
Overshare and collapse: How sustainable are profit-oriented company-to-peer bike-sharing systems?



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Die vorliegende Studie untersucht, ob bzw. in welchem Maße gewinnorientierte und als Business-to-Customer-Geschäft konzipierte Fahrrad-Sharing-Systeme nachhaltig sind. Basierend auf den von *Martin* (2016) entwickelten Zuschreibungen der Sharing Economy wird untersucht, ob kommerzielle Fahrrad-Sharing-Systeme diese ihnen beigemessenen Charakteristika tatsächlich aufweisen. Die Ergebnisse sind ernüchternd: kommerzielle Fahrrad-Sharing-Systeme sind (1) ökonomisch (noch) nicht rentabel, (2) stellen keine nachhaltigere Form des Konsums dar, (3) führen nicht zu einer stärker dezentralisierten, faireren und nachhaltigeren Wirtschaft, (4) erfordern eine weitreichendere Regulierung, (5) sind anfällig für Monopolisierungstendenzen und (6) basieren auf weder neuen noch disruptiven Geschäftsmodellen. Die Autoren plädieren für weitere Forschungsanstrengungen, um nachhaltigere Systeme zu entwickeln.



The primary concern of this study is to examine if or to what extent profit-oriented bike-sharing systems are sustainable. Based on the frames attributed to the sharing economy developed by Martin (2016), the authors analyze whether the commercial company-to-peer bike-sharing systems actually show these attributed characteristics. The results reveal that profit-oriented bike-sharing systems (1) do not pay off (yet) in economic terms, (2) are not a more sustainable form of consumption, (3) are not a pathway towards a more decentralized, equitable, and sustainable economy, (4) may need more regulation, (5) are subject to monopolistic tendencies fueled by venture capitalists, and (6) the underlying business-model is neither new nor disruptive. Further research needs to address the development of more sustainable systems.



Sharing Economy, plattform-basierte Ökosysteme, Leihfahrräder, Nachhaltigkeit, Unternehmertum, Innovation, Geschäftsmodell

sharing economy, platform ecosystems, bike-sharing systems, sustainability, entrepreneurship, innovation, business model

1 Context and rationale

Revenue and transaction values facilitated by collaborative economy platforms in Europe demonstrated tremendous growth rates of more than 50 percent per year between 2013 and 2015 (*Vaughan/Daverio* 2016). Although most researchers agree that the sharing-economy ecosystem is rich and diverse (e.g. *Murillo et al.* 2017), many discussions and investigations refer to the whole sharing-economy spectrum in general (e.g. *Murillo et al.* 2017). Even those scholarly contributions that focus on a sector like transportation and mobility still cover a broader range of sub-sectors like car-, ride-, and bike-sharing (e.g. *Cohen/Kietzmann* 2014); nevertheless, since 2018 more scholarly contributions that clearly focus on the bike-sharing sector have been emerging (e.g. *McKenzie* 2018; *Nikitas* 2018; *van Waes et al.* 2018). Therefore, this research effort concentrates on one specific sub-sector in order to learn more about the specifics of a particular business model of the sharing economy.

According to *Horn/Jung* (2018), the development of dockless bike-sharing systems encompasses an enormous dynamic: initially, the change towards dockless systems was hardly noticed, for instance, in Germany, but since 2017 it has become very obvious in the public spaces of German municipalities. Within just a few months, several new providers from China and Singapore, but also from Denmark, Germany, and the USA, have entered the German bike-sharing market with stationless offers. This development is not limited to Germany alone, but is a global phenomenon.

Recent press coverage of this phenomenon indicates its controversial nature—manifesting in headlines like “Bike-sharing pedalling towards becoming a British way of life: Number of towns and cities with schemes has more than doubled in two years to 25, with some being used to bridge divides” (*Walker* 2017) at the positive end of the spectrum and “Verkehrsplanung: Tausende Mieträder verstopfen europäische Großstädte [Traffic planning: thousands of rental bicycles jam large cities in Europe]” (*Balser/Giesen* 2017) or “Bike-sharing firm ofo’s dramatic fall a warning to China’s tech investors” (*Reuters* 2018), at the negative pole.

Individual possessions and consumption are central characteristics of a lifestyle oriented towards material prosperity; but, the promise of happiness of the individual-focused consumer society has been questioned from different sides for some time now, which is reflected in the so-called “economy of sharing” and “collaborative consumption” (*Heinrichs/Grunenberg* 2012). What expectations, therefore, are associated with the sharing economy? People aspire to practice new forms of common or shared production and consumption to meet their increasing need for a more environmentally friendly and sustainable way of life and for social exchange; and with the new (technical) possibilities offered by social media, the sharing economy should make it possible (*Heinrichs/Grunenberg* 2012). High expectations are therefore associated with this new form of economic activity: a decentralization of value creation, an increase in social capital and environmental relief through better utilization of material goods (*Heinrichs/Grunenberg* 2012) or—as *Schor* (2016, 18) puts it—a “path [...] in which sharing entities become part of a larger movement that seeks to redistribute wealth and foster participation, ecological protection, and social connection”. But the controversy about the rapidly developing sharing economy suggests that it is far from clear whether it is delivering on its promises of salvation. Therefore, this contribution intends to trace the extent to which the sharing economy lives up to the expectations placed on it. As already mentioned, the sharing economy is highly

differentiated. Therefore, it would not be appropriate to attempt to answer such a question in general for this entire sector: the company-to-peer bike-sharing systems are rather picked out as an exemplary object of analysis.

Bike-sharing systems that are platforms for temporarily sharing access to a specific asset (bicycles), are also subject to strong growth. In Germany, for instance, the compound average growth rate (CAGR) of these systems' bicycle fleets between 2000, the year when such systems were introduced, and 2016 was about 16 percent culminating in a steep increase after the year 2016—between 2016 and 2018 the capacity more than doubled (+121 percent) (Figure 1). Moreover, the number of public-use bicycles in the world has risen from 700,000 in 2013 to 2,294,600 in 2016, which corresponds to a CAGR of about 35 percent between 2013 and 2015, followed by a sharp rise of almost 81 percent from 2015 to 2016 (authors' own analysis based on the blogger Russell Meddin's data as published by Richter 2018).

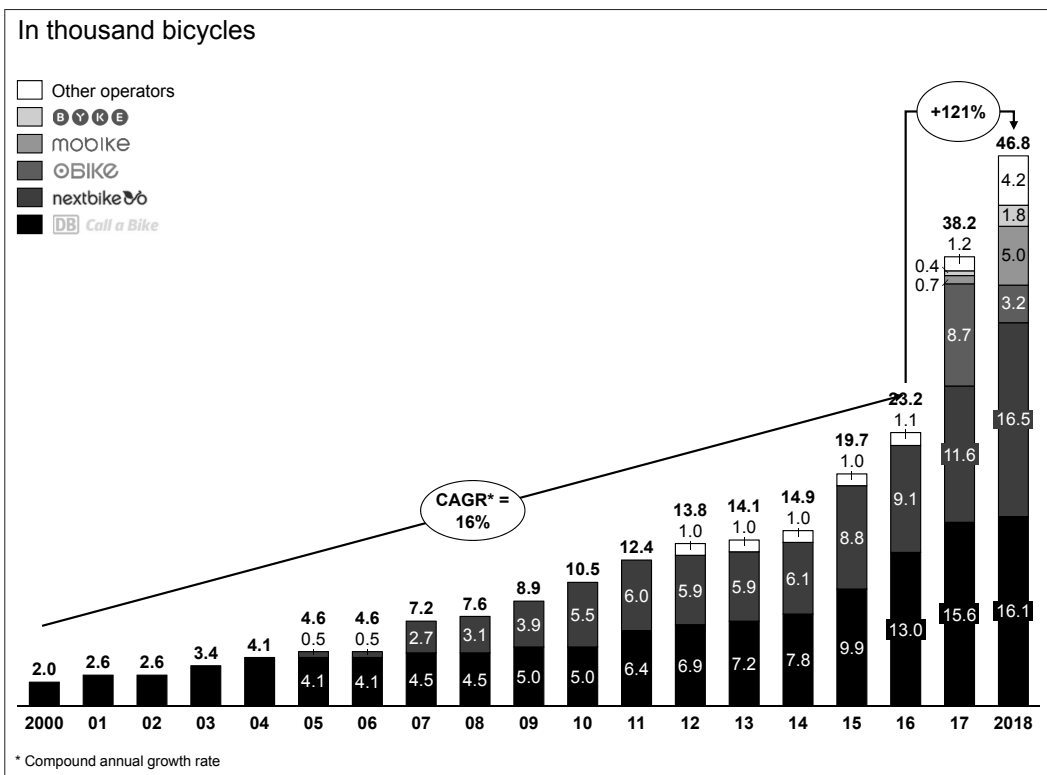


Figure 1: Development of the bike-sharing systems' fleet size by main operators in Germany, 2000–2018 (Source: Authors' own analysis and representation based on the data provided by De Maio/Meddin 2007–2019)

