POTENTIAL JUSTICE-IMPLICATIONS IN SYSTEM DESIGN OF BICYCLE-SHARING SYSTEMS

a case study of bicycle-sharing in Copenhagen and Malmö

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SUMMARY

Background

Bicycle-sharing systems (BSSs) have increased rapidly around the world over two decades, and this has led to an increased interest among academic research. Shared mobility may have the potential to improve accessibility and social inclusion, and proponents claim it does so. However, most academic research has focused on optimization and logistics of management within the present system design. It is rarer with research investigating impacts on justice and inclusion aspects. The few findings that exist indicate, however, that the user group is homogeneous, and most users are likely to be white, male, and middle class. The full inclusive potential of BSSs are accordingly not fulfilled, and research in the field could benefit from challenging rather than confirming the typically exclusive system design. Consequently, this research explored the reasoning behind the configuration of three BSSs in Copenhagen and Malmö to seek the potential justice implications it may have.

Method

This research had a qualitative case study approach, including document analysis, literature review and interviews. The interviews were the primary source of information and conducted with municipal and private BSS-providers in Copenhagen and Malmö, complemented with a smaller review of planning documents. How the BSS-actors' considerations compare to theoretical work on transport justice was subsequently evaluated to seek the potential justice implication in each systems' design.

Findings

The research concludes that the stakeholders' consideration shows attentiveness to a utilitarian approach in the system design, shaping what is considered doable and desired, even if the BSSs' motives indicate otherwise. This attentiveness means for the distributive justice that neither fairness nor equity can be considered achieved within the BSSs' current system designs, as different needs are not adequately acknowledged. Thus, the research has been able to show that existing BSSs in Copenhagen and Malmö follow a typical BSS design, which is more in line with the traditional transport planning approach and utilitarian ethics, than advice from transport justice research. This indicates that the BSSs may be prone to result in similar justice consequences as has been previously identified, excluding some groups of people by inscribed priorities of particular users and uses over others'. The examined BSSs may aim to enhance levels of accessibility, but since they do not priorities the need of those with the least opportunities, they do not follow the main recommendation from transport justice research. Since, research in transport justice determines that transport investments can only be considered fair if investments and services are distributed according to the greatest reduction in inequality of opportunity, which none of the current system designs of BSSs in Copenhagen and Malmö do.

KEYWORDS

Bicycle-sharing systems; social exclusion; distributive justice; transport justice; script

PREFACE

In collaboration with the Swedish Road and Transport Research Institute (VTI), as a final part of the Spatial Planning program with specialization Urban and Regional Mobility at Nijmegen School of Management Radboud University, I have done this thesis project. I would like to give a big thank you to my external supervisor Malin Henriksson who was supportive, answered questions and helped with valuable contacts to the first interviewees. I also want to thank my supervisor Arnoud Lagendijk at Radboud University for guidance and support, especially in theory and method.

Finally, I would also like to thank all interviewees who participated in the study. All showed great interest and commitment. Thanks to the interviewees who took the time to read through my transcripts to provide comments, these have been very valuable.

Nice reading!

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1. Introduction

1.1. The potentials for bicycle-sharing systems revised

The number of bicycle-sharing systems (BSSs) has increased rapidly over the last two decades, as of 2019, over 2130 individual BSSs exists worldwide in over 1500 cities (Meddin, 2018, cited in Fishman & Allan, 2019). An increased interest has followed this among academic research since BSSs have plenty of acclaimed potentials and reported benefits; including a reduction in traffic congestion and carbon emissions, increased cycling modal share with subsequent health improvements, and justice benefits due to its implied inclusiveness (Fishman & Allan, 2019; Ricci, 2015; Shaheen et al., 2010). Unfortunately, some of the suggested potentials are exaggerated or hard to measure (Médard de Chardon et al., 2017; Ricci, 2015).

The literature on modal substitution, for example, indicate that use of a BSS most often replaces journeys previously made by walking or public transport, reduction in road congestion is therefore limited, and reductions in carbon emissions exaggerated because few car trips are substituted. As a reduction in car use is often a primary goal, more research is needed on how to stimulate this modal shift and accurately measure the benefits (Fishman, 2015; Médard de Chardon et al., 2017; Ricci, 2015). One way to stimulate the substitution of cars is to integrate BSS with public transport since the combination has proven synergies for both modes as the catchment area of public transport increases when the bicycles serve as part of an intermodal journey (Fishman, 2015; Jäppinen et al., 2013). Consequently, more users could benefit from the BSS.

Likewise, strengthened societal equity is a plausible effect of BSSs, and the inclusive potential is often an argument for implementation (Médard de Chardon et al., 2017). Though, contrary to proponents' arguments, uptake of BSSs have been shown uneven across socio-demographic groups (Buck et al., 2013; Clark & Curl, 2016; Goodman & Cheshire, 2014; Ogilvie & Goodman, 2012; Uteng et al., 2019). Emerging research indicates a somewhat limited user group with an under-representation of females and populations from deprived areas in U.S. cities (Howland et al., 2017; Smith et al., 2015) as well as in London (Ogilvie & Goodman, 2012). Research has also been able to show that users of BSSs tend to have higher income and education levels than the general public (Buck et al., 2013; Davis, 2014; Fishman, 2015). Accordingly, BSSs' potentials do not spread consistently among possible recipients and maybe least among those who would benefit most from increased transport options. As Sherriff et al., (2020, p. 2) puts it, BSSs "tends to continue, rather than challenge, existing social exclusions".

Some undeniable benefits nevertheless exist, BSSs offer users an enriched mode choice with improved accessibility, providing trip flexibility (Fishman, 2015; Ricci, 2015; Shaheen et al., 2012) and resilience at transport system disruptions (Saberi et al., 2018). It can furthermore lower the threshold for new cyclists and hence increases visibility and normalization of bicycling, thus raising awareness among drivers of cyclists (Goodman et al., 2014). However, to fully achieve inherently and proclaimed potentials with BSSs, it is a necessity to expand accessibility and enlarge usage to be covered by the entire demographic spectrum. That is why it is important to consider equity aspects of BSSs and assess stakeholders' understanding of justice about who benefits from the prevailing system design, as to achieve a more sustainable and inclusive service and society. Therefore, this thesis investigates the potential justice implications of BSSs through an in-depth case study of two Scandinavian cities, Copenhagen and Malmö.

1.2. Research problem statement

1.2.1. Societal relevance

Research in transport justice theory has been able to show that traditional transport planning focuses more on the performance of transport systems rather than the people using or failing to use, the system (Martens, 2012b, 2017; Pereira et al., 2016; Schwanen et al., 2015). A related concept within transport justice is 'transport poverty', centring around the consequences of failing to reach transport

opportunities, wherein insufficient transport opportunities are often related to severe social, economic and health problems (Lucas, 2012; Lucas et al., 2016). Some identified groups in risk of this state are single parents, mainly women; low-income groups or unemployed; ethnic minorities; and people with disabilities (Church et al., 2000; Lucas, 2012; Lucas et al., 2016). Vulnerable groups in risk of transport poverty, thus overlap with the least common users of BSSs, suggesting that these underrepresented user groups are likely to experience transport disadvantage in utility and uptake of bicycle sharing. The contemporary failure of BSSs to benefit across the socio-demographic spectrum signifies a traditional transport system focus rather than user-centric emphasis.

Accordingly, this gives emerging indications that the typical system design of BSSs might result in similar mistakes as traditional transport planning has made, by disproportionately benefitting some population segments (Buck et al., 2013; Clark & Curl, 2016; Goodman & Cheshire, 2014; Hoffmann, 2016, p. 121; Howland et al., 2017; Mateo-Babiano et al., 2017; Ogilvie & Goodman, 2012; Shaheen et al., 2014; Smith et al., 2015; Uteng et al., 2019). It is questionable and raises justice problems if public subsidy and investments in BSSs prevail without sufficient considerations on inclusive measures, not the least if implemented as an inclusive and just transport mode. Dissemination of findings on how to fulfil the inclusive aspect is vital if uptake of BSSs should approach a more even use across the socio-demographic spectrum (Howland et al., 2017; Mateo-Babiano et al., 2017; Ogilvie & Goodman, 2012; Smith et al., 2015).

Lastly, according to Ricci (2015), only two studies (concerning the North American context) have systematically analysed BSS-actors' views on the process of implementing BSSs with focus on lessons learned of drivers and barriers (see Shaheen et al., 2012, 2014). Even though this thesis only considers BSS-actors in Copenhagen and Malmö with a specific focus on justice perspectives, and not implementation as a whole, this indicates a lack of studies concerning BSSs in the Scandinavian context.

1.2.2. Scientific relevance

Notwithstanding advancements in environmental justice (Brulle & Pellow, 2006), the healthy city conception (Rydin et al., 2012) and other social policy advancements aimed at reducing inequalities in planning practise and outcome, transport injustice consequently persists (Church et al., 2000; Lucas et al., 2016; Martens, 2017; Pereira et al., 2016). Transport development decisions have proven to disadvantage deprived neighbourhoods (via, e.g. amplified pollution exposure and diminished accessibility) while concurrently benefitting affluent neighbourhoods (Martens, 2017; Rydin et al., 2012). Furthermore, both in planning at large and transport planning particularly, gender dimensions are notably lacking, which has generated a narrow focus on "the male 'journey to work' during rush hour by car [as] the main category of journey …" (Rømer et al., 2007, p. 35). The implementation pattern of BSSs has also shown these tendencies (Mateo-Babiano et al., 2017; Uteng et al., 2019).

Since the usual implementation pattern of BSSs has resemblance from issues raised in the transport injustice notion, once again traditionally underserved citizens are at risk of not benefitting equally from the potentials of BSSs compared to their more prosperous counterparts (Carney, 2012; Fishman et al., 2014; Howland et al., 2017; Nixon & Schwanen, 2019; Smith et al., 2015). Nevertheless, academic studies on BSS and cycling often focus on technical matters such as logistics or system management, less attention has been on societal issues regarding equity and inclusion of underrepresented user groups such as women, low-income residents (Howland et al., 2017; Mateo-Babiano et al., 2017; Nixon & Schwanen, 2019), or the elderly (Winters et al., 2015). These types of studies have only just begun, but they have nonetheless shown their importance. Howland et al., (2017) surveyed, for example, BSS-operators in the U.S. and found that operators were more likely to have acted if the organization had written equity policies. If an understanding of the value of equity policies are better diffused, more even uptake may occur. Surveying BSS-operators' and related authorities' justice-understanding might thereof aid spread the understanding of the value of equity policies and an inclusive provision.

With enhanced comprehension of BSS-actors' considerations in system design, the prevailing barriers to improved inclusiveness from the suppliers' perspective can be shown more accurately (Parkes et al., 2013; Smith et al., 2015). Enhanced recognition of issues standing in the way to meet the needs of diverse citizens may further enlarge the user base of BSSs (Carney, 2012; Howland et al., 2017; Nixon & Schwanen, 2019; Ricci, 2015), in the long run, this might help achieve the full inclusive potential of BSSs. Enhanced recognition may also lead to suggestions for how a more just service can emerge, and increased uptake of BSSs can furthermore support in the limitation of transport poverty and its associated economic and health disadvantages (Nixon & Schwanen, 2019; Ricci, 2015).

1.3. The research's view of equality and justice

As the problem statement revealed, there are indications that contemporary BSSs have built-in justice problems. This thesis was, therefore deliberately, focused on equity or more precise distributive justice since it implies to cater after ones need. Equality, on the other hand, if used in a descriptive sense as in 'sameness', is treating everyone the same regardless of needs. As such, equality aims to promote fairness, but can only work if everyone's baseline is identical. The descriptive interpretation of equality is thus not a desirable condition for achieving fairness. Assessing distributive justice then implies to see in what ways diverse and distinctive needs are thought about since fairness actually can be reached by treating according to differences, which sometimes pose limitations to some individual liberties (Sen, 2009 and Rawls, 1999 as cited in Pereira et al., 2016). The words equity and justice are not clearly differentiated in the academic literature (Pereira et al., 2016), the terms are therefore used synonymously in the following thesis and is understood as distributive justice unless stated otherwise.

The above understanding of equality and justice is common for academic work in the field of transport justice (more on that in 3.2.1). Based on conclusions and recommendations from transport justice research, this thesis conducts a critical analysis of inherent justice consequences in the current system design of three BSSs in Copenhagen and Malmö. The study focusses on BSS-actors' (providers and planners) considerations in system design via a qualitative research approach, including document analysis, literature review and interviews.

1.4. Research aim and research questions

This research aims to consider inscribed justice aspects in the system design and its distributive consequences; offering a critical analysis of stakeholders' understanding of justice and motives for the provision of each BSS. From this, the main question that guides the research is; What are the potential justice consequences of Copenhagen's and Malmö's BSS-actors' considerations in current system design?

The following sub-questions work as intermediate steps to assess these consequences and answer the main question:

1. What view of justice derives from the motives behind each BSS?
2. How are the target groups for each BSS inscribed in the system design?
3. Given the transport justice perspective, what does the current system design mean in terms of justice?

1.5. Further research

Although this thesis exclusively focusses on the stakeholders' considerations in system design, citizens who are users or potential users are the focus of this inquiry. Further research is thus necessary to fully comprehend the outcome and effects of these considerations by focusing on users' and non-users' perceptions and receptions of the studied BSSs.

2. Bicycle-sharing research review

The purpose of the research review is to illustrate previous strives for improving bicycle-sharing via the historical development of BSSs, identified barriers to uptake of bicycle-sharing, and lastly present some implementation motives for cities and providers.

