# Collaborative Business Models and Platforms in Shared Mobility Transitions: The Case of Bikeshare Integration

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## 1 Introduction

Advances in smartphone penetration, geolocation and remote locking, online payment and battery performance have rapidly expanded the technological possibilities of shared access to vehicles in the past decade. These advances have also improved the commercial prospects for shared mobility, especially for smaller, lighter and cheaper vehicles, such as bicycles and micromobility modes (Boyd Cohen & Kietzmann, 2014). Services that provide shared access to these modes offer cities a relatively rapid means of increasing their mobility offering to residents and combatting car dependency. Ultimately, their success could produce a shift from a global status quo dominated by mass private ownership of

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passenger vehicles towards an Internet-enabled, integrated system that meets residents' mobility needs without the need for private ownership, especially of motorised vehicles (Machado et al., 2018). Such a shift is considered essential to realising the vision of mobility-as-a-service (MaaS) (Hensher et al., 2020). However, this transition will entail a profound transformation of aspects such as the business models through which mobility services are provided (Heikkilä, 2014; Yanying Li & Voege, 2017; Hensher et al., 2020) and the platforms or interfaces through which these services reach users. Promising innovations such as web-based platforms have already come to play an essential role in connecting users to the multiplicity of (new) mobility service providers. In particular, platforms that accommodate multiple providers merit closer study as they continue to proliferate. These platforms may constitute a distinct kind of business model in themselves, based on a degree of internal collaboration coupled with outward competition between providers. Their potential has also generated interest from the public sector, as local governments seek to harness platforms of this kind to deliver everyday urban mobility services that were formerly provided by the state. This chapter offers an exploratory review of how business models based on collaboration have been defined in various literatures and applies the results to a case study of three mobility services platforms shaped by public-sector actors.

Recently, the concept of the Collaborative Business Model (CBM) has emerged as a means of describing entities or practices that are characterised by very deep, sustained and technologically mediated integration between actors. In contrast to currently dominant frameworks in business model research, such as Osterwalder's Business Model Canvas (BMC) (2004), some proponents argue that CBMs are characterised (inter alia) by value propositions that cannot be satisfactorily analysed in terms of a focal firm and its partners, but depend intrinsically on collaboration between multiple actors (de Man & Luvison, 2019).

CBMs are an emergent stream of business model research, although business and management scholars have long attended to the theme of collaboration between firms. In the field of transport/mobility studies alone, scholars have explored collaboration between actors through frameworks such as business ecosystems (Kamargianni & Matyas, 2017),

business alliances (de Man & Luvison, 2019) and agency theory (Boyd Cohen & Kietzmann, 2014). However, CBMs may offer a more powerful means of describing and analysing the advanced degree of integration and coordination between actors that will necessarily underpin the mature MaaS systems of the future. They may capture transformative features of collaborative entities and practices that are marginal in current business model research but which may occupy a central role in a future in which interoperability across entire sectors is the norm.

For this reason, CBMs may be particularly productive as an organising framework applied to contemporary urban mobility systems, in which progress towards MaaS has been slow and uneven (Mulley, 2017). Some scholars have explicitly attributed this lag to unresolved regulatory and institutional barriers that remain long after purely technological ones have been resolved (Ambrosino et al., 2016; Berger et al., 2014). More specifically, research into current empirical attempts to achieve MaaS has often pointed to a conflict between the assumptions of mainstream business model research (e.g. the assumption of competition between firms with similar offerings) and the requirements of an integrated mobility system, such as the non-duplication of services (Boyd Cohen & Kietzmann, 2014). This difference is especially marked given the norm of significant public ownership of 'natural monopolies' in transport (especially rail, trams and buses) in Europe, which created stable conditions for their development and maturation through the twentieth century[1] (Amaral, 2008; EC DG MOVE, 2019). Insofar as they potentially depart from these assumptions, CBMs may therefore offer novel insights into the limited progress that cities have made towards MaaS.

The analysis of MaaS also offers benefits to current understandings of CBMs, which differ very widely among scholars. The term 'collaborative', in particular, is used to refer to a broad set of meanings both within and beyond CBM literature, some of which are potentially contradictory. For example, Gyimóthy distinguishes between corporatized extractive models and altruistic communitarian or commons models of collaboration within the term *collaborative economy*. Botsman and Rogers (2011) introduce *collaborative consumption* to refer to Internet-enabled

[1] In 2001, the EU First Railway Package began the process of creating a single passenger rail market.

marketplaces as distinct from the more solidarity-minded and mutualist principles of peer-to-peer sharing platforms (especially in the early phase of platform development). In contrast, the term *collaborative* has a smaller range of meanings in the context of MaaS, because of the constraints imposed by the nature of the space required for storing and operating vehicles on public or semi-public[2] land. This space, which is fundamental to MaaS, is typically conceived of and governed as a commons, or common pool resource, and access to it is usually highly institutionalised. This institutionalisation has, in European cities, developed over centuries to produce distinct outcomes and mechanisms for domains such as outdoor restaurant seating, public markets, mass gatherings and tourist flows (Brandajs & Russo, 2019; de Magalhães & Freire Trigo, 2017). Furthermore, the means of access to this resource within MaaS differs widely between different modes: the space required by automobiles is generally highly commoditised (as parking space), while that required for modes such as bicycles is usually governed more informally or non-commercially (Petzer et al., 2019, 2021).

For this reason, the study of MaaS platforms that incorporate bicycles (most often in the form of docked or dockless public bikeshare) highlights a potentially productive tension within the term *collaborative* (and related terms, such as *cooperative* and *coordinated*) into CBM research. Additionally, considering MaaS platforms that include bikeshare[3] through the lens of the CBM brings to this new field a long empirical record of collaboration around a limited resource (space). This resource constraints, and is constrained by, the incentive for firms to compete, as this has been a constant feature of urban mobility governance for centuries (Akyelken et al., 2018; Gössling et al., 2016). The effects of this constraint are most pronounced in the case of platforms that already include, or make provision for, multiple providers of services based on the bicycle. This

[2] 'Public land' here refers to land owned by the state and intended for public use, such as roadways, sidewalks and squares. Semi-public here refers to space that is generally perceived as public and operates much like public land, but is owned or operated by a private firm, such as parking space at railway stations or what Carmona (2015) terms 'pseudo-public' spaces, such as London's privatised public squares.

[3] Following Fishman (2016) we define 'bikeshare' as shared cycling-based mobility systems providing temporary access to any form of bicycle and variations thereof, that is available to the public.

difference constitutes an essential distinction between MaaS and other parts of the 'collaborative economy', where commons resources may well be significant but are seldom fundamental to day-to-day operations[4] (Karppanen, 2017; Nieuwland & van Melik, 2018).

The meaning of *collaboration* in the empirical field of MaaS platforms that include bikeshare may therefore depart in significant ways from its meanings (which are themselves diffuse) in business model research.[5] By the same token, the forms of de facto collaboration, cooperation or coordination that can be empirically observed in these MaaS platforms could produce a more nuanced understanding of the nature of collaborative business models in general, and the diversity contained within this term. For this reason, we propose to further develop and critically assess the concept of CBMs that offer consumers access to bikeshare as a service (both on its own and as part of wider MaaS platforms), to answer our research question:

*What are the existing challenges in creating MaaS platforms that integrate multiple bikeshare providers, and how could CBMs contribute to overcoming these?*

In this chapter, we discuss how CBM can be defined in relation to MaaS, identify current efforts to integrate bikeshare into MaaS platforms and assess the challenges in these efforts. We address these questions by conducting a systematic literature review into conceptualisations of CBMs across various subject areas in Sect. 3.1. We supplement this with a thematic analysis of a systematic review of literature on the business models of MaaS platforms in Sect. 3.2. To underpin our theoretical findings, we analyse three cases—the Netherlands, Antwerp (BE) and Helsinki (FI)—in light of these organising concepts by drawing on interviews and grey and academic sources in Sect. 3.3. In particular, we will investigate, in greater detail than previous studies, the extent to which MaaS platform formation and bikeshare integration in these cases

[4] For example, research has shown that Airbnb has significant impacts on the 'commons' of neighbourhood liveability and affordability in certain contexts, but these effects are not yet well quantified or legally defined (Nieuwland & van Melik, 2018). In contrast, public space is explicitly governed by regulations around its permanent and temporary use.

