Public transport and media innovation:

a platform perspective

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Abstract

This research examines how public transport companies can innovate their business models by investigating how platform principles could be used to add value to their customers. Platform principles are basic concepts that explain general characteristics and practices of online platforms. The increased usage of online platforms has impacted various industries, disrupting existing business models and market structures. With respect to public transport and mobility in general, online platform are becoming the main access points to mobility while at the same time they also facilitate new forms of mobility and integrate these with existing types of transport. Within literature addressing online platforms, most studies focus on the question how platforms as external parties enter and affect existing markets. This research seeks to contribute to this literature by adopting the viewpoint of public transport companies within such existing market. Given the growing importance of online platforms in today's society and their potential to rearrange the way mobility is organised, it is essential for public transport companies to reconsider their strategies. Instead of letting the entrance of external online platforms happen to them, *how can public transport companies in the Netherlands strategically make use of platform principles to innovate their business models?*

To answer this question, semi-structured interviews were conducted with ten experts whose field of expertise relate to strategy in public transport.
The findings reveal that application of platform principles by public transport companies has the potential to create a significant amount of added benefit for passengers. As public transport generally operates according to fixed routes and timetables, tailored communication and help on how such inflexible type of transportation fits one's personal needs can truly add value. Where public transport companies typically tended to focus on efficiency of their operations, platform principles provide the means to shift towards a more passenger centred view and respond to increasing importance of platforms within the mobility sector. Furthermore, by applying platform principles, public transport companies can contribute to the organisation of integrated mobility services, which is often referred to as mobility-as-a-service (MaaS). Within such a system, public transport companies can aim for different strategic positions. This research identified several factors that are of significance in this strategic process.

KEYWORDS: online platforms, public transport, mobility-as-a-service, business model innovation, public transport companies

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1 – Introduction

"The most important transportation innovation of the decade is the smartphone" (Goldwyn, 2014). Today, almost every trip in a city begins with a phone. All sorts of mobile apps allow people to do everything from comparing different route options, booking a taxi, or checking the real-time location of a delayed train. These services are facilitated by the media innovation of online platforms; online infrastructures that connect users and suppliers (Van Dijck, Poel, & De Waal, 2016). The spread of portable personal communication devices such as smartphones, and access to mobile internet has boosted the number of online platforms that offer services related to transportation (Aguiléra, Guillot, & Rallet, 2012). Most of these platforms act as communication channels of travel information and facilitate the emergence of an increasing number of shared mobility initiatives such as bike sharing or ride-hailing (Lisson et al., 2017, Meyer & Shaheen, 2017). Most important however, is the ability of platforms to integrate the services of different modalities into tailored mobility packages, often referred to as "mobility as a service" (Van Themsche, 2016; Jittrapirom et al., 2017). Several studies even show that online platforms for passenger transportation have the potential to change the way our entire transport is organised (Hietanen, 2014; Snellen & de Hollander, 2017; Van Dijck et al., 2016).

This fits in the broader trend of platforms intertwining more and more with many elements of society. Accordingly, Van Dijck et al. (2016) state that we are starting to live in a "platform society". In this society, platforms, as a media-related innovation, are entering other industries in society and start challenging business models of existing industries and the way society is organised today. Transportation is one of these industries. This disruptive behaviour of online platforms requires for "more research dedicated to detailing how this particular coming together of socio-technical and business practices manifests itself in concrete terms for specific enterprises" (Langley & Leyshon, 2016, p.3) as well as for investigation on how at the same time public values can be safeguarded (Van Dijck et al., 2016).

Even though in academic literature, research about online platforms is rising, the amount of literature devoted to this field is still quite small and mainly applies a generic approach, focusing on general theoretical concepts rather than the application of the phenomenon on specific cases (Van Dijck et al., 2016; Langley & Leyshon, 2016). The discourse is often centred around the promising aspects of the online platforms (Van Dijck et al., 2016) including in particular the fact that platforms empower the individual through technological innovation, which adds value for consumers and entrepreneurs (TNO, 2015; Van de Glind & Van Sprang, 2015). Platforms, for instance, could make certain governments and institutes redundant since citizens can manage their own business via platforms which is one of the key principles of what is called collaborative consumption or sharing economy (Botsman & Rogers, 2010). This empowerment of the individual could lead to more sustainable transactions against lower costs (TNO, 2015; Van de Glind & Van Sprang, 2015).