As Figure 2 shows, the same kind of growth pattern of a period of moderate growth followed by extraordinary growth has been observed before—in particular, during the so-called dot-com bubble of 1997–2000. This raises the question of whether a parallel can be drawn to the equivalent dot-com bubble burst—fueled by the finding by Kasproicz

(2016) that the majority of peer-to-peer platforms founded between 2010 and 2014 have already disappeared—or whether this is just the typical pattern of a new disruptive way of doing business, which will reach a plateau that is sustainable over a longer period. Consequently, this research deals with the economic, as well as ecological sustainability of bike-sharing systems. Practitioners like (potential) investors or jobseekers face a clear need to assess the healthiness of the industry sectors and companies they want to invest in or accept a job offer from, since their own financial fortunes are at stake—especially since the first bike-sharing operators like oBike (*Deutsche Welle, DW 2018*) and ofo (*The Economist 2019*) have already failed.

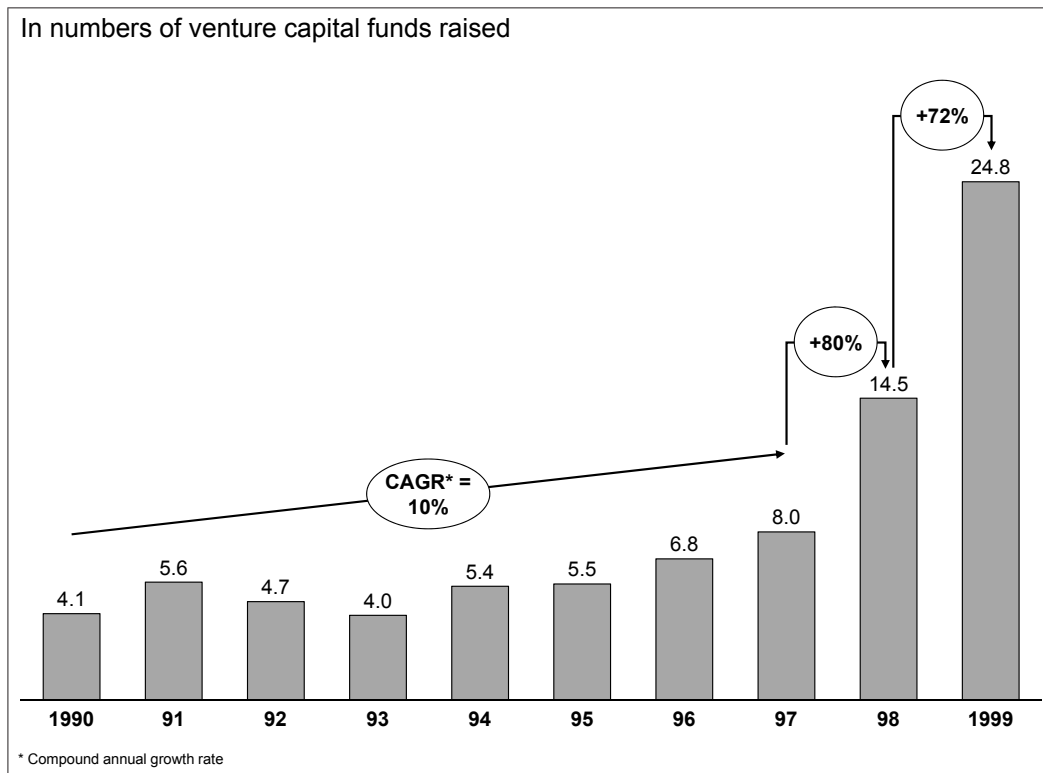


Figure 2: Development of the number of venture capital funds raised in Europe, 1990–1999 (Source: Authors’ own representation based on the data provided by Boltazzi/ Da Rin 2001 as cited in de la Dehesa 2002, 15)

Thus, carefully studying the relatively new phenomenon of the sharing economy is important both for start-up companies and incumbents (*Matzler et al. 2015*). Furthermore, scientific researchers are also highly interested in better understanding early-warning signals of a crisis in general (*Candelon et al. 2014*), or in specific sectors like banking (e.g. *Dabrowski et al. 2016*), or politics and the military (e.g. *O’Brien 2010*), rather than relying on the sensational future growth rates projected by one single professional-services firm: *Cheng 2016; Kathan et al. 2016; Martin 2016; Puschmann/Alt 2016; Habibi et al.*

2017; Muñoz/Cohen 2017; Murillo et al. 2017—all drew on a forecast computed and released by PricewaterhouseCoopers, PwC (n.d.).

2 Theoretical context

2.1 Controversial definitions of the sharing economy concept

Following Laamanen et al. (2018, 213), the sharing economy is thought of a “socioeconomic ecosystem that commonly uses information technology to connect different stakeholders—individuals, companies, governments, and others—to share or access different products and services and to enable collaborative consumption” (see also Belk 2014; Woskowiak 2014; Hamari et al. 2016). Adhering to the notion of the sharing economy as a socioeconomic ecosystem, enhances our understanding of how the sharing systems work and how their elements are interrelated.

The multi-faceted nature of the concept is reflected in the fact that scholars still struggle to agree on a common definition of the concept called sharing economy (e.g. Acquier et al. 2017). There is a great variety of broader (e.g. Laurell/Sandström 2017) and more narrow definitions of the term sharing economy (e.g. Frenken/Schor 2017) that are used by different researchers (Murillo et al. 2017). In order to overcome issues of concept and definition, some scholars have suggested drawing on an umbrella construct as brought forward by Hirsch/Levin (1999) and to use more inclusive frameworks to position the academic and practical works. Whereas Acquier et al. (2017) suggest a framework that rests on three foundational cores (access, platform, and community-based economy) and their overlaps, Habibi et al. (2017) favor, by drawing on Belk (2007 and 2010), a continuum of a wide range of non-ownership forms of consumption, such as swapping, bartering, trading, renting, and exchanging with pure sharing and pure exchange as opposite poles.

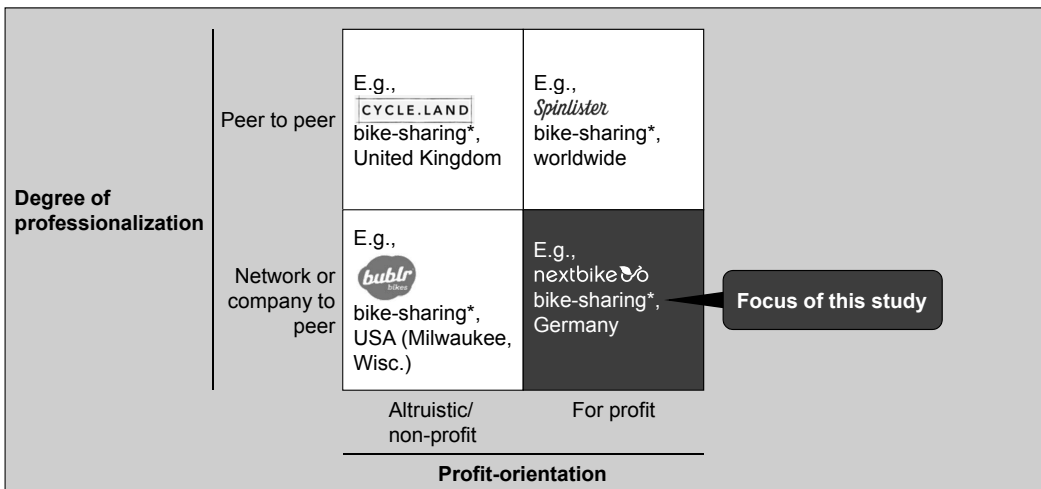


Figure 3: Organizing framework for the bike-sharing economy (Source: Authors’ own representation)

