Master thesis

Public bike sharing in Munich

A critical view on bike sharing and redistribution of urban space

Prepared by

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Preface

The following document is written for the attainment of a joint master's degree in the Erasmus Mundus Program *Joint European Master in Environmental Studies – Cities and Sustainability*. This master's program is based at Aalborg Universitet, Universitat Autònoma Barcelona, Technische Universität Hamburg-Harburg and Universidade Aveiro. The master thesis was written at Aalborg Universitet in the period from February 2015 until June 2015.

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Abstract (English)

Urban sustainable mobility is a main issue within contemporary cities. Within the emerging technologies of collaborative mobility, bike sharing schemes (BSS) are a rapidly growing transportation infrastructure implemented in cities world-wide. However, the scientific research on BSS remains a patchwork of mostly technical and quantitative studies. Qualitative and critical research on the motives and the implementation process of bike sharing schemes is vastly underrepresented, whereas this study is looking at this missing part of the literature on bike sharing schemes.

This study investigates the motives of politicians, the city administration and other stakeholders to implement a bike sharing scheme owned by the public transport provider in the German city of Munich. Five main motive complexes were identified: 1) bike sharing schemes as public transport, 2) city image and marketing, 3) market research on inter- and multimodal mobility, 4) other benefits and 5) environmental and health benefits. These motives were discussed in regard to the synergies of public transport and BSS and the development of fourth generation BSS. In an additional analytical step a critical theoretical framework on bike sharing schemes was developed, drawing from insights of critical urban theory, urban political ecology and the framework of splintering urbanism. This was used for a critical discussion of bike sharing schemes as a conflict on the redistribution of urban space towards less impacting modes of transport and their nature as a (premium) mobility service.

Abstract (German)

Nachhaltige Mobilität ist heutzutage ein zentrales Problem in Städten. Unter den sich entwickelten Technologien kooperativer Mobilität sind Fahrradverleihsysteme (FVS) eine schnell wachsende, weltweit in Städten eingesetzte Transportinfrastruktur. Die wissenschaftliche Forschung zu FVS ist jedoch ein Flickenteppich aus meist technischen und quantitativen Studien. Qualitative und kritische Forschung zu den Motiven und dem Umsetzungsprozess von FVS ist unterrepräsentiert, weshalb diese Studie sich mit diesem fehlenden Aspekt der Literatur zu Fahrradverleihsystemen beschäftigt.

Die Studie untersucht die Motive von Politikern, der Stadtverwaltung und anderen Beteiligten ein vom öffentlichen Verkehrsanbieter initiiertes Fahrradverleihsystem in München einzuführen. Fünf Themen wurden hierbei identifiziert: 1) FVS als öffentliches Verkehrsmittel, 2) Stadtimage und –marketing, 3) Marktforschung zu Inter- und Multimodalität, 4) andere Vorteile und 5) Umwelt- und Gesundheitsvorteile. Diese Motive wurden in Bezug auf die Synergien von öffentlichem Nahverkehr und FVS und der Entwicklung von FVS der vierten Generation diskutiert. In einem zusätzlichen analytischen Schritt wurde ein kritischer theoretischer Rahmen entwickelt, angelehnt an kritische Stadttheorie, urbane politische Ökologie und dem Konzept ‚splintering urbanism'. Dieser Rahmen wurde für eine kritische Diskussion, von FVS als Konflikt um die Umverteilung von urbanem Raum zu nachhaltigen Verkehrsmitteln und ihrem Charakter als (premium) Mobilitätsservice, verwendet.

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1 Introduction: Urban mobility and bike sharing

Mobility is one of the main issues defining and influencing urban development in the past, the present and the future. Mobility, seen as the ability to move people and goods through the urban landscape, was and is an essential factor guiding the occurrence, non-occurrence and character of urban growth and development (Camagni et al., 2002). The mobility opportunities are largely influencing vertical social permeability, the mobility between socio-economic classes, within cities and the horizontal mixing, physical mobility within a socio-economic class, of its inhabitants (Priemus et al., 2001). The infrastructure enabling and supporting mobility therefore is a constituting factor of a city. This infrastructure generally is regarded as networked because of the physically and socially intertwined character in and in-between different infrastructure systems, e.g. the close connection between water and electricity networks or the shared corridors of public transport and main telecommunication lines (Graham and Marvin, 2001).

Both the mobility of people and goods in cities and their related networked infrastructure play an important role in forming a city, its social relations and composition. This process of 'forming the city', however, is far from neutral or natural. Indeed it is starkly contested and biased and the process should be interpreted as a highly complex, socio-technical one influenced by the interplay, clash, dominance, oppression and suppression of different actors and narratives on different levels and scales (Heynen, 2013). The resulting urban landscape mirrors this complicated process, with it not being a homogenous, easy definable and mappable object, but rather a messy, chaotic and steadily changing interplay of subjects.

Apart from the discourse on the subject of the city itself (Brenner, 2000) and the discourse on how mobility is influencing a city and vice versa, there is an observable and measureable side of the physical and social effects of the mobility patterns being in place throughout a city. In most cities nowadays the dominant mobility regime is characterized through individual motorized road-based transport in the form of the private automobile. This transport regime has manifold negative impacts on the environment and the society. Most notably it accounts for nearly a quarter of global carbon emissions and it is the major contribution to urban air pollution, e.g. smog, carbon monoxide, nitrous oxides and resulting tropospheric ozone (Dora et al., 2011). In 2012 an estimated seven million people died from the consequences of air pollution (WHO, 2014). Cars are also one of the big noise emitters in cities, which are connected to many health problems, such as sleeping disorders or stress (Dora et al., 2011). The excessive use of private cars causes congestion which is a physical and social effect at the same time, causing stress situations, time losses, grid-locked urban streets and increased air and noise pollution and emissions through longer vehicle running times. Private vehicles are further occupying a significantly large amount of space in cities, not only through inner-city streets and highways but also through a considerable amount of parking facilities (Manville and Shoup, 2005; McCahill and Garrick, 2012). For a more complete review on the impacts of private vehicle use in cities the book by Newman and Kenworthy (1999) is recommended.

The most common alternatives to private vehicles are summarized under the term 'eco-mobility' or simply 'sustainable modes of transport' and are commonly seen as public transport, cycling and walking (EcoMobility, 2015). In many cities these forms of transport have been neglected politically and financially for decades in favor of the car (Banister, 1998). This naturally results in a deteriorating state of infrastructure, a sometimes total lack of infrastructure and/or over-crowded, low-quality public transport vehicles especially causing problems during rush hours. In earlier decades this led to a substantial shift of users away from these sustainable transport options and a significant growth of private vehicle usage and today is hindering a shift towards 'eco-mobility' (Banister, 1998). With the continuing growth and the worsening state of the environment in urban areas, the impacts on health through air pollution and noise and the immense consumption of public space by private vehicles, the need to invest into sustainable transport options and related infrastructure is constantly growing (May, 2013).

Contemporary examples of an investment in infrastructure for sustainable transport options are public bike sharing systems (PBS) also known as bike sharing schemes (BSS). Bike sharing schemes go hand in hand with a 'renaissance of cycling' in cities throughout the world, although most notably in cities of the global North (Parkin, 2012; Pucher et al., 2011). In many cities the modal share for cycling doubled or tripled within ten years and the bicycle further became part of a trend towards ecologically oriented lifestyles amongst mostly young and wealthy urban residents.

The widest implemented form of BSS is characterized through a network of fixed stations where users can rent a bicycle at one station and give it back at every station within the network. The stations are often located at high frequented public transport stations or other important places throughout the city mainly in densely populated inner-city areas. The rental of a bicycle in most cases requires the user to sign up online beforehand or sometimes directly at the renting station. The user most often pays for the usage in form of a subscription for a certain period of time using a credit card or a bank account. Most BSS are accompanied by a smartphone application showing available bikes in real time, making the planning of trips and the connection to public transport possible. A crucial element of the concept is, that the first 30 minutes of each rental are free, which is supposed to lead to a high turnover rate of the bicycles and facilitates one way trips instead of round trips. Many bike sharing schemes are advertised as a 'last-mile' solution for public transport users, a new form of exploring a city for tourists as well as a healthy and environmentally friendly way to get around in the city (Ricci, 2015).

The first of this type of bike sharing scheme started in 1998 in Rennes (France), followed by *Vélo'v* in Lyon (France) in 2005 and *Vélib'* in Paris (France) in 2007. The latter two gained considerable public attention and were a main facilitator for the start of more than 855 systems totaling close to one million bikes until today (Meddin, 2015). For a detailed explanation of bike sharing, its characteristics and history see DeMaio (2009).

In Germany bike sharing only gained momentum in the last five years, making it less popular as in other countries, like France, Spain and China. The primary reason for this is said to be the high private ownership rate of bicycles in German cities. The first public bike sharing scheme in Germany was *Call-A-Bike*, founded in 1998 in Munich by a couple of university students. It was taken over by *DB rent*, a sub-company of the German railway and developed into a system in over 50 cities with ICE train stations, mainly offering a few bikes at the train stations for round trips with bigger station-based or flexible networks in Munich, Hamburg, Cologne, Berlin, Stuttgart and a few other cities. The second big German operator is *nextbike*, which operates systems in more than 30 German cities. In addition to those two big operators, there are some small systems operated by municipal transport operators. As mentioned before this development just gained dynamic recently, fostered through a program by the former Federal Ministry for Transport, Building and Urban Development in 2009. However, German BSS are still considerably less used than systems in other countries and cities, where average uses of four to six trips per bike per day are quite frequent. The by far most successful system, in terms of usage, is *StadtRAD Hamburg*, operated by the German railway and paid for by the city of Hamburg, which averages three hires per bike per day (DB, 2013).

Currently there only has been limited qualitative research on the political and administrative implementation process of bike sharing schemes, with most work on BSS being technical and quantitative patchwork on specific system characteristics (Ricci, 2015). The often contested history behind and the critical perspective on the implementation of BSS is missing in most scholarship on bike sharing. This research tries to shed light onto the complex set of motives behind the decision to build-up a public bike sharing system. Taking a critical point of view on bike sharing schemes will reveal formerly hidden discourses and aspects of the implementation process. It will also uncover politically often ignored characteristics of bike sharing systems, most visible in the specific area in which a system is build-up and the anticipated and actual user groups. It will contribute to a better, more in depth understanding of bike sharing systems and provides an underrepresented but vital part for the literature on bike sharing. This research also wants to include the topic of bike sharing into the body of critical research on cities and urban infrastructure and mobility and pays special attention to the framework of splintering urbanism by Graham and Marvin (2001).

Even without questioning if the current dominant way of implementation is actually the best way to reach goals of increasing health, providing low-cost mobility and reducing environmental impact, the complex characteristics of BSS regarding function, efficiency and equity make it difficult to estimate its effects beforehand (Ricci, 2015). However, bike sharing schemes have become an important part of urban mobility and are on the mobility agendas in more and more cities in the age of 'Peak Car' (Goodwin and Van Dender, 2013). Further acknowledging the lack of knowledge and the difficulty of predictions regarding bike sharing schemes, it becomes interesting to look at the intentions of city governments and other actors when implementing a BSS. This study therefore looks at these narratives and arguments around bike sharing, within the context of the German city of Munich.

This report is structured as followed. The next section will present relevant literature on the sharing economy, bike sharing schemes, the fields of critical urban theory and urban political ecology and will especially emphasize the framework of splintering urbanism and its connection to bike sharing schemes. The literature review and theoretical framework will be followed by the presentation of the research design and the used methodology. The results will be presented in two sub-sections. The first sub-section will talk about the general framework for cycling and the history of bike sharing schemes in Munich. This will be followed by the second sub-section talking about the new bike sharing system by the public transport provider of Munich, *MVG Rad*, and the reasons for its implementation. The discussion of the results in the following section will be succeeded by the conclusion of the research.

2 Presentation of relevant literature and the theoretical framework

As mentioned in the introduction, this research takes a critical perspective on bike sharing, paying attention to the interplay of the city, its inhabitants, mobility and the networked infrastructure. The literature review will start with a short introduction into the current discussions on mobility and the recent development within the so called sharing economy towards collaborative mobility. It continues with presenting the available body of literature on bike sharing. This body of literature is a collection of partial, mostly technical evidence on specific aspects of bike sharing missing a critical point of view. Therefore the thesis then takes its theoretical starting point on insights from critical urban theory and urban political ecology, with a special focus on the framework of splintering urbanism by Graham and Marvin (2001). This theoretical framework will be used to develop a critical perspective on bike sharing systems as a new type of urban infrastructure. It will explore how bike sharing stands in connection with a neoliberal market economy and how this might influence its character as a mobility service.

2.1 Mobility in the 21st century: collaborative mobility

Recent works by social scientists have brought the issue of mobility into the center of studies on the nature of society. Most known for this reorientation is John Urry and the concept of the 'mobility turn' or the 'sociology of mobilities' (Urry, 2000). It describes the need to switch the focus of analyzing society towards the study of mobilities. The 'mobility turn' is deemed necessary as most social research is seen as based on static analyses and methods not capable of grasping the nature of a society increasingly based around mobility and immobility (Sheller & Urry, 2006 referred to by Tironi, 2014). In connection with the work by Ulrich Beck on the 'risk society' (Beck, 1992), Kesselring (2008) describes the 'mobile risk society', which is living and moving in '*a social situation where the individuals are forced to navigate and decide whilst they are confronted with increasing lack of clarity, with social vagueness and obscurity*' (Kesselring, 2008, p. 78). Also in this description the need to be mobile is a constituting factor for the individual and inseparable part of modernity. Apart from this general description of the contemporary mobility condition, David Banister (2008) describes the problems transport planning is facing on the way towards a sustainable mobility agenda (see also Banister, 1998). The two major problems he describes are the perception of travel as a demand and the concentration on a travel cost minimization. His main claim calls for a more flexible approach towards transport planning and mobility, somehow complementing the social situation the 'mobile risk society' is confronted with. This leads to the need for more flexible mobility solutions, which ideally also reduce environmental impacts. An overarching term for some of such solutions is collaborative mobility (Beckmann and Brügger, 2013).

Collaborative mobility is a recently termed part of the so called 'sharing economy'. Within the line of the sharing economy collaborative mobility is the shared use of transportation vehicles and infrastructure, be it an automobile, a parking space or a bike or something else (Beckmann, 2013). The term and concept of the 'share economy' was first described

systematically by Martin Weitzman in the mid-1980s and become public in 1984 with his book *The Share Economy – Conquering Stagflation* (Weitzman, 1984). In Weitzman's definition the share economy was initially described as the flexible payment of employees according to the economic situation the company is in. The concept of the share economy today describes the collaborative use of goods within a systematic framework. Of course the concept of sharing is not a new invention (shared flats, ride shares, share of farming equipment in rural communities), but the systematic commodification of sharing is a novelty within the line of neoliberal economic development. Mostly unregulated platforms such as *airbnb* substantially change the economy and the structure of a local society, with whole neighborhoods turning into unofficial holiday flats, reducing already scarce housing. Some observers claim the concept of sharing is misused for another round of neoliberal capitalist accumulation actually resembling a 'renting economy' (Kallis, 2014), freeriding on the positive environmental image of the 'sharing economy'.