Besides, online platforms accommodate equality between consumer and producer, allowing organisations to innovate faster (Kreijveld, 2014). More recently, negative aspects of this platformisation are discussed more and more (Van Dijck et al., 2016). A big topic in this debate are privacy- and security issues which relate to the vast amount of user data collection by platforms (Fuchs et al., 2013; Van Dijck, 2013). Another important issue is the behaviour of platforms with respect to laws, regulations and the included protection of public interests. Platforms are often perceived as intrinsically open, neutral, and transparent which in fact they often are not (Morozov, 2013; Van Dijck et al., 2016).

Within literature addressing online platforms, most studies focus on the question how platforms as external parties enter and affect existing markets. Less research is conducted on how industries themselves can anticipate to the rising importance of online platforms. This research seeks to deal with this literature gap by exploring how this coming together of online platforms and transportation "manifests itself for specific enterprises" within the mobility sector by taking a business-oriented viewpoint. In other words, instead of letting the entrance of external online platforms happen to them, how can companies within that sector make use of the principles that make online platforms successful in order to improve their business models?

Such a question is particularly relevant from the perspective of publicly related companies like public transport companies. If online platforms have the potential to change the entire organisation of mobility but at the same time are criticised for their behaviour with respect to public values such as privacy, application of platform principles by public transport companies could be an interesting option from a societal perspective. Besides, public transport is already surrounded by many online platforms, since aspects like ticketing and travel information match very well with the possibilities that platforms can offer. In addition, public transport is by definition entangled with public values as it offers transportation for the public. Just like the fields of education and news media, public transport is a field where business- and public interests come together, which makes it particularly prone the impact of the "platform society" (Van Dijck et al., 2016).

Given the above-elaborated perspective, this research examines how public transportation companies can respond to the rising importance of online platforms within their sector. This is done by exploring how public transport companies can learn from the practices of online platforms to innovate their own strategy and business model since, in case of an industry facing great changes through the rise of new technologies and product improvements, it is essential for companies to adapt their strategy (Karagiannopoulos, Georgopoulos & Nikolopoulos, 2005; Teece, 2010). To describe the essential practices and characteristics of online platforms, four platform principles as introduced by Van Dijck (2013) and Van Dijck et al. (2016) are used. The research question of this Master thesis then becomes:

How can public transport companies in the Netherlands strategically make use of platform principles to innovate their business models?

Following the framework of Ostenwalder & Pigneur (2010), several elements from the Business Model Canvas are used to construct five sub-questions:

1. *How can platform principles be used by public transport companies to improve customer segmentation?*
2. *How can public transport companies strategically make use of platform principles to innovate their value propositions?*
3. *How can public transport companies strategically make use of platform principles to improve the relationship with their customers?*
4. *How can platform principles be used within the channel strategy of public transport companies?*
5. *How can public transport companies strategically make use of platform principles to create additional revenue streams?*

To answer these questions, semi-structured interviews were conducted with ten experts whose field of expertise relate to strategy in public transport. All of the interviewed experts are involved in the Dutch public transport sector. This suits the research's aim of exploring innovation possibilities through platform principles as the Dutch can be considered pioneers in this field. Several public transport innovations in traffic signals, timetable management, and ticketing find their origin in the Netherlands (Turnheim et al., 2015).

This thesis is structured as follows. In the next chapter, relevant literature is examined to construct a conceptual framework that provides the theoretical background for answering the different sub-questions. The third chapter explains the research design which includes a description of how the experts were interviewed and how the gathered data was analysed. The results of this analysis are then presented in the fourth chapter from where the research question is answered in the final chapter.