A more promising approach (than debating the question whether the sharing economy as such includes or excludes certain activities), can be achieved by applying a broad umbrella

construct, which allows for positioning a certain activity as the object of analysis in such a definitional framework. Moreover, it allows a comparison of previous and future findings within the various categories of the framework to identify commonalities and differences among the various manifestations of the sharing economy. Therefore, this research effort is positioned in a framework that is made up of very common criteria: altruistic versus for-profit (e.g. *Martin* 2016), peer to peer (P2P) versus company to peer (e.g. *Puschmann/Alt* 2016), and affiliation to a certain industry sector (e.g. *Cohen/Kietzmann* 2014, on mobility business models; *Cheng* 2016, on the tourism and hospitality sector)—resulting in a 2X2 matrix for each relevant sector. Despite the fact that bike-sharing examples for all quadrants of this matrix could be found (Figure 3), most bike-sharing systems are clearly positioned as a profit-oriented company-to-peer business in the transportation and mobility sector. For instance, the number of bikes listed on Spinlister, a profit-/exchange-oriented, peer-to-peer bike-sharing platform, stands in stark contrast to the number of bikes held by for-profit, company-to-peer systems in Germany (as of November 2017): 9 versus 7,900 in Munich and 73 versus 5,500 in Berlin (authors' own analysis based on *Spinlister* 2017; *De Maio/Meddin* 2017). Furthermore, no altruistic/non-profit, bike-sharing system could be identified by the authors in Germany—neither peer-to-peer nor network/company-to-peer. Because of this, it can be said that—at least currently—all types of bike-sharing systems, other than profit-oriented company-to-peer systems, are in a very small niche. Accordingly, the focus of this research is clearly set on the currently dominant for-profit company-to-peer systems.

2.2 Basic characteristics of the sharing economy

Research about the sharing economy is relatively new. Basically, it came to life during the last decade (*Slee* 2015; *Cheng* 2016; *Martin* 2016). As a consequence, no homogeneous theoretical body of work on the sharing economy and its various facets has evolved so far; researchers summarized and presented rather a “typology of controversies” (e.g. *Laurell/Sandström* 2017; *Murillo et al.* 2017, 68). Nonetheless, some basic characteristics of the sharing economy and its ecosystems have been identified:

The sharing economy is embedded in various business ecosystems that consist of platform firms and complementors (*Kapoor/Agarwal* 2017). In the bike-sharing case, the ecosystem is an integrated mobility service and the (dockless) shared bikes might provide a possible complement to public transportation for the last mile. What is interesting here is the dynamics of value creation (*Adner/Kapoor* 2010) and its sustainability. What are the focal firms, their suppliers, and their complementors, how do they create value and how is it changing over time and across technological generations (*Adner/Kapoor* 2016)? How sustainable is the ecosystem? A new ecosystem, for example, emerged when the mobile phone industry converged with the personal computer industry to form a new mobile computing industry (*Rong/Shi* 2014).

Because of the positive expectations of the sharing economy mentioned above, it can be seen as a social movement (*Schor* 2016) that must seek support for its views and goals and activate those people who already agree to these (*Snow/Benford* 1988). This aspect associates the sharing economy with an ideology of shared values, beliefs, and ideas. It is about the recognition of meanings: relevant events and conditions are interpreted in such a way that potential followers and supporters are mobilized, and opponents are immobilized (*Snow/Benford* 1988). This process is called framing. The term “frame” goes back to

Goffman (1974) and refers to interpretation schemes that enable the individual to locate, perceive, identify, and characterize events in his or her living space and the world in general. Such frames should serve here to compare the meanings attributed to the sharing economy in the sense of a “qualitative hypothesis test” with facts that represent an objective or at least inter-subjectively comprehensible reality. This requires an exact understanding of the frames to which the sharing economy is typically attached.

Martin (2016, 152) recently identified these frames exactly; he reviewed more than 200 English language “online articles and reports written by advocates, critics, and commentators” of the sharing economy from multiple countries by applying inductive qualitative research (a content analysis based on emergent codes). His analysis revealed that supporters of the sharing economy typically employ three frames—“the sharing economy is:

- (1) an economic opportunity;
- (2) a more sustainable form of consumption; and,
- (3) a pathway to a decentralized, equitable and sustainable economy” (*Martin* 2016, 153).

In contrast, people who resist and critique the development of the sharing economy employ three other frames—“the sharing economy is:

- (4) creating unregulated marketplaces;
- (5) reinforcing the neoliberal paradigm; and,
- (6) an incoherent field of innovation” (*Martin* 2016, 153).

Furthermore *Martin* (2016, 153) “conducted limited further validation of the framings” and found that “almost all of the 30 speakers observed at the event [*Ouishare Fest* 2015] employed one or more framings in a complete or partial form”. In addition, he continues with the observation that the economic opportunity framing “is congruent with the ‘success stories’ of Airbnb and Uber, [...] presenting the sharing economy as an innovation of self-evident value within the digital market economy” (*Martin* 2016, 158).

For the most part, these findings can be brought into congruence with *Cheng’s* (2016) research outcomes on the key foci of the sharing-economy research in general:

- Business model and its impact (based on content analysis):
The business-model focus clearly parallels the perspective on the sharing economy as an economic opportunity and therefore matches with frame (1).
- Consumption practice (based on co-citation analysis) and sustainability development (based on content analysis):
This focus refers to “theoretical appraisal of alternative consumption practice” (*Cheng* 2016, 64) as considered by *Bardhi/Eckhardt* (2012) and hence corresponds to frame (2) (a more sustainable—and hence alternate to the currently dominant—form of consumption). However, there are also barriers to sharing. *Bielefeldt et al.* (2016) report adoption barriers like personality and society related barriers on car-sharing participation in Germany.
- Lifestyle and social movement (based on co-citation analysis):
Basically, this quality is about how lifestyle movements encourage social change (*Laamanen et al.* 2015); therefore, it reflects the core of the frames (3), (4), and (5), regarding the various ways an economy is organized and can actively be changed and how this effects social behavior.

- Trust (based on co-citation analysis):
In the extant literature, trust is mentioned as a pre-condition for social transactions that need to be facilitated, for example, by drawing on customer reviews and ratings (e.g. *Botsman/Rogers* 2010; *Möhlmann* 2015; *Schor et al.* 2016; *Acquier et al.* 2017). There are different targets of trust in the sharing economy, such as peer, platform, and product (*Hawlitschek et al.* 2016). Therefore, trust might be seen less as a certain characteristic of sharing-economy systems and more as a pre-condition, and hence does not correspond to one of the frames mentioned above. The findings that the platforms of the sharing economy actually build social trust are not clear anyway (*Schor* 2016).
- Sharing paradigm (based on co-citation analysis) and nature of the sharing economy (based on content analysis):
Under the sharing-paradigm focus, the aforementioned definition controversy can be subsumed; hence, it does not directly match one of the characteristics found by *Martin* (2016) who applies a broader definition of the construct sharing economy.
- Innovation (based on co-citation analysis):
Obviously, innovation corresponds to frame (6).

In order to study the sustainability of one of the sharing economy’s sub-sectors, like commercial company-to-peer bike-sharing systems, drawing on the characteristics broadly attributed to the sharing economy is a promising approach, because one can conclude from the qualities of something whether it can be expected to be sustainable or not. This might be the reason why the research foci on the sharing economy are mainly congruent with the frames that are attributed to the sharing economy as typical characteristics. Therefore, the frames found by *Martin* (2016) are used as a guideline to analyze whether the commercial company-to-peer bike-sharing systems actually show these characteristics.