Collaborative mobility generally is concerned with three dimensions of mobility: the vehicle, the infrastructure and the user. It complements the conventional transport options of private individual transport and public collective transport with public individual transport and private collective transport (Beckmann and Brügger, 2013). These 'new' forms of mobility, like free-flow car sharing, bike sharing and online ride sharing platforms such as *Uber* and *Blablacar*, are expected to have several impacts for users and the environment. On the user side collaborative mobility provides a new possibility for flexibility and provides extensive opportunities for inter- and multimodality. For the environment collaborative mobility can help to reduce the impact on the ecosystem, through an increase in efficiency in automobile use, or generally a more efficient use of resources and infrastructure, reducing overall physical consumption. In the case of the use of sustainable transport options these environmental benefits could be substantially higher (Beckmann and Brügger, 2013). Naturally the above described issues within the general share economy are also valid for collaborative mobility. Within this a primary critical issue of collaborative mobility is who is able and willing to afford these new forms of mobility and who is not.

2.2 Body of literature on bike sharing

A relatively new form of collaborative mobility is systematic bike sharing within the urban context. Bike sharing schemes (BSS) also known as public bike sharing systems (PBS) are a growing mobility offer in cities throughout the world. Besides connecting to the before mentioned sharing economy and collaborative mobility, bike sharing stands in connection with a renaissance of cycling in cities, especially throughout the western world (Pucher and Buehler, 2012). The benefits of cycling for users and the general positive implications for transport in urban areas become more and more scientifically acknowledged (Castillo-Manzano and Sánchez-Braza, 2013; Daley and Rissel, 2011; Garrard et al., 2008; Horton et al., 2007; Kumar et al., 2012; Parkin, 2012; Passafaro et al., 2014; Pucher and Buehler, 2012, 2008).

Although, bike sharing only grew substantially in the last decade, its history can be traced back to the 1960s, when anarchist activists distributed the '*Witte Fietsen*' (white bicycles) for free use in Amsterdam. Generally the development of BSS is separated into three phases with the first phase being the white bikes in Amsterdam (DeMaio, 2003). The second phase starting in the mid-90s, with *Bycyklen* in Copenhagen amongst others, was characterized by a station network with coin deposit operated bikes as known from shopping carts. In the third generation, BSS made a big step towards a more high-tech solution (Shaheen et al., 2010). These current systems are characterized through an automated electronic renting process for which potential users have to register before being able to rent a bicycle. The pricing policy of these systems most often is modeled in a way to incentivize short-distance and one-way trips (Beroud and Anaya, 2012). Most BSS today also provide real-time information for smartphones, GPS-tracking and RFID-based rentals, with DeMaio (2009) referring to these developments as the evolution of a fourth generation of bike sharing schemes. Meddin (2010) adds to this, that future developments in BSS will see a closer integration into public transport, through further increased real-time information and the possibility to book a bike in advance. For a more complete overview on the history of bike sharing and recent (technical) developments in this field see DeMaio (2009, 2003), Beroud and Anaya (2012) and Shaheen et al. (2010, 2014, 2012a). A good discussion on the recent take-off of bike sharing is provided by Parkes et al. (2013) who draw on insights from diffusion theory to explain how bike sharing spread around the globe.

The literature on bike sharing has developed rapidly within the last five years with a steady growth of scholarly articles. However, most of these articles only cover a single or multiple aspects of one or a few bike sharing systems. So far there has not been a complete analysis, looking at the implementation process, all stakeholders, further development of the system and environmental, social and economic impacts, of any single system or an analysis of a single topic within a representative number of systems (Ricci, 2015). Therefore the literature around bike sharing is a patchwork of evidence concerned with mostly technical aspects of single systems, e.g. redistribution patterns, GIS-analysis, user patterns, with qualitative research on processes and impacts being underrepresented (e.g. Ahillen et al., 2015; Corcoran et al., 2014; Frade and Ribeiro, 2014; Ó Tuama, 2015; O'Brien et al., 2014; Vogel et al., 2011; Zhang et al., 2014; Zhao et al., 2015, 2014).

Ricci (2015), building on earlier work by Fishman et al. (2013), provides an excellent overview of current literature on public bike sharing. She examines evidence on users and usage of bike sharing, the impacts of bike sharing and the process of bike sharing implementation and operation.

Regarding evidence on the users and the usage of bike sharing systems Ricci is referring to work carried out by Shaheen et al. (2014, 2012b), Fishman et al. (2014), Murphy & Usher (2015), Goodman & Cheshire (2014) and Ogilvie & Goodman (2012). Murphy and Usher examined for Dublin that bike sharing users are mostly male, young and wealthy if compared

to the average population. For *Barclays Cycle Hire* in London Ogilvie and Goodman (2012) showed that the users are more likely to be male and socio-economically well off, with further evidence showing that in London women only account for 20 % of the undertaken trips (Goodman and Cheshire, 2014). Shaheen et al. (2014) report a mostly young and Caucasian user group for five North American bike sharing schemes. In an extensive survey of users of *Capital Bikeshare* in Washington, D.C. Buck et al. (2013) find bike sharing users to be predominantly white and young, but more users were female and had a lower household income, than regular cyclists in the area. However, overall the typical user of a bike sharing system is male, young, white and socio-economically well off (Steinbach et al., 2011). Besides the access to a debit or credit card, Ricci identifies the coverage area of the system as one of the most important factors determining the actual users of a public bike sharing system (Ricci 2015; see also Goodman and Cheshire (2014) and Ogilvie and Goodman (2012) for evidence from London). Further based on work by Shaheen et al. (2014, 2012b) Ricci concludes, that newly introduced systems like *CitiBike* in New York specifically target areas with a high share of the above described population groups to achieve a high usage. In a further study on the bike sharing scheme in London, Goodman and Cheshire (2014) found that the system, in terms of user distribution, became more equal over time through an extension into less wealthy areas. A study by Kretman Stewart et al. (2013) on the introduction of a bike sharing scheme in a low-income community in Minnesota showed the general interest of residents to use the system, but revealed problems mainly in the design of the system not being suitable for low-income resident's needs, regarding usage time, payment method and station locations.

As the main motive of bike sharing users Ricci identifies ''*convenience' in its broadest meaning*' (Ricci, 2015, p. 4) based on several surveys conducted by researchers and operators (e.g. Transport for London, 2015; Shaheen et al., 2014, for more information see Ricci, 2015, p.4). Regarding usage patterns Ricci presents evidence positively correlating cycling infrastructure and bike share station density to bike sharing activity (Faghih-Imani et al., 2014; Fishman et al., 2013; García-Palomares et al., 2012). Trip purposes for bike sharing rides were only identified in Northern America and the United Kingdom where commuting or work-related trips are the dominant purposes (Shaheen et al., 2012b; Transport for London, 2014). So far, no study looked specifically at bike sharing as a means of transport for tourists, but O'Brien et al. (2014) specified a typical rental distribution for a bike sharing scheme frequently used by tourists. Further multiple bike sharing scheme operators and policy guidelines see tourists as an important user group (ITDP, 2013; Kaplan et al., 2015), especially for the group of casual users, which received considerably less academic attention than regular users.

The impacts of bike sharing schemes are manifold, and range from direct increases of cycling in cities (Fishman et al., 2013) and health benefits for cyclists (Fuller et al., 2013; Pucher et al., 2010), to indirect impacts such as environmental benefits (Fishman et al., 2014) and increased economic activity around bike sharing stations (Buehler and Hamre, 2014). Albeit a fair amount of studies have been undertaken regarding the effects of bike sharing, there is a huge

variation in these findings, depending on the cultural background and the specific configuration of the BSS. Most impacts are indicating tendencies, but there exists no overarching study generalizing and quantifying the impacts of bike sharing. For the modal shift of users from a private automobile to a bike share ride percentages between 2 % and more than 20 % for regular users have been found (Fishman et al., 2013). As a general average value 10 % is widely accepted. However these figures are mostly measured for regular users, which are users owning a long-term subscription for minimum a month. For casual users, who own a short-term subscription, typically one day up to one week and can be responsible for 50 % of the trips, no modal shift values have been measured yet (Ricci, 2015). However, it is to be expected that the substitution rate for casual users is even smaller, as those often are visitors of a city and mostly do not have a car available. In addition they often already move with a low-impacting mode of transport. This naturally depends on the cultural context, as in more car-dominant countries (e.g. United States) also visitors are mostly moving with a private vehicle.

Fishman et al. (2014) examined the environmental impact, most notably the CO_2 emissions, associated with these modal shifts, which greatly depend on the reduction in car use in relation to the efforts undertaken to redistribute bikes between stations by motorized transport. Their results show that the environmental impact might be marginal to non-existent for many bike sharing systems. Overall there is little to no evidence showing a positive environmental impact of currently implemented bike sharing systems (Ricci, 2015).

Health benefits for cycling are a widely studied subject and most studies show that active transportation, like cycling and walking, improve health conditions, lead to less stress, less illness related leave days and generally improved living conditions (Fuller et al., 2013; Garrard et al., 2012; Pucher et al., 2010; Woodcock et al., 2014). However, the health benefits of cycling can be highly biased towards the wealthy, educated and young parts of the population. This especially is the case in cities where cycling is not the norm (Steinbach et al., 2011).

Two studies undertaken in relation to the direct impact of bike sharing stations on economic activity found that some users spend more money around bike sharing stations (Buehler and Hamre, 2014; Schoner, 2012). Regarding the financial viability of bike sharing schemes there so far have not been extensive quantitative studies, but one undertaken by Transport for London (2014) on *Barclays Cycle Hire* indicates that it is not running on profit. Generally systems are claimed not being able to only run from operation incomes, e.g. user fees, but need additional funding from public subsidies or advertisement rentals (Ricci, 2015). Many systems are funded by large multinational companies either receiving advertisement space from the city in return, e.g. *JCD Decaux* and *Vélib'* in Paris, or are able to use the system itself as a means for public relations and advertisement, e.g. *Citibank* with *CitiBike* in New York or *Barclays* with *Barclays Cycle Hire* in London. Especially in the United States several non-profit organizations are running bike sharing systems funded through donations or public subsidies, e.g. *Denver B-cycle* (Marshall et al., 2015). In recent years some systems developed being

owned and sometimes even operated by public transport providers, e.g. *MVGmeinRad* in Mainz, Germany.

Albeit, there exist several reports with policy recommendations and guidelines for the successful implementation of a bike sharing scheme (ITDP, 2013; Midgley, 2011; OBIS, 2011; TDG & PBIC, 2012), actual analyses of the implementation process are scarce. Shaheen et al. (2014, 2012b) conducted two comprehensive stakeholder analysis regarding the process of implementation and operation of bike sharing schemes in the North American context. Their surveys showed that delivery and operation of a BSS can be more problematic and costly than previously thought and publically perceived, especially regarding the need for manual bike redistribution. Other challenges met by stakeholders were issues concerning safety, insurance, low reputation of cycling and mandatory helmet laws. Available evidence from the policy guidelines and an extensive analysis of government models around BSS offered by Beroud and Anaya (2012) indicates that main factors of a successful implementation are '*political, policy and public support to sustainable travel and cycling in particular*' (Ricci, 2015, p. 9), e.g. a provision of cycling infrastructure and growing cycling levels (see also Fuller et al., 2013, Murphy and Usher, 2015).

Ricci concludes her review, besides elaborating on the need for more research on BSS, especially regarding robust studies on impacts and implementation processes, with a call for a more socially inclusive nature of BSS. She describes this on one side as a goal in itself and on the other side as a means to further increase the benefits of bike sharing and making them available for more people. Big parts of the solution to this problem lie in the geographic extension of a bike sharing system, its affordability and accessibility. Another aspect are the private companies gearing the systems towards a specific type of users, supposedly to generate more activity but also to generate income and attention for advertisements. Ricci describes this relation between the need to be economically successful and socially inclusive as being problematic.

Several scholars reported beneficial synergies between public transport and bike sharing through providing a last/first-mile solution and facilitating public transport by increasing its flexibility and reducing overcrowding on vehicles during rush hours (Goodman and Cheshire, 2014; Murphy and Usher, 2015; Shaheen et al., 2014, 2011; Zhang et al., 2014). Public transport generally has similar problem characteristics as bike sharing, especially the need to be economically efficient as well as socially inclusive. For public transport this tension was reduced through public financing, whereas the integration of bike sharing into public transport could provide a starting point for solving this issue. In further regards this can help to work against neoliberal and commodifying tendencies within the sharing economy. Public financing generally reduces the pressure of commodification and capitalization through secured finances. The integration of BSS into public transport can further enable a broader, more equal usage of bike sharing, through regulations regarding public accessibility and service availability of public transport.

2.3 Brief introduction to critical urban theory

The critic of the current neoliberal capitalist system is not only an issue within the sharing economy, but also is the theoretical starting point for this research. Many scholars have taken critical approaches towards problems of uneven urban development, generally subsumed under the field of critical urban theory. Critical urban theory brought Marxist and other traditional and contemporary critical approaches in social theory into the research field of classical urban theory and planning. It

'*insists that another, more democratic, socially just and sustainable form of urbanization is possible, even if such possibilities are currently being suppressed through dominant institutional arrangements, practices and ideologies. In short, critical urban theory involves the critique of ideology (including social–scientific ideologies) and the critique of power, inequality, injustice and exploitation, at once within and among cities*' (Brenner, 2009, p. 198)

or as Peter Marcuse puts it: *'[Critical urban theory is about] implementing the demand for a Right to the City'* (Marcuse, 2009).

A major collection of contemporary works on critical urban theory is presented in the book *Cities for people, not for profit* edited by Neil Brenner, Peter Marcuse and Margit Mayer (2012), including the field describing article by Brenner (2009) *What is critical urban theory?* However, critical research on urban topics and mobility does have a much longer tradition. A much regarded scholar working on urban issues in a critical context is David Harvey. Drawing mainly from works by Marx, Harvey exemplifies how the two forms of capital, mobile and fixed, depend on each other and only in combination can further expand in order to reduce capitalism's crisis tendencies in the short- and medium term. Harvey vaguely defines the fixed capital as 'spatial fix' (Jessop, 2006). In relation to this the city itself can be seen as a spatial fix of capital, the immobile part of capitalism, which facilitates the mobile capital to flow ever faster. The spatial fix could even be seen as a reason for why there are still cities which are growing. In order for capital to accumulate, not only the mobile capital has to extend, but it needs a fixed capital as a base, similar to an airport needing to grow to be able to host more airplanes.