2.1. Background of the bicycle-sharing

The concept of systematized bicycle-sharing originates from the Witte Fietsen (White Bicycles) initiatives in Amsterdam in the mid-60s (Davis, 2014). Within this system, bicycles were painted white for easy recognition and left on the streets, free to use by anyone. Unfortunately, the absence of security mechanisms led to widespread theft and vandalism, leading to a rapid ending of the initiative (DeMaio, 2009). The first systems were fair and accessible in that they did not charge the users; however, with only voluntary efforts, few requirements can be made regarding an inclusive design or spatial distribution. Hence, it is not reasonable to return to this configuration if fairer BSSs are to emerge.

A widely used conception is to categorize BSSs into 'generations' (Parkes et al., 2013; Shaheen et al., 2010). The white bicycles were part of the first-generation, along with a handful of other systems. During the second-generation, control and security measures were introduced, such as coin deposits and publicly organized providers. Denmark was one of the few countries taking part in the second-generation, with Copenhagen as the first city to implement a large-scale system in 1995 (Fishman & Allan, 2019). The low deposit price and lack of reliable monitoring led nevertheless to similar problems as in the first-generation (Shaheen et al., 2010). As like the first, the second-generation was inclusive regarding costs, but the feasibility and hence the ability to set justice requirements remained nonetheless weak.

In the years after the failed attempts, there were few developments of BSSs. Only after much-needed affordable security mechanisms emerged, more cities could successfully implement programs of their own (Fishman & Allan, 2019). In 1998, the first third-generation system opened in Rennes, France, and from 2005 until 2016, almost all established BSSs categorized as third-generation (Fishman & Allan, 2019). Through technological developments, the difficulties of the two earlier generations were now somewhat handled. Common characteristics of this generation are dedicated docking stations (used as pick-up and drop-off points), automated credit card payments or use of smart cards, improved bicycle designs (including electronic locking), and GPS-systems (Shaheen et al., 2010). Nowadays, it is also commonplace with the provision of a designated website or app, which gives users the possibility to receive real-time information (e.g. locations and status of parking and bicycles), handle accounts and payments, as well as lock and unlock the bicycles.

These developments allow better tracking, security and management of the bicycle fleets for users, providers and research (Shaheen et al., 2010). However, this does not come without new barriers; fixed stations inevitably lead to spatial variation (Chen et al., 2020; Mooney et al., 2019), some are not able to pay by credit card which often is required (Carney, 2012) and information only online might exclude people without internet access or skills (interview 1:22; 2:39; 3:43; 4:20). Nevertheless, it is not before the third-generation it makes sense to discuss issues of inclusivity and equity since it is only by now BSSs reached a level of system design and operation with the conceivable capability to handle justice requirements.

The main characteristic of the third-generation are that they are so-called fixed systems, users have to park at fixed points, in contrast to the more recent 'dockless' or free-floating systems allowing users to park anywhere (for more elaboration on dockless systems see Chen et al. (2020), and for a discussion on terminology see DeMaio (2018)). The free-floating is said to be a key feature in a now emerging fourth-generation alongside smoother installation, electric bicycles, and public transport integration.

Nevertheless, the exact features of the fourth-generation are yet indistinct (Fishman, 2019; Fishman & Allan, 2019; Parkes et al., 2013). Docking stations require extensive economic and human resources; emerging research results indicate that free-floating systems can operate more efficiently with similar economic and social input, which could counteract the inevitable spatial inequality of fixed BSSs (Mooney et al., 2019).

Every BSS in this research (Bycyklen, Malmö By Bike and Donkey Republic) can classify as third-generation in the sense that they have designated parking places. Although Bycyklen and Donkey Republic can also be part of the forthcoming fourth generation in the sense that they include varying new features. Donkey Republic differs slightly from the other two by only having hubs (geo-fenced rental locations) instead of physical docking stations, what they call 'The hub-centric model' (Donkey Republic, n.d.-f). Bycyklen stands out with GPS-tablets on every bicycle and electric assistance (Bycyklen, 2014a). Chapter 5 Findings and analysis presents a more elaborate description of each BSS.

Alternative versions of bicycle-sharing, which do not categorize as regular BSS are also increasing; two examples are, the Dutch OV-fiets, a nationwide smart card rental bicycles scheme aimed at the last leg of a public transport journey (Dutch Railways, n.d.) and a time-limited, free of charge bicycle library in Helsingborg, Sweden. The aim is to offer residents a chance to try different types of bicycles before purchasing, such as cargo, electric or foldable commuter bicycles (City of Helsingborg, n.d.). This thesis only concentrates on regular BSSs, but these and other alternative examples brought inspiration.

Lastly is the emerging trend of e-scooters necessary to mention. Due to the novelty of these free-floating schemes, there are little academic conclusions of the societal impacts or how this might impact further evolution of BSSs. Current results are ambiguous around the world; reports show both increases and decreases in ridership of existing BSSs at the introduction of e-scooters (Fishman & Allan, 2019). Respondents from Copenhagen commented on the introduction of e-scooters in the city by explaining issues with unlawful parking and blocking of urban space leading to nuisances for, among other, pedestrians and public services such as waste sorting stations (interview 1:2; 3:14; 3:27; 4:9; 6:15).

As previously mentioned, the evolution and increase in numbers of cities implementing a BSS have mainly occurred during the last decade, which has led to a parallel increase in academic studies aiming to improve BSSs in various ways. The research has, for example, highlighted that prevailing BSSs are not free from concerns, not least regarding who is benefitting from current system designs. Hence, the next section describes some of the identified barriers to bicycle-sharing.

2.2. Barriers to bicycle-sharing

There are not many studies on barriers to bicycle-sharing from a non-user perspective, as difficulty in obtaining data is apparent; users provide contact information while non-users do not. Although some barriers to uptake are acknowledged, and the need to do more research persists. Identifying barriers is vital both to increase uptake among underrepresented user groups and to inform system design for future BSS (Fishman, 2015).

Some identified barriers affecting uptake among underrepresented groups have already been mentioned, for example, credit card requirements (Carney, 2012) and a perceivable exclusion due to information only available online (interview 1:22; 2:39; 3:43; 4:20). Related concerns have been shown elsewhere, as in the U.S., where some operators perceived price or payment systems of their BSS to be a barrier (Howland et al., 2017). If citizens cannot obtain information about the BSS, the first barrier to overcome is unawareness. A survey in Montreal, Canada, showed that BSS-unawareness tend to be related to people's lower educational level and absence of BSS-stations within walking distance (Bernatchez et al., 2015). Safety and security have also been shown as a barrier both in perceived and actual risks, relating to station location, temporal considerations and lack of cycling infrastructure (Clark

& Curl, 2016; Fishman et al., 2014; Sherriff et al., 2020). By reviewing articles related to women and bicycle sharing, Mateo-Babiano et al. (2017) explain that females tend to be more concerned about safety than men when bicycling and that this is a causal reason for the gendered differences among some BSS users. However, traffic safety concerns should be less of a concern in Copenhagen and Malmö, since both cities hold relatively high-standard cycling infrastructure.

Other research has highlighted issues with the economy of scale (a proportionate saving in costs per unit, obtained due to enterprises scale of operation) producing homogeneity and exclusionary bicycle design in most BSSs (Nixon & Schwanen, 2019; Sherriff et al., 2020). They conclude that current forms of provision, with the involvement of private (for profit) firms in bicycle sharing, coupled with local authorities assurances to tax-payers for the systems to reach self-sufficiency quickly, have commonly led "to the prioritization of a particular type of user who is scripted into the physical design and business model …" (Nixon & Schwanen, 2019, p. 2). Variations in business and operation models can thus influence barriers to user uptake.

The reliance on private funding may, for example, influence station sitting, management, and implementation pattern of a system. Business and operation models can also have consequences for justice outcomes if profitability interests prevent adaptation to the needs of particular user groups, as argued by Nixon and Schwanen. Furthermore, the profit motive might hinder locating stations in predicted low-use areas which otherwise could enhance accessibility via more even geographical distribution (Shaheen et al., 2014; Smith et al., 2015). Achieving complete equal distribution of docking stations are nonetheless nearly impossible, as Martens (2012b) explains peripheries and centres develop naturally; as a result, inequality in spatial accessibility is inevitable.

Nevertheless, the spatial distribution of docking stations relative to trip generating areas is among the most crucial aspects for user uptake (Clark & Curl, 2016; Fishman et al., 2014; Ogilvie & Goodman, 2012). A typical pattern is low station density in deprived areas compared to high density in more affluent ones; findings from, for example, London (Ogilvie & Goodman, 2012) and U.S. cities (Ursaki & Aultman-Hall, 2016) have shown this. One investigation of London's BSS revealed, however, that citizens from deprived areas would use the system more, provided that the provider places stations locally and keep prices at affordable levels compared to other modes (Goodman & Cheshire, 2014).

The barriers mentioned above cannot be seen as an exhaustive list, but several that are relevant for this thesis as each examined BSS holds some of these barriers. Many difficulties to bicycle-sharing prevail in usability from a user's perspective, and the intentions behind a BSS closely link to the system design. Accordingly, the next section examines the operators' and cities' interests behind offering a BSS.

2.3. Operators' and cities' motives for implementation

Due to its perceived social and environmental benefits, BSSs are generally an uncontroversial intervention, with broad policy support (Parkes et al., 2013). Local authorities' and planners' motives for implementation includes both environmental and societal concerns. It can be a response to, local pollution and CO2 emissions, stimulate modal shift and strengthen the public transport's catchment area, reduce congestion, enhance public health and counteracting sedentary lifestyles, improve upon road safety particularly for cycling, and enhance the image of the city supporting local business and tourism. For commercial operators, there is a profit motive from user fees and commonly an opportunity to sell advertising on the bikes and other places. The deal between the city and an outdoor advertising firm is often that the firm provides the city with a BSS in exchange for advertisement spots around the city (Fishman, 2015; Jäppinen et al., 2013; O'Brien et al., 2014; Ricci, 2015; Shaheen et al., 2010). The motives behind the implementation are vital since this set the tone for what the

stakeholders value, how they motivate decisions and how to evaluate objectives (Parkes et al., 2013; Ricci, 2015).

However, some scholars question if services like BSSs should be termed 'sharing' at all, arguing that users are paying to have flexible access to valued resources for a certain period without the "financial, social, and emotional obligations embedded in ownership and sharing". These services are hence part of an 'access economy' rather than 'sharing economy', since users are after practical, as opposed to, social values (Eckhardt & Bardhi, 2015). Commercial operators and public organizations may simply use the phrase 'sharing' to evoke "a more 'authentic' form of inter-personal engagement" (Cockayne, 2016, p. 79). Yet, this evocation may sometimes be hard to achieve with a typical BSS in some urban regions, if anticipated users have unique needs. A more economical option can be to provide bicycles freely to displaced people according to a respondent in a London study, arguing that this "gives them a piece of property, cultivates a sense of solidarity and community and boosts their emotional well-being" (Nixon & Schwanen, 2019, p. 3). These values are thus difficult to achieve via access economy and the prevailing design of BSSs.

If providers state motives for providing a BSS, it can be utilized to resolve who has the ultimate responsibility to ensure sufficient access and fairness in the transport investment. According to Howland et al. (2017), transport agencies must ensure that transport programs cater to all population groups and that authorities evaluate projects to ensure they are not discriminating against any individuals. It is reasonable also to consider municipal authorities having this duty when writing procurements for BSSs and further on when evaluating the operator's performance. However, the typical current system design which is often in line with the notion of economy of scale might respond to authorities stated objectives but can still be seen as questionable if one agrees with the justice considerations of Howland et al.

2.4. Summary of research in bicycle-sharing

BSSs have recently undergone a significant development from the first-generation in the 60s and second-generation in the 90s, which was only implemented by a limited number of cities. Nowadays, there is an increase in contemporary third-generation and upcoming fourth-generation BSSs in cities worldwide, a development driven by both the public and private sector. The third-generation system overcame the initial problems mostly related to management, and the intended benefits of access to bicycles without the obligation of owning are now considered achievable. The car's status in the world's cities is also decreasing, and bicycle-sharing is one of many alternatives to provide city residents with healthier and more climate-friendly transport alternatives (Fishman & Allan, 2019; Parkes et al., 2013; Shaheen et al., 2010).

Research is also following this wave of worldwide development and implementation. In addition to developing the management and optimization of current system design, some studies aim to improve BSS by emphasizing that current system design is not free of concerns regarding who currently benefits and who is yet to be reached (Fishman, 2015). This kind of research has identified barriers to uptake, including concerns such as issues with adherence to the economy of scale which affects bicycle design and business models (Nixon & Schwanen, 2019; Sherriff et al., 2020), unawareness and information problems of the existence and use of a BSS among some residents (Bernatchez et al., 2015), and uneven geographical distribution with skewed focus on high-income areas particularly in London and U.S. cities (Ogilvie & Goodman, 2012; Ursaki & Aultman-Hall, 2016). By indicating potential users' barriers to uptake, research can better evaluate whether stated motives and acclaimed potentials with implementations are within reach with the current system design or not (Howland et al., 2017; Ricci, 2015).

3. Theory and conceptual framework

As shown in the problem statement and the review of bicycle-sharing research above, a common feature of BSSs is that only some population segments seem to use and benefit from the current standard system design. A proposition was also given in the problem statement, that the implementation pattern of BSSs often shares resemblance from the traditional transport planning approach. Hence, the theoretical framework is formed by first describing the traditional transport planning in its archetypical form and thereafter presents a response to this planning approach, namely the transport justice notion. Subsequently, since this notion has proven that contemporary configuration of transport systems inscribe injustice, the chapter proceeds with the overarching academic concept of 'script', which focus on the interchange of technological objects or systems and individuals. Lastly, the theoretical framework ends by describing how it guides the analysis.