2 – Theoretical framework

The various concepts mentioned in the introduction are discussed in more depth in this chapter, aiming to construct a conceptual model for this research. This process starts with examining what online platforms are and by examining the trends on how online platforms interact with public transport in more detail. Next, the focus shifts to how public transport companies can anticipate to the identified trends by including literature on strategy. The framework is then finished by adding elements from the business model canvas, which can be used to structure the operationalisation and the gathered data in later chapters.

2.1 Defining online platforms

To identify a workable set of platform principles, it is worth looking at a definition of online platforms first. In constructing a definition of an online platform, different aspects can and should be taken into account (Gillespie, 2010; Srnicek, 2016). A definition that incorporates the relevant perspectives for this research is the definition by Van Dijck et al. (2016). They define an online platform as:

"a technological, economic, and socio-cultural infrastructure that enables facilitating and organising of online social and economic traffic between users and suppliers using user data as fuel" (p.11).

From a technical perspective, an online platform is used as a computational term which relates to digital infrastructure that supports usage of applications. Online platforms, in that case, consist mainly of software, like for example operating systems or online platforms such as social media networks. On the other hand, hardware, like mobile devices or gaming devices, can be considered as a platform as well (Gillespie, 2010). In this research, the focus will be on digital platforms that consist of software.

Online platforms can also be considered a media innovation as they (rigorously) "change several aspects of the media landscape" (Storsul & Krumsvik, 2013, p.16). The success of online platforms originates to a large extent in the media industry itself, in particular, because social media network sites were part of the first wave of flourishing online platforms (Gillespie, 2010; Langley & Leyshon, 2016). At the same time also more traditional media sectors, like the music industry, have been disrupted by the paradigmatic innovations caused by platforms, changing organisations' value propositions and business models (Francis & Bessant, 2005; Storsul & Krumsvik, 2013).

Considering the rise of the platform society (Van Dijck et al. 2016), this media innovation of online platforms is entering other industries as well. Like the above-stated definition of online platforms mentions, (user) data is a crucial component of an online platform and as Parker et al.

(2016) state: "practically any industry in which information is an important ingredient is a candidate for the platform revolution" (p.11). Also in transportation, generation and collection of data are becoming more important (APTA, 2016; Snellen & De Hollander, 2017), which explains the identified potential for the media innovation of online platforms to impact the sector of transportation.

Apart from the technical and media perspective, an important third perspective from which online platforms can be examined needs to be included. This is the economic perspective which heavily influences the way platforms the online social and economic traffic (Van Dijck, 2013). Online platforms offer new business model options that allow for the creation and exchange of value by connecting people and resources (Parker et al., 2016). By making use of the possibilities offered by both the technical infrastructure and the social networks that are constructed using this infrastructure, online platforms act as multi-sided markets, in which multi-sided platforms connect groups of users or customers (Boudreau & Hagiu, 2008; Rochet & Tirole, 2006; Rieder & Sire, 2013). The unique aspect of online platforms is that they not only connect the different actors in the multi-sided-market but that they are also "coordinating the network effects of connectivity" (Van Dijck, 2013; Langley & Leyshon, 2016), they actively organize how connections are made and to whom each user can connect. The collection, usage, and exchange of user data plays a crucial role in this coordinating process (Parker et al. 2016, Srnicek, 2016; Van Dijck et al. 2016).

All in all, defining online platforms thus requires the inclusion of the perspectives of technological infrastructure, media innovation, and economy. The definition by Van Dijck et al. (2016) incorporates these different perspectives and forms the foundation from where several platform principles can be listed.

2.2 Platform principles

Platform principles, in this case, are considered to be basic concepts that explain general characteristics and practices of online platforms. Four principles are distinguished: interconnectedness, datafication, commodification, and selection. Interconnectedness is an essential property of online platforms (Van Dijck, 2013), whereas the latter three principles describe how platforms operate and were presented by Van Dijck et al. (2016) as platform mechanisms. The next parts of this section separately discuss each principle as well as how it relates to the other principles.

