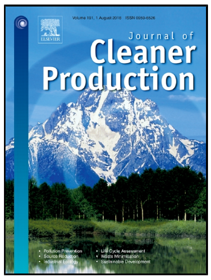
Accepted Manuscript



Business model innovation and socio-technical transitions. A new prospective framework with an application to bike sharing

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PII:	S0959-6526(18)31570-1
DOI:	10.1016/j.jclepro.2018.05.223
Reference:	JCLP 13080
To appear in:	*Journal of Cleaner Production*
Received Date:	01 December 2017
Accepted Date:	26 May 2018

Please cite this article as: Arnoud van Waes, Jacco Farla, Koen Frenken, Jeroen P.J. de Jong, Rob Raven, Business model innovation and socio-technical transitions. A new prospective framework with an application to bike sharing, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.05.223

WORD COUNT: 9340 (excl. first page & list of references)

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A new prospective framework with an application to bike sharing

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Key words
business model, socio-technical transitions, bike service innovation, bike sharing, technology assessment

Abstract
Most transition studies are historical in nature and fail to arrive at prospective conclusions about future potential. In this paper we develop a new prospective transition framework, which revolves around the interplay between business models and socio-technical contexts. By looking at the dynamics of increasing returns, industry structure and the role of institutions, we analyze the upscaling potential of innovative bike sharing business models as introduced in Dutch cities over the past ten years (two-way station-based, one-way station-based, one-way free floating, and peer-to-peer sharing). We find that station-based business models are well institutionalized but harder to scale up, while the recent one-way free-floating model has the greatest scaling potential if institutional adaptations and geo-fencing technologies are successfully implemented. Peer-to-peer sharing is likely to remain a niche with special purpose bikes.

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1. Introduction

Over the past two decades, there have been many empirical and conceptual studies on the emergence of sustainable technologies, in particular, in the realm of sustainable energy and transportation (Hekkert & Negro, 2009; Schot & Geels, 2008; Smith & Raven, 2012). These studies analyzed the conditions under which a niche technology succeeded in challenging an existing socio-technical regime (Geels, 2002) as well as the role of supportive technological innovation systems in such transition processes (Hekkert, Suurs, Negro, Kuhlmann, & Smits, 2007). In contrast to the abundance of *historical* studies on transitions, only few studies have adopted a prospective lens regarding the *future* upscaling potential of niche innovations.

Prospective studies so far focused on the upscaling prospects of technologies and infrastructures (Hofman, Elzen, & Geels, 2004; Markard, Stadelmann, & Truffer, 2009; Naber, Raven, Kouw, & Dassen, 2017; Truffer, Schippl, & Fleischer, 2017). Our study also deploys a prospective analysis, but focuses on business models (BM) (Jolly, Raven, & Romijn 2012; Vasileiadou, Huijben, & Raven 2015). Doing so, we follow the growing interest in sustainable BMs in recent years (Bocken, Short, Rana, & Evans, 2014; Bohnsack, Pinkse, & Kolk, 2014; Lüdeke-Freund & Dembek, 2017).

Exploiting radical innovation opportunities usually requires an organization to deploy new kinds of business models (Johnson, Christensen, & Kagermann, 2008). In the context of the current paper BM innovation may help to potentially overcome some of the key barriers to the upscaling of sustainable technologies (Wustenhagen & Boehnke, 2008). For instance, sustainable energy technologies such as solar energy often come with new ownership models, value chains, customer relationships and financial flows, as they do not easily fit the traditional business models that evolved around large, centralized energy systems. Another example are digitally-enabled sharing economy platforms, which come with new business models that make privately owned assets available for rental services. Despite this potential relevance of business models in the scaling of sustainable technologies, one can also expect that in the absence of deeper political, regulatory and market reforms, it is unlikely that business model innovation in itself will be sufficient to enact system wide changes, as argued by Bolton & Hannon (2016). This makes an analysis of the relations between business models and socio-technical transitions an interesting and topical avenue for research.

To date, BM innovation has rarely been studied in the context of socio-technical transitions (Boons & Lüdeke-Freund, 2013; Boons, Montalvo, Quist, & Wagner, 2013; Huijben & Verbong, 2013; Wells, 2013). To analyze the upscaling prospects of competing BMs, we develop a new prospective framework by going back to Nelson's (1994) co-evolutionary perspective on industry emergence as the interplay of technology, industry structure and supporting institutions. Co-evolutionary thinking has been foundational in many of the widely used transition frameworks today such as the multi-level perspective (Geels, 2002) and technological innovation systems (Hekkert et al., 2007). We believe therefore that our new framework provides a fruitful starting point for our analysis. By means of the framework, one can identify mechanisms supporting and hindering upscaling. In doing so, one can provide a qualitative prediction regarding the future potential of each BM, that is, to assess an innovation in terms of its likelihood to diffuse at a small or larger scale.

We use our framework to analyze the prospects of four alternative bike sharing schemes as introduced in Dutch cities over the past ten years, where bike sharing is broadly defined as services that provide temporary access to a bike. The emergence of bike sharing, and cycling innovations more generally, can be understood as being part of a currently unfolding urban mobility transition. The research question is as follows: *What is the potential of current business models for bike service innovations to scale up?* To understand the prospects of bike sharing in the context of a transition process, we will pay attention to incumbent elements in the socio-technical mobility system, including actors (individuals, firms, organizations), institutions (regulations, norms, beliefs) as well as material artefacts and infrastructure (Geels, 2004; Markard, Raven, & Truffer, 2012). In studying this phenomenon, we have the possibility to study a potential mobility transition "in the making".

2. Theoretical framework

We propose a prospective transition framework that serves as a heuristic device to assess the upscaling potential of niche innovations, such as new BMs, and their potential to reconfigure an existing regime or to evolve into a new regime. Our framework, visually depicted in figure 1, is a generic one as to allow for a comparative analysis across alternative BMs. The analysis is meant to identify the endogenous (i.e. internal to the BM) and exogenous factors that may stimulate and hinder diffusion and further upscaling, as well as their mutual (mis)alignment through increasing or decreasing returns on investments. We follow the view that upscaling involves co-evolutionary processes of increasing return to adoption of an innovation and the co-evolving industry structure and institutions (Frenken, 2015; Nelson, 1994). We apply the prospective transition framework to BM innovations rather than technologies or infrastructures. Our framework distinguishes between innovation dynamics (in particular increasing returns to adoption), industry structure (in particular the size, experience and embeddedness of firms) and institutional dynamics (in particular changes in regulations, norms and beliefs). Analyzing niche innovations along these three dimensions, as well as their interplay between the dimensions, allows us to assess the drivers, barriers and future upscaling potential of innovative BMs, and accordingly, the odds of socio-technical transition.

