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## Bike Sharing: Regulatory Possibilities Addressing Problematic Issues – Case Study Vienna

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### Abstract

**Introduction:** This paper analyzes the situation of bike sharing (station-based and free-floating) in Vienna, Austria with a focus on regulations to resolve problematic issues. Solutions of resolved past problems and present challenges are presented. Additionally, the situation is compared to selected cities around the world (Tianjin, Singapore, Melbourne, Seattle, Amsterdam and Oxford).

**Methods:** Expert interviews and literature review present the basis for the case study in Vienna. Information on policies concerning bike sharing schemes (BSS) in other cities and the establishment of regulations has been retrieved from newspaper articles, academic publications, bike sharing regulations itself.

**Results:** Issues with BSS in Vienna can be attributed to the different types of bike sharing. The station-based system resolved past problems and faces the need for modernization. The mixed system competed with private bikes for space at public bike racks and installed a management system to avoid this problem. Free-floating bike sharing schemes (FFBSS) on the other hand are mainly concerned with vandalism and illegal parking. The city tried to resolve these issues with a newly implemented local police regulation for FFBSS, which caused the operators to withdraw from Vienna. A similar course of events could be observed in some other cities as well. Additionally, it was discovered that different regulatory approaches vary significantly in duration of their implementation.

**Conclusions:** Dissatisfaction of the public with FFBSS is due to uncivilized behavior and the awareness of it, which can be influenced by the media and cultural background. Regulations should be defined in cooperation with BSS operators to ensure that they are not externalizing costs by demanding public resources but they also should be adopted together with cycling infrastructure and under conditions that make it possible to operate profitable.

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## 1. Introduction

In recent times, there has been a rise of bike sharing systems (BSS) in many cities around the globe. In addition to the more traditional station-based systems, free-floating bike sharing schemes (FFBSS) - a trend that has started in Asia - have been introduced to the market. Subject of this paper is Vienna, the capital city of Austria with a population of about 1.89 million (Statistik Austria, 2018). Bike sharing has been introduced to Vienna more than 15 years ago with a station-based system. Since 2003, the station-based bike sharing system (SBBSS) “Citybike Wien” is in operation, today with more than 120 stations in the inner parts of the city. The introduction of FFBSS in 2017 created new challenges for the city. This paper deals with problematic issues of all types of BSS and how they can be overcome by means of regulations.

With the new dockless FFBSS, users are not limited to stations but can park the bicycles almost anywhere. These systems have several advantages for the users, such as more flexibility to leave and pick up bicycles independent of docking stations, serving more remote areas of a city and no need for the installation of expensive stations with IT infrastructure. The bicycles are typically equipped with GPS sensors that make it possible to track movements and collect data, which in turn can be used for diverse purposes such as scientific studies or urban planning. On the downside, in Vienna, as well as in other cities, due to a lack of regulations, these innovative BSS caused problems such as blocked footways and acts of vandalism, which resulted in the need for completely new rules for bike sharing systems. These were elaborated differently by each city. For a better understanding of the specific problems and their solutions with respect to FFBSS and policies, the situation in Vienna is compared to other cities around the world.

## 2. Objective and Methods

Firstly, this paper aims to identify problematic issues of BSS according to different types of bike sharing. Secondly, we analyze which regulations have been established to overcome these issues and within which timeframe they came into effect. For this, Vienna serves as a case study. Finally, it is of interest if there are differences between Vienna and other cities with regard to the implementation of new regulations.

In order to gain extensive knowledge about the bike sharing situation in Vienna, an interview with Martin Blum, head of the Mobility Agency of the City of Vienna and official Representative of Cycling Affairs, was conducted. Further information on BSS in Vienna has been retrieved by e-mail communication with the bike sharing operators, newspaper articles and academic publications. Additionally, MA48, the municipal department no.48, which is responsible for waste management and street cleaning, provided data on the number of illegally parked bicycles that had to be removed by them. For the comparison with other cities, information on policies concerning BSS, newspaper articles, academic publications and bike sharing regulations of different cities have been reviewed. Six cities were selected according to the date of BSS introduction, date of coming into effect of regulations and geographic representation. The cities are Tianjin, Singapore, Melbourne, Seattle, Amsterdam and Oxford. The processes of the establishment of new rules for these cities are described in section 6, the differences are discussed in section 7.

## 3. Bike sharing systems in Vienna

The first idea for a bike sharing system in Vienna came up in 1991. The bike courier service Veloce tried to establish public bicycles but lacked political support. The next attempt was the “Wiener Stadtrad”, which was developed by Siems & Klein KG in 1997. The project had political support but lacked financial support and sponsors (Dechant, 2013). Finally, the first SBBSS system that went into operation was the “Viennabike” in 2002, followed a year later by its successor the “Citybike Wien”, which is still active today. In addition to the station-based system, several free-floating bike sharing systems were introduced to the city in 2017, namely ofo, oBike and the mixed system Donkey Republic. Fig. 1 shows the bicycle models of the different operators, demonstrating differences in design and quality. The different systems and their functionalities are described in more detail in the following.



(a) Citybike Wien locked in a station



(b) Ofo bike



(c) OBiKe



(d) Donkey Republic bike locked to a public bike rack

Fig. 1: Different models of shared bikes in Vienna (own images)

### 3.1. Viennabike – SBBSS

In May 2002, the private association Viennabike launched the first bike sharing system in Vienna. It was financed by brightly colored advertisement on the bicycles and subsidy from the City of Vienna. There were more than 230 stations in the inner part of the city, inside Vienna's second ring road (the "Gürtel"), where users could unlock one of the 1,500 bicycles with a 2 euro coin as a deposit (Werfring, 2002). In theory, after a ride, the bikes should be returned to one of the stations. In reality, the system failed because people were not returning the bikes. Some fell victim to vandalism, others were being used privately by people (Dechant, 2013). In the beginning of 2003, the association quit the contract with the City of Vienna and announced the end of the project (Der Standard, 2003a).