Two for this research relevant publications are concerned with the neoliberalization of urban space and respectively the mobility paradigm of liberal urban policy. Peck and Tickell (2002) theorize the incorporation of the neoliberal agenda within city governments partly through an increased involvement of private actors. Further drawing on Harvey's notion of '*urban entrepreneurialism*' (Harvey, 1989) they describe how cities are becoming sites of continued neoliberal capitalist market extension within a perceived need to attract and enhance capital flow, leading to extensive inter urban competition.

In a recent article, David Imbroscio (2012) criticizes the mobility paradigm of cities in regard to solving social problems through population movements. He describes how cities try to solve problems of economic opportunities for the urban poor, the creation of mixed income

communities, the availability of affordable housing, and racial distribution in cities through increasing mobility of the urban poor. In his critique he shows how this mobility paradigm is forcing an excessive mobility, leading to residential instability and how socially disadvantaged populations are forced to move into declining suburban areas. As an alternative solution Imbroscio (2012) proposes a placemaking paradigm, meaning *'the construction (or making) of more [socially and economically healthy] places in metropolitan areas'* (Imbroscio, 2012, p. 11). Albeit Imbroscio is talking about the forced replacement of people, there are significant parallels to the general mobility of people in cities. Instead of facilitating a competition for few places through increased mobility opportunities, one should think about how to facilitate less or shorter mobility for people through the improvement of places. This works against further urban sprawl, connects the population to economic opportunities, which in the best outcome facilitates mixed income communities and reduces social inequalities especially along race.

2.4 Brief introduction to urban political ecology

Urban political ecology is part of the research direction of political ecology, which looks at the distribution of burdens and benefits of socio-ecological processes (Robbins, 2004). Urban political ecology sees urbanization, the forming of the city, as '*primarily a particular sociospatial process of metabolizing nature, of urbanizing the environment*' (Swyngedouw, 2004, p.8 cited in Keil, 2005, pp.646–647) with the aim '*to expose the processes that bring about highly uneven urban environments*' (Swyngedouw and Heynen, 2003, p. 906). One of the foundational articles of urban political ecology was written by Erik Swyngedouw describing the city as a hybrid of nature and society, shaped by power-laden socio-ecological processes (Swyngedouw, 1996, see also Swyngedouw and Heynen, 2003). In their book *In the Nature of Cities* Nik Heynen, Maria Kaika and Erik Swyngedouw present articles from different scholars following the urban political ecology approach, reaching from theoretical exemplifications on the field to several works on urban water or hunger (Heynen et al., 2006). A contemporary overview of work in and critics on urban political ecology is provided by Heynen (2013), calling for the integration of feminist, racialized and queer positions. In a paper from 2012, Cook and Swyngedouw analyze the interplay of the city, social cohesion and the environment. In their analysis they explain how urban political ecology provides a viable theoretical framework to expose social and ecological (in)equality and (in)justice in the area of urban social cohesion (Cook and Swyngedouw, 2012).

So far there has not been extensive work on mobility and infrastructures through the lens of urban political ecology. In a first article, Monstadt (2009) outlines the possible interplays between urban political ecology and infrastructure to explore their role within the sociotechnical landscape of the city. Specifically he examines how urban political ecology in combination with urban and technology studies can help to understand the socio-ecological characteristics of urban infrastructure. Monstadt describes how urban infrastructure '*are material mediators which use natural resources and produce both intended infrastructural services and an unintended second nature by their emissions, waste, and land use*' (p.1933)

within a power-laden process. Monstadt points out, that there so far is no complete analytical framework of urban political ecology regarding infrastructures and that this requires '*paying more attention to the character of sociotechnical systems and their inherently ambivalent and long-lasting impact on the shaping of cities and their socioecological environment*' (p.1934) and a connection to the studies of urban governance.

Miciukiewicz and Vigar (2012) explore the connection of social cohesion and mobility from a critical perspective drawing on Graham and Marvin's (2001) notion of the splintering city. Their paper provides a good review of research on transport in urban areas, especially in regard of an uneven distribution of advantages and disadvantages of growing mobility offers and demands. They conclude their review with the claim, that there is a huge gap between academic research on the relation between transport, mobility and social cohesion and the reality of urban transport planning, providing evidence through the analysis of past and current European Transport Research and policy and policy-oriented research. Following their analysis Miciukiewicz and Vigar make a strong case for

'*a departure from fragmented, techno-modernist policy and policy-oriented transport research aimed at predominantly technology-led solutions to societal problems towards a comprehensive agenda for urban mobility that is more sensitive to socio-political contexts and promotes social cohesion*' (Miciukiewicz and Vigar, 2012, p. 1947).

2.5 The framework of splintering urbanism

Splintering urbanism is a critical theoretical framework for contemporary urban development developed by Stephen Graham and Simon Marvin (2001). They draw the picture of a contemporary urbanism and neoliberal urban development, where cities offer an ever growing array of networks, connections and possibilities for the ones who can afford them, but a further marginalization of the ones who cannot, increasing and further fragmenting an uneven urban landscape.

Their book *Splintering Urbanism* (Graham and Marvin, 2001) stands in close relation to work by Graham on the construction of premium network spaces (Graham, 2000) and the development of a *neoliberalization of urban spaces* described by Peck and Tickell (2002) a year later. The term splintering urbanism refers to the unbundling of the 'modern infrastructure ideal' of the late 19th and first half of the 20th century. Graham and Marvin describe this ideal as the roll-out of modern infrastructure systems (e.g. water, electricity, telephone, public transport) in the western nations with the intention to equally provide a centralized and standardized networked infrastructure to a growing population in order to have a 'coherent' city (Graham and Marvin, 2001, pp. 39–89). The unbundling of this ideal takes place through the reconfiguration of complete infrastructure systems into fragmented (premium) networked infrastructures by transforming former public or private monopolies into contested markets (p.13). In these markets the demands of wealthy citizens and multinational corporations are generally favored and met, instead of the demands of the economically weak

parts of the population, leading to an increasingly uneven urban development (p.14). Graham and Marvin identify five factors influencing the splintering of the 'modern infrastructure ideal' (pp.90-136):

1) The urban infrastructure crisis, refers to a perceived crisis of the modern infrastructure ideal due to a deteriorating state of the built-up networked infrastructure, mostly caused by a lack of funds.

2) Changing political economies of urban infrastructure development, basically describing the privatization of infrastructure and the rise of neoliberalism, through a perceived inability of the state to meet infrastructural needs.

3) The collapse of the modern notion of comprehensive urban planning, into a project by project planning.

4) The physical growth and extension of metropolitan regions, pointing out the extensive growth and poly-nucleated character of most modern metropolis, supposedly undermining integrated urban planning approaches.

5) The challenge of social movements and critiques, contesting the notion of a coherent nature of a city within the modern infrastructure ideal.

In a detailed chapter Graham and Marvin explain the theoretical background for the occurrence of this splintering urbanism grounded in theory on large technical networks, actor network theory, theories of the changing political economies of capitalist infrastructure and 'relational' theories of contemporary cities (pp.178-216). The exploration of this background, however, is outside of the scope of this work.

Of higher relevance are the mechanisms and characteristics Steven and Graham attach to splintered urban infrastructures. The central mechanism described by Steven and Graham is the 'infrastructural bypass' in three forms: the local bypass, the glocal bypass and the virtual network bypass (p.167). The local bypass is described as occurring in two forms, 1) the superimposition of a parallel infrastructure and/or 2) the segmentation of an existing infrastructure (pp.168-169). Effectively this in most cases leads to the bypass of least valued users and a higher connectedness of valued users through new and/or reconfigured infrastructures. As Graham and Marvin explain it: *'the selective reassembly of segmented network elements effectively leads to the selective rebuilding of different sets of social and spatial relationships'* (p.176).

Graham and Marvin describe three aspects of this process towards splintering urbanism. The first are wider trends towards social polarization and the construction of secessionary network spaces, referring to an increased social gap between rich and poor, leading to a stronger control of access to public spaces (pp.232-233). The second is the withdrawal of cross-subsidies within networked infrastructure systems in combination with the rise of infrastructural consumerism, meaning the customization of infrastructure 'products' towards

specific social groups. The third part of the process are socially polarizing influences of information and communications technologies (ICT), referring to the possibilities of access control brought by modern technologies (p.243).

The effects of this splintering urbanism are characterized through '*geographical barriers, network configurations, software codes, sociotechnical assemblies of built spaces and built networks, and the new access control capabilities of electronic technologies, […] increasingly configured to try and sever*' (p.301) the socio-economic affluent from the rest resulting in a '*highly uneven commodified competition*' (p.302) where naturally the disadvantaged are losing. Splintering urbanism in the end undermines the social (and physical) mobility within a city, by marginalizing spaces and making marginalized people less visible within an interlinked assembly of premium network spaces (p.302).

2.6 Bike sharing and the splintering city

When talking about splintering urbanism public bike sharing systems are not necessarily the first form of infrastructure that comes into mind. However a few scientific examples exist connecting BSS and splintering urbanism. One of these examples is the work by Martin Tironi on the public bike sharing system of Paris *Vélib'*. He examines the implementation process of *Vélib'*, looking at the narratives of a sustainable city used by proponents and opponents (Tironi, 2014). Proponents narratives were attributed with reference to the notion of the *mobility turn* (Sheller & Urry, 2006, referred to by Tironi, 2014), emphasizing the new form of mobility *Vélib*' is offering for the inhabitants of Paris. Opponents on the other side were attributed with using a narrative guided by an awareness to the political underpinnings and neoliberal character of *Vélib'* through the implementation by a multinational advertisement corporation, related to Graham and Marvin on one side but also in relation to a *neoliberalization of urban spaces* described by Peck and Tickell (Graham and Marvin, 2001; Peck and Tickell, 2002)

Building on Tironi's work, there are several characteristics of BSS resembling aspects of splintering urbanism. The most apparent is the high share of private companies operating these 'public' bike sharing systems (Beroud and Anaya, 2012). This can be regarded as the further opening up of the transport infrastructure into a competitive market following neoliberal orientations for privatization of public services. A second characteristic of nearly any BSS is a local bypass of big parts of a city's population. However, this is not necessarily happening in the way Graham and Marvin described it, but is apparent in bike sharing systems mainly being available in certain areas of a city. These areas are carefully targeted by operators according to expected usage through the dominant bike sharing users, which are male, young, white and socio-economically privileged (Ricci, 2015). *CitiBike* in New York City covers 5,4 % of the city area only serving affluent and touristic downtown Manhattan and some wealthy and white areas in Brooklyn. Similarly for London the coverage is at 6,4 % concentrated in central London. This enables a rich inner-city elite to bypass overcrowded public transport in everyday life and gives tourists an active way to move between main sights, but it does not at

all serve the needs of the big majority of the population. Although cycling and its infrastructure are genuinely seen as an active and inclusive mode of transport for large parts of a population, public bike sharing becomes a precursor of a splintering urban landscape. The provision of a new privately owned, managed and carefully targeted and priced mobility service, serving mostly socio-economically well-off, further increases the existing uneven development in cities.

2.7 Problem definition derived from literature review

Continuing from the outline of the problem in the introduction and drawing from the literature review it becomes much more apparent that research on the implementation process and the reasons and causes for the introduction of a public bike sharing system is limited and needs increased attention by scholars. City governments and operators are branding BSS as environmental friendly, healthy and a last-mile mobility solution, but research is just beginning to look at some of the effects of BSS in terms of health, safety, emission savings and congestion relief.

Except for the mentioned research by Tironi (2014) there is no study undertaken within a critical theory framework. This research therefore is taking a critical view on the nature of bike sharing and the drivers for its implementation. Additionally still little is known about how to successfully implement a BSS and even less in which context such a scheme is beneficial for transport development and the residents of a city. Therefore this study is looking at factors facilitating the uptake of a bike sharing system, but also critically assesses the reasons of the involved stakeholders for the implementation of a bike sharing system. The study questions the intentions for an engagement in bike sharing as any promised benefits are not much more than assumptions. It specifically asks: Why are bike sharing schemes implemented in cities? It further questions the role bike sharing plays in cycling promotion and the promotion of a less-impacting transportation regime in cities and will discuss this role within a critical theory framework.

3 Research Design and Methodology

For exploring the above described problem and question, the research strategy of the single case study was chosen, according to the research matrix and different forms of case studies proposed by Yin (2014). In a first step the case study is described and its selection is justified. This is followed by presenting the data collection with its threefold base of context knowledge, case study /process knowledge and the gathering of key documents. The last part describes the data analysis process.

3.1 Case study selection and justification

The chosen case study is the city of Munich, which is the state capital of the southern German state of Bavaria. Munich has just below 1,5 million inhabitants (as of 31.03.2015, Portal München, 2015) and is the most densely populated of Germanys major cities, with 4700 inhabitants/km² (Statistisches Amt, 2014). Munich is divided into 25 districts with the highest densities and the city center inside a ring road called 'Mittlerer Ring' (middle ring).

Munich's public transit system is well developed, with seven subway lines, a light rail system, a bus network and a suburban commuter railway. Regarding cycling infrastructure and conditions Munich provides separated or integrated bike lanes on many of its main traffic routes and 80% of the city area is speed reduced to 30 km/h. There also are more than 50000 Bike+Ride parking spaces at public transit stations. The city had a modal share of ways for cycling of 17,4 % in 2011, following 14 % in 2008 and 10 % in 2002, with current estimations at around 20 % (von Sassen, 2013). Munich is also home to the first public bike sharing system in Germany, *Call-a-Bike*, which was implemented by three students in the year of 1998 with around 1000 bikes inside the 'Mittlerer Ring'. This system changed owners, from the start-up to the German railway (Deutsche Bahn) in 2001, but still exists in a very similar form today. Since spring 2010, the city also boasts an extensive cycling marketing campaign '*Radhlhauptstadt München*' (bicycle capital Munich). In 2011, a second public bike sharing system offered by *nextbike*, a German bike share company, was established in Munich with around 300 bikes, scattered in different areas of the city and surrounding towns and villages. In November 2014, the city council granted the permission and the funds for a public bike sharing system offered by the public transport provider of the city, Munich Transport Association ('Münchner Verkehrsgesellschaft', MVG), with around 1200 bikes, called *MVG Rad,* scheduled to be rolled out in summer 2015 (MVG, 2015).