2.2.1 Interconnectedness

The rise of online platforms is a result of the emerging network society enabled by the development of internet communication technologies (ICT) (Van Dijk, 2012). Being in fact a product of the network society, platforms do not operate as lone wolves, but instead constitute an "ecosystem" of interconnected platforms (Van Dijck, 2013), which is one of the reasons for their increasingly

important role in society (Parker et al., 2016). Not only do they connect user activities to content and advertisers (Van Dijck & Poell, 2013), they also connect with each other.

Due to the gigantic scale on which this process of connecting is taking place, massive network effects have led the current ecosystem to be dominated by four American platforms: Google, Amazon, Facebook, and Apple (Van Dijck et al., 2016). Many platforms depend somehow on (one of the platforms of) these big players. To get access to, for example, the smartphone application of Uber, a user needs to use Google's Play Store or Apple's App Store (Nieborg, 2015).

As the ICT infrastructure expands, more devices get connected to the internet, and more aspects of people's lives are interacting with online platforms, which in turn results in societal processes being arranged more via these platforms. Ecosystems of platforms are increasingly entering society (Parker et al., 2016; Van Dijck et al., 2016). Van Dijck et al. (2016) therefore introduce the concept of the "platform society": a society in which "public, social, and economic traffic flows via online platforms" (p.31). As was mentioned in the introduction, transportation is one of these domains of society that is starting to get included in this platform society.

All in all, the platform principle of interconnectedness shows that online platforms are useless without their ability to facilitate connections between users, other platforms, and themselves. It also explains how platforms are increasingly interfering in societies. Furthermore, interconnectedness is an essential requisite for the practices of online platforms as it facilitates the gathering and exchange of data which is the "fuel" that keeps the ecosystems of platforms running. Handling of data by platforms is what constitutes the next platform principle.

2.2.2 Datafication

As stated in the definition of online platforms, data is heavily exchanged between platforms, but also between users. Datafication is facilitated by the digital, interconnected infrastructure that allows for the constant circulation of data, using algorithms, protocols and interfaces (Helmond, 2015). Van Dijck et al. (2016) distinguish two kinds of datafication.

The first kind involves datafication as the competence of online platforms to capture phenomena by quantifying, interpreting, and predicting them (Mayer-Schönberger & Cukier, 2013). The idea of collecting data about (media) usage and users is, however, not new as traditional mass media also apply datafication to serve the customer best and to target advertisements (Napoli, 2011). The difference with datafication by online platforms is the intensity of collecting and the possibilities for analysis of these data. Any action of a user on a platform is automatically recorded, standardised, and saved, mainly for the commercial purpose of personalising advertisements. Important to notice in this process is that these data are not "raw" (Gitelman, 2013). They are affected by the platform itself since the design of the platform provides a certain framework for the user-action to take place, buttons (thumb) and word limits (tweet) limit the expression intended by the user. Nevertheless, data-analytics is widely used nowadays. Especially the fact that the data can often be observed and

analysed on a real-time basis makes them valuable resources to many organisations, both from a commercial and from a public perspective (WRR, 2016).

The second kind of datafication is about the way users and platforms use data to direct their actions (Van Dijck et al., 2016). The real-time aspect of circulating data gives enables users to observe and interact with certain data on the platforms. Using fitness apps, for instance, allows users to continually measure and compare their performances with that of others. Not only is datafication constructed through this personal kind of communication, but also via mass communication. Social media can "add a real-time data dimension to mass media's notion of liveness" (Van Dijck & Poell, 2013, p.10). Van Dijck et al. (2016) provide the example of the news industry. In case of trending topics, not the news value of individual posts count, but instead the size of the flow of posts. These trending topics on its turn are presented to other users because it is trending, which amplifies the trendiness. This way, datafication is not only about platforms collecting user data but also how data, whether observed by a user or processed by an algorithm, is used to direct new actions.