3.1. The traditional transport planning as understood by transport justice scholars

The traditional transport planning approach is implicitly based on the principle of fairness or complete equality. This principle relates to its modernist roots and of other domains of civil engineering undertakings, such as water and electricity provision to all. Where the goal is to provide identical level-of-service across the transport system regardless of transport mode, income, race, gender, or residential location; which means that "everybody is to receive unhindered travel speed on the transportation network of her choice" (Martens, 2017, p. 25). This goal leads to a need for each link to have sufficient capacity to cater for the current and predicted usage; in other words, the demand rather than need (Martens, 2006). From the beginning as well as currently, the dominant focus of transport planning thus frames the task at hand to maintain speed and tackle the problem of congestion to maintain unhindered travel (Levine as cited in Martens, 2017).

Since economic limitations restrict the ideal to invest and improve everywhere, the cost-benefit analysis (CBA) approach emerged as an appraisal method of transport investments. Martens defines CBA as "the maximization of the net contribution of the project to the national income" (Martens, 2017, p. 24). This maximization seeks to generate information about the economic efficiency of any particular transport project by measurement of reductions in operating cost, travel-time savings or improvements in road safety (Bristow & Nellthorp, 2000; Martens, 2006). This process gives the traditional transport planning approach a utility ethic or what is known as utilitarianism. Since this normative ethic prescribes that the right action is the one that maximizes the benefit, that is, maximizing the outcome of benefit and minimizing the outcome of suffering (Martens, 2011; Pereira et al., 2016; Wee & Roeser, 2013). Figure 1 shows one way of describing the steps of traditional transport planning.

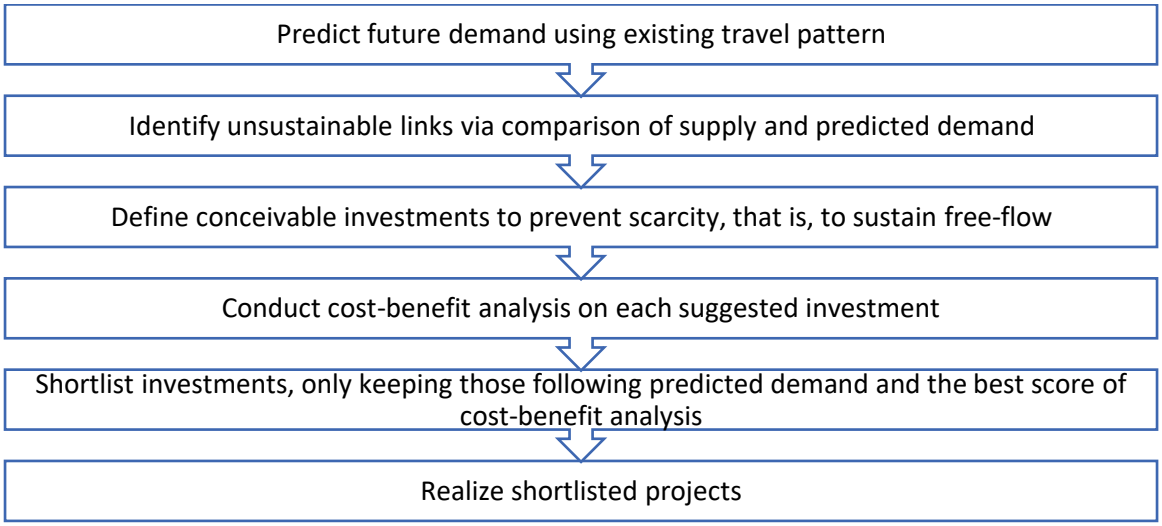

Figure 1 Adaption of Martens "informal rules of traditional transportation planning prescribing how to conduct 'proper' transportation planning" (Martens, 2017, p. 23).

Consequently, the investment decision mainly depends on predicted demand, supply, and economic efficiency at an aggregated level without considerations at a disaggregated level for the social impacts of the project (Beyazit, 2011). That is, due to the understanding of observed travel behaviour as an indicator of demand, this overlooks a suppressed desire for taking trips were it not for either economic, social, or transport system related constraints. Demand comprehended in this way produces a path dependence in the practice of transport investment, indirectly defining who can enjoy the distributional effects of transport spending by market-based criteria. This approach thus attends mainly to the needs of already affluent and especially mobile socio-economic groups rather than immobile individuals, as Figure 2 shows (Beyazit, 2011; Hananel & Berechman, 2016; Martens, 2017, p. 27; Nordbakke & Schwanen, 2015; Pereira et al., 2016).

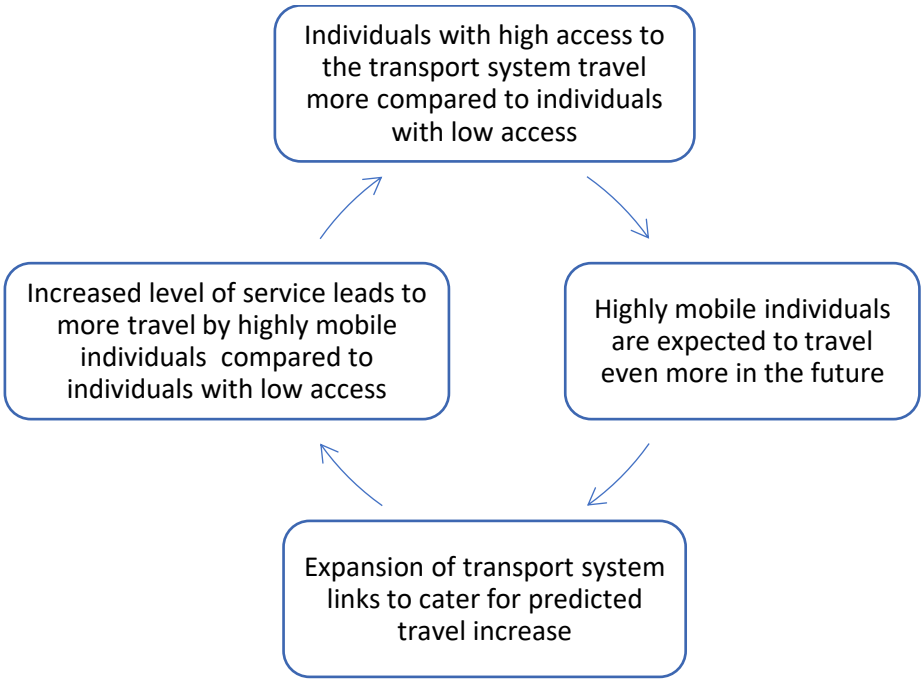

Figure 2 The self-reinforcing rule of demand based on existing conditions, adapted from Martens, (2006, p. 7).

The dominance of market considerations thus neglects the needs of disadvantaged and less affluent individuals, which are likely to desire more travel but unable to afford or obtain it. Based on neo-liberal thinking, the transport planning approach has formed into a socially unjust practice (Beyazit, 2011). The implicit assumption in deriving future demand from current travel patterns builds on the idea that these movements are a result of free choice. That is, the traveller has chosen one best action based on preference rather than constraints or ability (Martens, 2017, p. 28). However, as Pereira et al. (2016) explain this libertarian approach overlooks "the possibility of conflict between markets and distributive fairness" (Pereira et al., 2016, p. 11). The perceived efficiency goal hinders just outcomes and market failures in urban transport systems can also often compromise it (Santos et al., 2010).

However, recognition of justice concerns in the context of transport emerged already in the late 1970s. In the decades since, the traditional approach has been criticized on several grounds both regarding environmental and social concerns. But it was not before the 1990s that a spread of academic interest began to emerge (Beyazit, 2011; Hananel & Berechman, 2016). Since then, research has focused on various issues of justice in transport, such as women and transport (Rømer et al., 2007); transport-related social exclusion (Lucas, 2012); and the effects of ethnicity, age, class and disability on transport (Church et al., 2000). The vast and growing literature has been able to demonstrate that travel demand not only arises out of free choice but also as a result of constraints; including limitations related to economy, time, access to transport modes, and more broad inaccessibility to transport services

(Martens, 2017, p. 28). The next section presents recommendations on how to mitigate the outcomes of traditional transport planning from the research field of transport justice.

3.2. Notions of transport justice research

This section discusses transport justice research along with related academic work on accessibility and transport disadvantage, ending with how said notions apply to this specific research.

3.2.1. Introducing considerations — on justice and transport

Of significance when it comes to contemplations on justice is the lack of one single overarching definition of justice. It has been conceptualized in various ways and understood as a comprehensive moral and political ideal; related to (1) distributive justice, regarding the distribution of benefits (resources and opportunities) and burdens (related to particular decisions, actions, and changes) in society; (2) procedural justice, regarding decision processes and procedures of governance, such as participation and the participants' power to influence; (3) justice as recognition, stress acknowledgement and respect of the rights and entitlements of groups involved in or affected by governance decisions (Pereira et al., 2016).

The transport justice literature has so far mainly acknowledged 'distributive justice' by studying the distributional features of transport systems on different groups in society, features which benefit some while not others (Beyazit, 2011; Schwanen, 2020). This attention is not unexpected as Hananel and Berechman (2016, p. 79) argues, questions regarding distribution are especially relevant to transport since individual mobility is a necessity to consume and produce goods and services deemed as essential in modern societies. However, the distributional justice emphasis is not without critique, Young (as cited in Berg et al., 2019) argues, for example, that it is more important to focus on justice as recognition or 'institutional justice'. That is, to focus on how representative the planning is by presenting norms and representations that the planning explicitly create, thus criticizing the planner's expert role and impartiality. As, according to Young, this role and perceived neutrality contribute to strengthening authoritarian hierarchies when privileged groups' perspectives are presented as universal.

Still, as most transport justice literature takes a distributional justice approach, this thesis naturally and mostly follows a similar perspective, without aiming to either contribute on general justice principles or further the academic conceptualization of justice in transport planning. The thesis instead places focus on the enactment, by drawing upon certain commonalities within the academic field on transport justice as a guide to analyse the system design of each BSS. That is, the focus is on how each system design inscribes justice aspects and what distributive consequences this entails. The next section centres on these points, aiming to further elaborate the common vantage points within the transport justice literature.

3.2.2. Transport justice

Based on the recognition that traditional transport planning has focused on the performance of the transport system instead of the people actually using or failing to use the system, research in transport justice explores how ethical principles can enlighten transport planning and assessment (Beyazit, 2011; Hananel & Berechman, 2016; Martens, 2006, 2012b, 2017; Pereira et al., 2016). Oswald Beiler and Mohammed (2016, p. 287) define transport justice "as the expansion of environmental justice principles to transport through investigating mobility, access, and modal opportunity".

However, even if the majority of academic work in the field take a distributional justice approach, some apply other theoretical perspectives and yet others only implicitly apply general ideas of fairness and equity, which is why little conceptual clarity can be found of what transport justice exactly entails (Pereira et al., 2016). Hence, as Mullen and Marsden (2016, p. 110) explain, it would be incorrect to describe the debate as settled on 'one transport justice theory'. Though, according to the authors, can

three commonalities be outlined that are shared by the vast majority of arguments within transport justice:

1) each individual has equal moral value, so every life and everyone's ability to make something of their life matters;
2) society has a responsibility to construct political, social and economic arrangements which reflect the statement that every individual matters equally. That is, society should show equal concern, and this obligation is also valid for each individual, everyone has to accept individual limitations which can benefit others;
3) equality is not the same as 'equal treatment'; different needs and contexts require to be acknowledged.

In line with these three commonalities, transport policy can be considered fair if investments and services are distributed according to the greatest reduction in inequality of opportunity (Hananel & Berechman, 2016; Martens, 2012b; Pereira et al., 2016). Meaning that policies should aim to enhance overall levels of accessibility (Martens, 2017), but prioritizing the needs of risk groups to "mitigate morally arbitrary disadvantages that systematically reduce their accessibility levels" (Pereira et al., 2016, p. 15). Aiming to minimize inequality of opportunity requires identifying whether some defined group (e.g. in a particular geographical location, income or age group) experience less access than others. Derived from the three points above the argument is that if it is known and unhandled that some experience less access, then those individuals can rightfully say they are not being treated as equals and so have the right to different treatment according to need and context (Martens, 2017; Mullen et al., 2014).

However, this argumentation of access to the possibility of transport does not specify how to fulfil the accessibility; that is, this needs not to involve a specific transport mode. The critical aspect is only the requirement of being treated as equals, and thus that everyone has access to travel by some transport mode. This treatment can result in individual limitations if they compromise someone's access to travel, restricting specific modes while allowing others (Mullen et al., 2014); which means that a car-free zone is fair as driving there would limit pedestrian accessibility.

The underlying notion is thus that transport justice addresses individual's accessibility instead of specific transport modes mobility (Beyazit, 2011; Hananel & Berechman, 2016; Martens, 2006, 2012b, 2017; Pereira et al., 2016). By combining mobility limiting and accessibility enhancing strategies, the focus has shifted to a people-centred transport practice aimed at the ends rather than the means (Handy, 2005). As is understood, this approach comprehends accessibility as more than a spatial feature and exclusively a quality of locations (i.e. place accessibility). Key is accessibility as experienced by an individual (i.e. person accessibility), since individuals not places can experience injustice, reflecting how individual characteristics (e.g. gender, age, disabilities, and income) form variations in accessibility levels among individuals (Martens, 2017, p. 11; Neutens et al., 2010). So, person accessibility should be the primary focus of transport practitioners addressing issues of distributive justice in transport (Hananel & Berechman, 2016; Martens, 2017; Pereira et al., 2016); yet, for reasons of readability the term accessibility rather than person accessibility is used throughout the thesis.

3.2.3. Accessibility

As described in the earlier section, assessing fairness in accessibility levels requires ascertaining if some experience less access than others. Though, which metrics that are measured in an accessibility analysis significantly frames the results (Martens, 2012a; Neutens et al., 2010), because how accessibility is understood will ultimately determine what fairness in transport is (Martens, 2017; Pereira et al., 2016). Since this thesis' case study is not an accessibility analysis, in the sense that no firm conclusion should be drawn on the actual accessibility outcomes of each BSS, no list of accessibility metrics is necessary.