### 3.2. Citybike Wien – SBBSS

After Viennabike quit the contract with the City of Vienna, the company Gewista was chosen in a bidding procedure for the installation and operation of a new bike sharing system. Gewista is specialized in outdoor advertisement and street furniture. It was initially founded as a public company by the City of Vienna. Since 2002, it is majorly owned

by JCDecaux, the global leader of outdoor advertising, but people still suspect an affinity to the authorities of the city. (Der Standard, 2003b)

The new system was developed together with Hans-Erich Dechant, a former manager of Viennabike (Gewista, 2018) and Luud Schimmelpennink (Zee, 2016), initiator of the "White Bikes" in 1965 in Amsterdam, which is considered the first bike sharing system in the world. JCDecaux later exported the system as a product called "Cyclocity" to 69 cities worldwide (JCDecaux, 2017, Rottenberg, 2014). With this station-based system, each station is equipped with a terminal that is accessible around the clock, where users can register, choose a bike or look up other stations and the availability of bikes or free slots. The information of stations, available bikes and slots can also be retrieved on the website (<https://www.citybikewien.at/de/stationen/stationenplan>) and with the help of several mobile phone apps. In the beginning, it was necessary to register with a bank account card. Today it is also possible to register with credit card, mobile phone or a special Citybike card. For the registration, users have to pay a single fee of one euro. The first hour of every ride is free, each additional hour is being charged. At the end of each ride, the bike has to be returned to one of the stations. The Citybike business model relies on the advertisement that is placed on the bicycles, which makes it possible to operate the system without public funding. Only for the construction of new stations, the company received subsidies from the city (Energieinstitut, n.d.).

Citybike Wien went into service in May 2003 with 50 stations inside the "Gürtel". After the third expansion in 2015, now there are 121 stations (shown in Fig. 2) and more than 1,500 bicycles available year-round. Every year, Gewista records more than one million rides. (Dechant, 2013, Gewista, 2018)

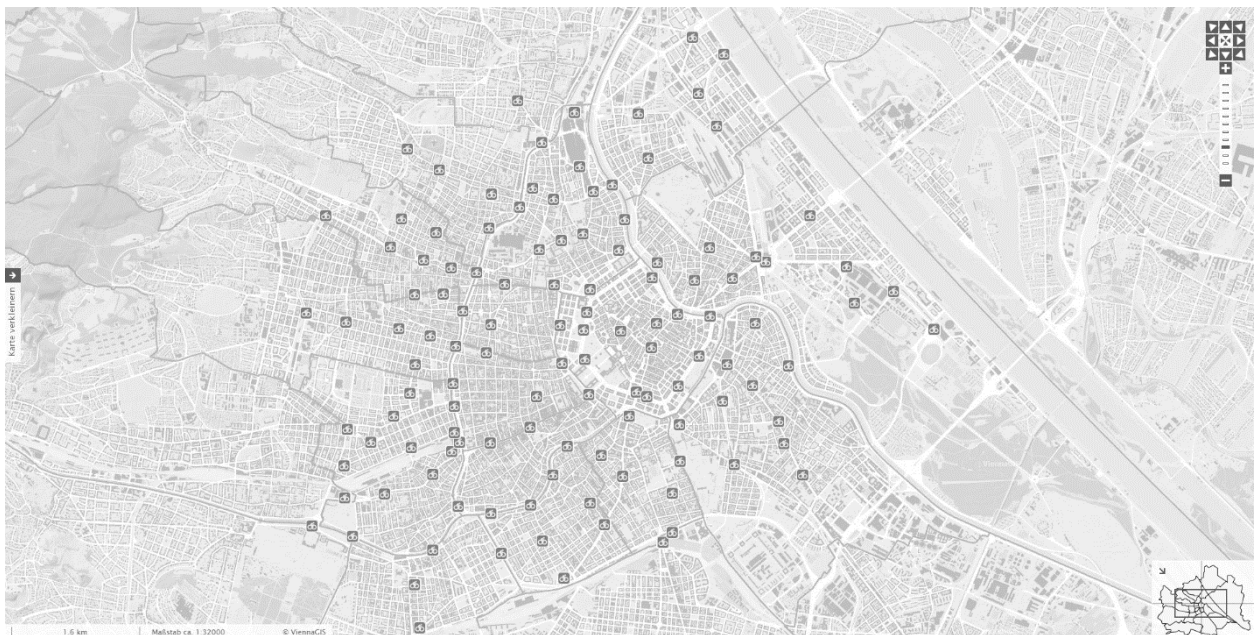


Fig. 2: Location of Citybike Wien stations in Vienna (source: [www.wien.gv.at/stadtplan/](http://www.wien.gv.at/stadtplan/))

### 3.3. Ofo - FFBSS

Ofo was the first modern FFBSS, created in 2014 in China as a student's project. Since August 2017, the ofo bikes were available in Vienna. A model of their yellow bikes is shown in Fig. 1 (b). There have been around 500 - 800 ofo bikes in Vienna, depending on the season (Kicking, 2018b). In order to rent a bike, ofo users have to download the

ofo mobile app, which is available for Android and iPhone. The payment can be made with credit card. The app shows available bicycles on a map. They should be locked with a fixed u-lock on the bike. To unlock it, the user has to scan the QR-code or enter the plate number on the bike manually with the app. A bicycle ride costs 0.50 euros for every 30 minutes. At the end of the ride, the bicycle can be parked anywhere, that is legal to park a bike. After stopping, the bike has to be locked manually whilst keeping the Bluetooth function of the phone activated or tapping “Trip completed” in the app, then the ride is terminated. A credit point system had been installed to reward responsible behavior and prevent reckless behavior. At registration, every user got 100 points. According to the ofo mobile application, when a bike was illegally parked, 50 points were deducted, damaging an ofo bike reduced the score to 0 and reporting a broken or illegally parked bike gave the user two and three points, respectively. (ofo, n.d.)

In July 2018, ofo withdrew from Vienna due to the new regulations that came into effect in August 2018. The reasons for this are discussed in more detail in section 5. (Pichler, 2018a)

### 3.4. oBike - FFBS

oBike is a bike sharing company from Singapore, founded in January 2017. The first free-floating bike sharing scheme by the company was introduced in February 2017 to Singapore (Kickinger, 2018b). European cities followed in the summer of 2017. In August 2017, oBike expanded to Vienna with around 1,800 of their bicycles (the grey and yellow model can be seen in Fig. 1 (c)). The bike sharing system works similarly to ofo's. Users have to download the oBike app and register with a credit card. In Vienna credit cards were charged with a deposit of 79 euros. The bikes are equipped with GPS sensors and available bikes can be viewed on a map in the app. By scanning the QR-code on the bike, it gets unlocked. The price for a ride depends on the credit points of the user. As with ofo, every user started with 100 credit points, when a ride cost 1 euro for every started 30 minutes. The oBike credit point system worked quite similar to the ofo point system. At the end of the ride, the bicycle can be parked at any designated public bike parking area. To terminate the ride, the bike has to be locked manually with the activated Bluetooth function of the mobile phone. (oBike, n.d.-a, oBike, n.d.-b)

In March 2018, the fleet of oBike was reduced to about 1,000 bikes because of vandalism and the announcement of the new regulation for free-floating bike sharing (see section 4.3) (Kickinger, 2018b). In July 2018 it was reported that the Austrian Facebook Page of oBike had been deleted and that oBike no longer had an office in Vienna, which made the operation in Vienna illegal from 1<sup>st</sup> August 2018 due to the new regulation (Pichler, 2018c). oBike never officially withdrew from the city, but the remaining bicycles have been removed from the streets by MA48 due to the new regulation (Pichler, 2018b).