With this history of cycling and bike sharing, Munich provides a critical case for a single case study (Yin, 2014, p. 51) for exploring the manifold reasons behind the implementation of public bike sharing systems. Especially the planned implementation of a system by a municipal public transport provider is a rare occasion and deserves increased attention. The roles and motives of city administration, politics and public transport provider in this process are crucial for understanding why a public bike sharing system is implemented. Specifically for Munich, the question arises why this municipal effort is only made now, albeit the experiences with bike sharing are long and plenty. Additionally the case study of Munich can give insight into

the interplay and connection between bike sharing schemes and public transport as well as provide insight into the recent technical development within bike sharing schemes. A side factor for choosing Munich as case study was that the thesis supervisor lives in Munich since many years and was able to help with first contacts for the data collection.

3.2 Data collection

The data collection had a threefold base: 1) context knowledge, 2) case study / process knowledge and 3) key documents. This rather general data collection approach, serves to obtain a broad base of knowledge on the topic and to get an overarching view on the case. It is inspired by Yin's (2014, p. 105) description of the *six common sources of evidence*, but also considers the two types of expert knowledge described by Meuser and Nagel (1991) in their classical essay on expert interviews. The interviews were conducted in the period from the 1st March 2015 until the 17th of April 2015. The development of the interview guides and the process of interviewing was informed by several publications on qualitative research using (expert) interviews (amongst others (Bähring et al., 2008; Leech, 2002; Meuser and Nagel, 2009, 1991; Weiss, 1994). All interview summaries or transcripts can be found in the appendix under 8.5.1. for context knowledge interviews and 8.5.2. for case study / process knowledge interviews.

3.2.1 Context knowledge

Context knowledge was gathered through three interviews with local experts on cycling policy and development and sustainable transportation in Munich. All interviews were either recorded or if not possible, notes were taken after the actual interview. Context knowledge helps to '*identify the issue*' under observation and '*does not qualify for verifying theoretical claims on the issue*' (Meuser and Nagel, 1991, p. 447 author's translation). Following this nature of context knowledge, these individual, semi-structured and talk-like interviews served to give an overview of cycling in general in Munich. They allowed to get a perspective in comparison to other cities in Germany regarding the role of cycling and cycling policy in urban transportation. They also helped to get a picture of cycling history and development in Munich, as well as an idea of the general trend and perception regarding cycling amongst politics, administration and inhabitants. They further were used to obtain information on the local actor network regarding public bike sharing in Munich and to gather contacts for further in depth case study / process knowledge interviews.

3.2.2 Case study / process knowledge

The second element of data collection was the collection of case study / process knowledge. Meuser and Nagel (1991) describe how decisions are prepared on lower hierarchy levels, as here the highest level of detailed knowledge exists, whereas people from these levels were preferred interview partners. The information derived from these interviews poses the core part of the collected data and is the main source of knowledge for the analysis of the research question.

This knowledge was gathered through nine semi-structured interviews informed amongst others by Gläser and Laudel's (2009) and Leech's (2002) recommendations and the already above mentioned author's. Interview partners were members of political parties, employees of relevant departments, a member of the transport operator and (former) contractual partners of bike sharing operators in Munich. The institutions of the interview partners are listed in the appendix under 8.1. The first three groups had a common interview guide, with three additional questions for politicians and two additional questions for members of relevant departments and the transport operator. These interviews were recorded for further analysis. For the contractual partners the interview guide was based on the one for the other groups. It was adapted to their position inside the research and due to the spontaneous circumstances the interviews took place in followed a more talk-like character. Furthermore not all of these interviews were recorded and therefore were subject to a memory protocol. The interview guides can be found in the appendix under 8.4.

3.2.3 Key documents

The third part of the data collection process was the gathering of key documents relevant for the case study (see also Yin, 2014, p. 109 on archival records). These were researched and found through an online research, mainly on the relevant official webpages by the city of Munich, its departments and the city council. Another source for these documents were the case study and context interviews, as the interviewees themselves used to refer to certain city council directives or political guidelines and plans. Out of this pool of relevant documents, key documents were chosen. These documents were not analyzed using some specific methodology, but were used 1) to inform the analysis and research process, 2) to back up and complement knowledge derived from the interviews in form of public and official information and 3) to provide a broader perspective for the case study. The identified key documents are listed in the appendix under 8.2.

3.3 Data analysis

The analysis process was instructed by work from Charmaz (2006) on grounded theory (which in turn is based on initial work by Glaser and Strauss, 1967) and the analysis of expert interviews described by Meuser and Nagel (1991). Meuser and Nagel's analysis involves a first step of transcription and/or paraphrasing of recorded interviews. This step is followed by giving headings to ever bigger parts of the transcript, starting with paragraphs to pages to questions. After this the interviews undergo a thematic comparison between each other, but still remain close to the interview's direct written content. Only after the thematic comparison the analysis continues with a sociological conceptualization and a theoretical generalization. For a more detailed description see Meuser and Nagel (1991).

The grounded theory approach by Charmaz follows a similar approach to Meuser and Nagel, but is even closer to the actual interview text and deeper 'grounded' in the collected data. It also starts with a complete transcription of the interviews followed by a phase called initial coding. This initial coding intends to summarize small parts of text, most often a line or a

sentence. After the initial coding and also afterwards memos can be written. These memos are small pieces of text intuitively summarizing thoughts on topics and ideas which come up during coding in relation to theoretical concepts concerning the data. Often a second round of coding, focused coding, follows having the goal of summarizing, structuring and unifying the initial codes. During and after this additional memos can be written, depending on topics and ideas coming up. To summarize and get an overview of the produced codes Charmaz proposes a codebook, where all the codes are gathered and summarized in distinctive topics. Further it includes direct quotes exemplifying the codes and topics. In the last phase a theory on the research question is built-up based on the codes and the memos, with literature (in a 'pure' approach) only being included and referred to at the end.

The analysis approach of this master thesis is based on a combination of these two methodologies. In a first step the recorded interviews were transcribed. Some of the interviews could not be recorded for technical reasons (e.g. equipment failure), but those were subject to a memory protocol and summary immediately after the interview. The second step was an initial line-by-line coding as proposed by Charmaz (2006) of all the interview material. During and after this process several memos were written in regard to overarching themes or theoretical ideas regarding the interview material. From here on the analysis departed from Charmaz and followed an approach more similar to Meuser and Nagel, by structuring the interviews' content according to topics, themes and first theoretical ideas. As there was no phase of focused coding, no codebook was developed. However, the memos were being used as first drafts within the final write-up process, following a standard structure with a results section and a discussion part.

4 Results

This chapter presents the results derived from the conducted interviews. It is divided into two parts with the first one presenting the general situation of cycling in Munich, serving as the framework for bike sharing schemes in Munich. This first part is mainly based on the background interviews and several official documents, but is also informed through relevant parts of the case study interviews. The second part delineates the development of bike sharing in Munich, starting with the already existing systems and other important aspects. The remaining part of the chapter describes the development of *MVG Rad* and the motives for its implementation. This second part is exclusively based on the case study interviews and the identified key documents.

4.1 Setting the mood: Cycling in Munich

4.1.1 Short history of cycling (and traffic) development in Munich

As in most German cities the urban landscape in Munich changed dramatically after World War II. After the extensive destruction of big parts of the city, rebuilding took place during the following ten years. This happened in a climate favorable for the private vehicle, as in the 1950s this was seen as the future of individual transport and promised growth engine for the German economy. This lead to the situation that slower modes of transport, e.g. walking and cycling, were pushed to the side of the street and forgotten in a planning process geared towards making the city best accessible by private vehicle (Interview 2, p.75, ll.28-31). Although there existed several suburban railways, an extensive, integrated and efficient public transport network only came to Munich with the Olympic Games of 1972. In the years around 1972 the tariff union MVV was founded (1971), the suburban railways were connected through a tunnel crossing the city east to west, the subway was started being built (1967) and the tram network reached its biggest extension. Since then the public transport network developed steadily and today is fairly efficient and appreciated. However, in Munich's streetscape it is still apparent that slower modes of transport were neglected, with bike lanes mainly being narrow and together on one level with pedestrian walkways.

Regarding cycling traffic a first revival amongst Munich's population took place in the 1960s (Interview 2, p.75, ll.31-32). This was mainly in relation to cycling as leisure and sports activity and not as a mode of transport in the city, wherefore the changes in infrastructure concentrated on side routes and bike lanes in green spaces and along the river Isar to provide infrastructure for leisure activities. Throughout the mid- to late-1980s a second revival followed, where the bicycle slowly started to be regarded as a viable mode of transport in the city. This second push for cycling was related to the oil crisis in the early 70s as well as the negative impacts of excessive car traffic. It specifically can be seen as lead by the inhabitants of Munich and the civil society which mobilized against noise and air pollution from private vehicles. They pushed for a different kind of city, with less pollution and less noise, today subsumed under the term of a more livable city, which the bicycle was representative for: '*they really want this type of city, not only the cycling but what cycling and a mobility system*

represents: cycling, walking (...) Against the car with all the noise and emissions' (Interview 2, p.76 l.4-6) This led to an extensive expansion of speed reduced zones, now covering 80% of the city area (RSB et al. 2009, p. 10). This movement continued into the 1990s and was strengthened through several initiatives like bicycle star tours with several thousand participants by the German Cyclist's Association (ADFC) and München 2000 Autofrei e.V. (today GreenCity e.V.). This is the period when the idea for *Call-a-Bike* (then called Fahrradpool) was born, which became Germany's first public bike sharing scheme in 1998. In the following years on-road bike lanes were increasingly introduced and city politics first paid attention to the bicycle as a mode of transport in the whole city from a systems perspective with a separate Traffic Development Plan Bicycle in 2002 (earlier traffic development plans for the bicycle were only for certain districts) (RSB, 2002). A continuing increase in the modal split for cycling was observable (figure 1).

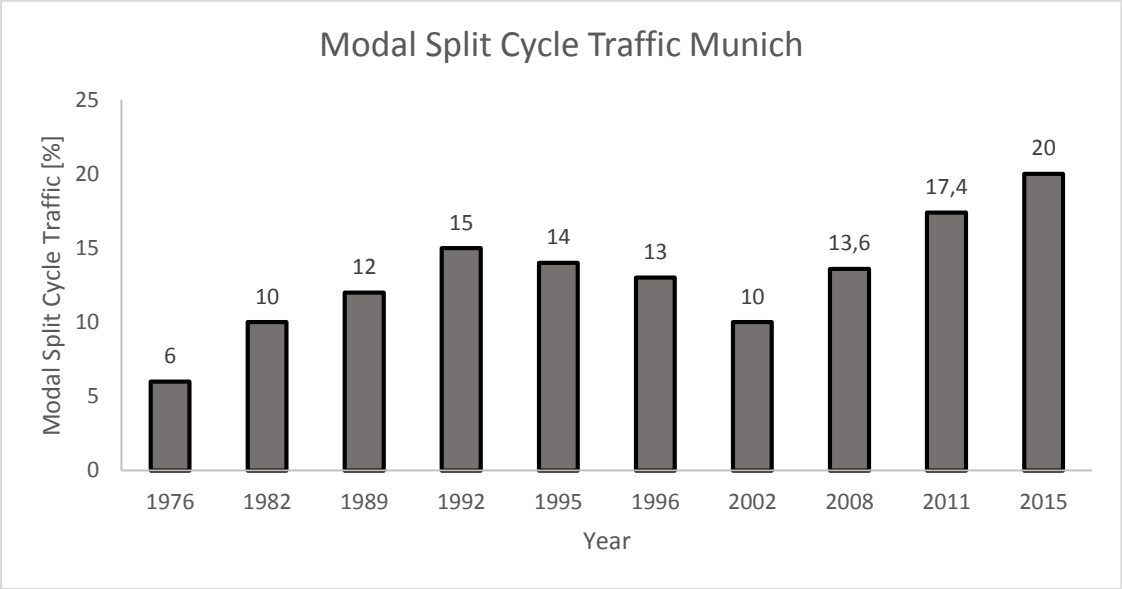

Figure 1: Modal Split for cycle traffic in Munich. Sources: 1976-1996: (SocialData, n.d.)*; 2002-2011:* (von Sassen, 2013)*; 2015: estimation according to interviewees.*

The main political push came in the period around 2007 when Munich hosted the VeloCity Conference in June 2007 (Interview 3, p.77, l.39- p.78, l.1). Two years later the city council passed the 'Grundsatzbeschluss Radverkehr' ('General Resolution Cycle Traffic'), deciding on an improvement for cycle traffic, mainly the closing of the main route network, opening of one way streets and the tripling of the funds for cycling measures from 1,5 to 4,5 million Euros (RSB et al., 2009). In 2010, Munich started an extensive cycling marketing campaign called '*Radlhauptstadt München*' (Bicycle Capital Munich) advertising the bicycle as an alternative and ecological mode of transport for the inhabitants of Munich (KVR, 2010).

Summing up it can be said, that the initial push for cycling in Munich came from the public and civil society and not from politics or the administration. One interview partner described it as a societal trend the city wanted to push further and succeeded to do so, but nothing the city

could have achieved on its own: '*cycling is substantially growing and more than politics can actually be held responsible for*' (Interview 8, p.128, ll.8-9, author's translation).

4.1.2 Current state of cycling in Munich: infrastructure and political landscape

The cycling infrastructure in Munich today in comparison to most other bigger German and European cities is quite good. Most of the main streets and routes in the city have off-road bike lanes, which are small, on sidewalks and do not fulfill modern cycling infrastructure criteria, but form a cycling network without many missing links. Most interviewees emphasized this characteristic of Munich, that although it neither is a frontrunner regarding infrastructure nor has one meeting the state of the art, Munich at least has bike infrastructure in large parts of the city: '*even if bike lanes do not fulfill current technical standards, neither in width nor in surface condition, there at least is a basic network*' (Interview 1, p.62, ll.13-15, author's translation). Furthermore, around 80% of the city area is speed reduced to 30 km/h, and more than 50 % of one-way streets are opened for both way cycle traffic. Munich has large amounts of Bike+Ride parking places and is continuously expanding those (Zorn, 2013). Some of the interviewees explained that Munich is at the limit of expanding the current cycling infrastructure without moving towards a drastic redistribution of space between the different modes of transport, most notably between the private vehicle and the bicycle: '*Now if one looks at the infrastructure itself, it really is about the space [and] a drastic expulsion. If I want to build a bike lane, I have to take [space] from another road user*' (Interview 1, p.61, ll.25-27, author's translation).

The political and administrational landscapes around cycling are complicated. In the cities' administration, five different departments are responsible for public policy regarding cycling, depending whether it's about infrastructure, traffic regulation, promotion, etc. Although each department is working towards improvements of the cycling conditions, joint efforts and especially their successful communication to the public are difficult and complex processes. As every participating department has to approve a press release or a joint report, the process of actual releasing a report can take a long time and involves much internal communication efforts, often hindering an effective communication to the public (Interview 1, p.64 l.29 – p.65, l.6). In addition, some interviewees talked about the administration at times being halted by city politics in implementing measures benefitting cycling in Munich: '…the*re would be much much more possible, if politics would not torpedo [pro-cycling measures]*' (Interview 1, p.64, ll.21-22, author's translation).