Review of >200 English language ‘online articles and reports by advocates, critics, and commentators’ of the sharing economy from multiple countries by applying inductive qualitative research (content analysis based on emerging codes)

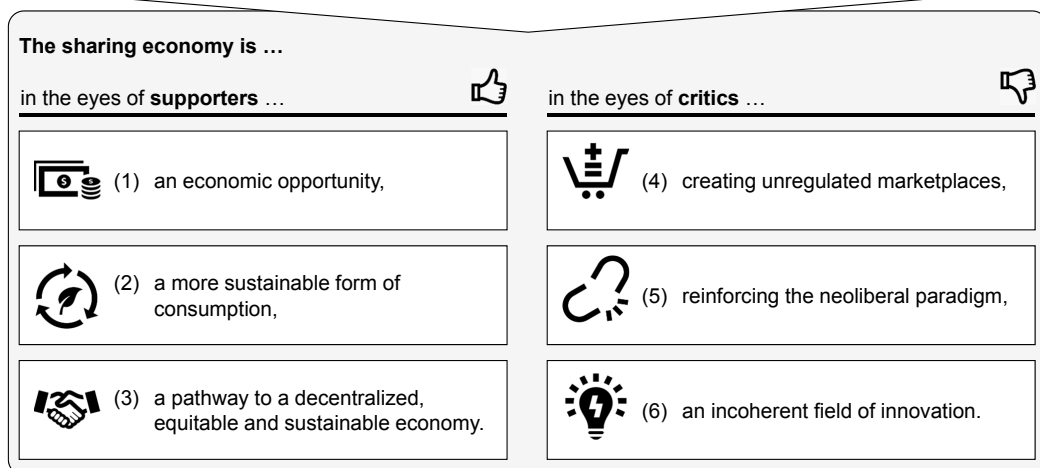


Figure 4: Frames of the sharing economy typically employed by supporters and critics (Source: Authors’ own representation based on *Martin* 2016, 152–156).

In addition, some researchers most recently claimed—according to the frames listed above—that bike-sharing systems create environmental and social values which outweigh the negative impacts of their operations (*Winslow/Mont 2019*). Consequently, this research effort is organized along the aforementioned frames (1) to (6) that are graphically summarized in Figure 4.

Thus far, meanings generally attributed to the sharing economy were discussed. Before these are examined in relation to the concrete sub-area of the sharing economy selected here, first the special features of this sub-area, i.e. the company-to-peer bike-sharing systems, are considered.

3 Types of profit-oriented company-to-peer bike-sharing systems

3.1 Company-to-peer bike-sharing systems as one-sided digital platforms

There are different conceptualizations of digital platforms (*de Reuver et al. 2018*). They can be defined as purely technical artifacts, where the platform is an extensible codebase of a software-based system that provides core functions shared by the modules interacting with it and the interfaces through which they interact (e.g. *Ghazawneh/Henfridsson 2015*). However, a digital platform can also be characterized as a socio-technological assemblage comprising the technical elements of software and hardware as well as the associated organizational processes and standards (e.g. *Tilson et al. 2012*). There is no doubt that both approaches apply to bike-sharing systems. The only difference is the scope, especially whether the bicycles themselves and the rental and payment processes are seen as parts of the platform or not.

A platform that connects different user groups such as buyers and sellers is typically referred to as a multi-sided platform (*Boudreau/Hagiu 2009*). Company-to-peer bike-sharing systems connect different customers exclusively with one system operator and not with several providers. In this respect, these are to be regarded as one-sided platforms.

An ecosystem includes third-party modules (so-called complements, e.g. an app) that complement this codebase, for example, an operating system like Android or iOS (*Tiwana et al. 2010; Boudreau 2012*). Therefore, from a technical perspective, an ecosystem comprises a collection of complements to the core technical platform, usually provided by third parties, whereas from an organizational perspective it comprises a collection of companies or individuals (so-called complementors) who contribute to the complements through their interaction (*de Reuver et al. 2018*). In this respect, company-to-peer, bike-sharing systems are not ecosystems yet because they lack complements provided by third parties.

Beyond these definitions, *Cusumano et al. (2019)* differentiate between “product/service thinking” and “platform thinking”. Unlike traditional businesses, success not only depends on quality, process or timing, as an independent product or service, but even more so on complementary innovations that determine what users can do with the product (*Cusumano et al. 2019*)—so platform thinking requires building an ecosystem. From this point of view, company-to-peer bike-sharing platforms are, due to their business logic, at least at the moment, more aligned with the conventional economy than with the platform economy.

3.2 Dockless systems without significant barriers to market entry

As in the car-sharing sector (Vaskelainen/Münzel 2018), there are two types of company-to-peer bike-sharing systems: station-based and dockless systems. In a station-based system, a bicycle can only be borrowed from a special bike rack (dock) and must be returned to a dock belonging to the same system. Dockless or free-floating bike-sharing systems, on the other hand, allow rental and drop-off at any location within the supplier area; the bike can simply be parked on site.

The dockless systems in particular offer hitherto unlimited access to the (German) market for new entrants:

“While every restaurateur needs a special permit to put tables and chairs on the sidewalk, it’s much easier for bike sharing providers. Only the operators of fixed bike sharing stations need a special permit for their fleets. The providers of so-called free-floating bikes, i.e., those without a fixed station, do not need one. This was decided by the Hamburg Administrative Court (Oberverwaltungsgericht Hamburg) in 2009. At that time, the Hanseatic city had put station-bound bike sharing out to tender, and Call a Bike had won the tender. The city then wanted the small fleet of 200 nextbike bikes to disappear from Hamburg’s streets. The city went to court and lost. The nextbike bikes were allowed to stay and are still on the road in the city.” (Reidl 2018, translated by the authors)

The bike-sharing market has undergone fundamental changes since the ruling with regard to fleet sizes and business models; the new circumstances could also lead to a different case law—however, as long as there is no other judicial assessment, the decision by the Hamburg Administrative Court continues to give a clear signal (Horn/Jung 2018). Land legislation may provide for the possibility of amending the relevant Land Road Act (Landesstraßengesetz) and subjecting the operation of bicycle rental systems at municipal level to a permit. In this case, cities could adapt their statutes for special use in such a way that the issuing of a “public lending bicycle license” is linked to defined criteria. A ban on parking rental bicycles in pedestrian areas or on connecting them to bicycle brackets cannot be achieved by this either. (*Allgemeiner Deutscher Fahrrad-Club, ADFC* 2018)

4 Assessment of profit-oriented company-to-peer bike-sharing systems

Research on bike sharing has only started to cover some of the challenges and problems that the bike-sharing systems typically face, for example, inventory rebalancing and vehicle routing (e.g. Schuijbroek et al. 2017), detection of broken bicycles (Kaspi et al. 2016), and breaches of privacy data (Touhidul Hasan et al. 2017)—leaving a research gap regarding the robustness and sustainability of bike-sharing systems.

4.1 Frame (1): an economic opportunity

Almost 90 percent of Swedish social-media posts about the practices of the sharing economy, which were analyzed by Laurell/Sandström (2017), are related to commercial exchanges—namely, selling (64.5 percent) and renting (24.8 percent). Regardless of the academic discussion on issues of definition, the actors in the sharing economy associate it with business traits.

This frame is as multi-faceted as the sharing economy itself; depending on which area you look at, other aspects are relevant. The question, for example, whether the sharing economy enables individuals to use their (underutilized) ability to earn money as micro-entrepreneurs in the so-called gig economy (e.g. *Martin* 2016) does not play a role with regard to company-to-peer bike-sharing systems. Whether business model innovations, driven by digitization or commercially lucrative businesses for entrepreneurs, companies, entire industry sectors, or even nations, emerge, is, on the other hand, also relevant with regard to company-to-peer bike-sharing systems. The main question here is whether one can earn money with such systems or whether they are economically self-sustaining.

Testing the viability of profit-oriented company-to-peer bike-sharing as an economic opportunity might appear somewhat odd, because it seems obvious that profit-seeking firms are attracted by exploitable economic opportunities. This, however, cannot be taken for granted as exemplified by the pioneers of bike sharing in Germany, Christian Hognl and Josef Gundel, who founded Call a Bike in 1997 (*Hirn* 1998). They went bankrupt soon after launching their bike-sharing system in Munich, Germany and sold the company to the German railway company, Deutsche Bahn (*Pfeil* 2003). In addition, the introduction of venture capitalists to the area has changed the dynamics of these initiatives, in particular by encouraging faster expansion (*Schor* 2016). This certainly raises the question whether, analogous to the dot-com bubble, (foreign) money is burnt in a kind of gold-rush atmosphere. Furthermore, “[b]ike sharing has not been a money-making venture for many cities, and many bike-share experts have doubts about the financial viability of the private companies” according to *Beitsch* (2017). Bike sharing does not yield a profit without sponsors or subsidies (*Doll* 2017): consequently, none of the bike-share providers made any profit so far (*Lee* 2017), but lost billions of Euros (*Rest* 2018).

In order to empirically substantiate such reports, the annual financial statements of nextbike GmbH published in the German Federal Gazette (*Bundesanzeiger*) were analyzed. Bike-sharing providers BYKE, Donkey Republik, LimeBike, and Mobike, which are currently active in Germany (*Deutsches Institut für Urbanistik, Difu* 2018), unfortunately have not published any sufficiently informative financial reports. The detailed financial reporting of the Call a Bike system managed by Deutsche Bahn Connect GmbH is regrettably concealed in the consolidated reporting of Deutsche Bahn AG. Therefore, only the financial performance of nextbike can be considered here as an example.