### 3.5. Donkey Republic – mixed BSS

The Danish company Donkey Republic is using a mixed bike sharing system. There are no specific stations for Donkey Republic bikes, but rented bikes have to be returned to one of the available drop-off locations. In Vienna these are located at public bike parking spaces. The bicycles have to be locked to the available bike racks (see Fig. 1 (d)). In April 2017, 100 of the orange Donkey Republic bicycles have been introduced to Vienna (Marhl, 2017). Currently, there are 250 bikes available year-round 24/7. According to Lüders (2018), Donkey Republic plans to expand its fleet in Vienna in 2019, depending on the developments in 2018.

There are two different memberships available, one targeting tourists and the other targeting locals. The occasional rider membership is free of charge and gives a 50% discount on all rentals. The commuter membership is for riders that want to use the Donkey Republic bikes regularly. It costs 18 euros per month and allows members to make an unlimited amount of rentals per month that last up to 12 hours each. Similar to the free-floating systems of ofo and oBike, at Donkey Republic payment, location and unlocking of bikes works with the help of a mobile phone app. In the past, the payment system in the Donkey Republic app worked as a prepaid-system where the duration of the rental had to be chosen beforehand. Starting with July 2018, a pay-as-you-go solution similar to other free-floating BSS operators has been implemented. (Lüders, 2018)

### 3.6. Greenride-Bike -FFBSS

The Viennese company Greenride developed the FFBSS „Greenride-Bike“ and planned to introduce 3,000 bicycles to the city in the spring of 2018. Their system was similar to the ones of ofo and oBike, but should be cheaper. The company announced to charge one euro for 24 hours in addition to a yearly base fee (Rachbauer, 2017). In the beginning of 2018, it was announced that Greenride stopped its bike sharing project due to the upcoming regulations that have been announced by the City of Vienna (see section 5). The company also criticized the city for not offering enough parking for bicycles. (ORF, 2018)

## 4. Analysis of problematic issues

### 4.1. Issues concerning Citybike Wien

With the Citybike system, many problematic issues of the past have been resolved by changes in operation. The Citybike has been installed because its predecessor, the Viennabike, failed due to vandalism and excessive rental durations. Vandalism has been eliminated by mandatory registration with personal data. Responsibility for the bikes has been therefore transferred to the customer. Excessive rental durations are prevented by progressive hiring rates which incentivize short rides. (Dechant, 2013)

The bicycles and docking stations are engineered to reduce maintenance and theft. Solid rubber tires rule out flat tires and render inflating them unnecessary. Small parts are welded to the steel frame. The bicycles are equipped with three gears, built-in front and back lights and a basket in the front. The user is responsible for returning the bicycle in good shape and is liable for theft and acts of vandalism with up to 600 euros, the total value of one bike. Damages can be reported to the operator on the terminal of the station. Technicians are automatically notified and sent out to repair broken bikes. Additionally, technicians redistribute bikes according to the needs of the users. Fig. 1 (a) shows a Citybike in one of the docking stations. (Blum, 2018, Dechant, 2013, Gewista, 2018, Gewista, n.d.)

According to Blum (2018), the Citybike system works quite well in its present form, which is a result of the great amount of know-how that has been fed into the system over the years. Still, today there are new challenges for this long-standing bike sharing scheme. Compared to cities in other countries, the stations are further away from each other with an average distance of about 700 meters. As Emberger and Pfaffenbichler (2017) have shown, the walking distance is a significant factor for the choice of mode of transportation. Depending on the built structure, most pedestrians accept a walking distance of 220 m to 350 m. The average distance of public transportation stations in Vienna is 250 m to 300 m. This issue could be resolved by installing more stations, which is complicated at the moment since the initial contract between Gewista and the City of Vienna was for the installation of only 120 stations. The city is obligated to carry out a public tender for new contracts, which is why an extension with the current operator cannot be made without such a procedure. A public tender involves an economic investment by the city which may be a reason why Vienna is reluctant to tackle this issue.

Another issue Blum (2018) addresses is the modernization of the bicycles and stations. Due to new developments and technologies, a more modern bike that corresponds to the models and quality available at the market today should be implemented. Additionally, nowadays there is no need for a computer terminal at every station. Existing stations could be adapted and new stations could be designed without such terminals that need electricity and a network connection. Instead, the renting procedure could be managed with an RFID-card or a mobile phone only.

### 4.2. Issues concerning free-floating systems

The issues that concerned both free-floating companies in Vienna, ofo and oBike, can be summarized as uncivilized behavior, a term which was also used by Jia, et al. (2018) to analyze the roles of different stakeholders with regard to issues with bike sharing. Uncivilized behavior includes indiscriminate parking and vandalism. In Vienna, the dockless bicycles of ofo and oBike have been parked on narrow sidewalks, blocking footways for pedestrians, on tactile

guidance systems and at public bike parking racks. Damaged bicycles that could no longer be used took up public space. (Blum, 2018)

The removal of illegally parked and abandoned bicycles require action by the city, which is only one of the tasks that are imposed on the city by these private companies. As summarized by UITP, et al. (2017):

*“The arrival of these rapidly growing dockless bike sharing schemes demand additional resources from public authorities, in terms of law enforcement, planning of adequate cycling infrastructure, and overall control. [...] Overall, a sustainable, equitable use of public resources, be those direct, or indirect should be applied, taking into consideration all costs of any bike sharing system, and not socialising private costs while maximising private profits.”*

#### 4.3. Issues concerning oBike

In addition to the issues generally assigned to free-floating systems, according to Blum (2018), there have been problems caused by oBike due to the low quality of the bikes. He argues that the model of their bikes is difficult to steer, hardly repairable and cannot keep up with the quality that is mandatory for European markets. The media reported several severe acts of vandalism concerning oBike. In one incident, an oBike was thrown on the rails of a metro line and a couple of cases of oBikes in the Wien River have been reported. According to a newspaper article (Der Standard, 2018), a spokesman of oBike addressed vandalism as the cause for the main problems, making operation inefficient. The new regulation requires operators to pay a fee for damaged bicycles that have not been removed within a certain period of time (see section 5). This is especially tough for operators if the smart locks including the GPS have been damaged and the bicycle cannot be located anymore.