[5] These definitions range from a mechanism requiring a dynamic of mutual trust between partners (Aagaard, 2019, 215) to the coordination of outward-facing actions (such as resource acquisition) between organisations (Dreyer et al., 2017).

is the result of voluntary 'collaboration', or a response to conditions imposed by government, and the consequences of these distinctions for the balance of risk and alignment between organisations (Yanwei Li et al., 2018). We discuss how the CBM concept could contribute to the success of bikeshare-inclusive MaaS platforms in Sect. 4 and provide conclusions and recommendations for further study in Sect. 5.

## 2 Methods

The systematic literature review method has been developed in the social sciences to synthesise findings from large bodies of information, especially where key concepts remain undefined or contested (Petticrew & Roberts, 2006, 21). We employed a 7-part systematic (literature) review approach to establish how CBMs are currently conceptualised across academic literatures. To ensure consistent quality and peer-reviewed status, we limited our search to Scopus, using the search term *TITLE-ABS-KEY* ('collaborative business model*') to retrieve 92 initial results, which were screened for relevance.[6] This process yielded 50 results which were coded using NVivo® software in an iterative process until saturation was reached. The rationale for coding was to establish the heterogeneity of interpretations or definitions of CBMs (see Addenda for sample lists and code tables).

The systematic review succeeded in providing an overview of heterogeneity in the meaning of CBMs, as well as a survey of related terms and their respective similarities and differences relative to CBMs. However, none of these sources addressed the field of MaaS, and only one addressed the question of commons or common pool resources to any extent (B. Cohen & Muñoz, 2015). We therefore conducted a second literature review to establish how and which business model terms were used to describe existing MaaS platforms, with an emphasis on the role of dominant business model frameworks (like the BMC) versus novel or niche frameworks. This survey was informed by the findings of the first,[7]

[6] Exclusion criteria: sources that mentioned but did not discuss CBMs; that focused solely on operational technical aspects of CBMs (e.g. business process engineering).

[7] For example, our inclusion of 'business ecosystem' and 'alliance formation' as alternatives to *business model* was prompted by highly relevant sources in the first survey that employed this term.

resulting in the Scopus search term TITLE-ABS-KEY ('business model*' OR 'business ecosystem*' OR 'alliance formation') AND TITLE-ABS-KEY (bikeshar* OR 'maas' OR 'mobility as a service' OR 'shared mobility'), which returned 45 initial results. This comprehensive sample was refined to 26 sources[8] for further thematic coding using NVivo® until saturation was reached.

We supplemented the generic and theoretical findings of two sets of surveys of peer-reviewed journal articles with the particular and embedded findings of multi-site case studies of MaaS platforms that included bikeshare. Multi-site case studies are effective means of testing theoretical assumptions against empirical data, revealing variations among ostensibly similar cases and defining new areas for research by exposing unanticipated findings (Yin, 2014). We selected three Northwestern European MaaS platforms for further study by means of semi-structured interviews with MaaS platform designers or project initiators, supported by web searches for grey literature published by these same platforms, as well as selected academic sources mentioned in grey literature or in interviews. The choice of platform designer or initiator as research participant allowed us to focus on the MaaS platform itself as an example of a potential CBM, and the design choices and constraints that shaped these platforms. Our interview questions aimed to inform limited organisational case studies focusing on a parameter of interest (MaaS platform design and structure), rather than the business ecosystem of each MaaS case as a whole, or the business models of participants in the platform. Our interview questions therefore asked platform designers to describe their platforms in terms of BMC categories (viz. Key Partners, Key Activities, Key Resources, Value Propositions, Customer Relationships, Channels, Customer Segments, Cost Structure and Revenue Streams) to aid comparison with the results of our literature surveys. These questions were supplemented by more open-ended questions regarding the aims and objectives of the platform, and the challenges encountered in operationalising it, to capture aspects of each case that may diverge from, or not be easily expressible within,

[8] Exclusion criteria: sources that explicitly excluded bikeshare or any form of micromobility (due to the modally distinct nature of open space allocation discussed above), or that focused on developing-world contexts (as our study cases were limited to high-income European contexts).

the parameters of the BMC (see Addenda for interview protocols, a list of interviews and a list of grey literature sources).

Three cases were selected for contrast in scale, in degree of initial success in achieving bikeshare-inclusive MaaS integration, and for consistency as relatively wealthy Northern European urban contexts. The first case is the CROW Deelfietsdashboard, a Dutch multi-city proto-platform for interoperable bikeshare that is currently in its pilot phase and which is intended to serve as the basis for a public-facing app. The second is the Antwerp Marketplace for Mobility, which already includes a public-facing app. In both the Dutch and Belgian cases, the platforms are limited to the provision of wayfinding and information services, and cycling modal share is very high by global standards. The third case, Helsinki's Whim app, is one of the very few current examples of a MaaS platform that provides public-facing services beyond wayfinding and information; here, cycling modal share is much lower than in the Dutch and Belgian cases. The three cases vary widely in terms of platform design, in terms of regulatory context and their relationship with institutional gatekeepers of common resources, and in terms of the services they offer. By means of interviews and a review of grey and selected academic literature related to these cases, we contrast theoretical claims made in academic literature about CBMs and MaaS, respectively, with the challenges arising from real-world attempts to operationalise bikeshare-inclusive MaaS.

## 3 Results

Our analysis of the CBM literature sampled reveals three distinct interpretations of the word 'collaborative' (see Table 1), as well as two characteristic tensions within CBMs: namely, that between collaboration and competition and that surrounding the role of place and the commons in CBMs. We find that only a small minority of sources (see group 3 in Systematic review of CBM literature in Table 1) explicitly describes CBMs as analytically distinct from other existing BM frameworks, especially Osterwalder's BMC (2004). In all other sources, CBMs serve

**Table 1** Coding frequency and data for CBMs

| Group of sources derived from coding | Coding: Files | Coding: References | Would exist without collaboration | Can be expressed in conventional BM terms | Focus |
|---|---|---|---|---|---|
| **Group 1:** CBMs as practice | 29 | 34 | Yes | Yes | B2B |
| **Group 2:** CBMs as activity or sector | 13 | 14 | No | Yes | B2B, B2C, for-profit P2P |
| **Group 3:** CBMs as analytically distinct | 5 | 5 | No | No | B2C, B2G, non-profit P2P |

either as a means of describing the practice of collaboration between organisations (group 1), or as a reference to sectors deemed to belong to the sharing (or 'collaborative') economy (group 2). These three sets of interpretations provide a valuable overview of the theoretical and empirical uses to which the term CBM has been put.