At the end of 2016, the cumulative annual deficits outweighed the cumulative annual surpluses. In the year-end financial statements for 2017, a net income for the year of just under half a million EUR is reported, so that the cumulative result to date is positive at 244 thousand EUR (Figure 5).

nextbike works closely as a bike rental supplier with cities and municipalities who publish tenders for bicycle rental systems or award concessions to companies (*Woop/Bollert* 2018). In 2017, revenues increased by approximately 27 percent to 17.6 million EUR; this increase is mainly due to projects with the Munich utility (Stadtwerke München) and deliveries to nextbike Polska SA (*nextbike* 2018). The volatility of the business model can be seen from the fact that one order and the delivery of bicycles to a subsidiary alone will increase sales by more than 25 percent.

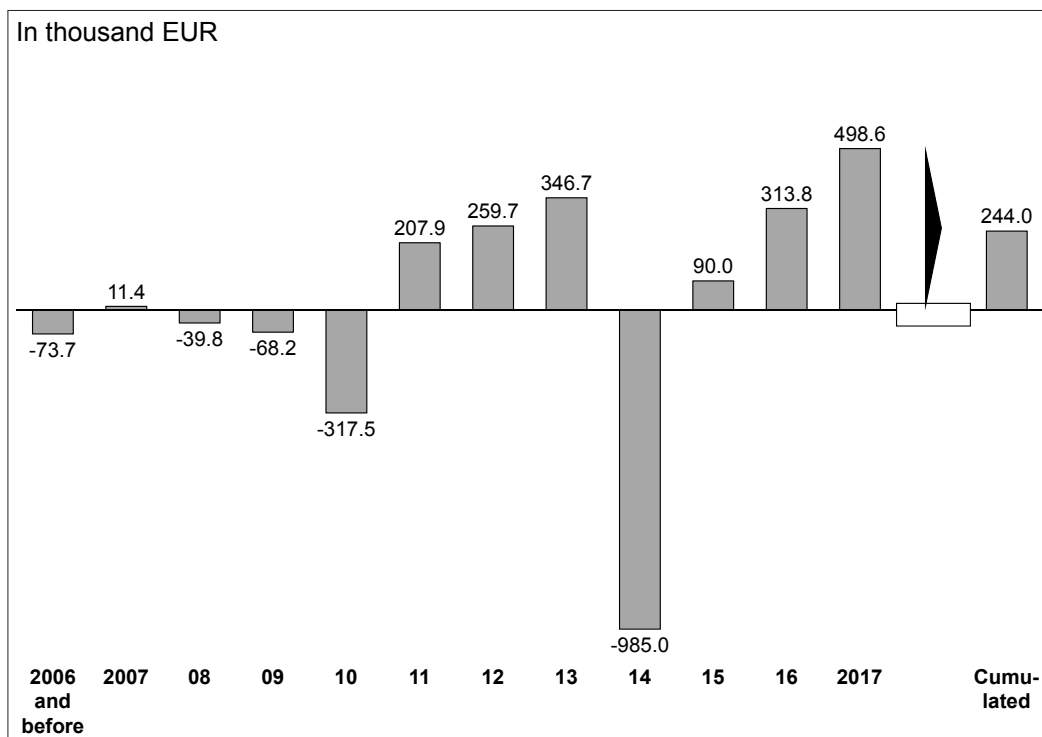


Figure 5: Annual surpluses and deficits of nextbike GmbH, Leipzig (Source: Annual financial statements published in the German Federal Gazette [*Bundesanzeiger* 2008–2018])

With regard to the question of whether the tendering or concession-giving municipalities can run a bike-sharing system in an economically feasible way or cover the costs they pay to the respective operators, *Ziehme* (2012) carried out a cost-benefit analysis for the City of Bremen. Two alternatives were considered: the first one showed that the user fees could cover only about one third of the annual operating costs (excluding depreciation on the investments to be made and imputed interest). Assuming that about 36 percent of the annual operating costs could be generated through advertising on bicycles and stations, a financing gap of about 31 percent remained to be covered by cooperations, sponsorships, or the public sector. And even with the second alternative, which is much less conservatively calculated in terms of the achievable user charges, there was still a financing gap of about 19 percent. Therefore, it seems doubtful that bike-sharing systems are economically self-sustaining.

In general, it remains unclear that one can make profits by maintaining a company-to-peer bike-sharing system. Therefore, further investigations of the financial aspects are required.

The size of the target group for bike sharing should not be overestimated. A survey by *Nikitas et al.* (2015) in the bicycle-friendly town of Gothenburg in Sweden, which was the first town to be awarded the title “Bike City” by the international cycling association, Union Cycliste Internationale in 2007 (*Heinz* 2011), showed that even after several years

of operation in 2014, more than 76 percent of those surveyed stated that they never used the local bike-sharing system Styr & Ställ (Figure 6).

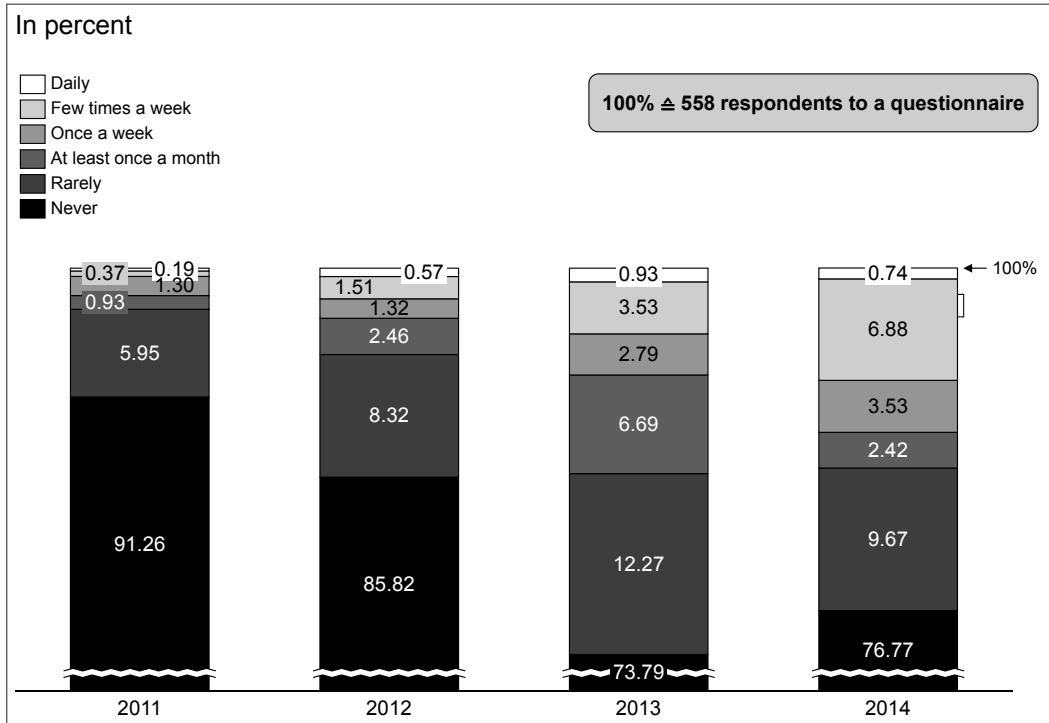


Figure 6: Frequency of using Styr & Ställ, a bike-sharing scheme in Gothenburg, Sweden (Source: Authors' own representation based on data published in Nikitas et al. 2015)

The intensity of use is also typically not high. Authors' own calculations on the basis of data from the German Federal Ministry of Transport and Digital Infrastructure (*Bundesministerium für Verkehr und digitale Infrastruktur, BMVI 2014*) and *De Maio/Meddin (2007–2019)* have yielded an average of 1.9 monthly rentals per bicycle in Usedom (UsedomRad), 3.9 in the Ruhr area (metropolradruhr operated by nextbike), 6.4 in Nuremberg (NorisBike operated by nextbike) and 22.9 in Mainz (MVGmeinRad), and 34.8 in Kassel (Konrad operated by DB Rent; extraordinary intense use by tourists due to the art fair documenta 13 in 2012) for the period from May 2011 to September 2014. This corresponds to between 0.06 (Usedom) and 1.16 (Kassel) rentals per bicycle per day, and even in the best months only between 0.14 (Usedom) and 2.39 (Kassel) rentals per bicycle per day could be recorded (*BMVI 2014*). In addition, the share bikes per loan are only used for a short period: in Mainz 90, in Kassel 73, in Nuremberg 69 and in the Ruhr area between 48 and 61 percent of the trips lasted less than half an hour (*BMVI 2014*). Other sources (e.g. *Ziehme 2012; Rabenstein 2015; Behörde für Wirtschaft, Verkehr und Innovation der Freie und Hansestadt Hamburg, BWVI Hamburg 2016; and Nikitas 2016*) assume somewhat higher usage intensities between 0.3 and 3.5, some even up to 8.0 rentals per bicycle per day.