#### 4.4. Issues concerning Donkey Republic

The only problem that has been associated with the system of Donkey Republic was the use of public bike parking racks and therefore taking away space for private bicycles (Blum, 2018, Der Standard, 2017). The practice of using these bike racks is legal according to the StVO (*Straßenverkehrsordnung 1960*), the Austrian road traffic regulations. Nevertheless, the company reacted to the complaints and installed a management system to redistribute the bicycles to bike parking racks that have enough capacity to support the bicycles of Donkey Republic in addition to the private ones. According to Blum (2018), there are only three months of the year (May, June and September) where there is a problem with the capacities of some public bike racks. For the moment, he judges the situation with Donkey Republic as stable and argued that the City of Vienna is installing 2,000 to 3,000 new public parking spaces for bicycles every year. According to MA 46 (2017), the number of public bicycle parking spaces has increased from about 27,000 in 2010 to nearly 44,000 in 2017.

#### 4.5. Removal of illegally parked shared bicycles

Damaged or illegally parked bicycles have been reported to the “Abschleppgruppe” (“towing group”) of MA 48, which removes the bikes, brings them to the storage site in Vienna and charges the bike sharing companies for this service (Mobilitätsagentur Wien, 2017). MA 48 provided data concerning the removal of dockless bicycles (Jurkovits, 2018). According to the data, 129 oBikes and ofo-bikes have been removed in the period from September 2017 until June 2018. MA 48 did not remove any Citybikes or Donkey Republic bikes. In the Interview, Blum (2018) stated that he can’t give a number of complaints the city has received concerning bike sharing, since they are reported to different authorities. However, he said that there is a correlation between reports in the media and complaints by citizens. He assumes that a larger amount of media reports makes people more aware of the free-floating bicycles and this leads to more complaints.

## 5. Establishment of regulations for FFBSS in Vienna

According to the legal basis in Vienna, operators of FFBSS did not need a permit or a license to place their bicycles in the city. Blum (2018) stated that the companies ofo and oBike contacted the City of Vienna before introducing their bicycles to the city to clarify the legal status. He was in contact with the operators and tried to make them aware of the situation in Vienna, which he described as challenging for FFBSS companies, since there is a strong public transport system with a share of 38% in the modal split (Wiener Linien, 2018) and Citybike Wien, a well-functioning SBBSS.

As a first reaction to the new bike sharing system and the issues they brought with them, in September 2017 Radlobby Wien (Viennese Bicycle Lobby) published quality requirements for FFBSS (Radlobby Wien, 2017a), demanding a legal framework for the regulation of free-floating BSS and referencing the positioning paper of UITP, et al. (2017). Then, in October 2017, Radlobby Wien (2017b) published an aid for the parking of free-floating bicycles, which has been put on the basket of ofo bikes in cooperation with ofo. In May 2018 it was announced that there will be a local police regulation for FFBSS (Blum, 2018, Kickingner, 2018a). After the administrative procedure, the “local police regulation concerning dockless rental bikes” (“*Verordnung des Magistrates der Stadt Wien betreffend stationslose Mietfahrräder*”) was published by Magistrat der Stadt Wien (2018), (the Municipality of Vienna) on 28 June 2018 and came into effect on 1 August 2018. The process in Vienna from the introduction of the free-floating BSS operators ofo and oBike in July 2017 to the coming into effect of the local police regulation in August 2018 took 12.5 months (see also Fig. 3)

The new regulation (Magistrat der Stadt Wien, 2018) includes the following rules:

1. Every bike rental operator is allowed to offer a maximum number of 1,500 bicycles.
2. The operator must have an office in Vienna.
3. The operator must have a business license for the operation of a bike sharing company.
4. The contracting partner guarantees the handling of data in accordance with the law.
5. The bicycles must be accredited with an official mark at the operator’s expense.
6. Dockless rental bikes must adhere to the parking rules according to § 68 Abs.4 StVO 1960.<sup>1</sup>
7. Dockless rental bikes are not allowed to be parked on public green areas, sidewalks and places in front of buildings that are of cultural significance, with the exception of bicycle racks that are positioned there.
8. The operator must emphasize compliance with the § 68 Abs.4 StVO 1960 in user agreements.
9. The operator must remove bicycles that are parked against the rules or have been damaged by vandalism within 4 hours between 6 a.m. and 6 p.m. on weekdays and within 12 hours at other times from the moment they have been notified by the authorities.
10. Bicycles that are found without an official mark and reported bicycles after the removal time are removed by the Municipality and stored for 8 weeks. Costs for the removal and storage are to be paid by the operator.
11. Violating the rules is an offence that can be subject to a penalty according to the Viennese City Constitution.

The penalty for violating the rules can be a fine up to 700 euros, according to Mobilitätsagentur Wien (2018). For the accreditation, the bicycles have to be engraved with an identification number. The regulation applies to FFBSS (of0 and oBike) as well as to mixed systems (Donkey Republic).

After the announcement of the rules, operators of BSS reacted with negative feedback. According to Blum (2018), ofo criticized the limit of 1,500 shared bikes per operator in Vienna with the argument that it is not possible to operate economically viable with such a low amount of bikes. Similarly, the founders of Greenride-Bike, who planned to start

<sup>1</sup> § 68 Abs.4 StVO 1960 defines the rules for bicycle parking: bicycles have to be parked in a way that they cannot fall or hinder traffic. If a footway is more than 2.5 m wide, it is allowed to park a bicycles on the footway except for areas of public transport stations. On the footway, bicycles have to be parked in a way that they do not hinder pedestrians or damage objects.



operations in Vienna, concluded that their business would not be feasible with the upcoming regulation. Lüders (2018) of Donkey Republic, on the other hand, argued that the accreditation of the bicycles could have a big influence on operations since it had to be carried out in the middle of the cycling season. Therefore taking bikes off the streets during these months can lead to considerable loss of revenue. As stated before, the new regulation caused ofo and oBike to discontinue operations in Vienna while Donkey Republic is still active.