Politically the strongest advocate for cycling in the city council was and still is the Green Party. The other parties of the city council, albeit they are also active in the promotion of cycling – most notably in the existing marketing campaign 'Radlhauptstadt' – are in terms of space redistribution more car-friendly and mostly promote pull factors to reduce private vehicle usage: '*but eventually both parties […] are car-friendly*' (Interview 1, p.64 ll.5-6, author's translation; see also Interview 3, p.80, ll.5-10). A popular recent example is the restructuring of the Rosenheimer Straße, a main street in Munich. For this project, there exist several

proposals, with the Green Party and the administration favoring the more cycle friendly proposal introducing on-street bike lanes and reducing the number of available car lanes. The Christ Social Union (CSU) and the Social Democratic Party (SPD) instead favor the more car friendly proposal, which does not foresee a reduction of car lanes, but separated bike lanes on the pedestrian walkway. As the current city government is led by the CSU in cooperation with the SPD, the second proposal will most likely be implemented (Interview 5, p.93, l.35 – p.96, l.2).

Within the bigger picture of city development and traffic management politics and administration regard the investment into cycling and cycling infrastructure as in the framework of the 'Perspektive München' ('Perspective Munich') resolution from 1998, which foresees the development of Munich as 'Compact, Urban, Green' (LHM, 1998). Further insights into this will be provided within the next subsection about the reasons for cycling and cycling promotion in Munich and can be found in detail in the 'General Resolution Cycle Traffic' (RSB et al., 2009).

4.1.3 Reasons for cycling and cycling promotion in Munich

Reasons for the strong promotion of cycling in Munich are manifold. As written above, cycling was and is a societal trend, which the city successfully fostered. Part of this is that the bike is used as an accessory in shopping windows and that there is a significant amount of people buying bikes as status and lifestyle symbol: *'cycling at the right time of the year and in the right situation is hip in Munich*' (Interview 1, p.62, ll.27-28, author's translation); '*…and the bicycle established itself, apart from being an article of daily use, as an expression of individual style'* (Interview 3, p.78, ll.12-13, author's translation). Interviewees explained, that many inhabitants of Munich use their bikes for leisure activities like cycling to a cafe or through the park on sunny weekends (LHM, 2010). A smaller amount of inhabitants use the bicycle as a proper mode of transport or for environmental reasons (Interview 1, p.63, ll.10-19).

In addition to this trend Munich has three main issues regarding its transport system: 1) space, 2) 'overcrowding' and 3) pollution. Those issues are closely intertwined with Munich's current growth with a prognosticated population of around 1,6 million in 2030 from just 1,4 million in 2013 being in the perceived center of the problem (BLS, 2015). Most interviewees outlined this general problem area as the main political reasons for cycling promotion in Munich, as well as primary reasons for why people are switching to cycling as their mode of transport.

Munich is a dense city, with an average density of 4700 inhabitants/km². Inner-city areas have densities between 8000 and 15000 inhabitants/km² (Statistisches Amt, 2014). In these areas, only few parking places exist which are already overbooked with resident parking licenses, making owning a car and travelling there by car fairly difficult. Mainly because of densification, caused by Munich's growth taking place all over the city area the pressure on parking space is increasing. This pressure increases even further due to a marked increase in carsharing licenses, allowing parking everywhere in the city: *'Additionally the parking situation is*

aggravating, as more and more carsharing cars are allowed (…)' (Interview 1, p.62, ll.21-22, author's translation). Munich's population growth naturally leads to more traffic overall, resulting in more blocked streets and more people on public transport especially during rush hour periods. Generally interviewees were talking about public transport and streets reaching its capacity, especially main routes and inner city areas (Interview 1, p.65, ll.35-37; Interview 3, p.78, ll.33-35). Naturally the increased traffic leads to increased levels of pollution, with nitrous oxides reportedly being at the core of the problem (Interview 5, p.92, ll.32-34).

For the cities transport system, cycling is supposed to reduce the congestion pressure on the streets and overcrowding of public transport. For residents cycling can be a more comfortable, cheaper and even faster commuting and transport option, saving car related expenses, avoiding traffic jams and overcrowded public transport and eliminating the pressure to find a parking place. Interviewees stressed their hope, that increased cycling can help to reduce the pressure for more parking places. The benefits of reduced pollution and potential health benefits for cyclists were seen as co-benefits, but not primary reasons for the promotion of cycling and investments in cycling infrastructure. This problem area was also outlined in the 'General Resolution Cycle Traffic', serving as the official statement by the city for cycling and cycling promotion (RSB et al., 2009). Additionally, the report talks about the relatively small costs for cycling infrastructure in comparison to private vehicle or public transport infrastructure.

The main element in cycling promotion in recent years was the marketing campaign *Radlhauptstadt*, which was started to excite the inhabitants of Munich for cycling through first bringing the bicycle into their consciousness and second showing what Munich already offers for cyclists. After the first period it was prolonged in 2014 for another five years (KVR, 2014), as it is generally seen as having succeeded in its goals, is favored by all political parties and received a good feedback in its scientific evaluation and gained national and international attention (raumkom & WI, 2011). In addition since 2014 the city spends 10 million Euros yearly on short-range mobility, which includes infrastructure and promotion for cycling and walking (which was beforehand increased from 1,5 million Euros to 4,5 million Euros in 2009) (BayernSPD, 2014). However, critics say that marketing is not enough to further increase cycling in Munich, as the existing infrastructure is insufficient for the favored and planned increase in cycling. Therefore, the city needs a modern cycling infrastructure and commitment in terms of space redistribution in favor of the bicycle (Interview 8, p.138, l.31 – p.139, l.14). They claim, that especially city politics missed out to take a proactive stand in this issue in the last years: '*in my eyes, the city missed a chance to adapt the infrastructure to modern requirements*' (Interview 1, p.67, ll.9-10, author's translation). In relation to this interviewees referred to Munich as normally not being a frontrunner in terms of cycling and cycling infrastructure, as city politics and administration tend to prefer to wait for successful implementations in other cities and then adapt those to Munich's local circumstances, learning from mistakes made (Interview 8, p.130, l.3-6; Interview 4, p.83, ll.5-6).

4.2 Bike sharing schemes in Munich

The following part will explore how bike sharing in Munich, especially the new system *MVG Rad*, fits into the presented background of cycling and cycling promotion. It explains how bike sharing developed and what the political and administrational reasons for the implementation of BSS are in Munich. This will commence with an overview on the history of bike sharing in Munich describing *Call-a-Bike*, the National Contest Innovative Public Bike Sharing Schemes and *nextbike*. The second part will talk about *MVG Rad*, which is the newest BSS in Munich and is implemented by the local transport operator Munich Transport Association (MVG).

4.2.1 Call-a-Bike

Call-a-Bike was introduced in 1998 by a couple of students. It started with around 1200 bikes within the inner-city area of the middle ring, with the plan to increase the area to the whole city are of Munich with 2000 bikes. The concept of *Call-a-Bike* is characterized by a flexible system without fixed points to rent bicycles, unlike it is the case for most bike sharing schemes. This flexible system was implemented, because at this time neither politics nor administration wanted bike share stations in public spaces and was made possible through the development of a special lock. As a consequence there was a core area, inside the middle ring, where bikes could be left and locked at every street corner, but due to the unavailability of cell phones, had to be left at phone booths (Interview 10, pp.148-150). The renting was done through a phone call, from which the registered user received the number for the bike lock, which was also used for locking the bike after or during the usage. The inventors of *Call-a-Bike* wanted to increase cycling traffic in Munich and provide a flexible cycling option for everybody in Munich who does not have a bicycle available for whatever reason (Interview 10, pp.148-150).

After roughly three years in business the start-up company went bankrupt and asked the city to fund the bike sharing system, but the city refused to do so. Instead the German railway bought the system and concept and spread it throughout Germany, with mainly small fleets of bicycles at ICE train stations and some large systems in a few cities. The system in Munich remained as it was implemented and only experienced some small changes, like the connection with a smartphone application and a small reduction in available bicycles. In the season of 2014 (April – November) *Call-a-Bike* had roughly 1,8 trips per bike per day with around 1200 bikes throughout the area inside the Mittlerer Ring (Völklein, 2015). Overall *Call-a-Bike* does not interact with any cycling initiatives by the city. Interviewees mentioned, that due to the disperse distribution of the bicycles, there is no big effect on the public awareness for bike sharing and that users tend to be from a comparably small circle of frequent 'expert users', mainly tourists and business travelers, but not the average inhabitant of Munich (Interview 8, p.139, ll.18-22; Interview 6 p.108, ll.19-23).

4.2.2 National Contest 'Innovative Public Bike Sharing Systems'

The next important point in time regarding bike sharing in Munich was marked by a national contest for innovative public bike sharing systems by the former Federal Ministry for Transport, Building and Urban Development in 2009. The intent of this contest was to foster

the development of bike sharing in Germany by subsidizing the build-up of innovative BSS in selected model cities (WI & difu 2009). In Munich this contest gained the interest of the MVG as well as of the city administration, resulting in a cooperation in the development of a concept for the contest. This concept foresaw the introduction of a BSS along the U3/U6 subway line, in close connection to public transport in order to enable a comfortable last-mile solution (Interview 6, p.108 ll.3-7; Interview 8, p.129, l.28 – p.130, l.2).

This attempt to start a system was stopped by the Lenkungskreis Radverkehr (steering committee cycling traffic), constituted by leading members from the departments working with cycling. The reasons for this decision against a city-owned public bike sharing system are manifold. As one main issue described by the administration was the shortage of space throughout the inner-city area. The administration was not convinced that there are enough available spaces for the placement of bike sharing stations (Interview 4, p.84, ll.2-4). Additionally the contest came during the same period as the 'General Resolution Cycle Traffic', wherefore the administration said that they have reached their planning and working capacities regarding cycling (RSB, 2012). There might have also existed the belief, that without a functioning infrastructure a bike sharing system is not working as it is intended to. Another hindering topic was the existence of *Call-a-Bike* and the thought of BSS being most efficient as monopolies. Due to the existence of *Call-a-Bike* many actors in politics and administration did not see the need for an additional bike sharing system as there already was one, which then was modern and sufficient for the perceived needs of Munich: '*If Call-a-Bike would not have existed here, that I am sure, the city would have taken initiative earlier*' (Interview 6, p.110, ll.2-4, author's translation). A further reason mentioned by some interviewees was the short deadline for the application itself, whereas there was not enough time to have a thorough political debate or discussion and planning process (Interview 5, p.85, ll.1-2). A more unofficial explanation sees Munich's politics and administration fearing that car parking places will be lost by the introduction of the BSS, therefore voting against the application, seeing it as politically not feasible (Interview 8, p.129, l.38 – p.130, l.3). In general interviewees also explained that Munich, as mentioned earlier, tends to let others conduct pilot projects and test new ideas and concepts regarding cycling and wants to learn from the other cities and the mistakes they are making. Some interviewees see the contest as a missed chance to make an early step towards more efforts for cycling and a proactive way regarding changing mobility needs and structures.

4.2.3 Nextbike

In 2011, *nextbike* introduced a branch in Munich with around 30 virtual stations and 300 bikes. This system was locally managed by an established bike rental company from Munich. *Nextbike's* financial model is based on selling advertisement spaces on their bikes and has a comparably low daily usage fee making it attractive for tourists. Due to the small amount of bikes available there was no dense and city-covering station network (Interview 11, p.151,

ll.14-18). Stations were mainly located at selected main transport hubs, touristic locations and areas offering a high visibility for the advertisements.

Due to this form of implementation, a more tourist-oriented disperse BSS, some interviewees claimed the *nextbike* system was not really a suitable solution for Munich as a whole. Some even claimed it is not a functioning public bike sharing system in the sense of serving as a local transport option and together with *Call-a-Bike* provided an expert system (Interview 5, p.86, ll.4-9). This means that people who know about one or the other would use the system, but the general population is not even aware of them and is therefore not profiting of the benefits bike sharing has for urban mobility (Interview 8, p.139, ll.18-22).

Moreover, it was reported that the general cooperation with the city was sometimes difficult and *nextbike's* concept of flexible and virtual stations caused several incidents where bikes were standing in the way and blocking pedestrian walkways and crossings, due to inattentive users leaving bikes at illegitimate places: *'it partly lead to disagreements with the city*' (Interview 5, p.85, ll.32-33, author's translation); '*the cooperation with the city was difficult. They by times had troubles with the way the system functions'* (Interview 12, p.153, ll.15-16, author's translation). *Nextbike* also cooperates reportedly successful with multiple companies and the administration within the municipal corporate mobility management program. In this program, companies can pay *nextbike* for the construction of stations and bikes for the purposes of the company, for example for business trips inside the city or commuting to and from work (Interview 5, p.86, l.11 – p.87, l.10).

The cooperation between *nextbike* and the local partner was ended after roughly two years in agreement from both sides, mostly due to financial reasons, with the system now being managed from somebody else until it is going to be 'substituted' by the new city owned system *MVG Rad*.

4.2.4 MVG Rad

The previous sections described the context in which the city owned system *MVG Rad* came into place. The first section explained the general perception and landscape in regard to cycling and cycling promotion, drawing a picture of existent insufficient but improving infrastructure, a steady increase of the modal split for cycling during the last decade, a generally favorable political, administrational and social landscape with a long history of civic engagement for the bicycle and a relatively high cycling awareness through an extensive continuous marketing campaign for cycling. Albeit this supposedly bike sharing friendly environment, bike sharing has not been overly successful in Munich: '*As of today, I think [bike sharing systems] play a marginal role in Munich*' (Interview 3, p.80, l.31, author's translation). *Call-a-Bike's* user numbers are only increasing recently and *nextbike* was not able to provide a viable bike sharing infrastructure for general usage by a broader population. The city itself decided against an own initiative for a bike sharing system twice (in the early years of *Call-a-Bike* and during the national contest). The following chapter will explore why the city now

decided to engage in public bike sharing. It will start by explaining the history of this decision and the characteristics of the planned system. The main part will consist of the motivations for the city to now implement this system and ends with a short outlook on possible favored future developments.