4.2 Frame (2): a more sustainable form of consumption

There is a widespread argument that the sharing economy drives a more sustainable way of consumption (e.g. *Botsman/Rogers 2010; Heinrichs 2013*) and enhances often underutilized resources (e.g. *Stephany 2015; Martin 2016; Muñoz/Cohen 2017*). This holds true as long as the sharing does not lead to increased consumption due to better access and new uses—so-called rebound effects (e.g. *Parguel et al. 2017*), either in a reduction of the operating life of the shared assets, or in increased transportation needs of the shared goods between providers and demanders (*Demary 2015*). Overall, the positive sharing effects must not be overcompensated by such rebound effects.

What does this mean for the company-to-peer bike-sharing systems in focus here? One relevant aspect is that bicycle rental systems of this kind may help to make public transport more attractive (*Verband Deutscher Verkehrsunternehmen, VDV 2010*), as the so-called last mile can be covered faster and more comfortably. Moreover, the utilization of the existing bicycle stock should be enhanced by such systems—ideally by people replacing less environmentally friendly means of transport with more bicycle use.

The extent to which a bike-sharing system influences the attractiveness of public transport seems to depend on specific local conditions. Figure 7 shows the proportions of other

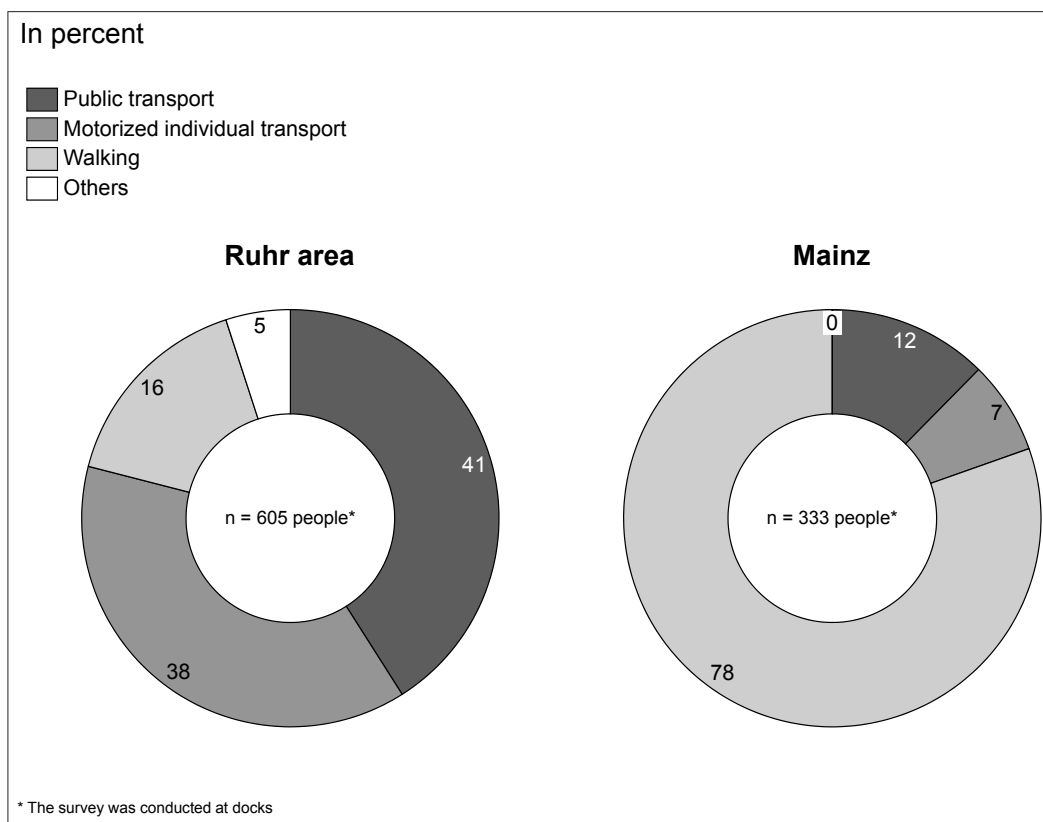


Figure 7: Proportions of share-bike rides combined with other means of transport (Source: Authors’ own representation and calculations based on the data published by *Rabenstein 2015*)

means of transport that were combined with share-bike rides. It can be seen that in the Ruhr area 41 percent of share-bike trips are combined with public transport, whereas in Mainz this plays a much smaller role with a share of only twelve percent. However, based on the data for the Ruhr area and also the United Kingdom (CoMoUK 2018) it can be assumed that at least in some cities or regions a bike-sharing system increases the attractiveness of public transport, as it is often combined with rides with a share bike.

Almost 10 percent of all rides with a shared bicycle, substitute motorized individual transport, for example, by car (3.3 percent) or motorcycle (6.3 percent): in 26 percent of the cases the respective distances were covered on foot, and 51 percent of the rides with shared bikes were formerly covered by means of public transportation, for example, metro, bus (Academic 2017) which was also ascertained by Fishman et al. (2013). These orders of magnitude are also confirmed by the empirical data published by Rabenstein (2015) for the station-bound systems in the German cities of Kassel, Nuremberg, Mainz, and the Ruhr area (Figure 8). The bicycles are therefore used as an alternative for (shorter distances with) public transport or walks. The less environmentally friendly car drives are only reduced to a small extent by bike sharing.

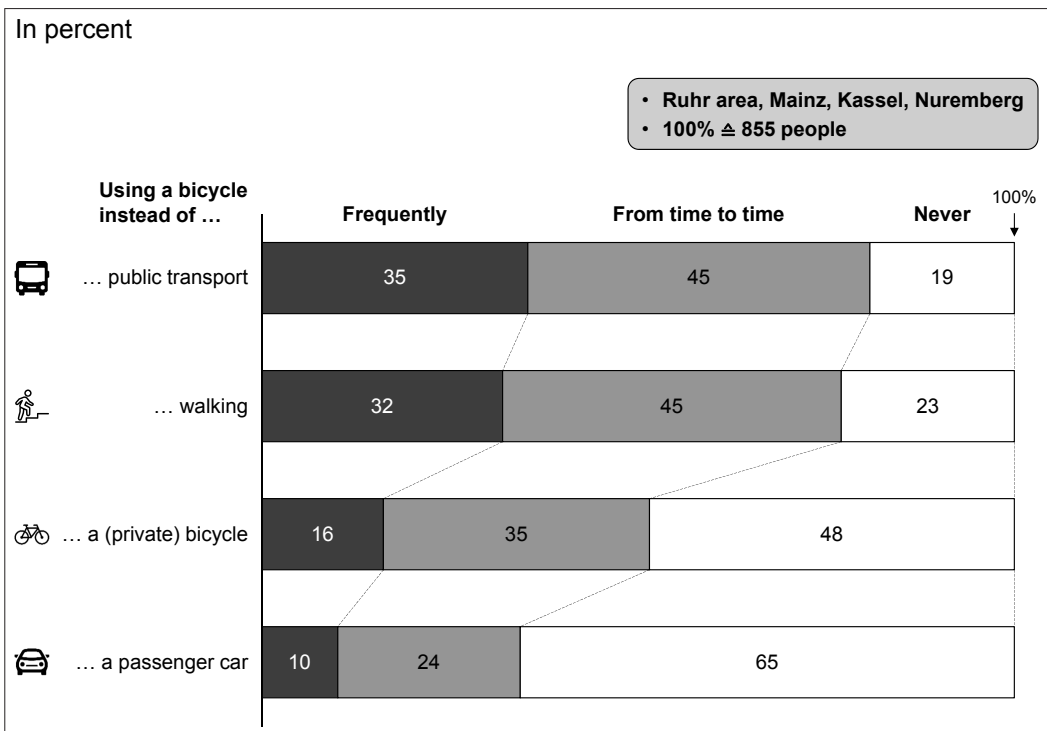


Figure 8: Proportions of various frequencies with which share bikes replace other modes of transport (Source: Rabenstein 2015)