## 6. Establishment of regulations for FFBS in other cities

Alkhaddour (2018) analyzed the regulations of different cities around the world concerning FFBS that have been issued until February 2018. The cities are Auckland (New Zealand), Sydney (Australia), Melbourne (Australia), Oxford (England), Durham (England), Edinburgh (Scotland), Charlotte (USA), Seattle (USA) and San Francisco (USA). The observed rules in these regulations can be summarized as license requirement, limitation of the number of bicycles, operational requirements, operating fees and the management of bike distribution and parking rules. Additionally, some cities demand from the FFBS operators to collaborate with the public authorities and share anonymized data. Alkhaddour (2018) further mentions that Tianjin (China) issued regulations (without analyzing them) and Amsterdam (Netherlands) had been in the draft stage of regulations for FFBS in February 2018.

For this study Tianjin, Melbourne, Seattle, Oxford and Amsterdam have been selected to be compared with Vienna, to represent Asia, Australia, the USA, the UK and continental Europe respectively. In addition to the cities discussed by Alkhaddour (2018), Singapore has been selected as well, because it was one of the first cities with a FFBS and the regulations concerning them came into effect around the same time as in Vienna (see section 6.2). In the following, the processes of the establishment of rules for FFBS for the selected cities are described. Table 1 summarizes characteristics of the different cities.

Table 1. Overview of characteristics concerning BSS in the selected cities

	Population	Area	SBBSS Area	No. of SBBSS bikes	No. of SBBSS stations	No. of FFBS bikes (mid- 2017)	Population divided by No. of shared bikes
Vienna	1.89 Mio. <sup>1</sup>	415 km <sup>2</sup> <sup>7</sup>	Inner City	1,500	121	2,600	461
Tianjin urban agglomeration	13.66 Mio. <sup>2</sup>	11,917 km <sup>2</sup> <sup>8</sup>	-	-	-	300,000	46
Singapore	5.79 Mio. <sup>2</sup>	722 km <sup>2</sup> <sup>9</sup>	-	-	-	100,000	58
City of Melbourne, local government area	136,000 <sup>3</sup>	32 km <sup>2</sup> <sup>10</sup>	Inner City	600	50	1,000	85
(Melbourne urban agglomeration)	(4.77 Mio). <sup>3</sup>	(9,990 km <sup>2</sup> ) <sup>10</sup>	-	-	-	-	-
Seattle	720,000 <sup>4</sup>	217 km <sup>2</sup> <sup>11</sup>	-	-	-	9,000	80
Amsterdam	860,000 <sup>5</sup>	219 km <sup>2</sup> <sup>12</sup>	-	-	-	6,000	143
Oxford	155,000 <sup>6</sup>	46 km <sup>2</sup> <sup>13</sup>	-	-	-	1,300	119

<sup>1</sup>(Statistik Austria, 2018)

<sup>9</sup>(Government of Singapore, 2018)

<sup>2</sup>(United Nations, 2018)

<sup>10</sup>(Australian Bureau of Statistics, 2017)

<sup>3</sup>(City of Melbourne, n.d.)

<sup>11</sup>(World Population Review, 2018)

<sup>4</sup>(United States Census Bureau, 2018)

<sup>12</sup>(Amsterdam.org, 2018)

<sup>5</sup>(Centraal Bureau voor de Statistiek, 2018).

<sup>13</sup>(Oxford City Council, n.d.)

<sup>6</sup>(Oxford City Council, 2017)

### 6.1. Tianjin, China

According to ITDP (2018), the first free-floating BSS (by the companies Coolqi and Quickto) came to the city in January 2017. Ofo, Mobike, Youon (now merged with Hellobike) and others joined within three months, increasing

the number of dockless shared bikes in Tianjin to more than 300,000. The city experienced problematic issues concerning bicycles blocking footways for pedestrians and vandalism of the bicycles. After a decision by the national Ministry of Transport to give cities the authority to manage free-floating BSS, municipal agencies in Tianjin published the “Tianjin Internet Rental Bike Management Interim Measures” in May 2017, which went into effect in October 2017. The measures define roles and responsibilities for operators, users, and the government. The regulations further suggest to include dockless bikeshare operators in the planning of future cycling infrastructure and to apply their data to the siting, planning, and design of the infrastructure, which is seen as a way to improve its long-term usability.

On a national level, the Chinese Ministry of Transport, together with nine other ministries, issued the “Guiding Opinions on Encouraging and Regulating the Development of Internet Bike Rental” in the beginning of August 2017. Additionally, in November 2017, the China Communication Industry Association released the “General Technical Requirement of IOT Based Bike Sharing Systems”, which regulates vehicle technology and features of the mobile applications. (Li, et al., 2018)

## 6.2. Singapore

As a first FFBSS, oBike started operations in Singapore in February 2017 with around 2,000 bicycles (oBike, n.d.-b). According to Lim (2018), it is estimated that in March 2018 there were about 100,000 dockless shared bicycles in Singapore by six different operators (oBike, ofo, Mobike, GBikes, SG Bike and ShareBikeSG) but only half of them were actively used. Despite efforts by the Land Transport Authority (LTA) to increase parking infrastructure and encourage FFBSS companies to operate responsibly, indiscriminate parking was resting such a large problem that the authorities established a new law (Lim, 2018). In the middle of March 2018 the “Parking Places (Amendment) Bill” (LTA, 2018) has been passed by the Parliament to address indiscriminate parking in public places because of vehicle sharing. The bill came into force in May 2018. The process from the introduction of oBike to the coming into effect of the Parking Places (Amendment) Bill took about 15 months. The new bill requires operators to apply for a license, share data with the LTA and remove illegally parked bicycles in a timely manner. Additionally, the fleet size of each operator will be reviewed every six months, based on the management of illegal parking and utilization of the bicycles (Lim, 2018). On 25 June 2018 oBike announced to cease operation in Singapore immediately due to the new regulations that require an application for the two year-license until 7 July 2018 (Cheng, 2018).

## 6.3. Melbourne, Australia

Melbourne was the first city in Australia to get a FFBSS with oBike starting operations in the middle of June 2017 (oBike, 2017). The company introduced around 1,000 bicycles to the city (Neef, 2017). After problems with cluttered sidewalks and illegal parking, in mid-October 2017 oBike signed a “Memorandum of Understanding” (MOU) with the City of Melbourne, together with the municipalities of the adjoining cities Port Philip and Yarra (City of Melbourne, 2017). The MOU defines roles and responsibilities about broken and inappropriately placed bicycles.