## 3.1 Systematic Review of CBM Literature

### 3.1.1 Group 1: Collaboration Refers to Practices That Occur Between Organisations

In the great majority of sources, CBMs are deployed as a descriptor for collaborative practices that take place between organisations (B2B). These practices vary widely within the sample, from structured and contractual to informal and sporadic, but all are essentially activities undertaken by organisations that are or could be described in conventional BM terms. For this group, 29 out of 50 sources, the term 'CBM' is thus a descriptor of collaborative *practices*, not of a distinct type of BM. These practices vary widely in scale (some connect entire value chains, others only consist of regular coordination between two firms) and are found across many

sectors (including manufacturing, the service sector and product-service firms). In general, within this group, the impetus or rationale for undertaking collaborative practices is provided by anticipated competition from rivals due to technological advances, market forces or established practices within a particular sector, but the decision to initiate collaborative practices is voluntary and strategic; further, the collaboration practised here is most commonly business-to-business (B2B), although consumers feature in some collaborations as significant and influential actors.

### 3.1.2 Group 2: Collaboration Refers to One Organisation's Key Activity or Sector

In a smaller group of sources, CBMs are used as a descriptor for single organisations whose business it is to facilitate collaboration, or who operate within a sector that the source considers to belong to the *collaborative* or *sharing economy*. As with group 1, these sources deploy the term CBM to refer to organisations with conventional BMs; in this case, these organisations profit financially from providing the means for others to collaborate, whether on a B2B, business-to-consumer (B2C), or for-profit peer-to-peer (P2P) basis. Group 2 includes many platform-based organisations, whose BM centres on the management of a platform as infrastructure for collaboration, as well as many project-based consortia. The 'collaboration' referenced in this use of CBM broadly serves as a synonym for activities that have traditionally been provided on a commercial basis (such as coordination activities, matching and networking), for which the advent of new communications technologies such as the Internet and smartphones represents an opportunity in terms of lower transaction costs, expanded potential markets or more efficient matching and coordination. Unlike group 1, organisations in this group depend on collaboration as a primary activity; within this group, a number of organisations have been set up explicitly as joint ventures or project-based consortia, while others have been founded in order to exploit perceived opportunities within the collaborative sector (such as Airbnb).

### 3.1.3 Group 3: Collaboration Refers to a Kind of BM That Is Analytically Distinct from the BMC

The smallest and final groups are presented in five sources as analytically distinct from conventional BMs on a number of grounds. Bleja et al. (2018, 2019) present a CBM as a *collaborative system business model* (CSBM) that is identical to the BMC in structure, but exists above the level of the individual BMCs of partner organisations, coordinating and consolidating their activities. For Grossman et al. (2017), the distinctiveness of a CBM from the BMC resides in its value proposition, which is irreducible to the value propositions of partner organisations, even if that value proposition is delivered or realised by the activities of individual partner organisations. As such, these sources argue that the organisations concerned could not exist except on the basis of collaboration and also cannot be adequately articulated in BMC terms. These organisations serve a range of markets including B2C, business to government (B2G) and not-for-profit P2P, as in the case below.

### 3.1.4 CBMs, Commons and the City

Three further sources within group 3 consider CBMs as analytically distinct due to their relationship with the commons in general (Gyimóthy, 2017), and on place, or the physical commons of the city (B. Cohen & Muñoz, 2015; Muñoz & Cohen, 2016), respectively. Gyimóthy (2017) introduces a distinction between two types of BMs within the sector of the collaborative economy, arguing that the term CBM has been widely but erroneously attributed to a particular archetype of 'corporatized extractive model' (such as Airbnb) that in fact represents a very conventional BM applied to the collaborative sector. Airbnb is an example of this model, in which individual private assets are exploited and the 'commons' of residential neighbourhoods monetised without an efficient mechanism by which the community can limit or demand compensation for the externalities of that monetisation (Nieuwland & van Melik, 2018). In opposition to this type of BM, Gyimóthy discusses the 'communitarian or commons' model of the collaborative economy, which differs intrinsically from the BMC in

a number of ways. This Commons CBM is premised on solidarity, mutuality and co-ownership. Value is created through non-monetary exchange on a basis of reciprocity, mediated by a strong commitment to a physical or digital commons (such as a place, a natural resource or a virtual community). The role played by the commons in Gyimóthy's commons CBM differs substantively from the assumptions of the BMC in areas such as key resources (which are shared in perpetuity between stakeholders) and revenue streams (which are non-financial).

Cohen and Muñoz (2015) and Muñoz and Cohen (2016) argue that one kind of CBM is that created in practice through the work of purpose-driven urban entrepreneurs. This is a response to the limitations of conventional business models in the face of complex, interconnected urban challenges, which tend to be strongly mediated by various urban commons (such as urban space). Purpose-driven urban entrepreneurship, and the CBMs it gives rise to, have a number of characteristics that are unique in our sample. Firstly, Cohen and Muñoz situate CBMs explicitly in the city, for which CBMs are both locus and focus, using an approach to urban entrepreneurship that draws on the related concept of the *place-based enterprise* (PBE) (Shrivastava & Kennelly, 2013). Secondly, while other sources have treated the impetus or incentive to collaborate as voluntary and strategic, the complexity and physical constraints of cities mean that collaboration is not optional for urban entrepreneurs, but a requirement imposed by place. Lastly, through their engagement with place, urban entrepreneurs are obliged to collaborate with the public-sector actors tasked with the stewardship of public goods or the commons, or what Poderi (2019, 244) terms *gatekeepers*, making the articulation of the commons an essential component of CBMs for urban entrepreneurship. The urban entrepreneur is 'embedded in place' and aims to resolve 'unique, interconnected city challenges' (B. Cohen & Muñoz, 2015, 2) in close collaboration with public and private-sector actors. This requires that the entrepreneur respond not only to a local 'market' but to the tangible, physical and geospatial circumstances of the city and its 'place-specific anomalies', including deeply embedded social, cultural and political conditions (B. Cohen & Muñoz, 2015, 2; Shrivastava & Kennelly, 2013).

### 3.1.5 Balancing Competition and Collaboration: CBMs and Platform Competition

Within our sample, the term *collaboration* is used with much of the same variation as the term *CBM*: as a descriptor for both formal and informal interaction between organisations, as a sectoral designation for organisations in the *sharing* or *collaborative economy*, and additionally as a method for BM design. In this study, we therefore employ the term *collaboration* to refer to purposeful interaction between organisations in the broadest sense, without connotations of altruism or an assumption of common purpose or alignment of interests between collaborating partners. The most specific interpretation of collaboration in our sample is that of Salazar (2015), who presents it as the antithesis of classical competition. On this basis, Salazar argues that CBMs exhibit *platform competition*, a kind of behaviour that is distinct from the assumption of rational competition between organisations embedded in the BMC (Osterwalder, 2004), because it imposes value co-creation and shared appropriation as a collective project for all platform participants. As such, it resembles the *keiretsu* phenomenon of interfirm co-specialisation in manufacturing (Dyer, 1996), although service or product-service platforms are less often tied to a focal firm or dominant design. Platform capitalism therefore departs from elements of the BMC such as the assumed relationships between the firm and key partners, as competition *within* platforms is balanced by the mutual interest that platform participants have in competition *between* their platform and others, and positive network externalities are an essential factor for the success of the platform.

These three conceptions of CBMs differ substantially in their implicit or explicit definition of what CBMs are (see systematic review of CBM literature Table 1), but share a common emphasis on interdependence between the focal firm and other entities or actors that is not an inherent feature of the BMC. This interdependence, which serves as an impetus for collaboration, takes two forms in our analysis. Firstly, the majority of CBMs across our sample are subject to tensions between collaboration and competition, which in BMC terms can be expressed as a departure

from the assumptions that underpin the category of Key Partners. Secondly, the CBMs presented as analytically distinct (group 3) are subject to significant tensions surrounding the commons. These themes of collaboration versus competition, and of engaging with the commons, are also prominent in MaaS and bikeshare literature, and will therefore be developed as common points of reference between these two literatures. They are discussed in the following sub-sections.