In 2007, for instance, 80 percent of the Call a Bike lending in Stuttgart, Germany stayed under the first free-of-charge minutes; furthermore, 47 percent of the bike-sharing users combine the offering with short-range public transportation (Stuttgarter Nachrichten n.d.

as cited in *Academic* 2017). This is confirmed by Stephan Anemüller, spokesman of the Cologne transport services Kölner Verkehrs-Betriebe AG (*Reidl* 2017) and explains why the German national railway company Deutsche Bahn AG and other transport-services companies invested in or, at least, subsidize bike-sharing systems, for example, the municipal authorities of Mexico City and Carrot. This is in line with research that found people used shared bikes for the first or last mile in their multi-modal runs (*Cohen/Kietzmann* 2014). Based on a total of 997,306 data sets collected in 2012 and 2013 in Kassel Mainz, Nuremberg, and in the Ruhr area, including the cities of Dortmund and Essen, *Rabenstein* (2015) reports proportions of journeys with a maximum rental period of up to half an hour between 50 and 90 percent.

Approximately 40 percent of the rides with bike-sharing are offering-induced and would not have happened if bike-sharing were not available (*Rappler* 2013; see also *Rabenstein* 2015 for similar findings). Hence, it could be said that the demand for mobility is increased by bike-sharing systems, even though the overall effect on pollution might not be huge.

Nonetheless, it seems that the bike-sharing providers build up over-capacities that result in excess bikes in circulation. In 2017, Germany witnessed a kind of arms race when the capacity of shared bikes was increased by some incumbent or new players. It is a widespread phenomenon that “new sharing economy organizations emerge and evolve regionally at a stunning pace” (*Mair/Reischauer* 2017, 14) and rapidly spread internationally. Mobike, for example, built up a production capacity of 50,000 bicycles per day—almost a third of the global production (*Rest* 2018)! It appears that—as many other platform-economy players—sharing-economy companies feel a get-big-fast imperative and hence seek a dominant position in their business area or—as *Muñoz/Cohen* (2017, 21) put it—follow a “winner-takes-all global domination strategy”. This suits perfectly the findings of *Martin et al.* (2015, 247) that sharing-economy systems tend to become “more commercially-oriented over time”. This unintended side-effect clearly counteracts any increased sustainability because it implies that less successful and dominant players will go bankrupt or be taken over by the more dominant organizations, as already witnessed in the recent past. The losers of this consolidation process cannot claim to run a “sustainable business”.

The condition that the operational life of the shared assets may not be shorter compared to the pre-sharing status seems not to be met at all:

“The biggest damages are caused by the customers themselves. Many of the only few-months-old bicycles already look banged up. They are scratched and battered—in some occasions the handlebars are twisted, the saddles broken off, and wheels are bent so much that it is impossible to go straight forward. Moreover, some providers report on mass theft” (*Lee* 2017, translated by the authors).

Furthermore, some bike-sharing platforms use inferior bicycles because they want to avoid high capital investments; for instance, the oBike bicycles do not have a gear shift, are equipped with hard-rubber tires and a weak kickstand, which results in a lot of bikes lying on the ground. The impression of poor quality and the fact that people pay for renting a bike results in a lack of incentive to treat the bicycles gently (*Bardhi/Eckhardt* 2012; *Acquier et al.* 2017). There is a need, therefore, to investigate whether excess bicycles are produced and brought into circulation and consequently become underutilized assets. “[Bike-sharing] companies [...] placed around 27 million shared bicycles in major cities



Figure 9: Share bikes in the Englischer Garten in Munich, Germany in September 2017 (Source: Schubert 2017; picture taken by Catherina Hess)



Figure 10: A share-bike graveyard with more than 200,000 abandoned share bikes in Xiaomen, China in April 2018 (Source: Wu 2019; picture taken by Wu Guoyong)

across China” (Wu 2019). Dumping thousands of bicycles that were produced for a very short period of usage does not seem to be very resource-conserving or eco-friendly (Figure 10). According to *Rest* (2018), Ralf Kaluper, the managing director of nextbike, comments on the dockless company-to-peer bike-sharing systems: “This is not a business but an ecological disaster.”

4.3 Frame (3): a pathway to a decentralized, equitable and sustainable economy

As a counter-measure to centralized capitalism, attributed with persistent environmental degradation, climate change and increasing inequality, the sharing economy is seen as a diverse field of innovation that promotes exchange and cooperation among citizens, strengthens citizens, communities and grassroots organizations, and creates more decentralized structures in the economy and society (Martin 2016). Closely connected to frame (2), scholars argue in favor of the sharing economy because it drives a shift toward a more sustainable economy and the development of collaborative commons (e.g. Parguel *et al.* 2017) and hence can be seen as a “potential new pathway to sustainability” (Heinrichs 2013, 228). Extant research indicates that sharing does not advance the economic system toward a more decentralized and sustainable one, per se, given the oligo- and monopolistic tendencies and the predisposition to create over-capacities, as discussed in the section on frame (2). Nevertheless, there are customers “who consider participating in sharing practices, and who likely demonstrate and engage in pro-recycling behavior, energy-saving habits, organic product shopping, and promotion of local businesses (Hellwig *et al.*, 2015). Participants of sharing-based practices are known to reveal strong intentions for sustainable consumption (Bardhi & Eckhardt, 2012)” (Habibi *et al.* 2017, 118). On the other hand, research indicates that there are also sharing system users that consider sustainability aspects as an added bonus that comes along with more important utilitarian advantages (Philip *et al.* 2015). This leads the authors to the assumption that sharing-economy customers need to be segmented. Nonetheless, it seems that the sharing economy does not fuel a development toward a more sustainable economy (Martin 2016) but rather attracts people who are passionate about this kind of development.

These thoughts and initial findings will be examined here in relation to the company-to-peer bike-sharing systems. In terms of bike sharing, this means that the respective platforms intensify the (social) exchange between their users and strengthen their community, as well as bring about more decentralized economic and social structures through their business models and their actions.

The bike-sharing platforms are not based on social interaction between users as are social media platforms. They simply serve to handle a loan process using a fully digitized process; the user interacts with the platform system, but not with platform staff or other users. The authors are also not aware of any user clubs or the like that could strengthen community building. In addition, of the 1,790 respondents to the “bike share users survey 2018” conducted in the United Kingdom, social contacts were not cited as the reason for share-bike use (CoMoUK 2018). Among the 14 given choices (multiple answers were possible), this was not listed; however, it was also not mentioned sufficiently frequently via the field “Other (please specify)” to be listed in the evaluation. Therefore, the social aspects of bike sharing do not seem to be in the foreground, although of course you can also rent bikes as a group and cycle together, or occasionally others will talk to you about share-bike use, which certainly serves some social exchange.

Although some of the platforms seek to display an endearing image, according to *Schor* (2016) they can also be ruthless. “[T]he more the platforms are backed by and integrated with the large corporations that dominate the economy, the more monopolized the sector will be, and the less likely value will flow to providers and consumers” (*Schor* 2016, 17). ofo and Mobike used the enormous capital injections of the tech giants to attract new users at dumping prices; start-ups who could not get their next financial injection left their bikes on the streets (*Rest* 2018). An ofo manager admits that the bike flooding was not ecologically sustainable, but it was a highly effective business strategy. Mobike and ofo monopolized the market and now account for over 90 percent of the share, effectively denying new entrants any opportunities (*Rest* 2018). In addition, some bike-sharing platforms also serve to pursue the goals of affiliated companies more consistently and to strengthen their dominance. Ecommerce giant Alibaba, for example, invested in ofo in order to distribute its own payment service Alipay, and rival Tencent inflated Mobike to anchor its WeChat Pay (*Rest* 2018). Furthermore, the question of the collection, storage, use, and marketing of personal usage data by the platforms also plays a role in their assessment with regard to frame (3). All in all, the (dockless) company-to-peer bike-sharing systems tend to pursue classical capitalist strategies and to seek central market power. This does not even correspond to the frame (3).