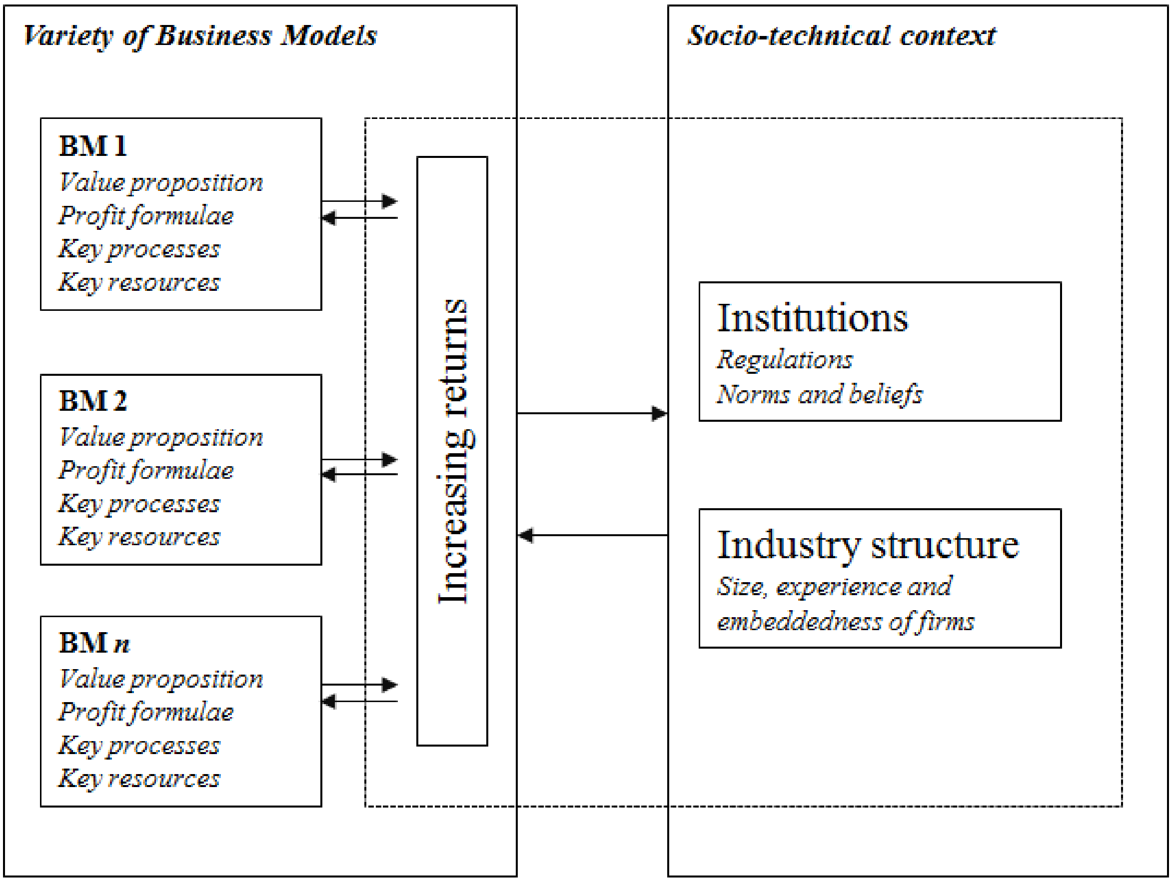


Figure 1: Visual representation of the prospective transition framework applied to business models

2.1. Business models

BMs of different four bike sharing schemes are central to our analysis. Attention for business models in the academic community goes back as far as the late 1950s, but the concept only started to receive substantial academic attention in the late 1990s during the rapid growth in internet-enabled businesses. Basically, a BM explains "the rationale of how an organization creates, delivers, and captures value" (Osterwalder & Pigneur, 2010, p.14). In various perspectives on business models researchers typically distinguish between the fundamental building blocks of a business (e.g., Johnson, Christensen, & Kagermann, 2008; Osterwalder & Pigneur, 2010; Zott & Amit, 2012). Following Johnson et al. (2008) we here break down innovative bike sharing business models into four building blocks.

First, the customer value proposition relates to how the business model fulfils a particular customer need. Examples of different propositions of bike sharing services are a 'last-mile' solution, tourist mobility or local urban transport. Second, the profit formula defines how the company generates financial value for itself, for example, through a subscription, pay-per-use model, or advertisements. Third, key processes refer to those processes that enable the delivery of the proposition. Examples are processes such as maintenance and redistribution of bikes. Fourth, resources refer to those resources to deliver the proposition. For instance, besides bikes, some systems are based on physical parking infrastructure such as docking-stations.[2] Finally, we adopt the view that according to Zott & Amit (2012), BM innovation can occur by adding new activities, by linking activities in novel ways or by changing one or more parties that perform any of the activities.

2.2 Increasing returns

In new industry development, the ultimate rise of a dominant technology or BM can be explained from increasing returns to adoption in the process of upscaling[3]. As the number of adopters grow, producers see cost per unit decline as they go down the learning curve and quality goes up through complementary innovations by suppliers, users and infrastructure providers. Equally, individual users often see the value of an innovation or service increase as the number of users increases, and 'network externalities' arise. This explains why, typically, the variety of business models decreases once a technology scales up, as only few profit from increasing returns to adoption.

In the case of bike-sharing schemes, more users enable a larger network of pick-up and drop-off locations for bikes, which increases the value of using the service. Such increasing returns to adoption of a bike sharing scheme holds for all four business models (explained below). More generally, in the context of urban innovations, increasing returns from spatial network externalities are important. The spatial density at which a service is made available determines in large part the attractiveness of a service, given that users want to minimize distances to the service (Arthur, 1989). Innovation diffusion is thus in large part a self-reinforcing dynamic driven by increasing returns to adoption for both producers and users (Arthur, 1989). Hence, one aspect of the upscaling potential of a BM concerns the extent to which it profits from increasing returns.

Particularly important in passing the threshold of widespread diffusion is the status of substitutes. In some cases, substantial switching costs are involved for adopters that change from one system to the next. These costs need to be compensated for by a larger user base yielding higher network externalities. Consequently, the higher the switching costs, the more actors have an incentive to wait for others to adopt first (Shy, 1996). Switching costs are not given, but to a large extent depend on firm strategies and the institutional environment. In particular, if a new technology or business model can be made compatible with existing standards, infrastructures and regulations, switching costs are generally low. Furthermore, if user practices can remain largely unchanged while adopting the next technology as an alternative to the old one, costs for consumers become more acceptable.

[2] We note that other conceptualizations exist in the literature for unpacking business models, such as the business model canvas model offered by Osterwalder and Pigneur (2010), which distinguishes between nine building blocks. Whilst this conceptualization offers a somewhat more fine-grained analysis of business models, we argue that the four elements proposed by Johnson *et al.* (2008) provides a sufficient mapping for our interest into how different business models in bicycle sharing relate to different challenges in institutional dynamics.
[3] In some cases, increasing returns do not lead to a single dominant design, but to a sustained co-existence of multiple business models serving different user groups.

2.3 Industry structure

Industry studies also teach us that the prospects of a BM at the early stage of industry development does not only depend on the BM characteristics, but also on the types of firms adopting it. Firms entering an industry with "pre-entry experience" in related industries tend to survive much longer than firms that cannot leverage any relevant industry experience (Klepper, 2002). In particular, the experience of founders and investors plays an important role in the choice of BM as well as their ability to scale up operations successfully. Furthermore, a high degree of local industry embeddedness may help them to adapt to local institutions as well as to change such institutions in their favor (Boschma, Coenen, Frenken, & Truffer, 2017). For instance, in particular foreign suppliers of bike sharing schemes in the Netherlands (NL) tend to collaborate with locally well-known cycling champions to increase their ability to shape institutions in their favor.