## 3.2 MaaS Platforms: Competition, Collaboration and the Commons

A discussion of business models across the scientific literature on MaaS is beyond the scope of this study. For our purposes, we limit ourselves to a discussion of key terms within the MaaS literature that describe elements of MaaS business models (see Table 2). We follow Smith and Hensher et al. (2020) in considering MaaS to be composed essentially of a single digital platform which grants users access to mobility services across multiple modes. This *mobility services* or *MaaS platform* (alternatively, a mobility *broker* or *aggregator*) integrates *mobility services* to connect *mobility service providers* (MSPs)—those who operate the physical means of transport, such as vehicles—with the users who demand mobility services. The data generated by the mobility system—such as route and timetable information for public transport, or trip data for bikeshare—constitutes a *data commons*, when it is (potentially) accessible as a common resource, and is often given form through *API*s. The data commons has a finite and tangible analogue in what Petzer et al. (2019) term the *physical commons*, or the finite stock of urban open space that is available for the movement and storage of vehicles; Meurs et al. (2020) refer to a similar concept when they describe *complementary network resources* as the supporting physical infrastructure that enables mobility services. Access to the physical commons is highly institutionalised and regulated, as well as modally distinct, and is governed by the *city government* acting as a commons gatekeeper or steward. This gatekeeper role can sometimes take the form of a *spatial monopoly* operated either by a government, or a public transport authority with exclusive right to operate certain mobility services within a geographic area.

**Table 2** MaaS terms used in this study

| Term used in this study (*with alternatives*) | Role or description |
|---|---|
| **MaaS platform**<br>*Mobility broker or aggregator* (Meurs et al., 2020; Pangbourne et al., 2020; Wong & Hensher, 2020)*; aggregator* (Jittrapirom et al., 2017)*; MaaS operator* (Polydoropoulou et al., 2020) | Integrates mobility services to connect demanders and suppliers of mobility services using an Internet-enabled platform |
| **Mobility service provider (MSP)**<br>*MaaS partner* (Polydoropoulou et al., 2020)*; transport provider* (Meurs et al., 2020) | Operates the physical means of transport—vehicles, with and without drivers |
| **Data commons** (Pangbourne et al., 2020) | A description of a state in which public data useful in mobility service provision is commonly accessible |
| **API** (Audouin & Finger, 2018, 5) | An application programming interface provides a feed of data about transport, such as route and time information for public transport |
| **Physical commons** (Petzer et al., 2019)<br>'physical resources' (Polydoropoulou et al., 2020, 158)*, Complementary Network Resources* (Meurs et al., 2020) | The physical stock of open public space available for the storage and movement of vehicles, especially informal parking space |
| **City government** (Polydoropoulou et al., 2020) | Oversees and safeguards urban commons |
| **Spatial monopoly** (Meurs et al., 2020, 4) | An MSP provider holding a monopoly on transport within a geographic area |

These terms are drawn from sources that vary considerably in focus and in their approach to MaaS, from studies of private-sector MaaS business alliances (G. Smith et al., 2018; Meurs et al., 2020) to a focus on public-sector MaaS policies (Göran Smith & Hensher, 2020), and using methods ranging from MaaS business model prototyping (Polydoropoulou et al., 2020) to econometric modelling of business models (Wong & Hensher, 2020).

The points of agreement across our sample touch on a set of interconnected problems.

Firstly, sources attribute the small number of full-service MaaS platforms operational today to the challenge of the complex and novel

partnerships that MaaS requires between multiple private- and public-sector actors in a rapidly evolving sector (Mulley, 2017).

Secondly, the degree of integration and interoperability that MaaS will demand at scale from platform participants remains a technical and organisational challenge within current regulations, even when this level of collaboration is entirely voluntary (Meurs et al., 2020).

Thirdly, a number of sources acknowledge that the fixed-route, high-volume public transport modes (rail, buses) and active modes (bikeshare) which are viewed as the backbone of MaaS, and the core of its sustainability and accessibility promise, also offer very low profit margins and have traditionally been supported by public subsidy as a result (Göran Smith & Hensher, 2020). In contrast, the private mobility services offered on MaaS platforms seek to maximise private profits for their owners. Further, the interests of private mobility services may align closely with those of the incumbent, ownership-based regime, such that the former could potentially stabilise (rather than disrupt) the latter, as Wells et al. (2020) demonstrate with respect to 'automobility-as-a-service'. Combining these kinds of services within a single organisation is a key concern in the design and operation of MaaS platforms.

The tensions identified in the CBM literature are also present in studies of MaaS. These factors are presented in Fig. 1, in which the diagram at the top right represents a MaaS firm's business model using the conventional elements of the BMC (Osterwalder, 2004),[9] while the infinity symbols represent the open-endedness of the composition of the set of platform partners. The problem of a lack of control over platform partners, and that of deep dependence on reliable access to the contested key resource of the physical commons, is a key concern for MaaS firms. It is represented here by the extension of the physical mobility commons of the city (in grey) into the business model of the MaaS firm at the top right (as a key resource, labelled KR) and also into the business models (labelled BMs) of other MSPs. The physical mobility commons is therefore outside of the focal firm's control, but also simultaneously in demand by an unlimited number of other claimants of space (represented

[9] Where KP = Key Partners, KA = Key Activities, KR = Key Resources, VP = Value Propositions, CR = Customer Relationships, CH = Channels, CS = Cost Structure, and RS = Revenue Streams.

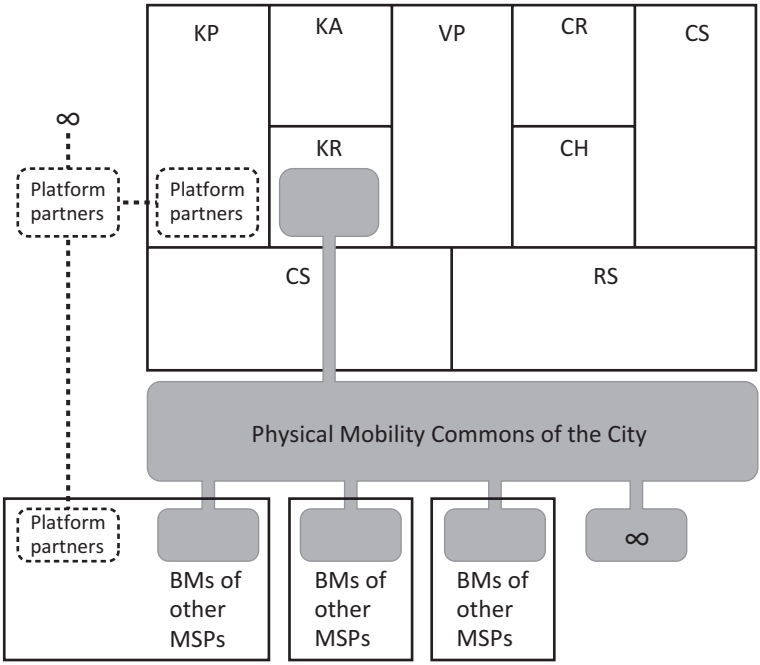


**Fig. 1** The physical mobility commons in relation to the business models of a focal MSP and other MSPs

by the infinity sign at the bottom left), both within and beyond the mobility sector. Platform partners may also be added to or reduced against the wishes or the interests of the focal firm, especially in cases where local governments play a strong role in regulating platforms or require platforms to be created.