Nevertheless, as suggestions from transport justice research guide the analysis, accessibility is at the centre of attention in this inquiry, and a definition of accessibility is needed. Following the conceptualization by Pereira et al., (2016, p. 8), accessibility is defined as "the ease with which persons can reach places and opportunities from a given location and be understood as the outcome of the interplay of characteristics of individuals, the transport system, and land use". The focus on accessibility (as signifying justice consequences) can also be justified since the understood purpose of a BSS is to improve individuals' access to places, activates, and opportunities they have reason to value.

3.2.4. Transport disadvantage

If an individual severely lacks accessibility options, it can be challenging carrying out everyday activities such as work, study and leisure activities, which risks excluding people from essential social functions. Research often calls this challenging situation transport poverty, but other terms also exist, such as transport-related social exclusion, transport disadvantage, and accessibility poverty. These terms sometimes relate and sometimes only correspond partly. Underlying the efforts to highlight this issue, is the realization that decisions on transport investments can have a profound and varied impact on the well-being of distinct groups (Lucas, 2012; Lucas et al., 2016). Since it is not within the scope of the thesis to untangle the terminology, it is sufficient to comprehend 'transport disadvantage' as difficulties in accessing transports.

Researchers have identified various risk groups, including single parents, mainly women; low-income groups, or unemployed; ethnic minorities; elderly; and people with disabilities (Church et al., 2000; Lucas, 2012; Lucas et al., 2016). As previously explained, these groups accordingly overlap with underrepresented user groups of several BSSs in both European and American cities (Howland et al., 2017; Ogilvie & Goodman, 2012; Smith et al., 2015); which can be said to contradict the general idea that bicycle-sharing inevitably offer everyone more transport options (O'Brien et al., 2014). So, one cannot draw simple conclusions that shared transport will necessarily support greater social inclusion, since market-based approaches run the risk of excluding less affluent citizens, as explained in 3.1. Furthermore, as described in 2.2, the typical system design of BSSs presents significant challenges to some subgroups, indicating that they might experience transport disadvantage in the use and uptake. That is, if seen through the accessibility lens, difficulties exist in the interplay between characteristics of individuals and the typical system design of BSSs.

3.3. The notion of script

The interplay between users and technology and at times its exclusionary outcomes have not only been studied in relation to transport systems. The role of users in the development of technology, in general, has been influential in studies of "semiotic approaches to user-technology relations", i.e. studies of how developers (for example engineers, operators and planners) construct users through the design processes (Oudshoorn & Pinch, 2005, p. 9). One widely disseminated notion in this research field is the concept of 'script' coined by the French sociologist Madeleine Akrich (1992). The concept of script focus on the interchange of technological objects or systems and individuals, how the design enables or constraints users and subsequently how these scripts materialize objects or system design (Henriksson, 2014, p. 41).

Akrich's concept of 'script' in technology design, entails prompts to the user on how the technology should be used. She describes the scripts as a film script for actors on what to say and how to act. Design of technology can, therefore, hardly be regarded as a neutral process but rather reveals the opinions and motives of the designer according to Akrich. Instead of defining the issue in terms of a shortcoming of users, the concept draws attention to the shortcomings in practices of configuring future users and usage; much like the earlier described critique in 3.1, on the traditional transport planning approach's view of demand as an indicator for future investments. Although, the designer is not the only active actor in this concept, as would be in a technologically deterministic view (assuming

that the technology purely determines the development of social structures). Instead, the concept of script comprehends the user as playing an active role in shaping the interplay to technology. An analysis utilizing the concept of scripts, therefore, needs to include both designer and user continually going back and forth between each party, considering the designer's anticipated users and the actual users, "between the world inscribed in the object and the world described by its displacement" (Akrich, 1992, p. 209). Akrich and Latour (as cited in Oudshoorn & Pinch, 2005, p. 11) therefore presented the conceptions of subscription, de-inscription, and anti-program to apprehend this active role of users. 'Subscription' refers to the extent one endorses what is anticipated by an object's or system's arrangement, while 'de-inscription' refers to renegotiation by the user. 'Anti-program' signifies all the users' programs of actions that diverge with the designers intended program.

The concept of script is useful in this thesis' analysis as it can highlight stakeholders' anticipated use and user of the BSSs, as a tool to explore justice aspects inscribed in the system design which may lead to the exclusion of specific users. However, since Akrich (1992, p. 209) explain that "we cannot be satisfied methodologically with the designer's or user's point of view alone", the analysis deviates from Akrich's advice by only comprehending the issue mediated through the stakeholders. By merely capturing the user's point of view via the BSSs-actors, the thesis only assumes indications of the link between prescribed use (i.e. script) and users' adoptions of the technology (i.e. anti-program, de-inscription, subscription). Yet, to mainly focus on the designers' script is conceivable within the limits of a master thesis. Moreover, a follow-up study based on this thesis is being prepared and will complement with users' and non-users' insights on how users approach the script.

3.4. Main proposition and conclusions from the theoretical framework

With the thesis theoretical outlook clarified, which complements chapter two's review of BSSs research, this section explains how the analysis utilizes the information presented so far and offers the thesis main proposition.

The issue represented to be, can be summarized as the following. Generally, contemporary BSSs are not inclusive forms of transport solutions, since they are less used by traditionally transport disadvantaged groups, while they are used more by traditionally 'transport benefitted' groups. In this, current BSSs risk to undertake similar mistakes that have been identified in the traditional transport planning approach by research in transport justice, for example, by focusing mostly on a demand and market solutions which lacks to acknowledge diverse needs. By acknowledging the shortcomings in the typical system design, this research understands that transport injustice prevails in most BSSs; this is the thesis' main proposition. Fairness in transport distribution, and thus also in BSSs' design, occurs if investments and services support reductions in inequality of opportunity. BSSs have the potential to support this reduction if the system design takes measures to include transport justice.

Inbuilt justice consequences in the three examined BSSs was sought as seen in Figure 3, by applying concepts from the script approach to divide the stakeholders' considerations between, on the one hand, the approach in traditional transport planning as comprehended in 3.1, and on the other, the common recommendations by transport justice research as explained in 3.2. This inquiry thus tests the thesis' main proposition for the selected case study objects; indirectly asking if their system designs are similar to many others elsewhere or if this finds alterations that carry other justice implications?

Finally, as stated in the introduction, citizens who are users or potential users are the focus of this thesis, even if the stakeholders' considerations in system design are examined and not citizens'. The examination thus comprehends stakeholders' considerations as fundamental for the system design, and the potential to make adaptations is perceived to lie mostly with these actors. The thesis consequently does not contest whose considerations in the system design is perceived, as proponents of 'institutional justice' request. Follow-up studies should then focus both on the actual outcome for

users and non-users to match their needs with the design of the system, and study how representative the planning process of the systems is. This would also, as previously mentioned, complete Akrich's analysis conceptualization of scripts and its accompanying terms subscription, de-inscription and anti-program.

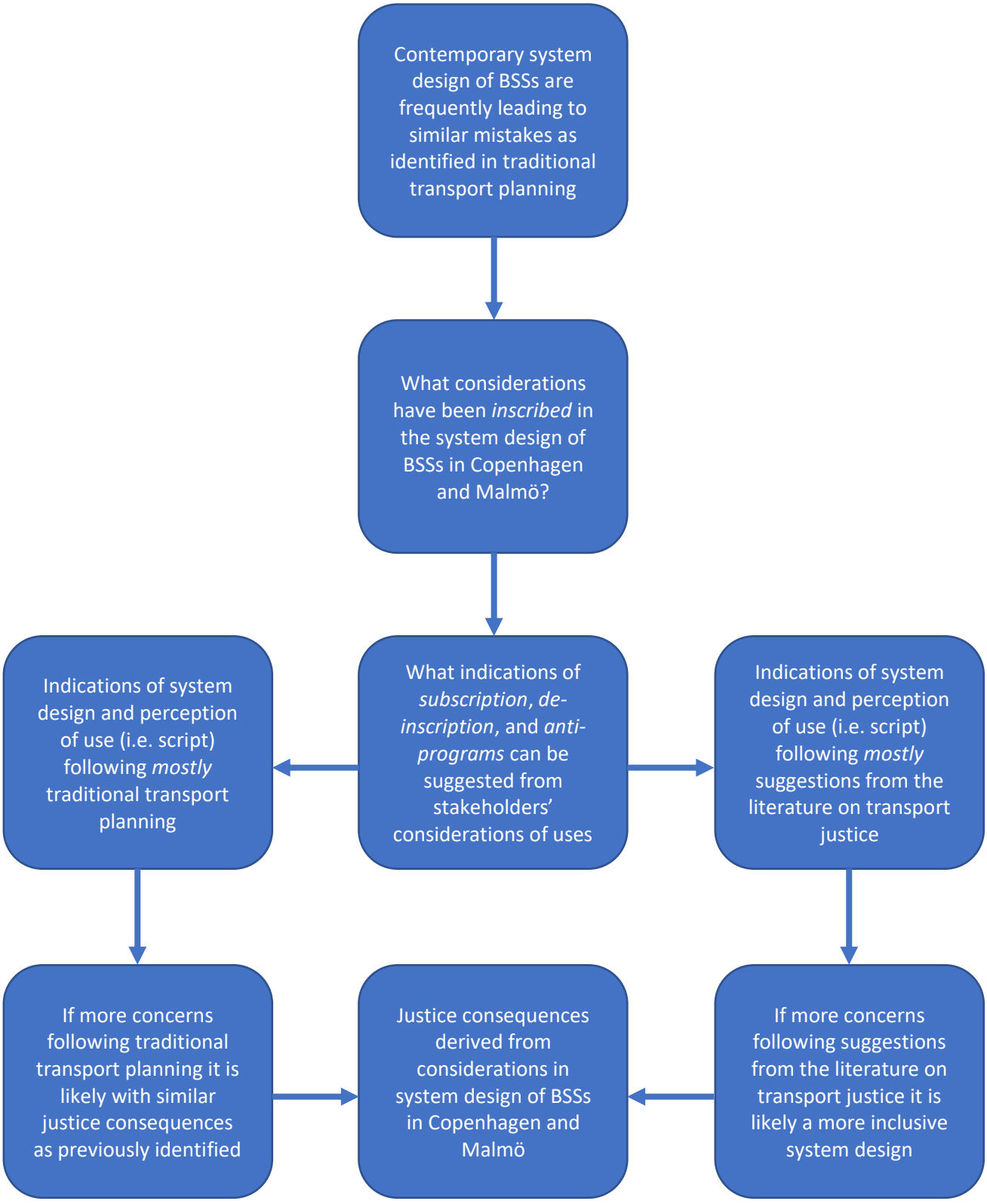

Figure 3 Flow chart over the analysis process, depicting the search of justice consequences.

4. Methodology, method and operationalization

This chapter begins with a reflection on the research's methodology leading to the selection of methods and then the choice of study objects. Afterwards, it discusses the interview-form and data analysis process. The chapter ends with an evaluative-statement about the research's trustworthiness and considerations on triangulation.

4.1. Reflections of the research strategy

Understandings in constructive or interpretive research arise from two levels, the subjective view of the socially embedded participants and the independent perspective of the researcher. On the first analytical level, it is crucial to try to understand the phenomenon from the interviewees' perspective. Concurrently, at the second level, it is also necessary to analyse the material with a critical and questioning look to provide a 'thick description' of the phenomenon of interest (Moses & Knutsen, 2012, pp. 9–12), in this case, the justice implications. At the second analysis level, I was consequently positioning as an autonomous observer. Through this, the time and information that the interviewees shared were taken seriously, even if it may result in the interviewees not recognizing or wholeheartedly agreeing with the representations. This process means that the thesis has an interpretive research approach, where a reinterpretation of responses to system design is presented based upon notions from transport justice research. Conclusions of justice are drawn from interview answers on system design, even though the interview questions did not ask the interviewees to comment on the justice aspects per se.

4.1. Selection of methods

In the initial phase of the study, the literature on the subject was reviewed. Several articles discussed the potential positive effects of BSSs, while others suggested a lack of critical studies on these effects. Above all, Nixon and Schwanen's (2019) article 'Bike-sharing beyond the norm' inspired me to explore with a questioning gaze of the justice implication in the prevailing system design of BSSs.

From this, it was clear that the thesis would have an interpretative research perspective as views on justice cannot be uncovered as one singular truth; rather, it lies in the eyes of the observer. As a result, qualitative research methods such as semi-structured interviews fit in, as it seeks to capture the socially embedded meanings of the participants (Yin, 2015).

Furthermore, an important aspect when reviewing stakeholders is the policy situation wherein each BSS operates in; such as municipal mobility policy and legally binding procurements between the involved stakeholders, which describes the specific financial, organizational, and regulatory context. Knowledge of these features is fundamental for the research to result in realistic and specific recommendations (Ricci, 2015). Therefore, the thesis also contains supporting documents for contracts, tenders and assignment descriptions, which were supplemented with municipal planning documents to build on the knowledge of each studied city's mobility context and whether they specifically mention bicycle sharing. The literature review thus served to developing understanding rather than as a basis for analysing in itself.

4.2. Choice of study objects

The legacy as a city for cycling generally and front-runner in bicycle sharing specifically makes Copenhagen an interesting case for investigation. The city is in many regards in a good starting position, not struggling as much as elsewhere with the identified barriers to uptake of bicycle sharing mentioned in 2.2. Concerning Malmö, the city is one of Sweden's most recognized places regarding citizen appreciation of bicycle planning. It has been named 'Bicycle Promotion Municipality of the Year' 2011, 2012, 2013 and 2015 by the Swedish national cycling advocacy organization (City of Malmö, 2019b). This context position Malmö in a similar favourable position as Copenhagen regarding uptake of a BSS, this is why Malmö is an equally worthy place of study.