The size of firms also plays a role in industry evolution. Larger firms have more access to resources and can leverage economies of scope when diversifying from an existing industry into a new industry (Lieberman & Montgomery, 1998). They can more easily overcome chicken-and-egg-problems by investing heavily in rolling-out a new service at initially low prices. As we will argue below, the largest provider of shared bikes in the Netherlands (OV-fiets) is the national railway organization, with substantial resources and experiences available. In this way, a critical mass of consumers can be reached allowing both the firm and its users to benefit from increasing returns to adoption. At a later stage, the initial losses can be recovered by increasing prices once consumers are locked-in. Smaller firms, by contrast, are more reliant on a large investor to access such resources. Though small startups may be more open to explore new BMs, the upscaling is often dependent on the adoption of a new BM by large incumbents (Bohnsack et al., 2014).

2.4 Institutions

As a third dimension in this co-evolutionary process, Nelson (1994) emphasizes the critical role played by institutional changes supportive of the further development and diffusion of the new technology or business model. As new technologies have their specific physical and social properties, institutions generally need to be adapted, or even invented, to solve specific problems or conflicts that arise. These may concern health and safety regulations, property rights, labor rights as well as the norms and beliefs embedded in existing practices. Transitions research has suggested that in the absence of deeper political, regulatory and market reforms, it is unlikely that BM innovation in itself will be sufficient to enact system wide changes (Bolton & Hannon, 2016). Hence, an assessment of how BMs may shape broader transition processes requires not only an analysis of BMs and the firms adopting them, but also of the potential (mis)fits between a BM and its institutional context.

Scott's (2008) distinction between regulative, normative, and cultural-cognitive institutions is relevant in the context of socio-technical transitions (Geels, 2004; Raven, Sengers, Spaeth, Xie, et al., 2017). Regulative institutions can be formal rules, policies or laws that concern for example bike parking. Their legitimacy is embedded in legal frameworks and other systems with formal authority. Normative institutions comprise of norms, habits, roles and responsibilities. Their legitimacy is embedded in moral and ethical systems. Cultural-cognitive institutions represent values, shared beliefs and assumptions. Their legitimacy is embedded in cultural repertoires. An innovative BM then, may align with and reproduce existing regulations, norms and/or beliefs already in place or, alternatively, challenge and depart from them. These prevailing institutions may thus pose barriers to the development and diffusion of an innovative BM, whilst changing them may be beyond the direct control of individual actors. Hence, upscaling requires "institutional work" (research, lobby, campaigns, etc.) to gain legitimacy for the new service in question within the context of an established institutional regime (Lawrence, Suddaby, & Leca, 2009). Only when the new practice is considered as a legitimate activity, firms and investors will be willing to invest heavily to roll out a new service (Zimmerman & Zeitz, 2002).

In sum, we view a transition process as the co-evolution between increasing returns to adoption, and changes in industry structure and institutions. During this process, different business models compete for users which benefit from increasing returns to adoption, rendering a single dominant business model a likely outcome. The scaling up process, however, also needs to be supported by sizeable and experienced suppliers and other stakeholders as well as by changing practices and regulations that provide legitimization. These factors, and the way they co-evolve, differ across business models. An analysis of the upscaling potential of bike sharing business model thus needs to analyze the nature and extent of increasing returns favoring its further adoption as well as the background of actors and the relevant institutional contexts involved.

3. Bike sharing typology

Our empirical object of study is bike sharing BMs employed in The Netherlands (NL). We believe that it is important for sustainability scholars to engage with cycling as a key area for innovations in (urban) mobility transitions, besides the more conventional case study choices such as electric vehicles (Bakker & Farla, 2015), biofuels (Nilsson et al., 2012) or bus rapid transit systems (Sengers & Raven, 2015). Cycling is a relatively mundane and long-standing practice, which is often neglected in sustainability transition research in favor of more technology-driven innovations (for exceptions, see Gössling, 2013; Raven et al., 2017; Sheldrick, Evans, & Schliwa, 2017). Furthermore, cycling is a far less powerful industry than the global automobile agglomerates. As a result, compared to the car regime, planning for cycling and cycling innovations is arguably under much more direct control of city actors, who are increasingly seen to be critical actors in sustainability transitions and experimentation (Evans, Karvonen, & Raven, 2016).

The Netherlands is known for its well-established cycling culture (Kuipers, 2012). The first public bike sharing system in the world – Witte Fietsenplan – was founded in Amsterdam in 1965. Although the idea of publicly available free bikes failed initially in this city, a revolutionary idea was born at that time. More successful is a widely used and nationwide system (OV-fiets) operated by the Dutch railways, which has been in place for over 10 years and mainly serves to cover "the last mile" for train passengers (Van Den Bergh, Van

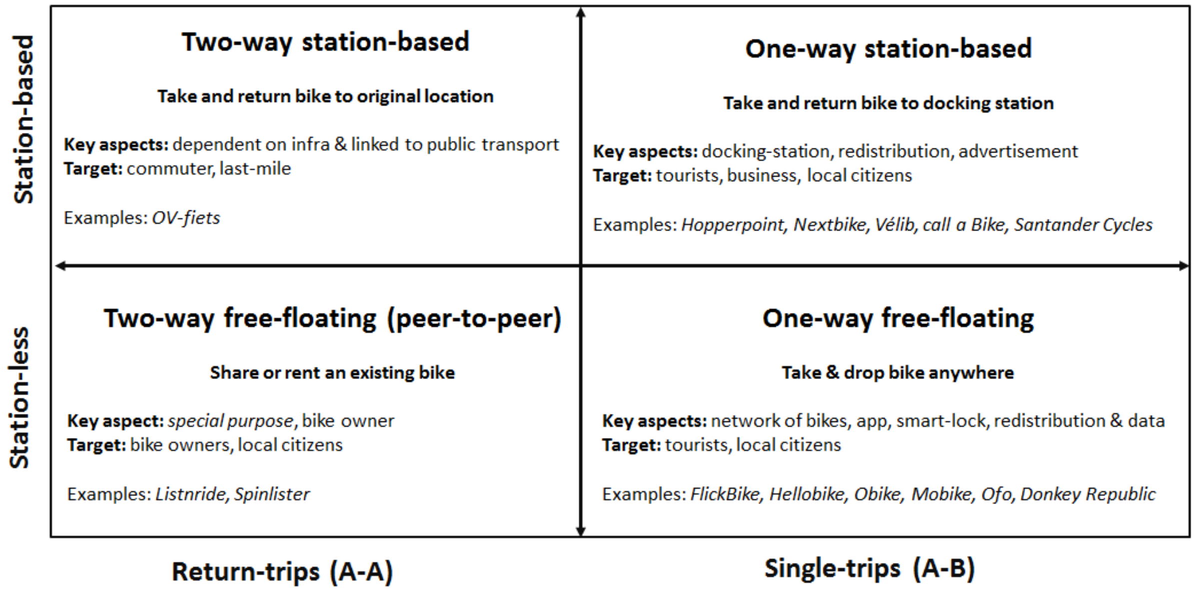
Leeuwen, Oosterhuis, Rietveld, & Verhoef, 2007). This bike sharing system currently experiences competition of various competing BMs for sharing bikes. These developments in NL are part of a much wider process with over 800 cities worldwide already embracing bike sharing (Fishman, 2016).