Datafication is strongly connected to other platform principles (Van Dijck et al., 2016). As discussed previously, the continuous circulation of data between actors is facilitated by a technological interconnected infrastructure. Besides, the design of this infrastructure is strongly dependent on the platforms' business models, which are discussed in the next principle.

2.2.3 Commodification

Commodification is about making something into a commodity, something that can be used to trade with (Van Dijck et al., 2016). The platform ecosystem is built on a commercial basis (Van Dijck et al. 2016) and, as mentioned earlier when discussing the definition of platforms, the relations between platforms and their related actors can be considered as multi-sided markets. Within this multi-sided market Van Dijck et al. (2016) distinguish two types of commodification. The first type relates to how platforms bring together supply and demand of platform users and owners. The second type deals with the commodification of interaction through the collection of user data. The next paragraphs explain these two types of commodification into more detail.

The marketplace

Online platforms provide new possibilities to match supply and demand, both for commodities sold in offline shops as well as for the creation of new commodities, like creating the earlier mentioned new mobility options. These new possibilities can be linked to new types of business models, referred to by Langley and Leyshon (2016) as platform capitalism.

To better understand platform capitalism and explore the possibilities of commodification Langley and Leshon provide a useful distinction between several domains of circulation and accompanying platform types. The first domain is that of the online exchange markets, at which products and services are sold. Secondly, the domain of social media and user-generated content is distinguished.

Here, it is about the creation and the (online) interaction with content. Thirdly, Langley and Leyshon mention the domain of the sharing economy. In their article, they use this concept as an umbrella term. According to Frenken and Schor (2017), such usage is often confusing but "self-propelling due to the performativity of the term itself". This is because "platforms want to be under the big tent of the 'sharing economy,' particularly because of the positive symbolic value of sharing." (p.4). In other words, the term sharing economy is often used as a buzzword that describes much more than what the real sharing economy is about.

Frenken et al. (2015) define the (real) sharing economy as "consumers granting each other temporary access to under-utilised physical assets ("idle capacity"), possibly for money." (Frenken et al. 2015, as cited in Frenken & Schor, 2017, p.5). This is thus about sharing physical assets, like offering a car via Snappcar. Other related marketplace interactions that are commonly put under the big tent of the sharing economy can be split and put under the remaining domains in the typology by Langley and Leshon. Offering rides on Uber, for instance, is not about physical assets, but about offering a service and can, therefore, be put at the on-demand service and crowdsourcing domain. The last domain consists of crowdfunding and peer-to-peer (P2P) lending that encompasses financial transaction like donating, lending, and investing. Table 2.1 presents an overview of the resulting typology of marketplace commodification on online platforms.

Table 2.1 - Typology of platform types that operate in different domains of digital economic circulations. Adopted from combining the categorizations of Frenken et al. (2015) and Langley & Leyshon (2016).

Domain of circulation	Platform type
Online exchange markets	Marketplaces for the sale of products and services. Exchange happens through physical distribution, downloads, or streaming. Examples: Amazon, Marktplaats.nl, Spotify
Social media and user generated content	Platform that invites user communities to post and interact with content Examples: Facebook, Twitter, Youtube
Sharing economy	Marketplace for consumer-to-consumer hire of physical assets that would be underused or not even recognised as such. Examples: Airbnb, Snappcar, Peerby
On-demand economy and crowdsourcing	Marketplace for consumer-to-consumer hire of services that would be underused or not even recognised as such, and for transactional or contractual work Examples: Uber, Lyft, TaskRabbit
Crowdfunding and P2P lending	Marketplace for donating, pledging, lending or investing money Examples: Kickstarter, Zopta

Commodifying interaction

This type of commodification is intertwined with the platform principle of datafication and can, therefore, be split in data commodification by users and data commodification by platforms (Van Dijck et al., 2016). Data commodification by users is about self-promotion, also described by the phenomena mass self-communication (Castells, 2009). As users are continuously exposed to statistics about their online activity, they start thinking of themselves as 'products' that need to be marketed (Marwick, 2013). Users of platforms therefore constantly try to obtain as much as possible followers to promote themselves. The goal of this self-communication is to obtain either economic capital or social visibility and recognition (Ellison, Steinfield & Lampe 2011).