Additionally, the business and operation model may influence the system design of a BSS (see 2.3). So, as the two cities offer an opportunity to review BSSs with dissimilar business and operation models operating in similar policy contexts, this can offer a more accurate research result on system design irrespective of the societal context. The BSSs studied are the municipal systems Bycyklen in Copenhagen (public contract, run by a non-profit private commercial foundation) (Bycyklen, 2014b) and Malmö By Bike in Malmö (public contract, privately owned and operated, advertisement financed) (City of Malmö, 2020). Besides, the privately owned and operated Donkey Republic since they have an operation in both cities (Donkey Republic, n.d.-b).

Finally, the research was a collaboration with the Swedish Road and Transport research institution (VTI) as a small part of the EU-project Transport Innovation Gender Observatory (TInnGO). Primarily with the Scandinavian TInnGO Hub which "aims to explore the diverse mobility needs of different groups of citizens and to develop smart biking approaches that take these differences into consideration in the design and planning of relevant mobility measures" (TinnGO, 2019). The University of Copenhagen and VTI manage the Scandinavian hub, and apart from the fact that Copenhagen and Malmö are two cities prominent in bicycle planning and bicycle sharing, this is a further reason for the choice of study places.

4.3. Semi-structured interviews

The choice of participants in qualitative research is often conscious, called purposive selection. The purpose is to select people who are considered relevant to the study topic and thus can generate the most data (Van Thiel, 2014, p. 46). This form of selection also applies in this study by identifying relevant actors for the BSS to be analysed. This process was iterative because some knowledge of the system was needed to assess the relevance of the actors. As Yin (2015) stress, it is necessary to make the selection out of appropriate reasons and not out of convenience. In this study, the central aspect was that the interviewees had an overarching view over implementation, planning and management of the system and that the research had multiple respondents from diverse interest groups which provide improved validity and reliability to the collected answers. Also, for the municipal BSSs, multiple actors concerned with the same systems give verification of different statements. Table 1 shows the six selected and interviewed stakeholders, when cited in the thesis, these numbers are used following colon and a number to indicate which quotation referring to the specific information. For all quotations with codes see appendix 2.

Since the research investigated justice aspects in each BSS, it can be seen as a weakness that no responsible politicians were interviewed, as those can be said to hold the ultimate responsibility role in securing just outcomes of implementation motives and system design. Nevertheless, the interviewed actors provided a sufficiently good picture of the systems and events surrounding them to provide reliable research responses.

Table 1 Conducted interviews, number and date conducted.

Interviewee	Interview number	Date conducted
Planner City of Malmö	1	15 April 2020
Operator Malmö By Bike	2	20 April 2020
(former) Planner 1 City of Copenhagen	3	22 April 2020
Planner 2 City of Copenhagen	4	29 April 2020
Operator Bycyklen	5	23 April 2020
Respondent at Donkey Republic	6	17 April 2020

The topics that each interview covered differed slightly responding to each actor's position and presupposed knowledge, but they always had some common themes. These were among others,

business model, operation model, bicycle design, BSS goal, city motives, user and target groups, and payment model. The interviews also covered the stakeholders' experiences and motives, as semi-structured interviews give room for that. The form of semi-structured interviews was chosen since the research needed informative and detailed data to gain proper insight into the stakeholders' considerations (Bryman, 2016, p. 468; Yin, 2015). Even though interview guides were created beforehand, the questions were not always asked in a specific order, and all respondents formulated answers freely and discussed some issues outside the specified themes. Appendix 1 contains the interview guide.

The interviews lasted between 60 and 120 minutes. The interviews were conducted in Swedish with interviewees talking about Malmö By Bike as Swedish is the native language of the two interviewees and the researcher, and in English for Bycyklen and Donkey Republic since those interviewees are Danish. Every interview began with asking permission for audio-recording and was allowed in all cases. The recording was used for a clean verbatim transcription to increase transferability and dependability. Following the process known as respondent validation, the interviewees received their transcript to be given the chance of withdrawal of statements and checked for accuracy. This process strengthens trustworthiness between interviewer and interviewees, together with the validity of data and thus the whole research (Bryman, 2016, p. 385). However, four out of six interviewees confirmed the email; the rest did not respond but may be assumed to approve the content. The full transcripts are not included in this thesis and are confidential since respondents were given anonymity, insofar as to other persons than the primary researcher, a summary of quotations is nevertheless available on request.

4.4. Data analysis

The data analysis was inspired by Guest's et al. (2012) applied thematic analysis, who encourages the researcher to thematize the empirical material in different rounds and for different purposes to identifying distinct themes in the material. This analysis process also follows Yin's (2015) recommendation for the five phases a qualitative analysis must go through compilation, disassembly, remounting, interpretation, and conclusions; this study applied these phases.

Disassembly means that the content is broken down into smaller parts (Yin, 2015); codes that became visible here were, e.g. 'BSS goal', 'bicycle design', and 'type of travel'. Communication from each BSS and municipal documents complemented these descriptive codes. When completed, this information was used to ask the next question; how the interviewees talked about the usage. That is, what subscription, de-inscription and anti-programs do the interviewees suggest? This initial coding and assembly was thus the remounting phase, which showed each BSS's script. The identified scripts were lastly related to presented notions in transport justice, to answer the inquiry of distributive consequences derived from what is inscribed in the system design, simply put, the interpretation phase. From this, the main question and conclusions were made.

The data analysis had a combination of an inductive and deductive coding process. Inductive in the sense that the codes were gradually developed building to research on BSS. This process needed to be repeated until no new codes were found, which indicate that a so-called exhaustive coding scheme has emerged. Deductive in the sense that relevant concepts regarding the concept of script and transport justice were identified through the literature (Van Thiel, 2014, pp. 145–146).

4.5. Trustworthiness

Lincoln and Guba (1985) describes four aspects of reliability and validity, or in their words 'trustworthiness', these are credibility, transferability, dependability, and confirmability. First, findings are credible or have internal validity if the research method is set up properly, by applying a precise analysis as well as relating the study to similar empirical studies or theoretical perspectives (Bryman,

2016). This precision was aimed at by linking the research to the notion of scripts, transport justice research and previous research in BSSs.

Secondly, the external validity or transferability relates to what is known as 'generalizability' which is an inherent challenge within case studies (Yin, 2014). However, it would be almost pointless to conduct a qualitative case study if the research had no generalizability claim at all. For example, Larsson (2009) suggests that a case is a puzzle piece, which, based on the specific context of the study, contributes to solving a large puzzle. To assure transferability, the researcher should make a detailed description of a case, so that the reader can draw its judgments about the findings to another context. The third point regards the reliability or dependability; if all research data is available, others can assess if the original findings were valid. Lastly, confirmability regards the researchers' objective viewpoint of the findings (Bryman, 2016).

Moreover, by using triangulation, the validity can be further strengthened. Triangulation means that several methods of data collection are applied or that the researcher chooses several data sources; for example, different people, places or times expressing the phenomenon (Yin, 2015). This study applied partial triangulation in the form of several data collection methods but emphasized interview data; in other words, the use of different interviewees commenting on the same topic as a form of triangulation. Furthermore, interview participants who represented different actors were actively selected to increase variation in standpoints. The validity of the study was also strengthened as respondents were allowed to comment on the collected data material. Clarification of certain questions also took place continuously with the participants via e-mail correspondence.

5. Findings and analysis

This chapter begins with a brief description of the mobility policy context in each city and background of studied BSSs, followed by the analysis process, as shown in Figure 3. System design and anticipated use have been analysed, which reveals the script for each BSS; leading to a division of aspects between suggestions from transport justice research and the traditional transport planning approach.

5.1. The cities' mobility policy context

As earlier described, Copenhagen has a robust institutionalized biking culture and identity (City of Copenhagen, 2011, 2013, 2014, 2019), and can also be considered a front-runner in BSSs with its former large-scale BSS implement already in 1995 (Fishman & Allan, 2019). This is persistent with evermore comprehensive goals for cycling; for example, by 2025, half of all trips to workplaces or schools are to be made by bicycle (City of Copenhagen, 2012). In 2018, 49% of all these trips were made by bicycle, so the city is near its goal (City of Copenhagen, 2019). Yet, this may generate an idea about cycling as 'for everyone' with insufficiently precise planning measures about who everyone is. Telling for this view is wording such as, "Choosing the bicycle happens regardless of age, wage or gender" (City of Copenhagen, 2011, p. 8). Though this is a common tendency, as an example, several BSS operators in the U.S. was found to have "statements employing general language such as 'providing accessible and affordable bicycles for all' or some variation thereof"(Howland et al., 2017, p. 8). The city might in practice work with some diversity-related issues in bicycling, but without explicitly stated strategies. Authorities and providers can seemingly also write vague goals without taking any action on diversity, i.e. the other way around.

The city of Malmö's mobility goals likewise emphasizes growths for active mobility (City of Malmö, 2013, 2016, 2018), albeit not as extensive as Copenhagen's. The goal for Malmö is that 30% of the residents' trips should be made by bicycle by 2030; the latest figures indicate a bicycle share of around 25% (City of Malmö, 2019a). However, policies for inclusion and justice in mobility planning are slightly more explicit. Both steering documents from the region of Skåne (the highest political body in the area) and the City of Malmö concludes, for example, that since women, children, and disabled individuals use and rely more on public transport; resources to public transport and bicycling is strengthening these groups' accessibility (City of Malmö, 2013, 2016; Region Skåne, 2017, 2018). This assumption indicates some awareness of inclusive perspectives and diverse needs. Consequently, there are some differences between the cities, but overall, they have similar mobility objectives.

5.2. Brief background of each BSS

Bycyklen or 'the white city bikes' was launched in 2014 and contract holder is now 'By- og Pendlercykel Fonden' (The Urban and Commuter Bicycle Foundation), which is a private commercial foundation founded by the contributors Danske Statsbaner (DSB) (the largest Danish train operating company), municipality of Frederiksberg, and the City of Copenhagen. The fund is non-profit, and a requisite in the statutes dictate all profits to be reinvested in green mobility. Bikeshare Danmark A/S is the operating company; they own all hardware and is responsible for operation and customer service (Bycyklen, 2014b). The purpose of Bycyklen is to be 'the fourth leg of the public transportation' and to "promote green and healthy transport as well as to reduce congestion and CO2 emissions" (Bycyklen, n.d.-a).

Malmö By Bike is a BSS initiated by the city of Malmö, and the outdoor advertising firm Clear Channel won the procurement. The system opened in central Malmö, May 2016, with 50 stations and expanded at a second stage to about 100 stations in the city, and a total of 1000 bicycles. The BSS is fully financed by Clear Channel and by a minor part user fees. The municipality receives the BSS in exchange for existing advertising-funded weather protections and city information boards to Clear Channel. The system's primary purpose is to serve as a complement to the city busses and as part of a multimodal journey into the city centre with public transport (City of Malmö, 2020).

Donkey Republic is a Copenhagen-based BSS created 2015 and is nowadays a global company operating in 50 cities with a total of 15,000 bicycles, around 3000 are in Copenhagen and 300 in Malmö (interview 6:1; 6:24). They are funded mostly by user fees and the founder perceive the company as "a new bike-sharing service that's going to disrupt urban transport". Additionally, the company withhold a political advocacy side (Walker, 2015), evident through their goal "… to make urban transportation simple and more sustainable, as well as to make city life in general better for everyone" (Donkey Republic, n.d.-e).

5.3. The system design and expected use of examined BSSs

This section presents the system design for all studied systems, giving indications of how and who can use each BSS. Table 2 below shows an overview of key characteristics for each examined BSS.

Table 2. Characteristics of studied BSS, listed categories suggest some measurements upon which social exclusion may be contingent. Source, own compilation from each system's website.

BSS	Cycle type	ICT required	Pricing model	Payment form	Temporal constraints	Spatial constraints	Mode of provision
Bycyklen	Uniform unisex electric bicycle	Smartphone and internet access	Fee for duration	Payment card	Cost of duration	Strongly encouraged to park at automated stations, stop and lock on the way allowed	Public contract, run by a non-profit private commercial foundation, sponsorship and user financed
Malmö By Bike	Uniform unisex pedal bicycle	Smart card or smartphone and internet access	Year or 24/72-hour subscription	Payment card	Unlimited one-hour rides during the subscription period	Required to park at automated stations, stop and lock on the way forbidden	Public contract, privately owned and operated, advertisement financed
Donkey Republic	Uniform unisex pedal bicycle and electric bicycle	Smartphone and internet access	Fee for the duration or monthly subscription	Payment card	Cost of duration or unlimited 1 to 24-hour rides during the subscription period	Geofenced automated hubs, stop and lock on the way allowed	Privately owned and operated, user financed

5.3.1. Information, payment systems and pricing

As has been explained, transport expenses can be a potential barrier to movement, and the relative cost of transport as a proportion of total income makes the impact uneven across income levels; moreover, payment card requirement can additionally be an obstacle for some (Carney, 2012; Lucas et al., 2016).

All systems studied require payment cards for transaction and registration (Bycyklen, n.d.-b; Clear Channel Sverige AB, 2019a; Donkey Republic, 2019), even though both interviewees from Bycyklen and Donkey republic clarified that other forms of electronic payment options were forthcoming (interview 5:21; 6:8). The interviewee from Donkey Republic explained how the payment system could affect users and the company's upcoming changes like this.

> *In January, we released Ideal as a payment option, and before that, it was only Visa and Mastercard. That limited students and even early professionals, for instance, in the Netherlands to join. We are also in the way to release PayPal since it was a limiting factor for Germany and parts of Europe where people cannot easily get credit cards or even debit cards. But in Denmark, we have a different situation, it is quite normal to get a credit or debit card with whatever income group, and that's where we see the rather equal division on users' income levels (interview 6:8).*

So, the national contexts are significant in this situation as mentioned by some respondents (interview 5:21; 6:8), since payment card ownership is among the highest in the world in both Sweden (98%) and Denmark (97%) according to data from The World Bank (2017).