## 3.3 Case Studies

### 3.3.1 The Deelfietsdashboard (Rotterdam and Other Cities, NL)

In the Netherlands, bikeshare has long been integrated into public transport through the highly successful OV-Fiets system, a 24-hr bike hire system operated across the country's railway stations by the national

railways. Following the rapid arrival of dockless bikeshare providers in Dutch cities in 2017–2018 and ensuing regulatory backlash in major jurisdictions (Petzer et al., 2019), the Netherlands' five largest cities[10] signalled in 2018 that they would henceforth allow dockless bikeshare providers to operate only through a single, interoperable platform, after the model of the OV-fiets (Slütter, 2018).[11] This platform would support governance of the physical and data commons by cities (through data sharing) and, more significantly, allow any user access to the services of every bikeshare provider present on the platform (Fietsberaad, 2018). This leveraging of access to some of the world's largest cycling markets against the achievement of a high degree of integration prompted the creation of the Openbike[12] initiative (de Haan, 2018; Slütter, 2018). Openbike brought together 12 bikeshare providers in a collective attempt to satisfy these requirements by developing a common technical standard in partnership with the five city governments. Funding for a pilot project to set up a test platform came from the Netherlands Ministry of Infrastructure & Water, which culminated in the Deelfiets ('bikeshare') Dashboard. In this phase, the function of the Dashboard was to relay real-time operations and geolocation data from MSPs to city governments for monitoring and enforcement of the activity in the physical commons. This phase was explicitly intended to lay the groundwork for a public-facing full-service platform (Boor & Vincent, 2019) by March 2019, structured around the GBFS+ data-sharing standard. At the time of writing (September 2020), progress towards this goal has stalled (Boor interview, 13/05/2020 and 16/07/2020), due to the challenges MSPs encounter in attempting to modify their business models to prepare for interoperability of services with other MSPs.

The first of these is the variation in value propositions and size between these individual MSPs, which range from multimillion-dollar multinationals to one-person startups (Petzer et al., 2019), as well as major

[10] Amsterdam, Rotterdam, The Hague, Utrecht and Eindhoven.

[11] 'Evenals de gemeenten Amsterdam, Rotterdam, Utrecht, Den Haag en Eindhoven die interoperabiliteit als voorwaarde stellen voor het toelaten van deelfietsen in de stad' (Slütter, 2018, 27).

[12] Participating providers are BimBimBikes, Cykl, Donkey Republic, Du Nord/Haagsche Stadsfiets, Emotion sustainable mobility, FlickBike, Hello-bike, Mobike, Nextbike, Urbee, Luud Schimmelpennink and Gobike. The national giant, OV-Fiets, is noticeably absent.

differences in the duties and deposits they require users to perform and pay (Boor interview, 13/05/2020). A second fundamental challenge lies in the aggregation of users acquired by each provider into a common pool accessible to all, especially in light of the cost to firms of acquiring a user. Third, the access to their respective commons that cities have promised, and the specific performance, enforcement and rebalancing requirements that major jurisdictions such as Amsterdam and Rotterdam have already signalled in new, dedicated policies (Gemeente Amsterdam, 2017, 2018), combined to impose high minimum operational costs on providers, against no guaranteed minimum in profits (Boor interview, 16/07/2020). Lastly, the public interface of any potential platform would have to resolve design issues rich in potential conflicts, such as the prominence given to each provider for a potential user request or query (Slütter, 2018).

The Deelfietsdashboard therefore develops out of what might be called coerced collaboration: dockless bikeshare MSPs initiated this collaboration in response to a decision by the Netherlands' largest cities to exclude dockless bikeshare from the physical commons (i.e. to refuse these MSPs permission to operate on public land and use public bicycle parking) absent an interoperable platform. In BMC terms, this could be articulated as a loss of control over the Key Partners that individual MSPs, as well as the mobility platform itself, must collaborate with to deliver interoperable services. Indeed, the challenge of combining direct competitors on a single platform has, to date, proven overwhelming, and more recent developments in Amsterdam indicate that the city has abandoned its support for an interoperable platform in favour of local concessions in which three MSPs will be invited to operate a fixed fleet size for a fixed term (Gemeente Amsterdam, 2019). The commons aspects of the Dashboard affect the Key Activities and Key Resources elements of the BMC. In its current pilot phase, a key activity of MSPs is to contribute to the data commons through APIs that allow participating local governments to see all authorised dockless bikeshare activity in real time. This contribution is an interim step to the original vision of the five cities, which is that access to their physical commons would be conditional on success in creating an interoperable platform for all (dockless) bikeshare MSPs. This case is conceptually illustrated in Fig. 2, which represents users (in darker grey at top) connected by arrows to the MSPs whose

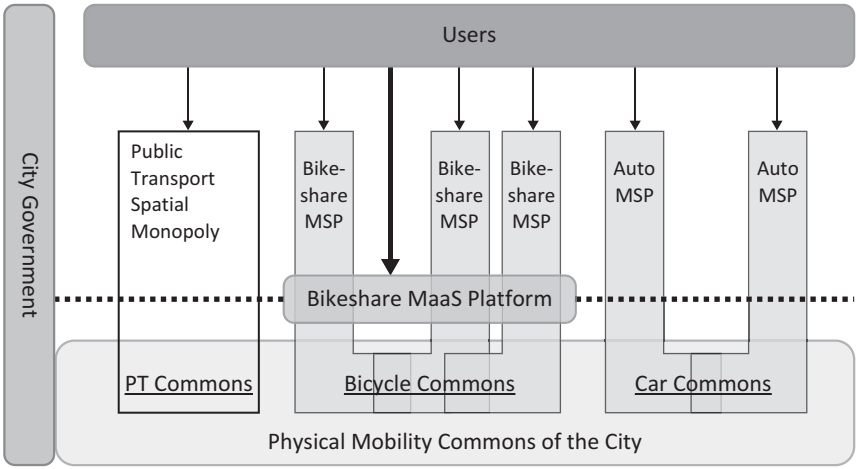


**Fig. 2** A conceptual model of the physical mobility commons of the city in relation to compulsory bikeshare MaaS platforms, users, government and other MSPs

services they consume. These public transport, bikeshare and automobility MSPs each make claims on the physical mobility commons of the city (in light grey at bottom); these claims overlap for different MSPs belonging to the same mode, creating a distinct public transport ('PT'), bicycle and car commons. City government (at left) is adjacent to the commons and creates regulations (a dotted line) that restrict commercial access to the physical commons in Dutch cities. These regulations affect other MSPs but are suspended for bikeshare MSPs included in the 'Bikeshare MaaS Platform' (medium grey, where the dotted line is suspended). This platform thus offers an enhanced service to users (represented by a thicker arrow) as a result of its wide range of MSPs.

### 3.3.2 Antwerp Marketplace for Mobility (Antwerp, BE)

In Antwerp, a city of 520,000 and home to Europe's second-busiest port, imminent major roadworks required for freight movement required a concerted approach to the city's mobility as a whole, in order to preserve accessibility for residents. In 2016 this broad agenda prompted the

creation by the City of Antwerp and its partners[13] of the Marketplace for Mobility (MfM), which is described as a 'cooperation framework' including three forms of commercial partnership, rather than a market platform (Kishchenko et al., 2019). The MfM could be described as a proto-platform, in that all formal relationships are between the city and individual service providers. The city retains full control of the physical commons of Antwerp by structuring MfM interactions on a clearly defined project basis on 'no fix, no pay' terms, meaning that no measurable impact means no financial support from the city (Kishchenko et al., 2019; Vernaillen, 2020). Furthermore, in commons terms, the city makes it mandatory for all mobility service providers to limit their fleet size, to share data with the city and to be integrated, at least on a data-sharing level, with at least two MaaS platforms. This leveraging of access to the city's physical commons against a requirement for contribution to the data commons has produced striking results: Antwerp is the only global market in which Bird, a last-mile electric scooter provider operated by the powerful rideshare giant Uber, shares data in this way (Vernaillen, 2020). Antwerp also offers its own wayfinding and information platform, which will soon offer full MaaS services: direct access to multiple service providers, payment, tax and payroll integration (Vernaillen, 2020), all built around an open-data, open-source platform standard with no vendor lock-in (Kishchenko et al., 2019; Maroey, 2019).