4.4 Frame (4): creating unregulated marketplaces

The typical argument against regulations is that they hinder the full potential of the sharing economy (e.g. *Sundararajan* 2014). This contrasts with the already-mentioned judicial decision that was very much in favor of the (free-floating) bike-sharing platforms in Germany: In 2009, nextbike lost the tender from the City of Hamburg, Germany against the bike-sharing operator Call a Bike. Subsequently, Hamburg wanted nextbike to remove their fleet of 200 bikes. As nextbike did not meet this request, they were sued by the municipal authorities of the city. However, the administrative court decided that nextbike’s fleet could stay, stating that no special license is required to run a free-floating bike-sharing system in Germany—only for systems relying on docking stations. This decision paved the way for unrestrained, winner-takes-it-all strategy, resulting in cities being flooded with bikes from different operators (*Reidl* 2017). Consequently, authorities and citizens complain about unregulated markets for free-floating rental bikes. Research based on interviews with relevant experts is required to find out whether a more restrictive regulation will happen, otherwise, cities will be jammed with an unsustainable number of share bikes.

4.5 Frame (5): reinforcing the neoliberal paradigm

Research results by *Martin et al.* (2015, 247) show that sharing-economy systems tend to become “more commercially-oriented over time”, indicating a certain tendency towards a reinforcement of the neoliberal paradigm. This is underpinned by the fact that “sharing platforms [...] are often accused of exploiting loopholes to avoid rules and taxes” (*Kathan et al.* 2016, 668) and collaboration with local authorities (*Cohen/Kietzmann* 2014). This frame is often referred to in connection with the so-called gig economy, i.e. job placement via matchmaking platforms. The main aim of the platform is to circumvent (deliberately) regulations affecting work, such as social insurance, protection against dismissal, etc. (e.g.

Prassl 2018). It is the profit-oriented part of the sharing economy, in particular, that argues that the sharing economy enhances the efficiency of free markets and, therefore, does not require regulations (*Stephany* 2015). As already explained in the previous section on frame (4), the company-to-peer bike-sharing systems are prone to monopolistic tendencies (see also the “winner-takes-it-all” and “winner-takes-the-most” phenomena mentioned in other articles of this special issue) fueled by venture capitalists. In this sense, clear neoliberal developments can be identified in this area of the sharing economy.

4.6 Frame (6): an incoherent field of innovation

Moreover, the sharing economy is seen as a “field of related innovations” (*Martin* 2016, 150) that has already or will disrupt traditional businesses (e.g. *Muñoz/Cohen* 2017). On the other hand, some scholars argue that sharing-economy business models, like those in the mobility sector, have existed for decades (*Orsatto/Clegg* 1999) and are just enhanced by new information and communication technology such as the Internet, allowing them to scale up rapidly (*Demary* 2015): “For instance, first-generation bikesharing models emerged in the 1960s in Amsterdam and as of December 2013, there were nearly 700 programs in cities around the globe, most of them aided by significant advances in bikesharing technology” (*Cohen/Kietzmann* 2014, 282). In other words, the business-model to rent bikes is neither new nor disruptive, but the way this business-model is operated is quite innovative. Therefore, the new way, fueled by technology, is an update for the older business model: an update that is mandatory for players who want to stay in the game.

With respect to sustainability, the question is whether other disruptions already loom on the horizon; at least electric scooters seem to be up and coming. Will people still use share bikes for the first or last mile when they will be able to order an autonomously driven car with a smartphone app? Autonomously driven vehicles have some advantages over the share bikes, for example, better availability since they do not need to be nearby when required, better shelter against wind and weather, reduced placing-space requirements. It might be that the trend to vehicle-connectivity and autonomous drive will disrupt even the bike rental business models of the sharing economy.

5 Discussion and Conclusions

5.1 Discussion

Sharing bikes for commercial purposes are not new at all. Nevertheless, digitization has been tremendously enhancing the private efforts in vastly scaling up the business. The framing analysis shows that company-to-peer bike-sharing systems ...

- (1) do not pay off yet in economic terms,
- (2) are not a more sustainable form of consumption,
- (3) are not a pathway towards a more decentralized, equitable and sustainable economy,
- (4) may need more regulation,
- (5) are subject to monopolistic tendencies fueled by venture capitalists, and
- (6) show neither a new nor a disruptive business model.

Commercial bike-sharers cannot cover their costs—at least in their early days—and hence require external funding. If governmental support is hard to get, for example, due to often lengthy procurement processes of the public authorities, (dockless) bike-share companies

successfully try to attract venture-capital funding (*Institute for Transportation & Development Policy, ITDP 2018*), for instance, by spicing up their equity story with additional revenue potentials based on selling data collected from their customers. This aspect requires getting big fast in order to become the dominant player, which in turn results in competition. This means that commercial bike-sharing companies, if they tend to build a sharing-economy ecosystem, which allows locking in their customers, have to behave unsustainably. By excessively building up their own ecosystem capacities rather than capitalizing on existing assets of all market players, enormous over-capacities have been built up just to monopolize potential or to protect already-gained market share. Since only about ten percent of all rides with a shared bicycle substitute motorized individual transport by car or motorcycle and due to the short life cycle of share bikes, it seems very unlikely that the negative environmental impact of the resource deployment of all the share bikes is outweighed by its positive effects. Furthermore, the appeal of imagined future economic rewards is so strong that—without any regulations—the shared value of the common good suffers by producing enormous amounts of abundance and waste in our cities. Finally but definitely much too late, the “invisible hand of the market” (*Smith 1776*) will take effect in producing even more waste and environmental costs. A consolidation of the share-bike market has already taken place as the bankruptcy of first market participants like oBike clearly show.

5.2 Conclusions

The government should regulate the market to limit the waste of resources and the negative ancillary effects, for example, customers’ loss of deposits or the cost of disposing abandoned share bikes on the taxpayers’ account after their operators went bankrupt. Accordingly, more than ten cities in China have started to implement such policies since mid-2017 (*ITDP 2018*).

Environmental politicians and activists should call common claims into question, demand sound end-to-end environmental records of bike-sharing system and base their decisions on these facts.

Bike-sharing operators need to rethink the widespread tit-for-tat strategy, as a response to new market entries or increases in capacity, i.e. merely adding new cities to their network and raising their own capacities. This strategy might lead to ruinous competition from a long-term perspective. Venture capitalists, on the other hand, should base their investments on credible business plans rather than on overblown economic expectations. Job seekers and potential business partners, for example, companies that offer maintenance and repair services, should scrutinize the robustness of bike-sharing companies and avoid being at the mercy of one single partner before accepting a job offer or entering into a contract.

As in other industries, the company-to-peer approach should be reconsidered and, possibly, be replaced by a peer-to-peer approach. It should be pointed out that the basic idea of the sharing economy is to share existing goods, not to produce them excessively. The fashion industry (*Todeschini et al. 2017*) is a good example that this approach works well and is much more sustainable both in economic as well as in environmental terms.

In addition, it would be worth considering equipping private bicycles with the necessary sharing technology and integrating them into a peer-to-peer bike-sharing platform to generate a more sustainable asset utilization. Another idea in line with the sharing economy

would be to merge bike-sharing platforms (and even other sharing mobility platforms) and to integrate that into a one app solution, a development that has already begun in the car sector through the merger of car2go and DriveNow to become SHARE NOW. As it is more likely that regulation of cities and metropolitan areas will increase, it is to be expected that there will be an increasing need for strategic alliances and mergers and acquisitions on the side of the mobility platform providers to deal with these challenges.

As a consequence, an integrated mobility platform would also create the space for a new ecosystem, meaning that complimentary solutions could be established. One of these possible complimentary applications could be in smart tourism, for example, connecting sharing mobility solutions with mobile entrance to site-seeing spots or integrated access for the public transportation system. Another possible application would be in using mobility data to establish new routes or new offerings alongside the most frequently used routes.

By using private bicycles only, it should be possible to reduce damage, violation, and littering as the quality of the bikes is higher and they belong to a person not just an anonymous platform or company. It could even create a competition for the best bikes or “super-bikes”, but of course, this is only possible if you are a “super-user” rated appropriately by the owner. Accordingly, rental time might increase, since you do not rent a bike for just ten minutes or the last mile, but for a day, week or even a month. More differentiation may also happen in the market, depending on consumer demands (sport, transportation, sight-seeing, etc.). In addition, it would be possible to mitigate risks through a new insurance market for shared bikes and personal injuries and thereby establish a completely new ecosystem.

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