The other type of commodifying interaction, data commodification by platforms, is the most important type of commodification. As stated, the platform ecosystem is built on a commercial basis using user-data as fuel. Where platform users do not necessarily obtain more economic power through commodification, the online platform themselves do (Van Dijck et al., 2016). Platforms have transformed the world of advertising. For the biggest platforms like Google and Facebook selling user-data is the primary source of income (Ingram, 2017).

These commercial intentions of (most) online platforms should not be neglected (Van Dijck et al., 2016). Though platforms often appear to be neutral marketplaces, they are not. Platforms play an active role in framing the "market encounters" on their marketplaces (Çalişkan and Callon, 2010). This is what the last platform principle is about.

2.2.4 Selection

Datafication and commodification are inextricably linked with the fourth principle: selection. As stated in the used definition of Van Dijck et al. (2016), platforms do not only facilitate online social and economic traffic; they also organise it. The unique aspect of online platforms is that they not only connect the different actors in the multi-sided-market but that they are also 'coordinating the network effects of connectivity' (Van Dijck, 2013). It is what Langley and Leyshon (2016) refer to as 'the intermediary logic of the platform'. By using algorithms and user data as input, platforms can personalise the content for and interaction with its users.

However, it is not just the algorithms of platforms that contribute to the selection principle. Similar to the principles of datafication and commodification, the process of selection is about the interaction between the platform itself (through is algorithms and layout) and the users (through their (re)actions). So although algorithms are at the basis of the process of selection, the users of platforms themselves contribute to selection as well. Like mentioned at the principle of datafication, users themselves select their action and thereby contribute to for example the trendiness of topics. This provides popular users with power since their activity is likely to be amplified by the algorithms that often promote content that generates a lot of activity. This effect is theorised by Merton (1968) as the rich get richer effect.

A big question regarding the selection mechanism is: according to which motives do platform organise this social and economic traffic (Van Dijck et al., 2016)? In other words: how are supply and demand matched? This question was presented earlier and relates to one of the challenges online platforms pose to public transport companies. The exact configuration of the algorithms that execute the selection is often top-secret (Pasquale, 2015) and usually their selection is not the most democratic solution (Van Dijck et al., 2016). For the case of transportation, this is often about the complex situation of serving public values as well as private (commercial) ones. An example of such a complicated situation is the case of Uber's dynamic pricing just before the arrival of hurricane Sandy in New York in 2012. As people wanted to escape the city, prices for rides using Uber went up to eight times higher than the regular rate. Uber explained this was to stimulate the supply of ride offerings, whereas others argued that Uber just wanted to profit from the increased demand, leaving people with no choice but to take a ridiculously expensive ride (Lowrey, 2014). It is remarkable that Uber's dynamic pricing algorithms automatically raised the prices.

Besides the topic of how platforms bring together supply and demand, another relevant topic to discuss with respect to the application of this principle onto the field of transportation is the role of reputation systems. An essential requirement for economic or social transactions is the guarantee of trust (Van Dijck et al., 2016). From the perspective of (public) transportation, this is primarily about the quality of the trip (operator side), but also about identification (traveller side) (Van Themsche, 2016, Van Lierop, 2017). To accommodate this requirement, online platforms organise trust by creating selection mechanisms that making use of the wisdom of the crowds (Van Dijck et al., 2016). Suppliers and consumers can rate each other, usually by giving them a score between 1 and 5. This way, a reputation system that measures the reputation of users and commodities is created.

The relevance of the reputation systems is about the fact that online platforms are thus able to arrange the required level of trust for the transactions on their marketplaces without traditionally needed rules and regulations from an authority (Van Dijck et al., 2016). Given the link between authorities and public transport combined with the earlier discussed interactions between platforms and transportation, this poses questions to both governments as well as public transport companies about how public values can be guaranteed in this online environment (Sundararajan 2014; Van Dijck et al., 2016).