Besides the prerequisite to holding a payment card, Bycyklen and Donkey Republic (Bycyklen, n.d.-b; Donkey Republic, 2019) oblige internet access and skills to obtain price information and register as a user, in addition to a smartphone that is required to find and unlock the bikes. Malmö By Bike similarly has an app and information online, but also a few stations with physical pay stations (interview 1:22; Clear Channel Sverige AB, 2019a). By providing physical pay stations, Malmö By Bike opens up to users who are not as interested or knowledgeable in the latest technology, making their script slightly different from the others in that regard.

The systems have different price models and pricing. Some examples, Malmö By Bike's year subscription for €24 with an unlimited number of one-hour trips during the period (Clear Channel Sverige AB, 2019b); Donkey Republic has monthly membership for €12-14 with an unlimited number of one- or twelve-hour trips besides pay-as-you-ride for around €0,15/minute (Donkey Republic, n.d.-d); Bycyklen does not have monthly or annual subscription, instead they have pay-as-you-ride for around €0,15/minute and the opportunity to get lower minute prices if you buy several hours into your account at once (Bycyklen, n.d.-d). Respondents from all systems indicate that they consider their pricing to be low enough that all income levels should be able to afford to use their BSS (interview 2:9; 5:4; 6:3; 6:6), section 5.4 elaborates this further.

5.3.2. Physical access and bicycle design

As mentioned, concerns have been stressed over the excluding effects of homogeneous bicycle design in many contemporary BSSs (Nixon & Schwanen, 2019; Sherriff et al., 2020). This type of homogeneous bicycle design is equally true for all systems in this study.

Bycyklen's bicycles are identical electric bicycles with three gears, adjustable saddles, locks for locking outside designated stations, luggage carrier in front and back, and tablet for information and GPS (interview 5:3; Bycyklen, n.d.-b). Electrical assistance was not a requirement during the procurement, nor was it primarily announced as an aid function for users, it was rather emphasized as 'innovative' and was a necessity to support a modern redistribution software installed in each bicycle (interview 5:22; 3:36). Section 5.3.3 below, further explains the reasoning for the electrical assistance. None of the interviewees was part of the procurement process back in 2013, but the operator of Bycyklen explained the choice like this.

INT: But have there been any requirements in the tender regarding the design? Stating an inclusive design, able to be used for so-and-so, being electric for ease of use for example?

RES: No, it was not mandatory to be an e-bike. But the company who proposed and actually won the tender. One of the reasons that they won was because they were considered most innovative compared to the other bidders, as I have been told. I wasn't part of it myself, but I been told that those who won was the most innovative. Both because of the e-bike proposal and the tablets. That was actually regarded as a really innovative feature. I mean, put tablets on the streets on every bike back in 2013 it was actually quite cool (interview 5:23).

Another reason for this choice was also that the tablet made it possible to use GPS without internet access. This was seen as an innovative advantage when the system was developed since it was expensive for foreign tourists to use the internet at this time. Internet charges have significantly changed since then, so now the tablets are somewhat obsolete and are gradually removed (interview 3:35). Last summer, an app was developed as a substitute for the tablets, which the interviewee sees as simplifying the registration process and reduces the need for maintenance (interview 5:27; 5:28). Of course, while it is not only tourists who may have less internet access, this does say something about whom the stakeholders regard as users. Offering GPS-tablets is one way to make the bicycle more inclusive and not only innovative; but 'innovative' was thus the keyword, rather than inclusive for different user groups.

Malmö By Bike has third-generation pedal bicycles also uniformly designed with three gears, luggage carrier in front, adjustable saddle and no locking option outside stations (interview 2:24; 1:31; City of Malmö, 2015, p. 10). This bicycle design was developed by Clear Channel and accepted by the municipality when the company presented its proposal. Nonetheless, the municipal interviewee explains that they have discussed shortcomings in the chosen design afterwards, such as the possibility of having child seats and other accessories that would broaden the utility of the bicycles. However, the municipal actor finds it difficult to change now after the procurement process and during an ongoing contract period.

RES: … women may do other types of travel and may need their own bike a little more. You have the basket and seat for the child; I do not know.

INT: Were there any such thoughts when you were designing the bike?

RES: Yes, or we have discussed it afterwards anyway. I don't know if anything was said about it during the procurement process.

INT: Like seats for children?

RES: Yes exactly, and then all bikes would need to have it, and it should be safe too. It puts quite high demands on us then that it is appropriately maintained. It is not possible that only some bikes have it because it does not work.

INT: Yes, you have to know as a user that it is always available?

RES: Yes. You have some requirements on the bike there in the assignment description. That it would meet the requirements of the Transport Board regarding light and reflections and so on, it needed to be unisex bikes. Then we accepted the bike that Clear Channel presented. Then it is difficult to make adjustments now because we have a signed contract (interview 1:29; 1:30; 1:31, my translation).

From these quotes, it is clear that the municipal interviewee understands that the chosen bicycle design constraints certain uses and reflects if the current design limits women especially since they are assumed to travel with children more often than men. In contrast to this perspective, the operator explains the chosen design as follows.

> *Yes, and it is designed in such a way that it should fit short and long, you can adjust the saddle. It has a simple basket with a rubber strap so that women who often carry a handbag with them can put it in front, but you can also have another bag or if you have been in the shop and bought something. There is foot brake on it and also handbrake. The foot brake is important because, if you only have a hand brake, many people are used to braking with the feet, a pure safety aspect. We have made it to suit all types of people and as robust as one can have it. But also keep down on features, so the bike doesn't cost too much (interview 2:24, my translation).*

From the operator's point of view, maintenance, cost, and security are their concerns as the bicycles are already perceived to be able to suit everyone (interview 2:16; 2:17; 2:24). Also interesting is that the image of what women need is space for a handbag, which shows a stereotypical interpretation of gender. The need to carry luggage, regardless of gender, can hardly be met through space for a handbag. This reasoning gives strong indications that they see it as a necessity to follow the logic of the economy of scale and that 'everyone' only concerns those who fit within the prevailing business and operation model.

Donkey Republic has mostly pedal bicycles with multiple gears but also some with electric assistance all uniformly designed, adjustable saddles, locks for locking outside designated zones, luggage carrier in front and back, and following ISO 4210 standard for safety and performance requirements (Donkey Republic, n.d.-a). Moreover, among the examined BSSs and stakeholders, they are the only one with a stated 'equal opportunity and diversity policy' (Donkey Republic, n.d.-c, p. 5). Though, when the respondent told how the policy was applied, it proved that the influence was minor.

> *INT: I had a question regarding the design of the bikes. You think of course a lot about maintenance and quality for the design of the bikes. Have other thoughts of inclusion had an impact on the design of bikes? You have an equal opportunity policy. In it, you state: "Challenging discriminatory assumptions about disabled people and to providing reasonable adjustments to ensure disabled people have access to our services". Can you tell me more how this provision of reasonable adjustments is made?*

> *RES: I think the main thing is introducing electric vehicles, e-bikes, yeah. So, I think the number. I think 25% of the grown-up population cannot use pedal bikes. They don't feel comfortable; some of them have injuries; some of them cannot put the assistance needed to effectively move around on a bike. Besides that, I don't think we have included any alerts or messages into the app, but I don't think we have adopted any of that so. Just the focus on electric vehicles has been the part of that. (interview 6:9)*

As the quote above indicates, Donkey Republic shows awareness of individuals' various physical abilities and how it can affect the ability to use their service. Both their policy and the respondent indicate this awareness, although the understanding is only evident by offering electric bicycles.

5.3.3. Provision of service, the anticipated type of travel and business model

Provision of services regards the spatial distribution of the system and how this unavoidably favour some destinations and thus citizens over others. As earlier described, research has linked this to be a

factor explaining the under-representation of particular user groups (Ursaki & Aultman-Hall, 2016; Uteng et al., 2019). The station placement, along with providers' and cities' objectives, indicates what type of travel is 'allowed' by the system. All this can be called the configurators' anticipated type of travel, which this section describes for each BSS.

Bycyklen's 130 stations are placed in the municipal area of Copenhagen, Frederiksberg and lately also the neighbouring municipality of Rødovre. These are all central parts within the larger greater Copenhagen area. Within this area, the BSS's app map reveals a fairly evenly distribution of stations suggesting no prioritization of specific neighbourhoods, built on the likeliness of uptake for example. The respondents also confirmed this universal allocation and by referring to the procurement contract (interview 5:8; 3:59). Nevertheless, a prioritized user group that is mentioned by interviewees, on their website, and through the stations' location are commuters (interview 3:12 3:18; 5:24; Bycyklen, n.d.-e). With 46 of the docking stations located at S-train (a hybrid urban-suburban rail network operated by DSB, serving the Copenhagen area) and metro stations, Bycyklen aims to be the 'fourth leg of public transport' (Bycyklen, n.d.-a). The clear focus on commuters and BSS to transit integration is the foremost BSS-goal which comes from a city-led attempt to tackle congestion (interview 3:61; 5:3). The Copenhagen bicycle strategy, from 2011, also states this focus, where BSS and transit integration is stated and understood as a measure against congestion (City of Copenhagen, 2011, pp. 18–19). Besides strengthening the journey for already train-commuters an indirectly anticipated type of travel can thus be seen, former car travellers.

Additionally, the electric assistance is understood as enabling longer bicycle commutes (interview 3:34), and according to Copenhagen's regional transport authorities, untapped potential exist for more cyclist-commuters between 5-20 kilometres, as shown by a pilot project called 'Try an Electric Bike' receiving a promising response from participants (Incentive for the Capital Region, 2017). The conceivable utility of Bycyklen can then seem promising, especially since another respondent argues that a second goal for Bycyklen is to give residents the chance to try an electric bicycle before making their own purchase (interview 5:6). This goal can be seen as a new utility of the electric assistance, as the initial reason was, as previously explained, a necessity to support the redistribution software and the integrated tablet. Particularly noteworthy is the reasoning behind the tablet, since it was explained as support to tourists (interview 3:35), even though the BSS itself is highlighted as primarily designed for commuters. The necessity to still focus on tourist explains an interviewee like this.

> *The numbers I know from Bycyklen is that the money is made on tourists. The commuters they break even pretty much, they are making no surplus on the commuters. So Bycyklen is doing something for the commuters because they are obliged due to the contracts with the municipalities. But they also know that if they want to do any development, they have to get into the tourist market because that's where the money is made (interview 3:16).*

This focus is also confirmed and explained as an economic necessity by Bycyklen's operator in order to maintain the areas they are obliged to support (interview 5:12).

> *… because we have been in the city from 2014, we actually do know in which places the bikes earns the most. So, when they put all these newcomers, without a licence, in the places where it commercially makes the most sense. Then actually, they make it harder for us to support all these areas that we are obliged to support (interview 5:10; 5:11).*

Lack of regulating competition in the form of other micro-mobility solutions and BSSs have been a large issue for Bycyklen and weakens the conditions of the initial business plan. Hence, some politicians oppose the competition, whereas others oppose public spending on Bycyklen which they perceive as a 'tourist mobility system'. Yet others view competition as positive to spur the best possible function

(interview 3:4; 3:25; 3:26; 3:29; 4:2; 4:4; 4:22; 5:9; 5:11; 5:12; 5:13). So, even if commuters are the main target group, the tourist has already from the start been an indirect necessity of the BSS, both affecting the business model and initially even the bicycle design.

Similarly, Malmö By Bike's target groups are, according to the 'Service concession for rental bicycle systems in Malmö — Mission description', mainly public transport commuters, then tourists and lastly Malmö residents. The system is thus primarily for a commute to the city centre and to relieve the inner-city buses by transferring passengers from bus to bicycles. The second target group are tourists as the BSS is perceived to be beneficial for all visitors to discover the city. Finally, the municipality hopes that citizens living in the city will get the opportunity to try cycling, and can use the BSS as an extra bicycle when residents do not have access to their bicycle. Together with public transport, the city regards the BSS to be a competitive alternative to the car, which can increase the number of travellers with public transport (City of Malmö, 2015). Similar to Bycyklen, an indirect expected type of travel appears, former car travellers; as Malmö By Bike, is assumed to increase the attractiveness of public transport.

The operator and municipality carried out the implementation of the BSS' in two stages, the first focused on the centre and public transport to workplaces, and the next workplace and less well-off areas (interview 1:19). The municipal interviewee remarks on the implementation stages as follows:

> *But you started to build it from the centre, and then in stage 2, you come further out. Then we highlighted vulnerable areas in the destination point analysis in Stage 2. Workplaces and vulnerable areas were the first, or what you say, yes to lift those areas in every way we can. We know that not everyone has access to a bicycle of their own in these areas. (interview 1:20, my translation)*

Despite the relative high bicycle modal share (in comparison to other Swedish cities), access to bicycles varies widely between the different neighbourhoods in Malmö, where the neighbourhood of Rosengård, for example, is characterized by the fact that about a third of the residents never or rarely have access to a bicycle (City of Malmö, 2015). However, as the interviewees explain the service is not meant to compete with bicycle ownership or regular rentals for tourists, and the requirement to only park at the designated stations (since the configuration forbids stop and lock on the way) constrain the use. The interviewees do not, therefore, regard the usage scope as a substitute for regular bicycles (interview 1:5; 2:8). The emphasized motivation is that the system aims to fulfil another need and is primarily an extension of public transport, what the municipal interviewee calls an "A-to-B-trip" (interview 1:5; 1:6). The municipality must, therefore, consider that it is this type of bicycle trip the inhabitants of the vulnerable areas lack, rather than access to the full uses of ordinary bicycles. However, as a respondent in a previously mentioned study argued, access to a BSS might not always be the answer (see 2.3); which led Nixon and Schwanen (2019, p. 3) to propose that "if the focus is on refugees and asylum seekers, then donating bikes is far less complicated than sharing and likely a more frugal option with respect to space, opening hours, and/or expensive coordination and payment technologies". Hence, if it is general access to bicycles in these areas that the municipality strives to fulfil, there are alternatives that might work better. Especially as the motive to enhance access to bicycles and the BSS's aim to fulfil a particular bicycle trip appears inconsistent. Still, the stations' placement of Malmö By Bike in the vulnerable areas indicates that it supports a universal allocation, thus also shares similarity with Bycyklen in that specific aspect.