As with the Deelfietsdashboard, the set of Key Partners with which any individual MSP must necessarily partner is outside of its control, since collaboration in the city's official platform is a requirement for any MSP that seeks access to Antwerp's physical commons. Figure 3 represents the Antwerp case conceptually. In contrast to the previous case in Table 2, it shows a multimodal MaaS platform that also incorporates all of the MSPs within each mode. The pair of horizontal dotted and solid lines interrupted by the platform represent the various modally specific regulations that limit access to the physical commons; the city-backed platform ('MaaS Platform') partially shields participating MSPs from these.

[13] The Antwerp Port Authority, the Province of Antwerp, the Belgian federal railways (NMBS), the Flemish transport authority (De Lijn), the Antwerp mobility authority (beheersmaatschappij antwerpen mobiel) and a mobility consultancy (Traject).

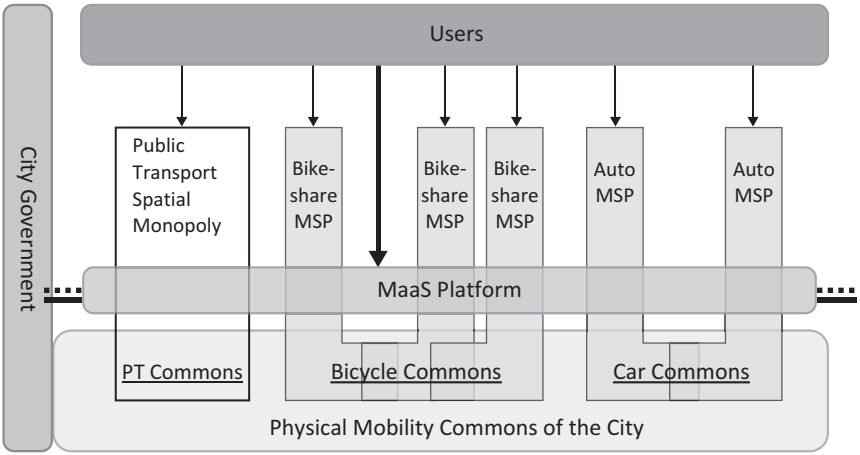


**Fig. 3** A conceptual model of the physical mobility commons of the city in relation to a compulsory multimodal platform, users, government and other MSPs

### 3.3.3 Whim Helsinki (Helsinki, FI)

Helsinki is home to Whim, the world's first platform to provide full MaaS services (wayfinding, information, booking, un/locking and payment). Whim, launched by the firm MaaS Global in 2016, is the outcome of more than a decade of purposeful state planning, starting with Finland's world-first Intelligent Transport Strategy in 2009 and culminating in the 2017 Transport Service Act, the world's first comprehensive national legislation for the regulation of MaaS (Kivimaa interview, 30/06/2020). The Transport Service Act (TSA), for example, abolished quotas on mobility service fleet sizes; required all transport service providers to make essential data such as route, timetable and fare information publicly available; and established a framework for full interoperability of ticketing by requiring mobility service providers to open their ticket APIs (Audouin & Finger, 2018).[14] The TSA therefore created a publicly accessible and legally defined and enforced data commons for the kinds of information that MaaS platforms depend

[14] Taxi, ride-hailing and ride-sharing services are largely excluded from these requirements (including the surge pricing mechanism pioneered by Uber), although in October 2020 the Finnish Government tabled specific amendments to the Act that require greater price transparency for this sector (Finnish Government, 2020).

on. These requirements were informed by close but informal cooperation between the City of Helsinki and the founder of MaaS dating from 2013, in which an agenda of regulatory changes required for a successful MaaS platform was established (Audouin & Finger, 2018; Heikkilä, 2014). This cooperation continued as the City of Helsinki positioned itself as an international champion of MaaS, leading in 2015 to an open call for the creation of a private-sector MaaS firm. Out of 200 interested parties, 23 went on to collaborate through a new organisation, MaaS.fi, which went on to release Whim (as MaaS Global) in 2016.

The Whim platform business model is therefore an example of voluntary collaboration between competing firms to create a new organisation. The resulting joint venture operates a MaaS platform that acts much like a profit-making private-sector firm, as it integrates the mobility services of both public and private-sector MSPs into a platform that presents the public with full access to all modes, according to various subscription models (Ramboll and MaaS Global, 2019; Hietanen interview, 13/12/2017).

Figure 4 presents the case of MaaS in Finland in conceptual terms. In the Finnish case, the mandatory creation and maintenance of a data

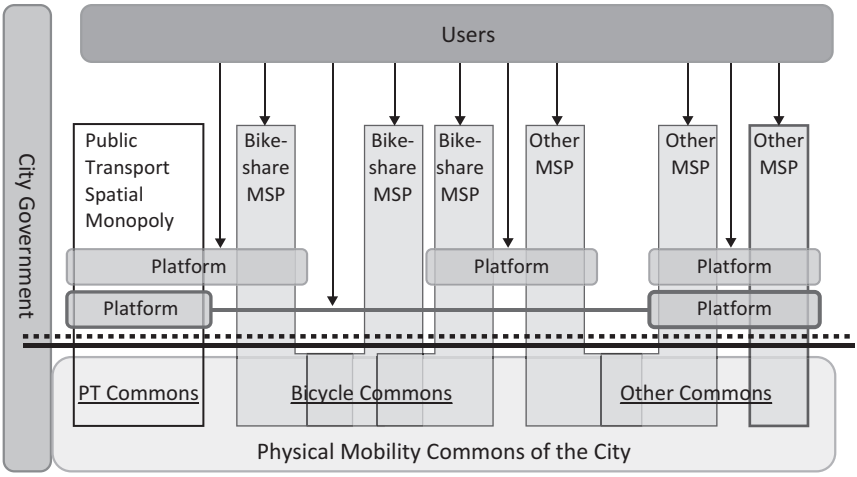


**Fig. 4** A conceptual model of the physical mobility commons of the city in relation to multiple platforms, users and government

commons of basic information that can support MaaS platforms allows for the possibility of many MaaS platforms that offer different combinations of modes. Some, such as a rival platform pioneered by a public transport operator (white box), may attract a significant user base in their own right and produce a different form of competition between service providers. The pair of dotted and thick solid lines emanating from 'City Government' represent modally mediated regulations that limit or constrain access to the physical commons; these remain in operation and apply to the various MaaS platforms. However, unlike in Antwerp (29%) (Broer, 2016) and in Dutch cities, the bicycle has a small modal share in Helsinki (6% in 2012) (Ramboll and MaaS Global, 2019), meaning that the 'Bicycle Commons'—referring to the sum of the infrastructure and space required for bicycle movement and storage on public land—is relatively less saturated and contested by users.

## 4 Discussion

The cases of an interoperable bikeshare platform in the Netherlands, a multimodal proto-platform and 'cooperation framework' in Antwerp and a true MaaS platform in Helsinki that originated as a collaborative business present clear contrasts in the areas of competition versus collaboration, and that of coding and valuing the commons (see Table 3).

In theoretical terms, the forms of collaboration that exist de facto between organisations and other stakeholders in our three cases have much in common with other MaaS platforms surveyed in our snowball literature review, but little in common with the CBM examples in our systematic review. This illustrates, in particular, the difference that mobility makes, in tying firms that have otherwise conventional business models to the very particular constraints of the public outdoor space required for moving and storing shared vehicles.