Bike sharing BMs provide an interesting research entry to empirically apply our prospective transitions framework, with an eye on investigating enablers and barriers towards socio-technical transition. First, the emergence of bike sharing systems can be understood as being part of a broader unfolding urban mobility transition. Second, a new generation of bike sharing BMs is enabled by the combination of a digital lock, GPS and smartphones, which are rapidly growing and challenging more traditional models of bike sharing.

Analytically, bike sharing BMs can be mapped along two dimensions. One dimension distinguishes between return trips versus single trips. “Two-way” bike sharing systems require the user to return to the bike back to the location where it has been picked up (A-A), while “one-way” systems allow users to pick and drop the bike anywhere (A-B). The second dimension along which bike sharing BMs can be distinguished concerns parking. In some systems, it is compulsory to park the bike in a designated docking-station, while in more recent free-floating systems, a shared bike can be parked like any other private bike.

Cross-tabulating the two dimensions results in Figure 2 which classifies the four BMs. The oldest model (since 2004) in NL is the aforementioned OV-fiets, which adopted a traditional two-way station-based model. While the one-way station-based model is well established in large European cities like Paris (Vélib’), Berlin (call a Bike) and London (Santander Cycles), it has been less common in NL. More recently, since 2016, innovative one-way free-floating systems have been introduced. Users download an app and with the app can lock and unlock a bike anywhere they like. Finally, a number of peer-to-peer systems emerged where residents can rent out their own bike and request the lender to return the bike where it has been picked up. This peer-to-peer sharing model, however, has only limited success so far.

Figure 2: Bike sharing typology[1]



[1] source: our own data; see section 5.

4. Research design

The research was designed following conventional comparative case study methodologies and following traditions in interpretative and qualitative research (Yin, 1994). Such a design was deemed most appropriate given that bike sharing schemes are (in most cases) a relative new and highly dynamic phenomenon. The four business models shown in Figure 2 are central to the comparative analysis. To get an overview of different bike sharing services in NL a desk study was conducted, as part of a broader study into cycling innovations in NL. Based on web-searching ‘deelfiets’ (shared bike) or ‘deelfietssysteem’ (bike sharing system) we selected 9 cases that are operational in NL for more in-depth analysis. Table 4 in the appendix provides an overview of the cases.

Data collection, analysis and developing a case study narrative occurred in an iterative and engaged fashion. Specific data was collected through semi-structured interviews with seven out of the nine cases (see also Table 4). Interviewing these actors in a rapidly developing bike service market was an iterative process. New developments (such as policy changes) and insights from one interview led to new questions for the next interview. The semi-structured interviews ranged between roughly 30 and 90 minutes. All interviews were conducted face-to-face and recorded. See Table 3 in the appendix for the interview protocol. All interviews were transcribed and were sent back to the interviewee for approval.

Next to this, other sources were included to triangulate data as much as possible. including websites of providers, policy documents, news reports and press releases. In the period of June 2017 – December 2017 the ongoing debate in newspapers was closely followed by collecting and coding 33 relevant articles in 2 major Dutch newspapers (25 in *Het Parool* and 8 in *NRC*). This debate reflected the (institutional) dynamics between bike sharing providers and municipalities. Additionally, data-collection also included analysis of (4) policy documents, (5) press releases and (14) websites of different providers.[4]

The prospective transition framework elements functioned as sensitizing concepts for the empirical analysis (Blumer 1954). Descriptions of key concepts from the literature focused attention to particular empirical phenomenon, which enabled a further conceptualization of the nexus between business models, increasing returns, institutions and industry structures (see Table 1).

Table 1: Key concepts and descriptions

Concept		Description
BM concepts	Value proposition	Refers to the particular BM proposition offered to target customers of a particular bike sharing service, such as a 'last-mile' solution for commuters from public transport stations or local urban transport for citizens or tourists.
	Profit formulae	Refers to the revenue model through which a bike sharing service provider extracts financial value from the services offered such as a pay-per-use model or advertisements.
	Key processes	Refers to the particular actions or steps necessary within a business model to enable the delivery of the value proposition, such as the need for maintenance or to redistribute bikes
	Key resources	Refers to the particular financial, material, human or other assets involved in the delivery of the value proposition of a particular bike sharing service. Examples are bikes, docking-stations and personnel.
Co-evolutionary concepts	Increasing returns	Refers to the benefits that producers and users of bike sharing services experience when the number of users increases. Examples are costs reductions through economies of scale (supply side) or improved user accessibility through higher spatial densities (demand side). Also switching costs for adopters to change from one to the next bike sharing system determine the attractiveness to use it.
	Industry structure	Refers to the size, experience and local embeddedness of suppliers involved in the bike sharing services provided.
	Institutions	Refers to the regulatory environment, norms and values in which bike sharing services develop, such as legal frameworks and public values regarding bike ownership and urban space.

Emerging typologies of business models and explanations and assessment of the potential of these business models to scale up where presented at various events, where feedback was collected in a transdisciplinary fashion. The first author engaged with both entrepreneurs and policy-makers at a local and national level by participating in events as presenter and audience. Results from initial analysis were presented at three policy- and practitioners conferences[5], on radio and television. These engagements with stakeholders subsequently resulted in new empirical observations and analytical reasoning. Throughout this engagement the first author maintained a diary database with observations, citations and reflections.

5. Results and analysis

5.1 Two-way station-based

Business model

[4] Additionally, a survey amongst 476 users of one of the providers of one-way free floating bike sharing services in NL, enabled a deeper understanding of actual user practices and perceived benefits of this scheme (Van Waes, Münzel, & Harms, 2018).

[5] Nationaal Fietscongres, Tilburg, the Netherlands (21 September 2017), Inspiratiedag Tour de Force, Ede, the Netherlands (23 november 2017), Annual meeting Fietscommunity, Utrecht, the Netherlands (30 November 2017).

The two-way station-based model is provided by OV-fiets and Keobike. The *value proposition* of the two-way station-based model is offering a "last-mile" solution. *Target customers* are public transport commuters who arrive by train or bus and need to cover the so-called last mile to their final destination. The bikes offered are standardized bikes, which can be obtained at transport stations[6] by using a chip card (public transport smart card) and can be rented for the day. This model functions as an extension of the public transport system (OV-fiets and Keobike) and is designed to mainly facilitate round trips (from a station to a destination and back to the station). The public transport companies see two-way station-based bike sharing mainly as an extension of their services: '*We don't want to be a public transport company focusing on bus-transport only. We aim to be a mobility company, which means we must also provide other modalities such as cycling'* (interview Keobike). The *profit formula* entails revenues and costs. Revenues are obtained by charging a fee per trip. Costs are linked to the *key resources* and *key processes*. Besides the bikes, fixed stations, parking infrastructure and personnel for distribution and repair are *key resources* in this system. For upscaling this model, often public funding is needed (Provincie Noord-Brabant, 2017). *Key processes* entail maintenance, repair, active redistribution[7] and intake.

Prospective transitions analysis

Due to the current widespread adoption of OV-fiets the two-way station-based scheme is the most established bike sharing model in NL. It is widely used by commuters. The main challenge of scaling OV-fiets is '*to meet demand and ensure the availability of bikes and parking places'* (interview OV-fiets). The system is dependent on infrastructure assets and physical locations, making it costly, and therefore less scalable. *'To rebalance a system is the Achilles heel of bike sharing systems: that is very costly'* (interview OV-fiets).