4.2.4.1 The history of MVG Rad

The first time Munich's transport provider MVG thought about an engagement with bike sharing was during the time of the national contest in 2009: '*we wanted to participate*' (Interview 7, p.117, l.16, author's translation). In cooperation with the city administration, the MVG was working on a pilot project, which ended up not being implemented. Since then the idea for a public transport provider owned public bike sharing system existed and was discussed and planned internally. Especially the aspect of what is going to be done by the MVG and which parts should be organized externally was a central part of this discussion (Interview 7, p.122 ll.29-30). The first political appearance of a BSS in the city council was in December 2010, when a motion by a CSU-member presented the possibilities of a BSS for Munich and the region (Kronawitter, 2010). In this period the relevant actors were following the outcomes of the national contest, with the MVG looking into possible options for a public bike sharing system on their own. A second motion by the Green Party was brought into the city council in May 2013, explicitly demanding a close involvement of the public transport provider and an integration into the mobility offers in Munich (Die Grünen - rosa liste, 2013). At this point in time the MVG had already decided they wanted to introduce a BSS within their public transport offer. Most likely there were internal communications between the MVG and the Green Party to coordinate the plans of the MVG and the motion of the Green Party, although this was not clearly mentioned by any interview partner. In the following period the MVG developed a concept for the scheme until the basic resolution for a public bike share system in February 2014 commissioned the MVG to continue the planning in a close cooperation with the relevant departments (RAW, 2014a).

Although the final decision to implement *MVG Rad* was only made in November 2014 the MVG made an European call for bids in summer 2014 searching for a system operator for a term of ten years, who provides the infrastructure and will also be responsible for the daily management, e.g. redistribution of bikes and repairs (Interview 7, p.121, l.37 – p.122, l.3). Furthermore a working group for the station location concept was founded to find suitable locations for the bike sharing stations in cooperation with the Department of Public Order and the Department for Employment and Economy. In addition to this the MVG also cooperated with the district governments, benefitting from their local knowledge (Interview 7, p122, l.36 – p.123, l.2; Interview 5, p.89, ll.12-25). With the implementation resolution on the 20th of November 2014, *nextbike* was chosen as the winner of the bid. The actual build-up is currently being planned, with a scheduled start in summer 2015 (MVG, 2015). The implementation resolution further defines the financing for the system. The city of Munich will cover the 5 million Euros investment costs for bikes, stations and eventual civil engineering costs, whereas

the MVG is covering 2 million Euros of other investment costs, e.g. IT, marketing, project management, and 8 million Euros for the operation of the system for ten years (RAW, 2014b).

All interviewees described the implementation process as without any major obstacles. Often there was a positive feedback and even questions why this is only happening now, with some actors already asking for a substantial expansion of the system. Several interviewees mentioned that especially on the district level politicians were particularly open towards *MVG Rad* and were also open to reduce private vehicle parking places in favor of bike sharing stations, which generally is seen as politically difficult within city level politics and the administration: *'the district council members are more radical, they say we don't care about parking spaces'* (Interview 5, p. 89, ll.29-30, author's translation).

4.2.4.2 The characteristics of MVG Rad

MVG Rad will start its operation with 1200 bikes distributed at 125 stations. The stations are mostly located at public transport stations within the middle ring with a number of stations in the neighborhood of Nymphenburg-Neuhausen, a residential neighborhood with an important tourist attraction, and stations at the final stops of the subway lines. Other station locations are at important points of interest, like the university and the German Museum. In addition to the stations *MVG Rad* has a service area, a little bit bigger than the middle ring where bikes can be left without being at a station, although there is a financial incentive planned to leave a bike at a station (Interview 7, p.120, ll.3-23).

This combination of a stationary and a flexible system is termed semi-flexible and a novelty within BSS: '*regarding the topic of semi-flexibility […] we eventually developed this ourselves'* (Interview 7, p.121, ll.22-23, author's translation). Regarding the built-up of the stations at the beginning only half of the stations will be physically implemented. The other half will be virtual, in order to let the system start immediately with full capacity and not have it delayed because of construction delays or other complications during construction (Interview 5, p.88, l.29 – p.89, l.4) (the station map is shown in figure 2 and in full resolution in the appendix).

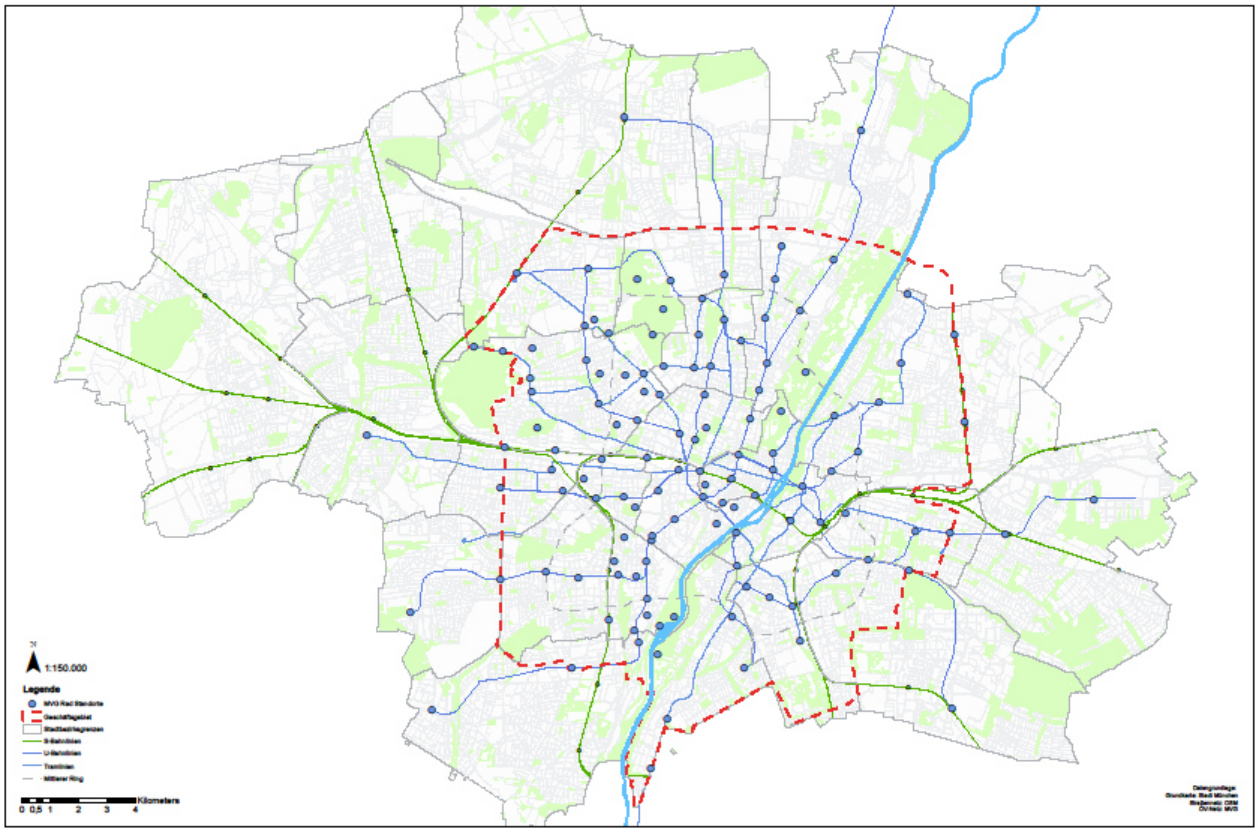

Figure 2: Station map of MVG Rad. The red dotted line surrounds the service area, blue points are station locations. Blue lines indicate subway lines, whereas green lines indicate the lines of the suburban commuter railway. Source: (RAW, 2014b).

The details of the pricing were not yet publically available, when this report was written, so this information might not be completely accurate. The pricing scheme reportedly foresees different payment options: A yearly rate which includes 30 minutes free usage per day; a pay by use approach, where the user pays the usage by minute, as it is the case for *Call-a-Bike* and the integration of *MVG Rad* into the pricing system of the region, possibly allowing the included usage of a bike after a public transport trip, eventually in combination with a mobile ticket (RAW, 2014b).

The peer groups seen by the MVG and the other interviewees are tourists, mostly non-scheduled traffic by inhabitants and commuters from the surrounding neighboring communities. For tourists, *MVG Rad* is seen as an active and comfortable way to explore Munich. For inhabitants, *MVG Rad* is providing a flexible way to get around Munich. This includes the enabling of complex mobility patterns, often difficult to manage with conventional public transport. It also includes peripheral traffic in terms of time and space (Interview 5, p. 91, ll.2-4). *MVG Rad* is seen as increasing the service area of a public transport station and enabling cross-cutting connections which were not possible before by public transport. In terms of peripheral time, it helps to close gaps of the public transport system at night, as *MVG Rad* will be available all the time. For commuters, *MVG Rad* is supposed to provide a last-mile solution for their public transport trip. Many commuters have bikes located in the city which they are using only a few times a month. The city would like to reduce the

number of rarely used personal bikes as they are taking much needed bike parking space at main transport hubs (Interview 5, p.103, ll.25-29). Another characteristic the MVG paid special attention to was to keep the bicycle free of advertisements: '*…no third party advertisements on the bikes. […] It was a difficult but fundamental decision to say, it is a used for transport and for that it should stand and not for Nivea. […] Otherwise we would not have done it I suppose'* (Interview 7, p.127, ll.18-27, author's translation).

In general *MVG Rad* is planned towards being a last-mile solution for public transport users, becoming an integrated part of public transport in Munich also for tourists, providing a flexible mobility service within the city and reducing pressure on other modes of public transport.

4.2.4.3 Reasons for the implementation of MVG Rad

This part will present the stated reasons for the implementation of a city-owned bike sharing system in the city of Munich. The five overarching themes of these reasons are 1) bike sharing and public transport as an overarching guideline, 2) city image and marketing, 3) market research for intermodal and multimodal mobility, 4) further benefits of bike sharing and 5) environmental and health benefits. These reason complexes span from political reasons (bike sharing as public transport, city image and marketing), economic reasons (market research), technical reasons (further benefits) and social and environmental reasons (environment and health). The interesting aspect of what has changed from 2009, where a city-owned bike sharing system was neglected, will be part of the discussion following in the next chapter.

4.2.4.3.1 Bike sharing and public transport

This theme complex can be seen as an overarching guideline for *MVG Rad*. Every interviewee emphasized the characteristic of *MVG Rad* being owned by the public transport provider in Munich, making it an official part of public transport in the city. The CEO of MVG referred to *MVG Rad* as being the fourth column of public transport offered by the MVG in Munich, with the intention of enforcing the synergies between the bicycle and public transport (Interview 8, p.130, ll.18-22). The interviewee from the MVG referred to it as their contribution to the Radlhauptstadt marketing campaign: *'I always say, this is our contribution to Radlhauptstadt München*' (Interview 7, p.118, ll.26-27, author's translation). The design of *MVG Rad* will be similar to that of the buses, subways and trams and the bike sharing stations will be signposted at every public transport stop they are adjacent to. The MVG essentially sees *MVG Rad* as a means to advance the existing public transport system in order to improve service for current customers, but also to gain new customers (Interview 7, p.117, l.30 – p.118, l.2). *MVG Rad* helps to improve public transport service and accessibility in the periphery in time, especially during night hours, when other public transport is not running (Interview 5, p.91, ll.2-5), and the periphery in space, where public transport service is more disperse and infrequent (Interview 9, p.145, ll.10-12), although especially the second point has yet to be realized. Furthermore, as Munich's public transport system is centrally organized *MVG Rad* is supposed to allow users to make tangential and 'cross-cutting' trips, avoiding a trip into the center and back, essentially improving the interconnection of the existing public transport: *'We have an*

extremely radial public transport system, so we are eventually missing the tangents' (Interview 5, p.91, ll.10-13, author's translation).

The interviewees see it as extremely beneficial to have bike sharing as a part of public transport for multiple reasons. A first benefit is seen in the fact that the system is not owned by a private actor out of the control of the city. Being part of a city-owned company, enables the type of system the city wants and sees as beneficial and which essentially is not geared towards the benefits of a private company (Interview 7, p.116, ll.26-31). Furthermore public bike sharing is seen as having the most positive effects on the city's traffic situation, especially if it is integrated into public transport. Therefore it provides a last-mile solution and brings the chance to reduce long car journeys into or out of the city, as it enables the flexible movement at the end of the journey (Interview 9, p.145, ll.6-8; Interview 5, p.90, ll.31-32). The often anticipated problem of bike sharing systems reducing public transport usage and revenue is not an issue, simply through the fact that bike sharing is provided by the public transport company. Therefore *MVG Rad* being owned by the public transport provider works against the cannibalization of public transport through bike sharing and significantly reduces conflicts around the introduction of bike sharing (Interview 5, p.91, ll.15-21; Interview 8, p.130, ll.13-18).

Apart from incorporating bike sharing as public transport there are also several reasons within the current public transport system for the implementation of *MVG Rad*. The most reported reason was the topic of taking bicycles on public transport. In Munich this is only possible in the subway and the suburban trains during certain hours and not in buses and trams. With *MVG Rad* the MVG wants to offer people, who are not able to take a bicycle on public transport, a possibility to use a bike at the end of their trip (Interview 7, p.115, l.34 – p.116, l. 8). It is also hoped that *MVG Rad* helps to reduce the pressure on the public transport system, especially during rush hours by shifting trips towards *MVG Rad* (Interview 8, p.136, ll.29-30; Interview 5, p.91, ll.8-9). One interviewee saw *MVG Rad* as a possible way to come by the problems of leisure travel, which often is disperse, infrequent and difficult to serve with public transport (Interview 4, p.83, l.10-11). By offering a flexible always available public transport option leisure travel is therefore hoped to be served better.

Overall *MVG Rad* is seen as an additional way to increase the use of sustainable transport modes and a further advertisement for public transport, eventually helping to reduce trips made with a private vehicle. Following some arguments *MVG Rad* can even rather be seen as an addition to 'eco-mobility' than as a measure to increase cycling in specific: '*I see it less under the aspect of cycling promotion, but under the aspect of promoting sustainable modes of transport. For me it more belongs there thematically*' (Interview 6, p.113, ll.24-26, author's translation).

4.2.4.3.2 City image and marketing

This second set of reasons has to do with the city image and its marketing. Some interviewees described that cycling and especially a public bike sharing system nowadays are regarded as an integral part of a city, not only for tourism but also in terms of marketing itself as a livable city (Interview 6, p.109, ll.29-31). The modal split of a city is not only seen as an indicator of transport distribution but also of the quality of life in a city (Interview 3, p.79, ll.5-8). BSS stand for a flexible mobility and an environmentally conscious and healthy transport alternative and have become part of the mobility options in many cities in the last ten years. Therefore *MVG Rad* is also seen as a reaction to this general trend amongst cities to offer this new mobility service.

Especially for tourism, bike sharing schemes have become an important image aspect. All interviewees and the official city council documents about *MVG Rad* pointed to tourists and other visitors, who normally do not bring a bike, as important peer groups for bike sharing (Interview 5, p.95, ll.13-23) (RAW, 2014a). Having the opportunity to travel Munich using a bike sharing system is seen as a way to make the movement of these groups more sustainable but especially more enjoyable as most visitors already use public transport (Interview 7, p.117, ll.9-14). This aspect is also perceived as a certain 'going with the time', because the availability of bike sharing is felt to have become a common and expected feature of cities (Interview 6, p.109, ll.29-31). For the MVG it further was important not to lose this customer group, but to offer a complete mobility solution for visitors in Munich (Interview 7, p.117, ll.9-14).