In contrast, the ambitions of governance actors to achieve public goods by compelling firms with conventional business models to collaborate deeply through platforms illustrate the potential of collaborative business models to deliver on these social agendas. This is especially marked in the case of purpose-driven urban entrepreneurship (Muñoz & Cohen, 2016).

**Table 3** Key characteristics of MaaS platforms per case

| Case country | Conditions for MSP collaboration | Data commons conditions | Conditions for MSP access to physical commons | Services offered by platform |
|---|---|---|---|---|
| NL | Mandatory | MSPs must share with cities | (Initially) Strictly conditional on platform participation | Pilot: To city governments—trip and fleet information |
| BE | Mandatory | MSPs must share with city | Identical to those for private citizens | To public: Information and wayfinding (further services planned) |
| Fi | Optional | Both cities and MSPs must share data publicly by law | Identical to those for private citizens | To public: Information, wayfinding, plus full services—booking, un/locking, payment |

In the Dutch case, these aims have not been met, and progress towards an interoperable national bikeshare platform is arguably moribund. The objectives that have justified five Dutch cities' demand for such a platform also appear difficult to achieve within the limitations of conventional business models and classical competition. However, these factors suggest that more support, more mitigation of risk and more efforts to level the playing field are required from governance actors, especially at the national level, where Finland's interventions have proven so decisive.

However, the risk involved for individual participants in such a platform is high, and the requirement that service providers (rather than, for example, intermediaries operating in a deregulated market) expose customers to the offerings of direct competitors runs counter to classical notions of competition that underpin Osterwalder's Business Model Canvas (2004), and which remain implicit across groups 1 and 2 in our CBM sample. This risk has not been managed or mitigated, as in the Finnish case, by the creation of an overarching regulatory framework that imposes a level playing field for all mobility service providers across all modes, at least in terms of information and ticketing functions. This is

striking, considering that the Netherlands was the first country in the world to require open data sharing between all public transport operators in 2008 (Boor interview, 13/05/2020). The designer of the Deelfiets Dashboard proto-platform expressed regret that publicly available open data sharing had not been built into this system from the outset to address this competition problem (Boor interview, 16/07/2020), due to opposition from pilot funders.

In Antwerp, a collaborative business model may be said to exist in a loose sense in the form of the Marketplace for Mobility and its public-facing wayfinding and information app. Taken together, these MaaS proto-platforms facilitate the simultaneous provision of (sometimes competing) services by multiple providers to the City of Antwerp and its MfM partners. Risk is limited by the creation of non-overlapping and explicit project parameters for firms, which have formal relationships with the MfM (as client or *opdrachtgever*) rather than with each other. Antwerp's unilateral imposition of the requirement that service providers share their data with the city, and integrate their services with a minimum of two MaaS apps, has been successful in leveraging access to the city's commons to attract firms, even where this requires fundamental changes to their business models, as in the case of Bird scooters.

However, the development of a MaaS app that goes beyond wayfinding and information services is likely to require the development of a distinctively collaborative business model (as per group 3 in our CBM sample) rather than modifications of service providers' own business models, which is likely to pose a significant challenge. For example, the City of Antwerp has set a precedent by manipulating wayfinding services in order to achieve certain public goods, such as minimising city-centre automobile traffic and reducing automobile congestion to facilitate the movement of passengers and port freight. Providers of services such as taxis and automobiles may find that they become less visible to users requesting trips along particular routes or at particular times. Secondly, the principle of *no fix, no pay* represents a high risk for current MfM participants, especially since the current logic of the MfM is focused on the replacement of peak-hour automobile trips as the primary assessment criterion. Thirdly, the degree of integration between major mobility governance stakeholders at the federal, language community, provincial and urban levels is currently very minimal in

comparison with the Netherlands (Vernaillen, 2020). This general fragmentation is reflected in the lack of a standard data sharing protocol between the national railways and local urban transport, or the fact that the federal Belgian mobility planning document expired in 2014–5 and has not been renewed. This lack of structured cooperation through official channels has, paradoxically, fostered an entrepreneurial culture of direct, informal contact between stakeholders.[15] For Antwerp, this has produced a high degree of flexibility and autonomy in defining the parameters of the MfM. It may also have potentially reduced the arenas in which powerful mobility operators, such as Uber, are able to (cost-)effectively lobby for favourable regulations. By the same token, the city's own requirements and policies do not have the force of law and may therefore run counter to the duties and imperatives that commercial law imposes on firms with conventional business models. Antwerp's experiment, while it thus benefits from a regulatory vacuum at some levels, may lock out organisations that would benefit from modifying their own business models to accommodate the demands of a MaaS platform, but are prevented from doing so on fiduciary grounds.

Regarding the success of Whim, however, closer examination of its first-in-the-world offering suggests that such prodigious success may have a price for Finland's urban commons, since the platform faces few demands from the city, such as for the limitation of shared vehicle fleets to prevent saturation of the physical commons. This factor may not yet be readily apparent as cycling mode share in Helsinki is low, but it is unclear that MaaS, in the particular instance of Whim, can be harnessed as an instrument to raise it, or to deliver on the City of Helsinki's current and future policy goals. Similarly, in Antwerp, automobile modal share is high, cycling rates are low compared to the Netherlands, and public transport use is falling (Vernaillen interview, 29/05/2020). The pressure on public open space, outside of car parking, is correspondingly lower than in Dutch cities, and the policy goals of the MfM are overwhelmingly framed in terms of managing automobile congestion and safeguarding

[15] For example, one of the initial challenges in setting up the SWtA project was simply gaining access to existing data streams regarding programmed and real-time route data from De Lijn, the Flemish public transport authority (Vernaillen, 2020).

the accessibility (by automobile) of the port and freeway system.[16] In the Netherlands, where the public urban space required for vehicle storage is highly contested due to the strength of cycling as a rival to automobility, the barriers against MaaS, and bikeshare, are higher. In the Dutch context, therefore, the achievement of MaaS (as in Helsinki) may be less beneficial than the achievement of a CBM for bikeshare (as per the objectives of Openbike), and the greater challenge of achieving MaaS via CBM (rather than MaaS at any cost) may be well worth the wait.

## 5 Conclusions and Recommendations for Future Research

The three cases of bikeshare integration into MaaS platforms reveal that MaaS platforms and the MSPs that partner with them still face significant challenges in achieving the integration, in commercial terms, that is already possible in strictly technological terms (i.e. integration of booking, un/locking and payments). The CBM sources we have analysed largely retain the assumptions of the BMC, such as that of classical competition between focal firms, a high degree of control over prospective key partners and key resources, and a value proposition that can be largely attributed to a single focal firm. In our cases, these conditions do not obtain. This chapter thus contributes a first attempt at a systematic review of the Collaborative Business Model across various literatures. It clarifies the meaning of collaboration and of the CBM within that sample according to three major interpretations. Of these, the most common is a 'narrow' interpretation of collaboration as a practice voluntarily undertaken by one or more organisations for an indefinite period, on a formal or informal basis. In the second-commonest interpretation, collaboration is a sectoral designation for organisations considered to form part of the sharing economy. Only a small minority of studies ascribe a 'broader' interpretation to collaboration and to CBMs as analytically distinct from

[16] The entire SWtA project is framed, in policy terms, as an anti-car congestion measure designed to maintain accessibility for freight and passenger movements on the city-region's roads, and all of the MfM's projects are evaluated, in project materials, in terms of one key metric: the number of peak-hour automobile trips avoided (uitgespaarde autoverplaatsingen).

the BMC, and of these, those relating to urban contexts all insist on the role of the commons as the basis of that distinction.

