksson:** Investigation, Writing - original draft, Writing - review & editing, Project administration. **Anna Wallsten:** Writing - original draft, Writing - review & editing, Project administration.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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