From the supply side there are (low) increasing returns to adoption of the two-way station-based model, based on the fact that the suppliers gain a better bargaining position in relation to the suppliers of bikes and infrastructure. From the demand side, users have increasing returns to adoption based on spatial network externalities: the value of the subscription rises when there are more stations where the bikes can be collected. However, currently bikes are only available at public transport stations, making the spatial availability limited. Also, these companies do not aim to provide bikes outside stations (interview OV-fiets). The costs of switching to this model are low.

This model is integrated in the public transport system and is exploited by incumbent public transport companies (*industry structure*) which provides a monopoly on strategic locations for bikes. This model is embedded in the chain of intermodal transport, fostering the combination bike-train transport. The exploitation of this bike sharing model is not the core business of its providers as is illustrated by the following quote: '*Cycling plays an important role in the chain of mobility. We learned from research that the decision to take the train is strongly influenced by the extent to which it is easy to reach the train station or your final destination from the train station'* (interview OV-fiets).

[6] The OV-fiets is obtained from manned parking stations. The Keobike is obtained from automated stations.
[7] This model does allow single way bike sharing (from A to B), but then an extra fee is charged because that requires rebalancing the system.

In terms of *institutions*, two-way station-based models such as OV-fiets have been supported by (local) governments in the past.[8] The placement of stations is embedded in existing procedures. With regards to *informal institutions* and user practices, there are no frictions: two-way station-based bike sharing has public support and is more popular than ever.[9]

5.2 One-way station-based

Business model

The *value proposition* of the one-way station-based model is to facilitate local transport from one designated location to another i.e. this system allows users to make one-way trips, often within a city. In this system bikes can be obtained from multiple locations and the user is not obliged to return the bike to its original location. *Target customers* are city residents as well as temporary visitors. The *profit formula* is based on pay per use and subscription fees and advertisements on bikes (*revenues*) and the *costs* are linked to bikes, the docking-station infrastructure and personnel. A *key resource* of this model is fixed docking-stations. Initial investments by local authorities for bikes and docking-stations was needed so the provider could focus on exploitation (interview Hopperpoint). More broadly, entrepreneurs emphasize this type of funding is key for bike sharing systems, because start-up companies cannot bear the risk of investing large amounts in bikes and infrastructure (interview HelloBike; interview Hopperpoint). Operationally, the system is automated and no personnel is needed. However, redistribution is often needed to rebalance the system, which is costly. This is why some providers charge extra fees for users that return a bike at another station. *Key processes*, then, entail redistribution, maintenance and repair.

Prospective transitions analysis

The one-way station-based model is relatively small in NL. The dependency on docking-station infrastructure makes one-way station-based systems less scalable than those not dependent on docking stations. From the supply side the same increasing returns to adoption apply as in the case of two-way station-based systems. Similarly, from the demand side users profit from an increasing network of stations and bikes. However, compared to the two-way station-based system, users profit more from spatial network effects as this model is based on making trips between different docking-stations; the number of docking stations will often exceed the number of public transport stations. Switching costs to users are relatively low, depending on the subscription fees of the service.

In NL, a few actors are exploiting this BM, varying from a small local entrant (Hopperpoint) to an established international one-way station-based provider (Nextbike), who collaborates with a regional public transport company. Collaborating with local public transport companies contributes to better local embeddedness and integration in intermodal transport. The model is supported and sometimes partly funded by local authorities. Local governments initially supported the placement of docking stations. The regional government financed half

[8] OV-fiets is supported by the national government, as they are located at key locations and it plays a key role in solving bike parking problems at major train stations (Ministerie van Infrastructuur en Milieu, Fietsersbond, Federatie Mobiliteitsbedrijven Nederland, Interprovinciaal Overleg, Metropoolregio Rotterdam Den Haag, NS, ProRail, Rover, Stadsregio Amsterdam, 2016).

[9] OV-fiets has seen an increase of bike rides of 33% in 2017 (NS, 2018).

of the Hopperpoint system so it could launch in two cities (Provincie Noord-Brabant, 2016). *Institutional* barriers are relatively small and relate mostly to the fact that docking stations sometimes need space in the public realm.

5.3 One-way free-floating

Business model

The *value proposition* of the free-floating model is that it allows users to take and drop a bike anywhere in a city without the use of physical infrastructure.[10] A bike can be localized and unlocked using a smartphone application. Once a bike is locked after use, it is open to new users again. Some providers (HelloBike, Urbee, Donkey Republic, Mobike)[11] use digital geo-fencing technology through which a geographical area can be 'fenced' in an online app, which indicates the areas where bikes can be parked. These areas can be public spaces, or public or private bike parkings.[12] *Target customers* are temporary visitors such as tourists but providers also aim at local citizens[13] or businesses that can provide the service to their employees. These users are offered access to a bike – varying from regular bikes to e-bikes – within walking distance. Some providers use bikes with a design that is very different – often smaller – from Dutch bikes. Often these bikes are also not adjustable in size as their model is standardized.

The *profit formula* is based on pay per use, deposits[14] and potentially selling user data in the future (*revenues*). There are no substantial *costs* related to infrastructure such as docking-stations. Costs are linked to *key resources*: a dense network of available bikes equipped with digital locks that can be opened with a smartphone application.

Investments in free-floating models mainly come from the private sector. Free-floating providers are often extensively backed by large investors and technology companies (For example, Chinese market leaders Ofo and Mobike are backed by respectively Alibaba and Tencent) which allows for a large scale diffusion of bikes. Investments in the (local) free-floating models from NL and Denmark are much smaller and also have public funding.

Parking space is an important *(public) resource* for this model as the bikes are parked throughout cities. Another *key resource* is user data. Data on the type of user, cycling routes and geographical locations can be used by the bike service provider for decision-making. It allows to adapt the BM (in terms of pricing or relocating bikes), to regulate user behaviour (in terms of where to park bikes trough geo-fencing) or to market additional products or services based on a geographical location. Some providers focus on the (future) exploitation

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[10] Hybrid systems also exist, for example BTNbikeshare in Brighton UK. These systems use docking-stations but also allow to drop a bike within a designated zone.

[11] Providers could charge extra when returning the bike to a different designated area to account for rebalancing costs.

[12] A geo-fencing zone can be an 'allowed' area that users have to park a bike in not to be fined and/or preferred areas that users can finish a bike trip in. The former usually covers a large geographical area (e.g. city centre). The latter is usually smaller, linked to parking infrastructure, and contained within the former.

[13] This group might become more important in order to build legitimacy among citizens.

[14] For some one-way free-floating models, registering requires a substantial deposit payment (Obike: €79,-). These systems charge lower rates (€0,25/15 minutes) compared to competing systems. When introduced in a city, the pay as you go fee is very low to attract new customers.

of user data for marketing ends (via the app or on the bike) (interview Ofo). *'We want to create a geo-based marketing plan. When you plan your route, restaurants with discount coupons will be highlighted. We develop algorithms that display advertisements based on your location and time.'* (interview HelloBike).

Whereas for station-based models both docking-stations and bikes are obvious sites of marketing, a strong brand visibility on the bike itself is a key resource for the one-way free-floating model because it enhances their visibility on the streets. A strong brand identity helps their recognisability in geographically different areas both in a national and international context and attracts new users to the system. For this reason, some providers want to keep their own branding (interview Donkey Republic) whereas other providers adjust their bikes to local city branding (interview HelloBike).