Notable in this regard is that the above described BSS's aims are the municipal objective and perspective. The interviewee from Clear Channel, on the other hand, explained that they have no goal of their own because they simply want the BSS to be used by everyone as much as possible (interview 2:7; 2:25). This is so that the city authorities or the citizens do not question the link to advertising, and the company can motivate all advertising objects in Malmö (interview 2:26). That is, 'everyone' who

are currently able to use the BSS in its current form and where the individuals' needs fit the providers' script; which means according to the majority of users' demand.

Similarly, Donkey Republic needs to follow demand but give another reason on why. The BSS is part of the forthcoming fourth generation in the sense that they include varying new features such as electronic lock and self-service hubs (geo-fenced rental locations) instead of physical docking stations, what they call 'The hub-centric model' (Donkey Republic, n.d.-f). The hubs are spread out in the municipal area of Copenhagen and Frederiksberg, and in Malmö, they are mainly in the central part of the municipality. The respondent explains their standard procedure behind hub placement as follows.

> *So, we do create typically a large coverage area, and we see the peoples' riding pattern over time and then, based on that we create a second version of the map of drop-off zones. So, we might create more in some area where there is a lot of demand, and if we have a lot of dormant bikes in an area, we might close some hubs there. Because making an estimate without actually putting the service out there is rather difficult, based on bus routes or entertainment and so-and-so. So, we actually go there to put the bikes to see what the demand is. (interview 6:17)*

So, their anticipated type of travel becomes somewhat fleeting and responding to the demand. The demand is, in turn, a result of what bicycle design and operation model allows, as such, the demand is already constrained. The company intends to enable different types of travel and users. On their website, one can read the following about users.

> *The system serves multiple types of users: city residents — with different membership plans based on the frequency of usage, and visitors — with features such as group booking and the possibility to keep the bike for their entire visit. (Donkey Republic, n.d.-e)*

Still, as explained by the respondent, they need to focus on demand which derives from their business model in which Donkey Republic needs to be self-sufficient through user fees since they often do not receive subsidies from the cities they operate in and consequently cannot provide low use areas in those cities (interview 6:18; 6:20).

5.4. The BSSs' design and implications for users

The previous section described three different system designs alongside expected use for each BSS. This section explores the interviewees' indications whether the recipients are acting or not as anticipated. These are explored as suggestions of subscriptions (the user follows intended use), de-inscriptions (the user renegotiate the use), and anti-programs (individuals oppose anticipated use). Worth repeating, as this derives from the stakeholders' considerations, these indications on citizens' responses are still part of the script-formulation together with the BSSs' design and expected use presented above. However, the stakeholders' considerations over recipients' acts, offer further hints on the imagined use, user and user's needs, i.e. the script.

Although there are data and information regarding use of the BSSs, the interviewees' possibility to share actual documents from conducted user surveys were unfortunately weak due to diverse reasons, among others lack of response and organizational secrecy. Consequently, actors' orally conveyed knowledge and understanding of the use was the basis in the following section.

5.4.1. Expected and unexpected responses

At least one interviewee from each BSS shared key insights on how and who uses their system. All systems have a gender distribution of fewer women than male users and mostly young adult users (interview 1:28; 5:26; 6:6; 6:10), indicating similar subscribers as what has been found elsewhere. This

user turn-out can hardly be considered a surprise as the system design for all BSSs studied is quite conventional, which would attract a similar type of users.

Nonetheless, as explained before, all systems considered that their prices were low enough so that all income levels could use the service. For Malmö By bike, the low fees are deliberately set by both the city and the operator, to "create a feeling that it is so cheap that everyone can afford to buy an annual pass" (interview 2:9, my translation). The planner from the City of Malmö confirmed this and explained that it was a requirement in the procurement that it should be a low fee (interview 1:13). The respondent from Donkey Republic provided a similar picture by referring to their user survey which had revealed that they had a relatively equal representation of income groups based on the six Danish tax levels, with slightly more in the lower-income groups (interview 6:3; 6:5). The respondent continued by contemplating that "… also for the occasional user are the bike usage costs relatively low compared to e-bikes or e-scoters. I think the pricing level set the tone for whom the service is for" (interview 6:6). Bycyklen's goal is similar to Malmö By Bike, and one respondent said that all income groups travel with the S-train and hence that Bycyklen similarly does not disregard any level of income (interview 3:53; 3:56). The interviewee also mentioned own observations of students and food deliveries using the bicycles as examples that all income groups are represented (interview 3:47). These are all suggestions of user-subscription by the interviewees as indications that all income groups can use their BSS.

Although, social aspects such as different user groups were not as much of a focus during the implementation phase of Bycyklen, as improvements in mobility in terms of public transport integration (interview 3:56; 4:24). So, it can be disputed if the above examples can be understood as suggestions of subscriptions or if it preferably should be seen as de-inscriptions. Though, what is clear is that Bycyklen has primary attention towards commuters instead of tourist as Copenhagen's previous BSS, even if, as previously explained, tourist still is a business inevitability. However, in 2018 at least 80% of Bycyklen's users were locals (interview 5:24; Bycyklen, n.d.-e), although, this was not always the case and the system has received plenty of criticism since its introduction (Behrendt, 2014; Rathje, 2019). For example, one year after the launch, it did not live up to its goal of three rides per day per bicycle by local commuters. Instead, they were only used 0.8 times a day and mainly by tourists (Andersen, 2015), and ridership has also been unstable, usage decreased 22% from 2016 to 2017 (Bencke, 2018). Despite the troublesome start the BSS endures, in April 2018, Bycyklen had one of its biggest successes (interview 3:32), when the neighbouring municipality of Rødovre joined in (Kraul, 2018). During the first years of this expansion, it lived up to set objectives. According to the municipal interviewee, this shows the business plan has potential, and there are reasons for the city to invest, as well as, commuters who request the service (interview 3:32). However, it was not clear from the interviews whether this 80% of local users are commuters (i.e. user-subscription) or not, even if it was implied.

Malmö's BSS was likewise anticipated to support out of town public transport commuters travelling to the city centre for work, and according to the city of Malmö, their municipal BSS has been well-received. They are declaring on their website that many residents use the BSS, both commuters and visitors. With daily use of about 1800 trips and about 12000 trips in a week (City of Malmö, 2020). However, the most significant user group has become local citizens living inside the centre and in a survey conducted 2017 leisure trips were the most common, followed by work trips (interview 1:16: 1:35).

> *We get statistics from Clear Channel. There we have a little about users, age and gender. We have also asked for postal codes, to know which areas they live in. To follow up, if there are commuters we reach. What we could see then, is that it is primarily Malmö residents. We never got that far down that list to see if there were any commuters. So, it's also a little interesting. You could say that there are some flaws in our follow-up regarding whether we actually reached the target groups (interview 1:16, my translation).*

This consideration of the usages can thus be seen as a suggestion from the interviewed planner of de-inscriptions. Although they aimed to support commuters, the city has not followed up on its actual use. User numbers are thus highlighted on the city's website as a success, even though the target group of the BSS is not reached.

Regarding Donkey Republic, their system design lacks a specified target group beyond what is cost-effective users' demand. Hence, all use is perceived as expected use within their system. As such, use in any form can be regarded as subscription and not de-inscription explained by the company's fleeting target group.

5.4.2.Suggestions on user barriers and reasoning for opposition to the anticipated use

This section now turns to rejections of the BSSs and describes the stakeholders' primary considerations on why some do not use or cannot use their system. That is considerations on user barriers or suggestions of anti-programs.

The main opposition mentioned by several interviewees was citizens' bicycle ownership, which reduces the usefulness of a BSS. This opposition is noteworthy as the anticipated area of use does not aim to compete with one's bicycle, rather it seems aimed at complementing it (interview 1:2; 3:18; 4:21) For example, if a traveller comes by public transport to Malmö, bicycle sharing is understood as a better alternative than offering the opportunity to bring their bicycle on the train (City of Malmö, 2015, p. 3). If the citizen owns a bicycle or not should thus not matter in this case. Furthermore, in Copenhagen, there is an incredible number of bicycles, close to two per inhabitant. This fact has also been part of the criticism against the introduction of the municipal BSS. In one point of view, tourists and people coming into the city are mostly targeted, and not citizens who are the ones voting for the politicians and paying for the BSS via taxes (interview 3:23; 4:22). However, according to the operator from Bycyklen, it can be used in new ways in which these citizens could benefit. For example, as an extra bicycle or for one-way trips, explaining it like this:

> *But it's still an obstacle, even though we talk a lot about sharing economy. I mean, it's not everyone that has bought into that concept yet. I mean, I think we will see a lot more of that. But people need to discover the good things of sharing, the flexibility it gives you. You could bike out in the morning when the sun is shining, and when you have to go back, you don't need to bike because it's not your own bike, if it's raining. You could just take the bus or train if that's more convenient because of the weather have changed (interview 5:29).*

Consequently, the operator suggests that the benefits of sharing economy are not yet clear to everyone and that this and ownership stands in the way for some individuals to realize benefits that only a BSS can provide. Yet, the flexibility that BSSs provides may not always compensate for the difficulties in the bicycles' uniform design (as was shown in section 2.2). Only the planner from Malmö, as also previously described, contemplated about the fact that the bicycle design may not meet a specific need, and that ownership, therefore, is essential (interview 1:29; 1:20; 1:31).

> *INT: Why do you think so? Why do you think men are more?*
>
> *RES: Good question. Perhaps they are more inclined to adopt such a system. In the case of cycling, in general, there are a little more women who ride bikes than men. Although, now it is about 50/50 in the latest statistics. But women may do other types of travel and may need their own bike a little more. You have the basket and seat for the child; I do not know (interview 1:29, my translation).*

The mentioned critique of the non-inclusive bicycle design through the homogenous economic of scale approach could also be extended to include unstandardized uses also by individuals with an average

body who fits the bicycle design. That is, even if one has a body capable of utilizing the standard shared bicycle, the same individual may sometimes have a need that requires more diversity in options of bicycle designs. For example, if travelling with children or if carrying considerable baggage.

Even when individuals do not own a bicycle, such as the mentioned situation of many residents of the Rosengård district of Malmö where many immigrants live who usually are without broad bicycle familiarity (City of Malmö, 2015), spatial access to a BSS may be of no use unless combined with other measures. This situation is common and was also depicted for Copenhagen, so a planner from the city speculated if other micro-mobility options such as e-scooters might be more intuitive and hence useful than access to, for instance, Bycyklen (interview 4:18). Though, both Copenhagen and Malmö have schools that teach immigrants in general and specifically immigrant woman how to ride a bicycle, which is a measure that is required if bicycle-sharing is to be useful in some urban regions according to interviewees from each city (interview 1:22; 1:24; 1:26; 4:18). In Malmö, the planners intended to use this platform for marketing during the implementation stage two of Malmö By Bike, to physically meet citizens partaking in the city's cycling schools and discuss their awareness about the new BSS (interview 1:26).

Additionally, multiple interviewees describe that information about the system requires technological knowledge and interest (interview 1:22; 2:39; 3:43; 4:20). For example, a barrier to bicycle sharing for the elderly may be due to lack of internet skills if the registration process and payment systems only are available online or via smartphone (interview 1:22; 2:39; 3:44). One respondent further considers that the uncertainty and discomfort make the elderly prefer walking or public transport (interview 2:40). However, the only enabling quality that is considered by respondents is that electric assistance might help elderly and other unfit individuals to use the system (interview 3:39; 6:9). So, as literature have previously shown, and also these examples indicates, lack of skills and unawareness can be a barrier and reason to non-use.

Even if the interviewees understand that elderly is an underrepresented user group and representatives for each system give similar thoughts on the constraints, no one indicates that they plan to lessen these barriers. It seems that all presuppose that elderly and others for whom the technology is a barrier, cannot use the system and do not want to. None offers reflections that these potential users might desire to travel with the BSS even though they currently are unable to obtain it. Even if they reflect upon constraints and ability, the outcome is similar thinking as presented in Figure 2 for the "self-reinforcing rule of demand based on existing conditions"–the implicit assumption of the non-use as a result of free choice.

5.5. What transport planning approach does these considerations entail?

Finally, this section offers the indications that point to a system design following mostly proposals from research on transport justice or mostly the traditional approach for transport planning. The thesis main proposition explained that just transport planning aims to reduce inequality of opportunity. In contrast, a primary focus on demand and functioning of the system rather than users signifies a traditional transport planning approach.

As should be clear from the previous sections, all studied systems appear in many respects to follow the typical system design of BSSs. For example, their payment and registration systems are mostly online, and stations are automatic without staff, these solutions are accessible for most but not all, something which the interviewees also showed they knew but accepted. This configuration and understanding point to a focus on function for the masses without concern for varied user needs. Secondly, the bicycle design is homogenous bicycles with few adjustable functions, similarly suitable for most users and many uses but not all, indicating adherence to the economics of scale rather than diverse user needs. These are two typical features of many contemporary BSSs.

When considering the provision of service, Donkey Republic needs to geographically offer their service according to demand since they receive no subsidy from the cities or other income than user revenue. Whereas, the interviewees from Bycyklen claim not solely to follow the demand for their spatial distribution, but also caters to need and aims to support universally across their area of operation. This aim is much like how public transport is formed in many cities to cover the entire city, where revenues from high-traffic areas offset the losses from low-traffic areas by additional grants to provide the population with the service. Similarly, Malmö By Bike indicates that they aim to cover areas with regard to need, not only demand. By deliberately focusing on vulnerable areas to strengthen these residents' transport options in 'every way they can'. Malmö decided, however, to combine their BSS with the sale of city advertising, to cover the costs of the comprehensive service. The financing differs among the examined systems, yet all claim to set prices at a level possible to pay for all income levels; which is an example of how they adapt to different conditions of individuals.