Many interviewees also referred to *MVG Rad* being the next consequent step in cycling promotion as well as fitting the overall traffic development in terms of a more inter- and multimodal transport system (Interview 9, p.143, ll.16-22; Interview 4, p.83, ll.35-36).

4.2.4.3.3 Market research for intermodal and multimodal mobility

Market research showed that customers have the desire for more intermodal and multimodal travel options. Therefore this was one of the triggering reasons for the MVG to start a public bike sharing system as a public transport provider: '*the situation out of market research, that more and more people would like to combine different modes of transport, actually was our motivation*' (Interview 7, p.115, ll.32-34, author's translation). As the MVG wants to keep and gain customers for public transport, they want to position themselves in this new market development towards inter- and multimodality. To this end, the MVG is already cooperating with several carsharing operators in Munich. Operating a public bike sharing system, which is integrated into the pricing scheme and the public transport network of the MVG, is considered a good addition to the MVG's current mobility services to strengthen its inter- and multimodal character as a mobility company (Interview 7, p.116, ll.22-23).

This especially makes sense in relation to an improved service for commuters, which is seen as the second mayor peer group for *MVG Rad* (Interview 7, p.119, ll.14-19). Commuters have the need to get to and from the public transport station, which is often done by car, other

short public transport trips or a separate bike parked in the city. *MVG Rad* is expected to shift these trips and to foster the combination between public transport and cycling. By enabling it's users to perform one way trips, *MVG Rad* supports and allows complex mobility patterns, which are often difficult to undertake with public transport (Interview 7, p.119, ll.19-25; Interview 9, p.143, l.25 – p.144, l.6). Through its characteristics of a 24/7 service, *MVG Rad* also increases the flexibility for *MVG Rad* customers by making them independent from run times of public transport, especially during peripheral times.

4.2.4.3.4 Further benefits of bike sharing

This broad theme complex includes reasons of a more technical nature and partly are specific for the local situation in Munich. One big problem in Munich is a low availability of free public space, which has been an obstacle for the implementation of a stationary bike sharing system in the past. Since MVG is the owner of the system, this problem is reduced as the MVG can use its own available space at public transport stations for the build-up of the bike sharing stations (Interview 6, p.111, ll.11-17). Many interviewees talked about *Call-a-Bike* and *nextbike* not being visible in the city, due to missing stations (Interview 5, p.85, ll.4-5). With *MVG Rad,* the interviewees hope that bike sharing, the cyclability of Munich and its cycling infrastructure get more visible to the residents and visitors of Munich. This is hoped to function as a further promotion for cycling. Another problem in Munich, although not unique for a major German city, is the large amount of commuters having a bike parked at the major transport hubs in the city, blocking otherwise needed parking spaces. Often these bikes are only used a few times a month or get deserted. Especially city officials hope that *MVG Rad* helps to reduce the number of unused and rarely used bikes at these central hubs (Interview 5, p.103, l.9-28; Interview 8, p.133, ll.11-23).

Further, the 'General Resolution on *MVG Rad*' mentions that *MVG Rad* helps to secure the mobility needs of people without access to a car or without a driver's license (RAW, 2014a, p. 4). Currently a big part of Munich's population does not have access to the existing bike sharing systems and one of the goals of *MVG Rad* is to improve this situation. How the city intends to achieve this goal in detail cannot, however, be found in the general resolution nor was it explained by any of the interviewees.

Also not a specifically local reason is the financial aspect of the implementation of a bike sharing system. Compared to most other improvements for traffic, e.g. rebuilding of streets, increasing public transport capacity and frequency, construction of additional conventional public transport, *MVG Rad* is a cheap way to increase the transport capacity in Munich (Interview 6, p.113, ll.33-35). It doesn't require major construction works and can be implemented without an extensive redistribution of space from other modes of transport, making it easy to implement without major political difficulties (Interview 8, p.132, ll.17-23).

4.2.4.3.5 Environmental and health benefits

The last set of reasons is concerned with environmental and health arguments. Both were not seen as primary reasons or causes for the implementation of *MVG Rad* (Interview 8, p.131, ll.12-14; Interview 7, p.117, l.25 – p.118, l.21). One of the goals of the MVG is to reduce private vehicle usage amongst the inhabitants of Munich, which leads to environmental and health benefits. *MVG Rad* is part of this strategy, however, technical and political reasons and problems with public transport as described above were the main motives for engaging with bike sharing. In this context *MVG Rad* was also mentioned as a further pull factor in regard to the increase of the use of sustainable transport. They stand in contrast to push-factors restricting private vehicle usage, which is politically difficult and not necessarily favored by all interviewees (Interview 7, p.117, ll.28-30; Interview 9, p.147, ll.17-26).

A similar statement was made for health benefits of bike sharing, respectively cycling. The active movement involved in cycling is seen as beneficial, but there was no motive to implement a public bike sharing system for this reason, although the possible health benefit would be a positive side-effect (Interview 9, p.143, ll.1-10; Interview 7, p.118, ll.2-13): '*Of course environment and health are two external factors of transport which […] benefit, but as there is no […] internalization of external costs, there are no incomes from it*' (Interview 7, p.118, ll.15-18, author's translation).

4.2.4.4 Future developments

Most interviewees envisioned a similar future development for *MVG Rad*. A main concern was the expansion of the system with an increase in the number of bikes to 3000 – 5000 (Interview 8, p.140, ll.24-25). *MVG Rad* is foreseen to cover the whole city area, also serving inhabitants of outer neighborhoods (Interview 7, p.122, ll.11-23). There is the demand for an extension by politicians, the district governments and the city administration and the interest of hotels and companies to include *MVG Rad* in their mobility management (Interview 7, p.130, ll.25-27; Interview 5, p.98, ll.18-25). There also exist possibilities for cooperation with the corporate mobility management program carried out by the Department for Employment and Economy, as well as with hotels and neighboring communities. The possibility was mentioned to expand *MVG Rad* towards a bike sharing system for the whole metropolitan region. One crucial element for this development, emphasized by all interviewees, is the initial usage and success of the first roll-out phase as (Interview 9, p.146, ll.12-14).

Another development goal mentioned by several interviewees and also included in a motion by the CSU, is the integration of special types of bicycles like E-bikes and cargo bikes (RAW 2014b, p. 4). This seeks to improve the accessibility and usability of the bike sharing system by groups like elderly citizens and families and to broaden the purposes *MVG Rad* can be used for (Interview 6, p.114, ll.24-35).

5 Discussion

The discussion will pay special attention to several aspects of *MVG Rad*. It will first discuss specific findings regarding the implementation and backgrounds of *MVG Rad,* concerning the intentions for its implementation. It then continues with a more general analysis of *MVG Rad* and its nature as a bike sharing system. This will go in line with recent trends towards inter- and multimodality and the development of fourth generation bike sharing schemes. In two further sections *MVG Rad* and its role within cycling promotion will be critically discussed as a conflict on the redistribution of urban space and the connection between the literature on bike sharing, critical theory and splintering urbanism will be drawn.

5.1 Facilitating bike sharing schemes through increased cycling awareness

Looking back, several actors, such as the Green Party and the MVG itself, were in favor of a bike sharing system already in 2009 during the national contest. The reasons for a decision against a bike sharing scheme in 2009, were mainly space considerations and the capacity of the administration, but also short deadlines and the already existing *Call-a-Bike* system. One of the central questions arising now is what changes within the last years since the national contest made the implementation of *MVG Rad* possible. Following the arguments in 2009, there still was not enough space available in Munich and a considerable expansion of the administrative capacities has at least not been reported by the interviewees. There is naturally no short application deadline, but *Call-a-Bike* is still in existence and with *nextbike* even a second system is offered in Munich. So how is it that these still existent barriers were overcome within administration and politics?

The cycling marketing campaign *Radlhauptstadt* undoubtedly played a major role in this shift. All interviewees claimed the campaign made cycling not only politically more accepted but for some officials for the first time, it brought cycling and bike sharing into their mind in regard to urban mobility. *Radlhauptstadt* can be attested for creating a '*positive background noise*' (Interview 5, p.95, l.4, author's translation) for cycling. A second development has to be seen in the increase of bike sharing systems spreading across especially European cities – to which Munich sees itself in competition and comparison to. One interviewee explained, it was beneficial for many city officials to have tried a bike sharing system outside of Munich and experience the benefits they can have for urban transport, especially in the context of tourism (Interview 8, p.132, ll.28-30). The huge resistance of politicians and administration against a stationary bike sharing system is likely to have been reduced through experiencing the benefits of a stationary system in comparison to the flexible *Call-a-Bike*-like system. In a more comical remark one interviewee said: '*What I also think had a nice marketing effect [for bike sharing] is that the bikes always stand in order in those station-based systems*' (Interview 8, p.132, ll.30-32, author's translation). This may have also led to several actors becoming aware of the limitations of the current bike sharing systems, regarding their size, their character and actual effect on transport in Munich.

In general this led to an increased support and awareness for bike sharing and its possibilities by politicians and the administration. In this more favorable environment, several additional factors influenced the support for *MVG Rad*. One of these clearly is the more thoroughly planned concept behind *MVG Rad*. Whereas in 2009 the concept was developed within two months under immense time pressure, the development of the current concept lasted for several years with an extensive research phase undertaken by the MVG. It further was accompanied by an extensive planning process which included not only the administration, but also the local district governments, especially in regard of station locations. One interviewee repeatedly said: '*With this amount of planning, I cannot imagine MVG Rad not becoming a success story*' (Interview 4, p.83, ll.28-29, author's translation). Another explanation mentioned by an interviewee were rumors about the end of *Call-a-Bike*, increasing the need for an alternative functioning bike sharing system (Interview 9, p.144, l.17).

Apart from the barriers in 2009, an additional favoring factor for *MVG Rad* is the perceived positive image effect bike sharing has for a city. Although no interviewee mentioned this as a primary reason, nearly all of them talked about *MVG Rad* having a positive image for the development of Munich. It contributes to cycling promotion and to the sustainability and livability of Munich and eventually is part of transport emission reductions. In terms of overcoming the resistance against bike sharing stations, it definitely was an important factor that the MVG, a city owned public company, is the owner of the system. Based on the interviews it becomes apparent that a stationary bike sharing system would not have been implemented if proposed by a private company. This has a lot to do with officials in Munich wanting to decide how the public space in the city looks and is used in order to have a consistent appearance of the urban landscape: *'[Munich] is a special case regarding the urban landscape…there are very strict departments, who technically want to keep the whole public space free'* (Interview 5, p.85, ll.26-28, author's translation). This sort of influence and control is only given with the MVG being the owner and designer of the bike sharing system. In addition only through *MVG Rad* being publically financed the city can rightly claim the system as being part of Munich and its efforts to combat problems in its transport system and the improvement of living conditions in the city.

Overall the implementation of *MVG Rad* was greatly facilitated through an increased awareness for cycling and the perceived benefits of bike sharing in the context of urban mobility. This general finding supports earlier studies by Shaheen et al. (2014, 2012b), assessing that general awareness for cycling and cycling promotion facilitates the uptake of bike sharing schemes. This awareness on one side was raised through the local cycle marketing campaign and on the other side through the national and international personal experience of bike sharing by city officials in other cities. A further positive factor was the extensive planning process, which lead to the impression of a thought through system, in comparison to

the more spontaneous attempts towards bike sharing, by *Call-a-Bike*, *nextbike* and the concept for the national contest.

5.2 Towards inter- and multi-modality: 4th generation bike sharing and public transport

Departing from the direct implementation process, the way *MVG Rad* is implemented is in line with several developments within bike sharing and urban mobility and in the related literature. Shaheen et al. (2010) describe fourth generation bike sharing systems as being generally based on third generation stationary systems, although with a further improved user-friendliness, better background software, reduced station infrastructure and an improved integration into existent transport systems. Especially the role of real-time information and the synergies of bike sharing with public transport are expected to play an important role in future BSS. *MVG Rad* already shows some of these characteristics, such as a combination of a stationary and a flexible bike sharing scheme, the partial use of virtual stations and its close integration into public transport, through the choice of station locations, the owner, the design and the pricing system. A problematic point could be the missing station terminals, reducing the possibility of a spontaneous usage as the sign-up can only be made via an App, online or at a customer service point. This, however, can be seen as in line with the notion of a more high-tech development in bike sharing. The sign-up at a customer service point, could enable a cash payment, not involving a debit- or credit-card, eventually facilitating the usage of *MVG Rad* by low-income or less tech savvy residents. With the idealized integration of companies and hotels as station hosts and the possibility to book a bike in advance, *MVG Rad* is further developing its bike sharing system into a fourth generation, in line with the expected evolution of fourth generation systems.

As anticipated by the MVG, this characteristics fit well into a trend towards inter- and multimodal mobility behavior of urban residents away from the private automobile (Buehler, 2015; Kuhnimhof et al., 2012, 2011): '*more and more people would like to combine different modes of transport according to market research, […] this technically was our motivation*' (Interview 7, p.115, ll.32-34, author's translation). *MVG Rad* is designed in a way that effectively makes use of the synergies between public transport and bike sharing, posing the possibility of incorporating it into public transport. It brings the opportunity for an intermodal trip on both sides of a public transport commute, possibly reduces the use of public transport on short distances, leading to a decreased pressure on public transport, and eventually substitutes long trips made by car through an increased accessibility at the destination. As described by many interviewees this tight integration can have a bigger effect than just the simple sum of the existence of both transport modes in a city. This is also resembled in the literature, indicating that an increased array of transport modes helps to increase multimodal behavior (Spickermann et al., 2013). Bike sharing helps to generally bring attention towards cycling as an alternative mode of transport (Fishman et al., 2013; Fuller et al., 2013; Murphy and Usher, 2015; Shaheen et al., 2014, 2012a) and especially in connection with public

transport it eventually leads to an increased modal shift towards sustainable modes of transport (Bachand-Marleau et al., 2012 referred to in Ricci, 2015; Goodman and Cheshire, 2014; Murphy and Usher, 2015).

5.3 Bike sharing as a conflict on urban space and its redistribution

Urban space, specifically its distribution, is a central issue in Munich regarding bike sharing and the general transport development. In administration and politics, there is a large concern on how the available space is developed and distributed between different forms of usage, especially different modes of transport. The city council reportedly can debate for several hours about the conversion of parking spaces in the inner city area (Interview 5, p.89, ll.25-29). The restructuring of streetscapes in favor of more sustainable modes of transport is a difficult and debated undertaking and as presented earlier, was a major barrier towards the implementation of a stationary bike sharing system in Munich and also of *MVG Rad*.