This three-part division of interpretations of the CBM may be relevant for sustainable urban mobility researchers seeking to better understand how collaboration can be mandated as a governance approach for new mobility modes. In the case of cycling, which is appealing to urban decision-makers precisely because of the uncaptured positive externalities it produces for society, the Dutch case shows how difficult it can be to sustain a CBM where private risks remain high but the capture of private rewards (for service providers) is limited. Further, the few CBM sources that explicitly address the commons, and particularly the urban commons, suggest that public and private stakeholders in urban mobility could benefit by moving beyond a transactional logic in structuring mobility services, particularly where bikeshare is concerned. For example, purpose-driven urban entrepreneurship and Gyimóthy's (2017) account of commons or communitarian business models share a dual role for the commons as both the host and the recipient of concerted action. In business model terms, this could take the form, in MaaS, of proactive efforts by city government to offer MSPs and MaaS platforms a more stable, 'ring-fenced' stake in the physical or data commons. This is the case with Finland's TSA, which has given legal stability to a very new sector and produced a relatively mature and pioneering framework for innovation in bundled mobility services.

What is also striking in our cases is the extent to which 'collaboration' is imposed on MaaS platforms and MSPs by fiat of a city or regional government, acting as a commons gatekeeper or steward, without supporting interventions at other levels of government (especially national legislation). This is an underexplored avenue for further research into CBMs and, ultimately, for a more specific definition of the term 'Collaborative' in CBMs in opposition to closely related terms like coercion, coordination and cooperation. Public-sector decision-makers in cities contemplating the creation of a mobility services platform may take note of the difficulties that collaboration entails when it is imposed on different mobility modes. Analysis of the individual MSP business models reveals that these difficulties differ according to mode, and are therefore amplified in the case of a single-mode MSP, as in the Dutch case.

Our study is limited by the limited number of interviews carried out, as well as by a lack of comprehensive mapping of the business models of MaaS platforms, as well as MSPs. Future research on the fast-moving empirical field of MaaS platforms could better develop the theme of business model morphology among different types of MaaS platform, for example, as a function of high-margin, motorised, heavyweight mobility services, as opposed to low-margin, non-motorised modes, such as cycling and walking. Lastly, future research is likely to benefit from the growing number of MaaS platforms that offer services beyond wayfinding and information, thereby allowing for a richer comparison.

## Addendum: Interviews

### Interview Protocols

Q1–Q3: Please describe your (Q1) value proposition, (Q2) value creation mechanisms (prompt: resources, supplier and distribution channels and partners) and (Q3) value capture mechanisms (prompt: costs structures and revenue models) mechanisms *[interviewer presents two BM canvases to respondent: one blank, and one filled in with interviewer's projection of BM derived from grey literature]*.

Q4–Q6: Does your organisation (Q4) distinguish between commercial/for-profit and non-commercial/social elements of your value proposition? If so, please describe these (Q5) commercial and (Q6) non-commercial elements.

Q7–Q9: How does your organisation (Q7) mediate or limit the incentive to compete between participating service providers, and (Q8) between your organisation and participating service providers? What role does your organisation play in (Q9) mitigating or managing risks between service providers?

Q10: How did your platform come to be? What factors influenced its current design?

Q11: What limitations or barriers would you like to see removed? What forms of support would you like to receive now or in the future, and from whom?

## List of Interviews, Presentations or Meetings, and Grey Literature Sources Per Case

| | Case: The Netherlands (Deelfietsdashboard) | Case: Antwerp (Marketplace for Mobility) | Case: Helsinki (Whim app) |
|---|---|---|---|
| **Interviews** | Video interview with Sven Boor, 13/05/2020 and 16/07/2020, recorded and transcribed | Video interview with Stijn Vernaillen, 29/05/2020, recorded and transcribed | Video interview with Sampi Hietanen, 13/12/2017, recorded and transcribed<br>Video interview with Paula Kivimaa, researcher on MaaS in Finland, 30/06/2020, recorded and transcribed |
| **(Virtual) Presentations** | Boor, Sven, and Hink Vincent. 'Deelfiets Dashboard voor gemeentes: Hoe krijgt een gemeente inzicht in (real-time) deelfietsgebruik?' Presented at the Lancering gemeentelijk Deelfiets dashboard, CROW-Fietsberaad, Utrecht, 25/04/2019<br>Haan, Dirk Jan de. 2018. 'Het Deelfietsconvenant Openbike Brengt MaaS Voor Deelfietsen Dichtbij'. Presented at meeting 'Aan de slag met deelfietsen', CROW-Fietsberaad, Utrecht, 13/11/2018 | Maroey, Chris Van. 2019. 'Antwerp's Marketplace for Mobility'. Presented at the Polis Network, 27–28/11/2019, Brussels. https://www.polisnetwork.eu/wp-content/uploads/2019/11/4F-Chris-Van-Maroey.pdf<br>City of Antwerp. 'Smart Ways to Antwerp/Slim naar Antwerpen – Webinar NXTMobility'. 29/04/2020 (https://www.youtube.com/watch?v=lgacUjyRlSs) | Tuli, Apaar and Oxley, Brylie (MaaS Global/Whim). 'Designing the Future of Urban Mobility'. Presented at Data-Driven Design Day, 19/09/2018 (https://www.youtube.com/watch?v=8W5ljbKgjLQ) |
| **Apps** | – | Slim naar Antwerpen iOS app (https://apps.apple.com/be/app/slim-naar-antwerpen/id1343247830?l=nl) | Whim iOS app (https://apps.apple.com/fi/app/whim-all-your-journeys/id1110962965) |

(*continued*)

(continued)

| | Case: The Netherlands (Deelfietsdashboard) | Case: Antwerp (Marketplace for Mobility) | Case: Helsinki (Whim app) |
|---|---|---|---|
| **Websites** | Websites: CROW (crow.nl), Deelfietsdashboard (deelfietsdashboard.nl), Openbike (openbike.nl) | Smart Ways to Antwerp (slimnaarantwerpen.be) | Whim (whimapp.com), Helsinki Smart Region (helsinkismart.fi) |
| **Grey literature (reports and corporate literature)** | Mingardo, G., M. Streng, and J.J. Witte. 2017. 'Een deelfiets voor de Hele stad: Een onderzoek naar de kansen en uitdagingen voor Een Stadsbreed deelfietssysteem in Rotterdam'. RHV Erasmus Urban, Port and Transport Economics | Broer, Karin. 2016. 'Fietsdeelsystemen in Antwerpen: Het success van de Velo'. CROW-Fietsberaad (https://www.fietsberaad.nl/CROWFietsberaad/media/Kennis/Bestanden/CROW-Fietsberaad_notitie_excursie_huurfietsen_antwerpen_mei-2016.pdf?ext=.pdf) | Kanger, Laur, and Paula Kivimaa. 2017. 'Transformative Innovation Learning History: Finland - The Emergence and Consolidation of Mobility-as-a-Service in Finland'. Transformative Innovation Policy Consortium (http://www.tipconsortium.net/wp-content/uploads/2019/04/finland-TLHC-v5.pdf)<br>Ramboll, and MaaS Global., 2019. 'WHIMPACT: Insights from the World's First Mobility-as-a-Service (MaaS) System'. Helsinki: Ramboll (https://ramboll.com/-/media/files/rfi/publications/Ramboll_whimpact-2019.pdf) |
| **Academic sources** | Petzer et al. (2020), van Zessen (2017) | Kishchenko et al. (2019) | Ache (2011), Audouin and Finger (2018), Heikkilä (2014), Kivimaa and Rogge (forthcoming), Surakka et al. (2018) |

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