These two examples, the provision of service for Bycyklen and Malmö By Bike and all studied BSSs' concern on pricing, follow suggestions from transport justice. Nonetheless, they are the only ways the stakeholders signify their systems are designed to support a reduction in inequality of opportunity. Hence, in most regards can all studied BSSs' design in Copenhagen and Malmö be considered to follow a traditional transport planning approach, mainly with viewpoints on the transport system rather than a user-centric outlook. Moreover, with their current system design, each BSS mainly strengthen the situation of a usually accessibility-rich group of residents, if referring to the actual foremost user group.

A planner in Copenhagen explains that this is partly due to city authorities' will or lack thereof. With little political interest on diverse user groups or strengthening the position of risk groups to transport disadvantage, little is made towards that end since it is not part of the BSS's objective, as the planner explains.

> *In the end, it's our politicians who decide the regulation. It hasn't been something that they have been asking a lot about 'how do you get a wide diverse user group'. But it could be, I mean, it's something that in general as the municipality we are interested in. (interview 4:18)*

The political interest thus clearly set the agenda for how and what benefits a BSS is supposed to deliver. Both in Copenhagen and Malmö, the integration with public transport is a stated goal, strengthening the catchment area and working as a last-mile solution mostly for the trains. Accordingly, this is a response to other social and environmental concerns, primarily that of congestion, rather than strengthening accessibility for transport disadvantaged citizens. So, public transport commuters are perceived as the primary target group, while this ambition to reduce congestion, inevitably and paradoxically, also result in a focus on car owners and users, although the scientific basis for such a transfer is weak. Consequently, the approach tends to support travel patterns of prior car users and others who are accessibility-rich citizens rather than those in greater need and risk of transport disadvantage, following another identified outcome of traditional transport planning.

6. Conclusion

This thesis has described that the prevailing system design of most BSSs does not equitably distribute their benefits, and hence, risks generating similar difficulties as transport justice research has been able to show with the traditional transport planning approach. Contemporary BSSs are often less useful for 'transport disadvantaged' groups while more fitted to the needs of 'transport benefitted' groups, by focusing mostly on demand and market solutions which adheres to the majority while lacking recognition of diverse and unique needs. This exploration of BSSs and transport justice research led to the thesis' main proposition — transport injustice prevails in the typical system design of most BSSs. However, BSSs hold many acclaimed potentials and reported benefits such as reducing traffic congestion, increasing cycling modal share with subsequent health improvements, and justice benefits due to its implied inclusion of 'everyone'. Nonetheless, the full inclusive potentials have accordingly not been fulfilled, yet research in the field often focus on matters within the prevailing system design which risk confirming the exclusionary features rather than challenging and improving upon its social aspects.

Therefore, this thesis examined three BSSs through an in-depth case study of two Scandinavian cities, Copenhagen and Malmö. The BSSs that was studied is the municipal systems Malmö By Bike in Malmö and Bycyklen in Copenhagen, as well as the private company Donkey Republic since they operate in both cities. As the two cities allowed reviewing three BSSs with dissimilar business and operation models, yet which work in similar policy contexts, this offered a more accurate research result on system design irrespective of the societal context. The research aimed to consider inscribed justice aspects in the system design and its distributive consequences. By offering a critical analysis of stakeholders' understanding of justice and motives for the provision of each BSS, the stakeholders' contemplations were essential to depict the BSSs' justice aspects. From this, the main question that guided the research was; What are the potential justice consequences of Copenhagen's and Malmö's BSS-actors' considerations in current system design?

The theoretical framework consisted of three subparts which aided this search of inscribed justice consequences; explained first was the traditional transport planning approach as defined by transport justice research; afterwards was the response in the form of the transport justice notion described; lastly was the academic conceptualization of scripts explained. In its archetypical form, traditional transport planning is an approach rooted in its eagerness to satisfy demand, and repeatedly, this approach has supported already transport benefitted residents instead of those in transport disadvantaged. Due to this, the traditional transport planning has functioned to broaden social inequality. As a response to these disparities, transport justice research calls for a planning approach mainly concerned with need instead of primarily demand. Transport investments and services should, according to the notion, distribute according to the greatest reduction in inequality of opportunity. This view suggests that at the same time as overall accessibility levels rise, prioritization is necessary to the needs of risk groups to mitigate shortcomings in the traditional approach which consistently reduces the accessibility levels of the risk groups. Since this notion has proven that the configuration of traditional transport systems inscribes injustice, the academic conceptualization of scripts was lastly applied as the concept focuses on the interchange of technological objects or systems and individuals.

The analysis was conducted by applying concepts from the script approach to divide the BSS-actors' considerations between traditional transport planning focus and the common recommendations by transport justice. This inquiry thus tested the thesis' main proposition for the selected case study objects; indirectly asking if their system designs are similar to many others elsewhere or if this analysis could find alterations that bring other justice implications?

As the analysis showed, the stated motives behind the examined BSSs are similar to one another but differ slightly. The municipal incentives Malmö By Bike and Bycyklen aims to be geographically comprehensive services primarily for commuters and in some respects tourists. By comparison, Donkey

Republic holds a vision to improve city life at large and perceives both locals and tourists as the target group, yet with the prerequisite to follow users' demand.

What is more, even when stakeholders are involved in the same BSS the reasons to provide the service differs, the cities' representatives held some motives while operators held others. The study shows that the planner in Malmö had the agenda directed from political ambitions to mitigate congestion and enhance the attractiveness of public transport, and deliberately keep affordable fees and developed the system in less well of neighbourhoods to enhance their accessibility options. In contrast, the procured operator simply wants their BSS to have plenty of users, in relation to what is cost-effective, and as a justification for the company's right to handle outdoor advertising in the city. Consequently, the city's motives to provide the BSS aims to strengthen a more just transport mode, as the city itself emphasizes in their planning documents by concluding that women, children, and disabled uses and rely more on public transport (see 5.1). Investments that strengthen public transport, such as integrating a BSS to the transit system, is then understood by the municipality to be more just than investments that for example, strengthen private car driving. As such, Malmö's initial motives to offer the BSS follows the suggestion from transport justice research to prioritize the strengthening of accessibility options for those with fewer opportunities. However, the selected business and operation model and the resulting operator leads to a view of justice that follows the idea of benefits to the greatest number, that is, a utilitarian approach of the system design. Since, except the geographical distribution of docking stations, both bicycles' design and the payment system's configuration is mainly tuned to the needs and demand of the majority-user rather than those with fewer transport options.

Likewise, at first glance, Donkey Republic hold motives that aim at strengthening distributive justice with the vision to 'make city life, in general, better for everyone', make adaptions for the disabled, and keep affordable fees that most people can pay. However, the outcome is not what the company's motivation first indicates due to the need to be competitive and cost-effective. Therefore, the company has to follow the majority-users' demand and needs in bicycle design and payment systems' configuration, and also concerning the geographical distribution. That is the same logic as traditional transport planning and hence a similar utilitarian view on justice as Malmö's operator.

A need to be cost-effective likewise restricts Bycyklen, as the sponsors expect the BSS to be nearly self-sufficient while simultaneously being required to provide comprehensive geographical access within all municipalities where they operate, to fulfil the system's purpose to strengthen public transportation and reduce congestion with associated CO_2 emissions. Seemingly, this suggests that their initial motives, like the municipality of Malmö, aims at strengthening distributive justice. Yet, the ambitions to reduce congestion, inevitably and paradoxically, support travel patterns of prior car users who are an already accessibility-rich group. Furthermore, also their bicycles' design and payment system mainly follow the majority-users' demand, hence a utilitarian approach. Accordingly, the BSS is a response to other social and environmental concerns, rather than intended to reduce inequality of opportunity.

Moreover, if reflecting on all examined BSSs' standardized bicycle designs, this does not only concerns individuals with non-average physical capabilities, e.g. children, elderly or people with disabilities. The non-inclusiveness of the uniform bicycle design also extends to include unstandardized uses by individuals who generally fit the bicycle design. That is, even if one has a body capable of utilizing the standard shared bicycle, the same individual may sometimes have a need that requires more diversity in options of bicycle designs, for example, if travelling with children or if carrying large baggage. However, as these irregular needs are not 'allowed' by the BSSs, they cannot be met, whether or not a user will exist. Thus, the need to adhere to the above-described objectives create a homogeneity of system design for all examined BSSs. This finding suggests that the economy of scale trumps compliance to diverse needs and capabilities among individuals, inscribing only those who fit both the expressed and implicit target group and use. Where the stakeholders see use and non-use as reflections of

recipients free choice rather than produced by constraints in the prevailing system design and an indication of a latent will to use the services; this reasoning follows one of the main traits of the traditional transport planning approach.

Hence, attentiveness to a utilitarian approach in the system design shapes what is considered doable and desired, even if the BSSs' motives indicate otherwise, which means for the distributive justice that neither fairness nor equity can be considered achieved within the BSSs' current system designs, as different needs are not adequately acknowledged. Thus, the research has been able to show that existing BSSs in Copenhagen and Malmö follow a typical BSS design, which is more in line with the traditional transport planning approach and utilitarian ethics, than advice from transport justice research. This indicates that the BSSs may be prone to result in similar justice consequences as has been previously identified, excluding some groups of people by inscribed priorities of particular users and uses over others'. The examined BSSs may aim to enhance levels of accessibility, but since they do not priorities the need of those with the least opportunities, they do not follow the main recommendation from transport justice research. Since, research in transport justice determines that transport investments can only be considered fair if investments and services are distributed according to the greatest reduction in inequality of opportunity, which none of the current system designs of BSSs in Copenhagen and Malmö do.

6.1. Can bicycle sharing and research in the field be done differently?

It may be so that with the current situation, this is the feasible way of providing BSS in both cities. However, if the BSSs are genuinely interested in fulfilling their initial motives, and in spreading the positive effects this could have on individual and societal well-being, these system designs must change. Therefore, I conclude, similar to Nixon and Schwanen (2019) that research in the field would benefit from challenging the prevailing practices rather than confirming the typical system design of contemporary BSSs. Research needs to highlight barriers to uptake of common non-users, as well as studying current users' reception and desires, for example, via the concepts in script theory; to explore new business and operational models and demonstrate alternative forms of bicycle provision where justice is the goal. This exploration can help form a type of BSS where the proclaimed justice potentials are met with a needs-based approach to system design tailored to more user groups and uses.

This thesis' research is not large enough to give overarching recommendations for all cities interested in implementing a BSS, yet it might work as a suggestion to consider motives and objectives with the investment thoroughly. The prevailing system design of most contemporary BSSs benefit the majority; this may sound good if environmental goals are the main driver. Nevertheless, is it an investment worth considering if the proclaimed replacement effects on car travel and damping effects on emissions are exaggerated and not very common? We have an ongoing climate crisis, and all attempts to improve alternatives to cars should be welcomed; but, if reduced congestion and car driving is the goal, it is crucial to analyse and make investments in active mobility that makes a difference. Right now, BSS most often takes travel shares from public transport and walking and does seldom help to achieve environmental ambitions. So, cities and research should ask if there are other benefits that bicycle-sharing can provide? Such as increased access to bicycles and strengthened freedom of movement for those with the least access to bicycles. This goal is attainable, but not if the systems continue to adapt to affluence and demand instead of need. Bicycle-sharing should be formed to increase access to bicycles; this must still be the obvious and fundamental goal of these systems. Thus, cities should be open to trying new ways where recipients' need leads system design, not system design only being led by what is cost-effective, which effectively only considers the majority user. Giving away bikes for free or heavily subsidizing purchases of bicycles which are then shared or sold between citizens can also be considered a form of sharing as Nixon and Schwanen's (2019) example from London revealed. Undoubtedly, there are alternative ways than the dominant form of BSSs to reach the core goal of increasing access to bicycles for those who need it.

Nonetheless, even if it is vital to improve upon BSS's justice implications, an overarching view of the entire transport system is needed, and an improved form of BSS is only one way to contest the exclusionary effects in traditional transport systems. BSSs, as currently often configured, does however not work as a challenger, it instead strengthens the exclusionary effects of transport systems in contemporary cities.

6.2. Validation and limitations of the research

To conclude the thesis, I will highlight some limitations in the research and reflect on possible objections.

A first limitation is the number of interviews I held with multiple respondents from diverse interest groups and stakeholders as a form of triangulation. Even though this was strived for and shown rewarding to generate broad representations of various considerations, in total, the number of interviewees was rather low. Although, this was due to practical reasons together with time constraints, for example, that some organizations did not want to provide me with more than one respondent. Nevertheless, the research would benefit from including more stakeholders involved in the same case, such as local politicians responsible for implementation or legislative processes. Of course, I used planning documents and other written sources to support my interview findings, but this could only confirm interviewees' statements and is not the same as another in-depth interview with an involved person that provides an additional perspective. Hence, it would have enhanced the validity of my research if examined considerations had been based on even more stakeholders' perspectives.

Secondly, critics claim that findings produced by interpretive research lack reliability due to the inherent subjectivity of the paradigm. I still saw the interpretive approach as suitable since the thesis aimed to make conclusions on justice which are an inherently subjective matter. It is expected that conflicting and inconsistent explanations can be produced to explain the social phenomena, which may lead to the conclusion that the prevailing system design is indeed fair if one applies a different view of justice than those advocated by transport justice research; in so doing one could reject my results and recommendations.

Finally, a conceivable limitation is that my results can in part be considered self-evident while my recommendations can be seen as impractical. However, it is precisely this feasibility that future research and practice should explore, by showing and carrying out alternative examples of bicycle-sharing; but, in order to search for alternatives, it is good to first know in detail what to correct. This is something which I hope my research has been able to show more clearly.

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