The National Contest on Public Bike Sharing Systems, described earlier, was accompanied by a scientific evaluation, examining the problems of the implementation process of the bike sharing schemes in the participating cities. In most cities, the process of finding the station locations was named as a challenge, but was not seen as the biggest problem in any participating city (BMVBS, 2013). For systems outside Germany, there exists no direct evidence of any city on how to address the issue of station locations (Ricci, 2015), although *CitiBike* in New York City sparked discussions on the appearance of the public space (New York Times, 2013). In the case of Munich, this issue can be seen as rather challenging compared to other cities or at least as more difficult. The severity of this issue in Munich can for sure partly be explained by the high population density, especially in the inner-city districts. Another side is the before mentioned wish of the city to have a coherent appearance of its public space, as Munich's city administration perceived bike sharing station as obstructing the streetscape. But especially in relation to cycling infrastructure this space issue should be seen as a conflict on the redistribution of urban space towards more sustainable modes of transport.

The nature of this conflict essentially goes along two questions: 1) Which mode of transport should use which and how much space? and 2) How and by whom is this space developed?

The first question stands in close connection with the case observed in Munich. Here there was and is a conflict in politics and administration regarding which mode of transport gets what amount of space in the city. Within this discussion, the arguments run along lines of traffic development and management on one side and environmental and social concerns on the other side. Is a public bike sharing system more beneficial for traffic management and development than the parking spaces lost because of it? Is a public bike sharing system a feasible option for a less environmentally impacting and more socially just transport system within the same or less space? Essentially the question is if the city does benefit from the redistribution of space from the car to the bicycle? Clearly in theory if a less environmentally impacting development is to be achieved the distribution of space has to go in favor of the

bicycle to improve cycling conditions and at the same time reduce the easiness of moving with a private car in the city. But as seen in the literature review on bike sharing, the answers to the above questions are contested, difficult and highly depend on local circumstances and the political willingness to support cycling. In Munich bike sharing is seen as a good solution for the cities circumstances, but in terms of space redistribution it still is a rather cautious attempt and can only be seen as a beginning of an increased redistribution. Some interviewees, although seeing bike sharing and *MVG Rad* generally positive, referred to *MVG Rad* as being so widely supported precisely because it is not entailing a significant redistribution of space away from the car: '*this bike sharing system is a nice thing, which is good for our image […] and doesn't cost us street space. That one parking space or another has to be converted, some maybe don't see or they hope to be able to go against it in the detailed [process]*' (Interview 8, p.132, ll.18-21, author's translation).

The second question follows a political and economic line. Tironi (2014) describes the political and ecological narratives around *Vélib'*, where opponents of *Vélib'* attribute the implementation of Paris' bike sharing system by a private advertisement company to an '*outsourcing of the provision of public services to a private company*' (p.6) within the framework of a neoliberal urbanism described by Peck and Tickell (2002). This then also stands in connection with the development of premium network spaces (Graham, 2000) and a splintering urbanism, as bike sharing disproportionally serves young, wealthy, educated and mostly white males. This leads to bike sharing being a premium infrastructure developed by private companies on public space in order to capitalize on an 'urban elite', facilitated by narratives of a sustainable city within the sharing economy. The central issue of this second aspect therefore is to overcome this notion of a premium infrastructure and to turn bike sharing into a truly public infrastructure, serving the needs of the whole population. Munich is trying to do this through the public transport provider being the owner of the system as well as an extensive integration into the public transport system, regarding infrastructure, design and pricing. As a first step this works against the privatization of public space and the neoliberalization of the urban landscape. But within a market-oriented public service provision also a public service provider can own and provide premium infrastructures. Therefore steps have to be taken to increase the public nature of *MVG Rad*, serving also disadvantageous urban populations so that *MVG Rad* can be more than '*the most flexible way to have a bike available*' (Interview 7, p.124, l.14, author's translation).

In this described conflict on urban space lie two dangers. The first one lies in bike sharing being misused as the main role in cycling promotion, which it cannot be, because of its low distributional character in terms of urban space. Due to the necessity for actual cycling infrastructure to successfully promote cycling and run a bike sharing system in a long-term, the redistribution of urban space towards the bicycle is vital for a less environmentally impacting transport system. Additionally the limited evidence on the impact of bike sharing

schemes, raises doubts if bike sharing is increasingly used to make transport agendas look cycle and environmentally friendly.

The second danger lies in bike sharing becoming a premium mobility service and infrastructure for an affluent, increasingly mobile and young 'urban elite'. This would not only increase social gaps in terms of transportation access within a city, but also would mean that the actual benefits of bike sharing, being the possibility of providing a low-cost mobility service to increase mobility of low-income residents and improve access within low-income neighborhoods, often sparely served by existing public transport, are not completely used.

5.4 Further critical remarks on urban mobility and bike sharing

The above outlined conflict goes in line with the plead by Miciukiewicz and Vigar (2012) for a departure from technical solutions for societal problems. The distribution of urban space should first and foremost be regarded as a social issue. In the center of this should not stand how much space is needed to cope with the existent or predicted car traffic, but how much car traffic one actually wants in the city. As presented in the results, the reasons for implementing *MVG Rad* in Munich were in large parts of a technical or economic nature. The goal of *MVG Rad* to improve public transport through enabling inter- and multimodal trips in the inner-city certainly has a justification in itself and it is not the intention of this research to belittle it. The question I want to raise is: Shouldn't bike sharing as a mode of public transport have a focus on improving access to the city in general and answer mobility demands of those how are currently left out? As mentioned by Ricci (2015) '*it remains problematic to reconcile the need to demonstrate financial and usage success on one hand, and social inclusivity on the other*' (p.10). Also in Munich the main questions around *MVG Rad* were on the potential usage numbers and if the system will be economically viable or not.

In this context one interviewee said:

Public transport is always a subsidized business and if I want to make a bike sharing system a part of the public transport offer, then I will have to pay for it. I can't expect that essentially the bike sharing system is running on profit, which will not work. In this sense the MVG [and the city] have to be willing to subsidize [MVG Rad], […] as the system brings many macroeconomic benefits. (Interview 6, p.111, l.33 – p.112, l.2, author's translation).

As already outlined above, essentially these macroeconomic benefits are the most positive effects of bike sharing. Of course it might help to reduce pressure on public transport during rush hours, provide a denser public transport network in the inner city, compliment public transport and promote cycling. But bike sharing is first and foremost the systematic provision of the least impacting and cheapest form of transport after walking and it should also be used for this in case one wants to be serious on reducing our impact on the environment and increase social cohesion within cities. *MVG Rad* is taking the first steps, although for different reasons, by keeping bike sharing in public hands. There further is a consciousness that the biggest benefits of bike sharing can be realized, where public transport ends or does not

existent: '*you would need [bike sharing] more, where the bus connection is getting worse…where the settlement structure is less dense*' (Interview 8, p.133, ll.28-29, author's translation). On the other side it did not seem politically feasible to immediately bring bike sharing to areas where it is actually needed, but to areas where it has a marketing effect and could be economically profitable in a short term: *'[…] but there, [in the outer areas], it would not have a marketing effect*' (Interview 8, p.133, l.30, author's translation); '*At the end it is about how many users I can attract in order for it being economically viable*' (Interview 9, p.146, ll.12-14, author's translations). It specifically is not '*a social project in itself*' (Interview 7, p.124, l.6, author's translation), which is legitimate, but opens *MVG Rad* to a for-profit optimization for specific target groups in a competitive market: *'…it is the same if you sell sausages or public transport…only the one buying actually buys*' (Interview 7, p.123, ll.15-16, author's translation). As long as *MVG Rad* is only implemented in the inner city districts and geared towards the needs of 'young mobiles' and tourists, it is actually difficult seeing it as an integrated part of public transport. The focus of public transport should lie in the provision of an equal service for the whole population of a city and not the provision of a special service fostering the perceived inter- and multimodal needs of profit generating groups. After all, bike sharing is only a small part of cycling promotion and not an end in itself. The political initiative for *MVG Rad* should not be used as a reason to reduce general efforts for more and improved cycling infrastructure or hinder a reassignment of urban space towards low-impact modes of transport, away from the private automobile.

6 Summary and conclusion

This study aimed at looking at the political and administrative motives for the implementation of a bike sharing system. To explore these reasons it looked at the German city of Munich, as it has the longest history of bike sharing in Germany, through being home to *Call-a-Bike*, which is operated by *DB Rent*, since 1998. In addition *nextbike* operates a bike sharing branch in Munich since 2011. In the summer of 2015 the public transport provider of Munich, the Munich Transportation Corporation (MVG) will start its own bike sharing scheme, *MVG Rad*, in cooperation with *nextbike* with 1200 bikes at 125 stations, mostly throughout the central districts of Munich.

The data collection consisted of twelve semi-structured interviews, with politicians, members of the administration, the public transport provider, former operators of current bike sharing systems in Munich and experts on the local transport scene and the collection of key documents dealing with bike sharing and cycling in Munich.

The research identified five general topics as motives for the implementation of a publicly owned bike sharing system: 1) Bike sharing and public transport, 2) City image and marketing, 3) Market research for intermodal and multimodal mobility, 4) Further benefits of bike sharing and 5) Environmental and health benefits. The strongest emphasized topic in the interviews was that bike sharing is supposed to become an integrated part of public transport in Munich. For the MVG the initial catalysts for taking initiative were market research showing a trend towards inter- and multimodal behavior and the wish of customers for an improved possibility to take bicycles on public transport vehicles. Environmental, health and social considerations are part of the reasons for offering a bike sharing system in Munich, but are not primary reasons and sometimes more regarded as positive side-effects of an increased and improved public transport service, than actual motives in themselves. The most important peer groups seen by the interviewees are tourists and commuters, who wish to have a bicycle available once in the city center of Munich. Another important peer group are the so called ‘young mobiles’ who are claimed to have complex mobility demands and therefore are in need of flexible transport options.

The analysis of the history around bike sharing in Munich revealed, that in 2009 there have already been plans for a bike sharing system by the MVG, but it has been rejected by a guiding council for cycling traffic inside the city administration. The main reasons for this rejection, were doubts if there is enough space available in Munich’s inner-city districts to build bike sharing stations as well as unavailable capacities in the administration to handle the necessary tasks for a bike sharing systems. Both issues are still existent in Munich today, whereas the reason for why a stationary bike sharing system is implemented now posed an interesting question. This reason was identified as an increase in the awareness for cycling and bike sharing amongst politics and administration. This increased awareness of the benefits of a stationary bike sharing system within politics and administration reportedly was influenced

through a city-wide cycling marketing campaign called '*Radlhauptstadt*', which started in 2010 and the world-wide rise of bike sharing systems in cities.

For the planning and successful implementation of a bike sharing scheme the case of Munich shows that an increased awareness for the benefits of a stationary bike sharing scheme and its synergies with public transport is an important factor and comes along with an increased political and administrative support for bike sharing. An additional part in the analysis of *MVG Rad* was its contribution to improve inter- and multimodal transport especially in connection with public transport. This expected impact as well as the general design of *MVG Rad* resemble the evolution of fourth generation bike sharing schemes in the literature. This study therefore further contributes to the assessment of technological development within bike sharing schemes.

A further intention of this research was to develop a critical perspective on bike sharing systems. This critical approach is based in the overarching field of critical urban theory and urban political ecology and paid special attention to the analytical framework of splintering urbanism (Graham and Marvin, 2001). The theory based on this notion explains how formerly bundled infrastructure networks are unbundled through several mechanisms, amongst others current tendencies in the neoliberal economic system. This unbundling is characterized by different forms of bypasses and is described as leading to an increasingly uneven development of the social urban landscape resulting in growing social inequality, through reduced access to essential services. In this context bike sharing schemes are commonly only available in small and central areas of a city, bypassing large parts of a city. Research shows that the typical bike sharing user is young, educated, wealthy, male and white, whereas the areas for bike sharing systems are often carefully selected according to resident structures to achieve high usage numbers, and therefore the possibility for economic success. The use of a bike sharing system most often requires a debit- or credit card and users have to sign up for the system online or at often complicated station kiosks. Most bike sharing systems are connected to a smartphone application significantly improving the user experience. These characteristics lead to bike sharing, in its currently most applied form, being a premium service for carefully targeted and affluent users being able to afford and use this additional mobility service.

In a last step the analysis interpreted the implementation of *MVG Rad* as a conflict on the distribution of urban space amongst different modes of transport along two main questions: 1) Which amount of urban space is used by which mode of transport? and 2) How and by whom is the urban space developed? The first question describes a general conflict in city politics and administration between the modes of transport, mainly between motorized and non-motorized forms, along the lines of transport management and development and environmental concerns. The second question stands in connection with the above mentioned danger of bike sharing becoming a premium infrastructure service, within a neoliberal and market-oriented economic system. Both question are of a deeply political nature and should be treated as those, requiring a social and political instead of a technical solution.

Following the outlined conflict the public ownership of *MVG Rad* plays a great role in overcoming the dangers of providing a premium service. Through the public character the transport provider and also the city can greatly influence the location of stations throughout the city. This can provide bike sharing to a greater array of residents and promote bike sharing as a possibility for better access of underserved neighborhoods and increased mobility of groups who currently are not able to afford other mobility services. However, paying attention to the way *MVG Rad* is implemented questions have to be raised on its character as a truly public infrastructure. In further remarks *MVG Rad* and bike sharing schemes in general and their role within the promotion of cycling and 'eco-mobility' should be regarded carefully. A substantive shift towards more cycling and 'eco-mobility' in cities, should come with a substantial redistribution of space towards these less impacting modes of transport. Precisely this is not a feature of bike sharing schemes, whereas they can be seen as a facilitator of cycling promotion, but hardly as a substantial step towards the goal of a less impacting mobility regime in cities.

The findings lead to several aspects that need further academic attention. Essentially the nature of bike sharing as a premium infrastructure service needs further theoretical thought and an empirical analysis of systems being in operation for several years. In regard to Monstadt's (2009) description of the potential of urban political ecology for the study of urban infrastructures this study started to pay '*more attention to the character of sociotechnical systems and their inherently ambivalent and long-lasting impact on the shaping of cities and their socioecological environment*' (p.1934). However, it is a long road ahead to achieve this. Part of such a framework would be an in depth analysis over time of the impacts and users of *MVG Rad* once it started operation. A further aspect of this study that offers a direction for future research is the outlined conflict on the redistribution of urban space towards sustainable modes of transport. It was out of the focus of this research to examine the institutional processes, the parties and their motivation as well as the theoretical framework and the general transferability of this conflict. However, this is an interesting aspect of contemporary urban development and an important factor on the way towards a less impacting and socio-economically even future.

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