After signing the MOU, the situation with oBike did not change to the satisfaction of the city. Koob (2018) reported that new rules for oBike came into effect with 5 June 2018. Under the Environment Protection Act, local law officers are authorized to issue fines. The Environment Protection Authority (EPA) issued a litter abatement notice to oBike, demanding a management plan by 13 June with a fine of more than 3,000 AUD for every week of delay. Furthermore, they announced to charge 3,000 AUD per reported bike that had not been removed within the required timeframe. According to Koob (2018), between signing of the MOU (in mid-October) and end of May 2018 a total of 134 oBikes have been impounded by the City of Melbourne. Additionally, more than 100 oBikes had to be fished out of the Yarra River. On 12 June 2018 Jacks and Preiss (2018) reported that oBike would leave Melbourne instead of adhering to the new rules.

#### 6.4. *Seattle, USA*

The City of Seattle used to provide the SBBSS “Pronto Cycle Share” but decided to discontinue operations in early 2017 and embrace new free-floating schemes under the condition of applying for an annual Bike Share Permit (SDOT, n.d.). The legal situation in Seattle requires such a permit prior to operators placing bicycles in the city. This allowed the city to formulate rules beforehand. The “Bike Share Permit Requirements” (SDOT, 2017) have been published on 30<sup>th</sup> June 2017. They include rules concerning the equipment of the bicycles, parking, customer service, removal of bicycles in a certain period, sharing data with the city, fees for administrative work and a fee for each bicycle. The first companies that have been granted the permit are LimeBike and Spin, both in July 2017 (Lloyd, 2017). Ofo joined in August 2017 (Fucoloro, 2017), so that today there are three different FFBSS available in Seattle. According to Gutman (2018), the number of shared bikes has varied from time to time and has been around 9,000 to 10,000 since mid-November 2017.

#### 6.5. *Amsterdam, Netherlands*

Amsterdam is seen as one of the most cycle-friendly capitals in the world where 38% of all trips are made by bike (Zee, 2016). As described by DeMaio (2009) and Zee (2016), Amsterdam was subject to the first bike sharing scheme in 1965, which was also a dockless system. Similarly to the Viennabike, the system collapsed in a short period of time due to vandalism and private use. In 1999, a station-based system was introduced which also faced problems with vandalism and theft and was ended soon. (Zee, 2016)

There was no BSS available in Amsterdam until the summer of 2017, when several different bike sharing operators (oBike, Donkey Republic, Dropbyke, FlickBike, Urbee and Hello-Bike (Reid, 2017)) have been active in the city, accounting for around 6,000 bicycles (RTL Nieuws, 2017). In August 2017 the city decided to temporarily ban all FFBSS due to taking away too much space for the parking of private bicycles (O’Sullivan, 2017). The ban was possible due to article 2.5 of the local regulation “Algemene Plaatselijke Verordening”, which prohibits the commercial use of bicycles in the public space (RTL Nieuws, 2017). In December of the same year, it was announced that the city is working on a new license-system to reintroduce dockless shared bikes, where a maximum of three FFBSS operators can be awarded a two-year-license for the city, each with a maximum of 3,000 bicycles (Rottier, 2017). According to Newmark (2017), the City of Amsterdam has only given permission to the Dutch company Hello-Bike, which operates only in the Zuidas area of Amsterdam and is using geofence stations. Bueters (2018) reported that the first licenses for FFBSS would be awarded in 2019.

#### 6.6. *Oxford, United Kingdom*

After several free-floating BSS operators announced their intention to launch in Oxford, a Code of Conduct for dockless bike sharing operators has been established by the Oxford City Council and Oxfordshire County Council in August 2017 (Osborne Clarke, 2017). This code is a voluntary agreement to be signed by FFBSS companies. The first free-floating system to arrive in the English city was ofo, who introduced their bikes in August 2017, followed by Mobike and oBike in October 2017 (Daily Info, n.d.) but oBike pulled out of the city again in January 2018 (Reid, 2018). Today, there are three remaining FFBSS companies ofo, Pony Bikes and Mobike, who all signed the voluntary Code of Conduct. According to Oxford Mail (2018), there are 1,300 free-floating shared bikes in the city.

### 7. Discussion

All of the selected cities have different cultural backgrounds, which influenced the use and acceptance of bike sharing schemes. It can also be seen that there are different approaches for regulations concerning FFBSS. These differences are explored further in the following. Additionally, we analyze the scale of the problem with FFBSS and discuss business models of BSS and how they can influence user behavior.

### *7.1. Cultural differences*

Culturally there is a great difference between cities that already have a good cycling infrastructure and where the bicycle is part of the everyday life and cities where there are not many people used to cycle or accustomed to sharing concepts. In Vienna, the modal split of cycling is relatively low with 7% (Wiener Linien, 2018) but people are used to bike sharing with the SBBSS that has been around for more than 15 years. Contrary to this, in cycling-friendly Amsterdam most people already own private bicycles and the bike parking spaces are already very busy. Therefore, there are different challenges concerning change of culture for each city, if they want to promote FFBSS.

Another difference concerns the quality of bikes that the citizens are used to. As Blum (2018) stated, people in Vienna and other European cities did not accept oBikes because of their low quality. Additionally, there are various concepts of how clean the public space in a city should be. Since there is a high consciousness for cleanliness in Vienna, Blum (2018) argues that this is a reason for the unacceptance of indiscriminate parking and cluttering of public space with the striking colorful bicycles of FFBSS, though it has to be kept in mind that the media is a powerful source to form public opinion. Complaints increase with increased reports about the issues with bike sharing schemes. To Blum (2018), who has been involved in the process of the definition of rules for the new regulation, it was important to remove damaged and illegally parked bikes as soon as possible. Studies have shown that social norms influence human behavior. Cialdini, et al. (1990), for example, discovered in their study that more people litter in a car park if there is already more litter around. Similarly, it is assumed that illegally parked and vandalized bikes that are visible in the public space cause more people to act in the same way. Because of this, Vienna included a rule of the fast removal of illegally parked or damaged bicycles in the new local police regulation (see section 5, paragraph no. 9).