All in all, the principle of selection thus describes how framing occurs in market encounters on online platforms. This occurs on the one hand through the configuration of the infrastructure of the platforms and on the other hand through the interaction among the users of the platform and the platform itself. Given the commercial intentions as examined at the principle of commodification, awareness of according to which rules and values this framing functions is important.

Now that these four platform principles and a definition of online platforms have been examined, the next step in constructing a theoretical framework is to explore literature that provides theory on how online platforms are posing challenges for public transport companies.

2.3 Online platforms in public transportation

As was mentioned in the introduction, online platforms for passenger transportation have the potential to change the way our entire transport is organised (Hietanen, 2014; Van Themsche, 2016; Van Dijck et al., 2016; Snellen & de Hollander, 2017). To explore this potential, the current interaction between online platforms and the domain of transportation is examined. Using the results of several studies, three types of interaction can be distinguished. Each type of interaction poses several challenges to public transport companies.

2.3.1 Platforms becoming access points

In the first place, online platforms engage in transportation by being a communication channel for the traveller (Lisson et al., 2017; Van Dijck et al., 2016). The easy accessibility of platforms via ICT devices, especially the smartphone, provides the traveller with access to all kinds of information regarding his trip. These communication platforms can be owned by transportation companies (like NS-reisplanner), be part of a big online company (such as Google Maps or Facebook Messenger), or be an independent party (like Flitsmeister). At the moment, the communication mainly consists of providing travel information, trip planning advice, and customer support (Lisson et al., 2017). In the future, however, more elements such as payment and identification could also be part of this communication (Lisson et al., 2017). Besides, information is communicated by the traveller himself. For example, Flitsmeister, an app for information about speed traps and traffic jams, bases its advice both on data acquired via their user's input and via government provided data (flitsmeister.nl).

The main point here is that platforms, from whatever party, are likely to become the main gateway to mobility (Hietanen, 2014; Van Dijck et al., 2016; Van Themsche, 2016). Having continuous access to travel information via apps on a pocket-size computer provides an enormous amount of convenience and possibilities with respect to travelling. That is why this thesis started with a quote about the smartphone being one of the most significant innovations in transportation. But what does it mean for public transportation companies that every trip nowadays starts with a smartphone? According to Van Dijck et al. (2016), particularly the fact that platforms not owned by public transport companies could be getting in charge of matching demand and supply poses challenges, which relates to the platform principle of selection. Example: when planning a trip using Google Maps, why is an Uber-ride shown as an option and a regular taxi-ride not? It is because Google is an investor in Uber. Google is a commercial company. This makes platform Google Maps not an open

and neutral platform, which is often neglected by people that just use it to plan their trip (Van Dijck et al., 2016).

The challenge for public transport companies here is thus about how these companies manage the communication of their transport supply to their potential customers (Van Themsche, 2016). As mentioned at the principle of commodification, the commercial interests of most online platforms should not be neglected. Hence, there is need for public transport companies to think about how they can use the platform principle of selection.

2.3.2 Platforms as a catalyst for shared mobility

The second way platforms engage in transportation is by creating additional transport supply, which is embedded in the broader trends of platforms shifting consumption from ownership to access (Van Dijck et al. 2016). The additional supply is created in two ways. Platform companies can offer vehicles for rent, typically bikes or cars that can be picked up at specific locations (like Greenwheels) or anywhere the previous user left it (like Obike's free-floating sharing system). Travellers can use these vehicles by accessing the specific online platform. The second way platforms create supply is by applying the principle of collaborative consumption (Van de Glind & Sprang, 2015), which was identified as one of the promising aspects of platforms discussed in the introduction. In doing so, platforms allow individuals to 'unlock the value of underused property and services' (Van de Glind & Sprang, 2015), for instance by renting their car (Snappcar), or by becoming a taxi-driver (Uber). Platforms then (by being an access point) bring together those that want to offer transport possibilities and those that want to go from A to B, which is, in fact, the application of interconnectedness. A key success factor, particularly for the service-based collaborative consumption of transport, is the enabling of on-demand services by the availability of real-time access to travel information (Lisson et al., 2017).