Besides maintenance and repair, which is often outsourced to local social working places, redistributing and rebalancing the pool of bikes throughout a geographical area is a *key process.* Managing the float of bikes entails controlling locations and relocating bikes when bikes are not evenly spread or when they are parked outside designated parking zones.

Prospective transitions analysis

Both from the supply and demand side there are increasing returns to adoption of this service. Users subscribing to this service enjoy spatial network benefits: the more bikes are put on the street, the easier users can locate and unlock a bike in their vicinity. This model can scale independently from dedicated parking infrastructure. Also switching costs to these services are low. Using these models requires subscribing via an app and registering a bank account.

The key enabler of this innovative BM is the combination of the digital lock, GPS and the smartphone. The widespread smartphone ownership supports the development and diffusion of these systems as these are required for reserving and unlocking the bikes.

From an *industry structure* perspective: the market for these models consists mainly of newcomers with both local and international backgrounds. Global providers are often backed by venture capital investors, who are often not typical actors with a mobility or cycling background but mainly technology companies involved in e-commerce, social media, mobile and online payments, or ride-hailing. Some are market leaders in their home country and aim for international expansion. These actors are usually newcomers in the markets they enter, making them not yet *locally embedded*. A strong financial position does make them independent from substantial public funding to roll out a bike sharing system in a city. '*We do not claim any public subsidy'* (interview Mobike). Besides global players there are also smaller providers with a local (Dutch) or international (Danish) background. Some of these are (financially) supported by local authorities and integrate their system with an existing mobility card (interview Hellobike).

The one-way free-floating system does not match with local *formal (or regulatory) institutions* as it interferes with bike parking policy. As this model relies on public space for bike parking, which is relatively unregulated in NL (the Dutch are used to parking their bike on any place on the street), the recent emergence of one-way free-floating systems has become a problem in major cities such as Amsterdam. In this city, public space is scarce making bike parking in general already a challenge. The one-way free-floating bikes lead to uncontrolled bike parking situations: bikes are put on streets, fill up bike parking places or block pavements (Schravesande & Amghar, 2017). [15]

The lack of clear rules for bike parking is also an explanation for the rapid diffusion of one-way free-floating systems. When one provider announced the introduction of their service in Amsterdam the municipality allowed them to do so: '*there are no rules, so go ahead'*. (interview Flickbike). However, the rapid diffusion of different providers made the municipality of Amsterdam to temporarily ban them. The city representative explained: '*We don't want the shared bikes to take up scarce public space'. 'The goal of bike sharing concepts should be that they lead to less bikes in the city. But now it seems that they lead to more bikes*' (Gemeente Amsterdam, 2017a). A judicial basis for this decision was found in a rule – that also applies to traditional bike rentals – that providers are not allowed to provide services in the public space.[16] Bikes and rented bikes can use public space for parking. However, bike sharing (or rental) companies cannot use public space to offer their services.

In response to these developments in Amsterdam, and in anticipation of the introduction of bike services in other cities, major cities are currently developing new rules and conditions for bike services.[17] Some municipalities changed their regulative institutions.[18] In The Hague, for example, the municipality changed its local legislation in order to regulate free-floating bike services and to avoid unattended bikes in the public space. Such rules are in favour of station-based models because in this system bikes cannot be left unattended (Gemeenteraad Den Haag, 2017).

The above cases show that the development of one-way free-floating is hindered by *formal institutions*. This model lacked public acceptance and legitimacy, at least, in its introduction phase, in some (parts of) cities. The model has become controversial in some locations due to their rapid and widespread roll out in a short time period, which impacts liveability and public space in cities (Schravesande & Amghar, 2017).[19] In two months' time, the city of Amsterdam received around 200 complaints about bikes that were put on the streets by providers (Gemeente Amsterdam, 2017b). In a new policy plan, the municipality states: *the free introduction of bike sharing in Amsterdam has shown that public support quickly disappears when the needs of target groups (citizens and commuters) and existing urban problems (bike parking) are not taken into account.'* (Gemeente Amsterdam, 2017b).

[15] Out of the 5.000 to 7.000 bikes that were placed by four providers in Amsterdam, 750 (14%) were parked at locations where it was not allowed (Gemeente Amsterdam, 2017b).
[16] Traditional bike rental companies for example have to adhere to certain rules with regard to the number of bikes offered in front of their shops.
[17] Examples of such rules are designated locations for shared bikes, a maximum amount of shared bikes in a bike parking or providers that financially contribute to public infrastructure. Controlling such agreements would require sharing data from the provider with the authority (van Waes, 2017).
[18] Business models are also adapted in response to these institutional pressures. For example, a city announcing that bikes cannot just be parked in public space made a provider to focus on privately owned but publicly accessible parking spaces (interview Donkey Republic).
[19] One-way free-floating bike sharing does not always lead to major issues. For example in Rotterdam (the Netherlands) or Manchester (UK) this model was introduced without much resistance.

However, one-way free-floating models that apply geo-fencing technology have potentially a better match with formal institutions. First of all, these providers are aware of the potential challenges of one-way free-floating: '*Our system is designed in a way we could operate a free-floating model. But that is not desirable from an urban perspective because this will lead to bikes spread out everywhere. Also from an operational perspective this is a challenge: when maintenance is needed you need to go to a lot of different places to pick up bikes'* (interview HelloBike). Second, this model allows for controlled diffusion of bikes: '*An important element in our business compared to free-floating is that it is respectful to public space. We put hubs only where there is a bit of space and we also check with cities before we set up these hubs. If they say: please don't do these ones, we won't do it* (interview Donkey Republic). Third, different providers stress the importance of collaborating with local governments such as for example Mobike, that highlights collaboration with stakeholders to take into account different local interests ((Mobike, 2018).

5.4 Two-way free floating ("peer-to-peer")

The peer-to-peer model started only recently and differs markedly from other BMs in that the bikes are not company-owned but provided by private bike owners. The *value proposition* of the peer-to-peer model enables bike owners to rent out a bike they own to others. This user will have to take the bike from the owner's location and also return it there, making it a two-way model. Currently two platforms provide this service: Listnride and Spinlister. Offerings on the platform show a niche market focusing on special purpose bikes such as e-bikes, racing bikes and cargo bikes. This can be understood from the returns that bike owners can make. Cheap bikes for everyday use are abundant and carry little use value. Hence, few bike owners will offer such bikes. By contrast, special-purpose bikes are more scarce and of higher quality. Hence, the owner of such bikes can make a considerable return by renting out such bikes. *Target customers* are thus both bike owners and bike users in need of special purpose bike trips. The profit formulae of providers of this service is based on linking demand and supply of bikes. They charge a transaction fee (*revenue*) and *costs* are related to the development of the digital platform (*key resource*).

Prospective transitions analysis

The number of people sharing or renting out their own bike to peers via a digital platform is currently low in NL. Nevertheless, in theory this model has upscaling potential because no physical assets are required, it is not dependent on infrastructure and it is based on the existing bike capacity, which is large in NL. Both from a supply and demand side there are *increasing returns to adoption*. Suppliers are bike owners and the more bikes are listed, the more users could benefit, not too distant from their home. Also switching costs are low.