Another interesting issue with respect to culture is that in Vienna users of dockless shared bikes were encouraged to park them in the parking lane at the driving lane level where there are no bike racks (Radlobby Wien, 2017b), a practice which is legal according to the StVO. However, traditionally these lanes have been predominantly used to park motor vehicles. Therefore, car and motorcycle drivers might perceive this practice as if parking space is taken away from them and consequently resent these innovative BSS. Acceptance by them needs to come with a change of culture.

### *7.2. International differences in regulation*

When comparing different cities, it has to be considered that there are different cultural and legal backgrounds. On a legal level, for example, cities in North America, such as Seattle, had to permit free-floating BSS companies to introduce bicycles to their cities in the first place, whereas in most European, Australian and Asian cities, according to the law, FFBSS could immediately start operations. This gives cities like Seattle the opportunity to formulate rules in advance, before bikes enter the public space and maybe use existing permits for similar services of new mobility (e.g. car sharing, electric scooter sharing) as a blueprint. Vienna, on the other hand, let the FFBSS companies come into the city and decided which rules should be applied after a trial period where problems have been analyzed. Contrary to this, dockless shared bikes have been introduced to Amsterdam and banned later because there already was a legal basis in place for this. A similar process can be seen in Melbourne, where the EPA acted upon an existing law to issue large fees for indiscriminately parked free-floating shared bikes.

Another aspect concerning regulations is the timeframe in which new rules come into force. There is a significant difference between contracts such as the code that has been introduced by Oxford or the MOU of Melbourne and legal regulations such as the one in Vienna. Since these contracts are only a voluntary agreement with the bike sharing companies, it was possible to set them up in a short period of time, in Oxford even before the first dockless bikeshare operator came to the city and in Melbourne within 4 months. On the contrary, the local police regulation in Vienna is an official legal text that has to be reviewed by different authorities of the city. This process takes more time, which explains the large differences between the establishment of Oxford’s Code of Conduct, Melbourne’s MOU and the coming into force of official laws of other cities, which is not that different in Tianjin (9 months), Singapore (15 months) and Vienna (12.5 months). The different durations of these processes are shown in Fig. 3. It can be seen that it is more time-effective to set up voluntary agreements than new laws. More research needs to be done to find out what the effects of these two different instruments are, though the course of action in Melbourne suggests that voluntary agreements do not have a satisfying effect.

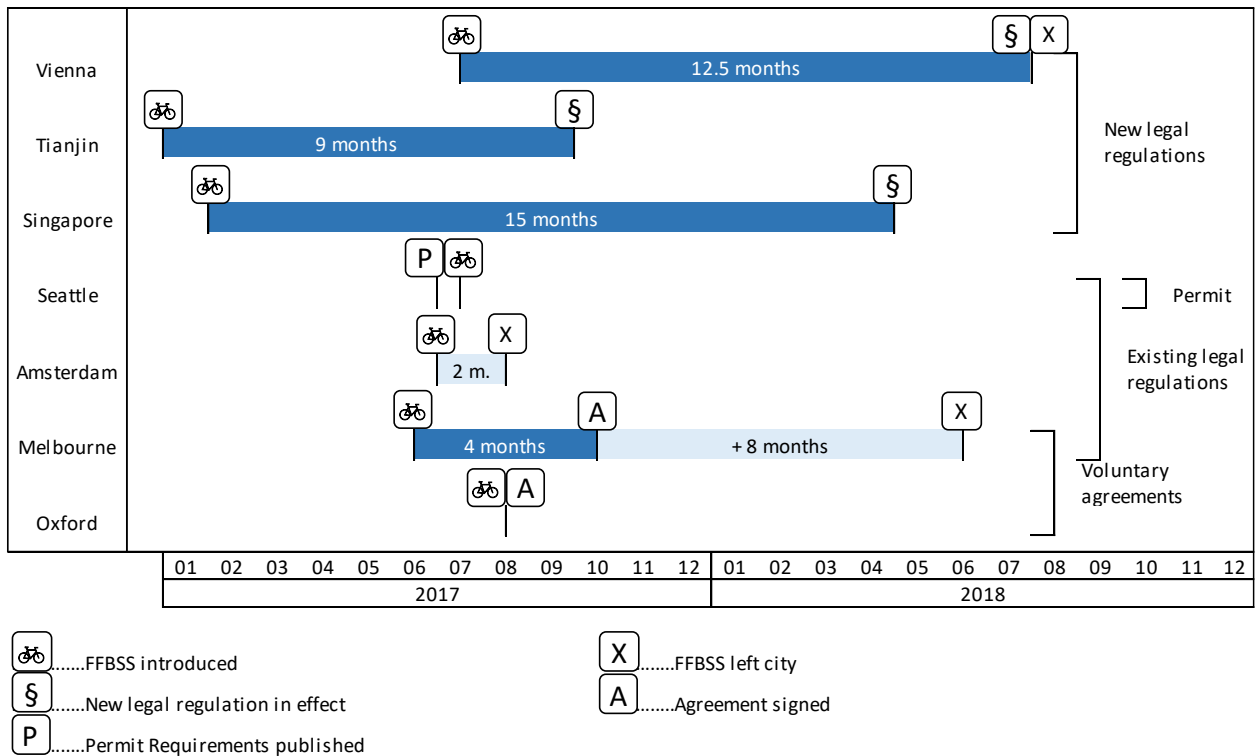


Fig. 3: Timelines from introduction of FFBSS until implementation of new regulation/permit/agreement and leaving of FFBSS

### 7.3. Scale of the problem

As already mentioned in section 4.5, a total of 129 free-floating bikes have been removed by MA 48 in Vienna during a period of about 10 months (September 2017 to end of June 2018). The only other of the selected city where information about impounded free-floating bikes could be retrieved was Melbourne. There (see section 6.3), 134 shared bikes have been removed by the authorities in about 7.5 months (mid-October 2017 to end of May 2018) and additionally 100 oBikes were reported to have been found in the Yarra River. Considering the total amount of shared bicycles in the cities, 2,600 in Vienna (initially 1,800 oBikes and 800 ofo bikes) and around 1,000 in Melbourne, it is concluded that the removal of bicycles is a slightly smaller issue in Vienna than in Melbourne. On a different scale,

Taylor (2018) described the situation in China, where individual cities like Xiamen piled up more than 10,000 of removed free-floating shared bikes in January 2018.

To put the issue of removing dockless bikes from the public space in Vienna further into perspective, a comparison with similar problems is being discussed. For example private bicycles are also removed by MA 48 if they are illegally parked or have been abandoned. The total number of private bicycles that have been removed by MA 48 in 2017 is 1,525 with a rising tendency (MA 48, 2017). According to Jurkovits (2018), every year 50 - 100 of the removed private bicycles are ones that have been illegally parked. The rest have been abandoned and it is assumed that people use this procedure to illegally dispose of old bicycles. Since there are much more private than shared bicycles in Vienna, it is not surprising that the total amount of removed private bicycles is higher than for the shared bicycles. It is however surprising that since September 2017 till July 2018, there have been more shared bikes removed by MA 48 than private bicycles because of illegal parking (129 versus 50 – 100). According to Statistik Austria (2016), the average number of bicycles in a household is 1.26, for the 887,300 households in Vienna. This results in a total amount of around 1.1 million private bicycles in Vienna. Though it cannot be said that all of the private bicycles are used regularly and parked in the public space, the numbers show that there is a great difference in scale.

Another issue, similarly to the illegally parked shared bikes is the removal of shopping carts, which are “parked” in public spaces. They also have to be removed by the street cleaning division and are collected at a storage site of MA 48. With a decreasing trend in the past years, around 18,000 shopping carts end up at the storage site every year (Jurkovits, 2018). Apparently, the shopping cart issue presents a much bigger burden for the city of Vienna than the removal of shared bicycles but in contrast to the FFBSS, it is not discussed as extensively by the media.

#### *7.4. Business model and data collection*

The acceptance of bike sharing systems could also be a question of the company’s business model. To date it is not clear what the business model of FFBSS systems is. The rides are often very cheap and it is not transparent what kind of data is collected via the mobile phone apps. If people have the feeling that they only get inexpensive or even free biking because their data will be used for advertising or dubious purposes, they are maybe less likely to trust the service enough to make use of it and tolerate the bicycles in public spaces. It is still not clear where the FFBSS trend is heading. Now, there is a battle between many different operators, the “Rainbow War” as it is often dubbed due to the colorful bikes. Blum (2018) argues that today many of the global players have extreme amounts of investment capital and try to take over the market with cheap services but are not yet operating economically viable. Eventually it will be inevitable for the companies to change this practice or pull out of the market, as it has already happened with oBike in Melbourne and Singapore and Greenride, ofo and oBike in Vienna. Blum (2018) expects that in the coming years only few of the different operators will still be in the market.

On the other side of the coin, data collection is considered one of the advantages of bike sharing systems. The data could be used to better understand user’s behavior and for planning and maintenance of infrastructure. This raises the question if cities should ensure that they take control over data collection by FFBSS companies or at least make sure that they gain access to the collected data. From a more radical point of view it could be argued that shared bikes should not only be controlled by the city with regulations but be in fact public bikes altogether. This could further ensure that the BSS is integrated into the public transport system. With the station-based Citybike and its predecessors in Vienna, it has been shown that the development of a functioning bike sharing system is an iterative process. In the end, the success was driven by the commitment of the city to develop such a system even though it has failed in the past. For now it seems that an example for a well-functioning FFBSS can be found in Seattle, where the city deliberately decided on welcoming the free-floating operators on its own terms which include data sharing with the Department of Transportation.

## 8. Conclusion

Problematic issues in Vienna vary between the different types of bike sharing. The station-based system benefitted from the experiences with its predecessors and most operational problems have been resolved over the years. Today, this system faces some modernization issues and its future is depending on further developments with the more innovative schemes and investment choices by the city. The mixed system of Donkey Republic overcame the initial issue of using public bike parking racks with operational changes but it is still unclear how the new regulations are going to affect the company. Problems concerning ofo and oBike have been mainly due to vandalism and illegal parking.

We conclude that the dissatisfaction of the public in Vienna with FFBSS is due to uncivilized behavior and the awareness of this behavior, which can be influenced by the media. The attitude towards these new BSS can be influenced by the cleanliness of a city, cycling culture and the level of bike quality that the population is used to. On the other hand, unclear business models and collection of data lead to unease with the city dwellers. A legal framework is needed to cope with these new forms of mobility services. For a win-win situation, regulations should be defined in cooperation with BSS operators. Most cities see bike sharing as a potential for a more sustainable transport system and welcome the introduction of such systems. In order for the new sharing schemes to work properly, rules have to consider all stakeholders: the operators, the public, the media and the government. As mentioned in section 5, especially the limit of 1,500 bicycles and the accreditation process according to the new regulation in Vienna have been criticized by ofo and Donkey Republic. The study of Jia, et al. (2018) similarly emphasized the importance of collaboration between bike sharing companies and governments. Regulations should ensure that the BSS operators are not externalizing costs by demanding public resources to maximize private profits. It could also be crucial to ensure collected data is shared with the city authorities. The research suggests that it is beneficial for cities to actively make shared bikes part of the city mobility offer. But if a city welcomes bike sharing schemes and wants to promote cycling in general, it has to offer appropriate conditions and infrastructure simultaneously. These include the provision of roads and bike lanes that are safe to ride on and enough parking possibilities.

Different legal backgrounds in cities result in different regulatory approaches that vary in duration. The approach by Vienna was not to react too fast on a trend where there is still a lot of upheaval in the market. After the initial phase, it was decided to establish a local police regulation. This caused Greenride, ofo and oBike to turn away from the market in Vienna. The future will show how the situation with FFBSS develops, if the public will accept these new schemes and if some operators are going to stay in the city and become a fixed part of the transport system. The current situation suggests that FFBSS using geofence stations, such as Donkey Republic, are more likely to be accepted by the city dwellers and to cope with new regulations. Such mixed systems present a compromise between the advantages of station-based and free-floating schemes. Users are not as flexible as with completely free-floating systems regarding the location to pick up and leave the bicycles. On the other hand, it is not necessary to build expensive physical stations with IT infrastructure and the placement of geofence stations is a lot more flexible. Additionally, vandalism and illegal parking can be largely avoided, as shown with Donkey Republic.

An interesting related aspect to explore in the future in this regard could be the effectiveness of the regulations, especially comparing the effectiveness of voluntary contracts with legal texts, since there is a significant difference in the timeline for the establishment of the two. A related topic which would also be worth investigating is the newly emerging electric scooter sharing. Further research is needed to explore whether e-scooter sharing is associated with similar issues and what kind of regulations are necessary in this regard. In Vienna, e-scooters are legally considered bicycles. Therefore free-floating e-scooter sharing companies also have to adhere to the new local police regulation for dockless rental bikes.

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