However, the interest in sharing or renting a bike seems low. So for the platform, it is a challenge to attract bike owners to list a bike. Also, the current form implies a two-way system, which limits user flexibility. Face-to-face meetings between owner and lender are thus necessary to hand over the bike key. When digital locks are applied onto privately owned bikes, the peer-to-peer transaction can be automated, which could lower the barrier for both owner and renter to engage with this type of bike sharing.

The actors are not directly *locally embedded* as this model of bike share is deployed by digital platforms, operated from Germany and the US.[20] This model also does not conflict with *formal institutions* such as parking policy because bikes are parked at and rented from peoples private homes. However, *informal institutions* such as bike ownership might form a barrier to this model of bike services. On the one hand bike ownership means that there is a large capacity of bikes to be shared, on the other hand it is also a barrier to this type of bike sharing because it means there is less demand.

See Table 2 for an overview of the different elements of the BM per type and the prospective transitions analysis.

[20] Peer-to-peer bike sharing could also occur without the use of digital platforms, however that is less visible.

Table 2: Business model and prospective transitions analysis

	BUSINESS MODEL ANALYSIS				PROSPECTIVE TRANSITIONS FRAMEWORK		
Business model	**Customer value Proposition**	**Profit formulae**	**Processes**	**Resources**	**Increasing returns**	**Industry structure**	**Institutions**
two-way station-based	Facilitate public transport commuters in last-mile transport Target customer: commuter	-Pay per use	-Active distribution and intake -Maintenance and repair	-Bicycles at public transport stations -Parking facility -Personnel for distribution and repair -Permits -Subsidy by local government	- Embedded in public transport system - Dependent on infrastructure - Increasing returns - Low switching costs	- Dominant model - Large public transport firms - Strategic positions at hubs - Bike sharing = not core business but complementary service	- No friction with formal and informal institutions - Bike viewed as part of mobility chain. - Use is embedded in intermodal transport
one-way station-based	Local city transport from one designated location to another Target customer: city residents, temporary visitor	-Pay per use -Advertisements	-Maintenance and repair -Requires redistribution	-Bicycles -Automated docking stations -App -Subsidy by local government	- Dependent on infrastructure - Increasing returns - Low switching costs	- Small in NL - Entrant - Dutch and German actors	- No friction with formal and informal institutions. - Supported by local/regional authorities
one-way free floating	Take and drop a bike anywhere Some providers work with geo-fence technology and designated public or private parking areas Target customer: locals, temporary visitors	-Pay per use -Deposit -User data -Advertisement	-Redistribution -Maintenance and repair -Float management	-Network of bicycles -Smart lock -App -Data -Public or private space -Private investments -Subsidy by local government	- Independent from infrastructure (some models work with geo-fencing zones) - Increasing returns - Low switching costs - Spatial network externalities	- Emergent - New entrants - Both global (China, Singapore) and local actors (Dutch and Danish) - Global actors backed by venture capital - Some local actors backed by public funding	Formal: - Friction with formal institutions - Bike parking unregulated - Providing service in public space regulated - Geo-fencing allows for regulation and is supported by local authorities Informal: - Lack public support & legitimacy due to impact on public space
two-way free-floating (peer-to-peer)	Digital platform that enables bicycle owners to rent out their own bike Target customer: users in need of special purpose bikes	-Income from transaction fee -Revenue from rental	-Development of platform	-Digital platform / website	- Few users from both demand and supply side - Independent from infrastructure - Based existing capacity	- Digital platforms	Formal: - No friction with formal institutions Informal: - Bike ownership which may be a barrier

6. Cross-case analysis

Our framework allows for an overall comparative analysis across different BMs on their future upscaling potential. See Table 2 how the transition potential of each of the four BMs is analyzed along three dimensions.

From the cases, we observe that increasing returns matter for all business models, but less so for peer-to-peer sharing, which remains limited to niche markets, in particular for special purpose bikes. We also observe that the traditional station-based models face physical challenges in upscaling their BM. Station-based systems are dependent on parking infrastructure which is both costly and spacious, which explains why such systems are often dependent on subsidies from local governments.

On the other hand, the advantage of these systems is that they are embedded in current mobility practices. They are integrated in intermodal mobility chains, mainly exploited by incumbent public transport actors, therefore widely used, publicly accepted and thus legitimated. The traditional models are widely supported by authorities and do not conflict with formal institutions governing the public space.

Innovative free-floating models have solved the physical barriers that station-based systems face. They are not dependent on infrastructure which makes upscaling easier. The cost of switching to these models is low. Also, more than the traditional models, these models have spatial network externalities: the wide availability of bikes increases the utility of adoption and the attractiveness to use the service.

Although this industry mainly consists of entrants without specific experience in transport, their promise motivates the backing by strong private investors (with a background in technology, e-commerce and social media), with no further dependency on public funding. Having large investors allows providers to enter the market with a high quantity of bikes and compete at very low prices. However, here the barrier to upscaling is of an institutional nature. Free-floating models have an unpredictable impact on public space, in particular parking congestion in popular areas, which has led to a ban in some cities. It also became apparent that one-way free-floating systems were incompatible with formal institutions e.g. local rules for bike parking and offering a service in public spaces, which made them, at least temporarily, illegal. What is more, in relation to informal institutions, part of the general public also perceives one-way free-floating systems as illegitimate. It is clear that strict regulation will hamper their upscaling potential.

Interestingly, one variant of the one-way free-floating model is based on geographical zones (geo-fencing) and may be supported better by local authorities in the near future, because the locations of bikes can be controlled. In this way, the municipality can put restrictions on the parking locations, which can be implemented in the app and updated when needed (in principle, even during the day). Rather than using physical infrastructure to control and regulate the impact of bike sharing on public space, providers deploying this model apply a digital infrastructure. In particular, geo-fenced free-floating model would, in principle, combine the “best of both worlds”: the user-friendliness of one-way free-floating systems and the ability to control public space of station-based systems.

Finally, the two-way free-floating model, or peer-to-peer model, is currently a niche for renting special-purpose bikes. In principle, this model has upscaling potential as it is not dependent on infrastructure and is based on existing bike capacity. This model operates in the private sphere and does not conflict with public institutions. However, from a user perspective, user friendliness is limited (the system is two-way and face-to-face meetings are necessary). This can be solved by applying digital-lock technology. The personal attachment to one’s own bike, as an informal institution, may nevertheless limit the scaling potential of this model in the near future.

7. Concluding remarks

We developed a new, prospective transition framework that we used for assessing the upscaling potential of bike sharing business models. The framework, which we derived from Nelson’s (1994) co-evolutionary perspective, was further refined by using more specific insights on the dynamics of increasing returns, industry structure and the role of institutions. Although the future course of innovations is inherently uncertain, we conclude that this prospective transition framework is a useful heuristic device to assess the future potential of BM innovations.

Empirically, we assessed the future potential of four alternative bike sharing systems as introduced in NL. Many new firms are entering the market with bike sharing services and related innovations. This market has become very volatile where it used to be relatively stable over the last 10 years with only one successful bike sharing innovation: OV-fiets. Although currently no data is available on the total number of bike sharing trips in NL compared to all bike trips, it must be noted that despite the increase in bike sharing innovations, bike sharing is still a niche in the Dutch urban mobility and cycling regimes.

Our analysis addressed the *potential of current business models for bike service innovations to scale up.* The combination of a BM perspective with a prospective transition analysis allowed us to explore the interactions that may lead to upscaling of the innovations.

We conclude that all models profit from increasing returns to adoption as the success of any bike sharing system will depend on its spatial network effects. However, we found that the innovative free-floating models (one-way and two-way) benefit more than the traditional models from these spatial network effects.

The traditional models are supported mainly by incumbent actors, while one-way free-floating models are exploited by new entrants that are backed by large investments. The resources from large investors make it possible to reach a critical mass needed for realizing increasing returns for producers and users alike.

Institutionally, traditional models are much better embedded in the existing urban mobility regime, mainly because they have been around for quite some time. Innovative, free-floating models are not yet embedded in local legislation and among the public. However, cities are developing frameworks for one-way free-floating models at this moment.

The traditional BMs in cycling services face the classical BM challenges inherent to any capital-intensive enterprise: how to get access to substantial resources for large scale investments in infrastructures, which do not directly increase profits, but are required for successful and wide-spread operation of a particular service. Arguably, the new generation of BMs are facing these classical BM challenges to a lesser extent, enabled by digital technologies such as the internet, location devices and smart phones, which make large-scale infrastructural investments unnecessary.

However, the innovative cycling services require entrepreneurial skills related to strategically reconfiguring institutions such as rules for using public space and ownership cultures. One may argue that such skills for institutional entrepreneurship may become core to the success of entrepreneurs in cycling services, as has been suggested in other case studies on the sharing economy (Grinevich, Huber, Karataş-Özkan, & Yavuz, 2017). The recent conflicts between municipalities and innovative bike sharing services suggest that an institutional alignment is currently missing, but this may also be considered as a first step for institutional change to happen as it created widespread awareness of the possibilities as well as difficulties of scaling up bike sharing schemes.

To answer our research question we thus need to evaluate the resource needs of the traditional BMs against the institutional alignment that the innovative, free-floating models require. Because cities in NL are developing policies and pilot projects with the innovative cycling services, their future looks quite promising. As the traditional BMs target a different consumer group of commuters looking for a last-mile solution, they may exist for a long time next to the new BMs.

We suggest three avenues for further research. First, a drawback of the current framework is its static representation. We suggest exploring what a more dynamic perspective (over time) on the co-evolution of BMs and socio-technical regimes could look like. Second, our framework misses a clear actor-perspective. Our research suggests a critical need for strategic work of entrepreneurs to change institutions. Hence, integrating our research with recent literature on institutional work and institutional entrepreneurship may be fruitful (Battilana, Leca, & Boxenbaum, 2009). We also suggest including a user perspective in the analysis, possibly by conducting a broad survey among (potential) users of different models. Third, the current research has focused on NL, which is a rather unique environment in terms of cycling. Research into international contexts could lead to new insights about bike sharing and the relationships between BMs and mobility transitions.

Acknowledgements

This work is carried out within the Smart Cycling Futures project (http://smartcyclingfutures.nl). The financial support from NWO (project number 438-15-160

397) is gratefully acknowledged. We would like to thank participants from the 8th International Sustainability Transitions conference in Gothenburg (June 2017) and the NTNU Transitions to Sustainable Systems conference in Trondheim (October 2017) for feedback on earlier versions of this paper.

Appendix

Table 3: Interview protocol

Concepts	Guiding interview questions
About the company	When is the company established and by whom? What was the motivation? What is your background and experience? Where are you active and why?
Business model	
Value proposition	What value is delivered and to whom?
Profit formula	How does the company create value while providing value for the customer? What are costs and revenues?
Key processes	What processes are needed to deliver value? What are key activities?
Key resources	What resources are needed to deliver value? How is the company financed?
Industry structure	What is the current status and size of the company? Who do you view as your competitors? Are you engaged in partnerships? What is their experience?
Institutions	
Formal	What kind of formal, rules, regulations and procedures you deal with? What is your view on local policy with regard to bike sharing? How do you meet rules? How can the development of bike sharing be supported? What are barriers?
Informal	What norms and (public) values are linked to your company? What is your view on the public bike sharing debate? What habits or cognitive frames are supporting or hindering the development of bike sharing?

Table 4: Key characteristics of bike services

System	Established	Introduction in NL	Business model	Description	Ownership structure	Bike ownership	Bikes & users	Locations	Funding	Interviewee + date
OV-Fiets	2004	2004	Two-way station-based	System linked to the national train system. Focus on last mile transport.	Since 2008 owned by NS (provider of rail services) and Prorail (exploitation of infrastructure) (government owned by Dutch state)	Company owned	14500 bikes available (end 2017) 2400000 rides per year	300+ Dutch train stations	Public funding used for upscaling this system (e.g. Provincie Noord-Brabant invested in 2017 in OV-fiets at local stations)	Project manager 27-April 2017
KeoBike	2016	2016	Two-way station-based	System linked to regional bus system. Focus last mile transport in rural areas	Owned by Sytus (regional bus company), a subsidiary of Keolis, a French public transport company	Company owned	240 bikes	20 locations in villages at the Veluwe and province of Utrecht	Budget was created from savings on public transport (bus). Public transport is subsidized by the province.	Project manager 12-April-2017
Donkey Republic	2016	201	One-way station-based	System using designated zones to take and drop bikes. Based on digital lock, GPS, smartphone and geo-fencing. Focus on local city transport	Private company	Owned by company or local bike rental partner	450 bikes	Amsterdam Rotterdam	Private investors, public funding (e.g. EU and local)	Co-founder 3-Sept-2017
Hopperpoint	2015	2015	One-way station-based	Automated bike sharing system using fixed docking-stations focusing on the business market (employers, businesses, municipalities). System also open to incidental private users.	Private company and partnership with company specialized in bike parking infrastructure	Company owned	50 bikes, 1000 users, 8 docking stations	Eindhoven Tilburg	Province of Brabant provided 50% of initial investments in the system (€800.000)	Co-director 3-April 2017
HelloBike	2016	2016	One-way station-based	System using designated zones to take and drop bikes. Based on digital lock, GPS, smartphone and geo-fencing. Focus on business.	Subsidiary of The Bikevertisement Company (a private company linking cycling to advertisement)	Company owned	500 bikes	Amsterdam (Zuid-As business district)	Municipal investments, companies at Zuidas and national subsidy	Managing director 1-Feb-2017
Spinlister	2011	2016	Two-way free-floating (peer-to-peer)	Platform for rental of private (special purpose) bikes.	Private company	Bikes owned by users	N.A.	Global	-	www.spinlister.com
Listnride		2017	Two-way free-floating (peer-to-peer)	Platform for rental of private (special purpose) bikes.	Private company	Bikes owned by users	N.A.	Global	-	www.listnride.com
FlickBike	2017	2017	One-way free-floating	System using designated zones to take and drop bikes. Based on digital lock, GPS, smartphone and geo-fencing. Focus on local city transport	Private company	Company owned	1000 bikes	Amsterdam	Private investors	Founder 27-Sept-2017

Ofo	2014	2017	One-way free-floating	System that allows to take and drop bike anywhere. Focus on local city transport.	Private company, backed by technology companies	Company owned	Plan to start	Global	Venture capital	Country manager 23-Aug-2017
Mobike	2016	2017	One-way free-floating	System that allows to take and drop bike anywhere. Focus on local city transport.	Private company, backed by technology companies	Company owned	Started with 150 bikes	Rotterdam	Venture capital	Advisor 15-2-2018

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