Regarding the perspective of public transportation, these new entrants on the one hand create competition for the traditional modes of public transport, especially within urban areas (KiM, 2016). The offerings by these new mobility platforms are often more flexible and accessible than those offered by train, tram, metro or bus (PBL, 2017). Instead of offering scheduled departures, platforms can offer on-demand-services. Instead of having fixed locations for access and egress, platforms can offer (in many cases) door-to-door transport. And instead of the need for a ticket or a dedicated card, mobility platforms include booking, ticketing, and payment all in one smartphone app. On the other hand, the shift in culture from owning a vehicle to using shared services also increases the likelihood people will use public transport (APTA, 2016). Besides, mobility platforms are suited to complement traditional public transport (APTA, 2016).

In short, the development of platforms as new entrants in the total supply of transport poses two challenges for public transport companies. The first challenge is about how to respond to the entrance

of these new transport suppliers that often offer more flexible and accessible services than public transport.

The second challenge concerns the trend of increasing demand for access-based mobility. Like stated, shared mobility initiatives could complement public transport (APTA, 2016). This is strongly linked to the platform principle of interconnectedness and the third way platforms are interacting with transportation.

2.3.3 Platforms as integrator

This third way deals with the integration of different kinds of transport supply (Van Dijck et al., 2016). As the platform principle of selection showed, platform actively organise the connections they facilitate. Integration takes place in two ways that are closely connected to the two developments described in the previous subsections. Firstly, the new mobility options offered by platforms described in the previous subsection can get integrated into the supply of existing types of transport. The on-demand transport services of the platforms seem particularly suited to for the access and egress of transportation modes that operate between fixed locations like rail-bound- and air traffic. KLM, for instance, offers the possibility to already book an Uber driver within their ticketing system (Van Dijck et al., 2016) and in Dallas, the regional public transport system Dallas DART cooperates with Uber to get people to and from the stations, increasing its service area (Jaffe, 2015).

Secondly, new platforms emerge that aim to integrate all transport options into one environment from where the traveller can pick the prefered way of going from A to B. This concept is often referred to as Mobility-as-a-Service (MaaS) (Hietanen, 2014). MaaS can be seen as the Netflix of mobility. The combination of several modes is offered to the traveller in a tailored 'mobility package'. Ticketing, payment and trip information would all be included on one platform (Hietanen, 2014).

Literature shows that this integration of transport options has several implications for the future of public transportation. An increased range of transport options (Snellen & De Hollander, 2017) allows for future public transportation that can focus on small-scale applications and personalisation of the offered service (KiM, 2016). Besides, Snellen & De Hollander (2017) even pose that due to the rise of these mobility platforms, in the future, "the traditional divide between private and public transport services may become obsolete" (p. 5). Within such new organisation of mobility, several roles could be taken up by public transport companies (Eckhardt, Aapaoja, Nykänen, & Sochor, 2017; Ebrahimi, Sharmeen, & Meurs, 2017), which is discussed into more detail in Section 2.6.2. Here, the challenge for public transport companies is thus about how to respond to the emerging of such integrated organisation of mobility.

To summarise, platforms are interfering in the field of transportation in multiple ways. These interactions are posing challenges for public transport companies. Platforms are becoming the main access points to mobility, requiring public transport companies to consider how their transport

products are offered to their customers. At the same time, online platforms are also facilitating new forms of mobility that are more flexible and often more convenient to use than public transport. Public transport companies are challenged to respond to these new entrants. To do so, the ability of online platforms to integrate different types of transport supply, which was identified as the third way of interaction, could provide possibilities.

The next step in constructing a theoretical framework is to explore literature that provides theory on how public transport companies could anticipate to the presented challenges by making use of platform principles. Therefore the concept of strategy is examined.

2.4 The importance of strategic positioning

In case of an industry facing great changes through the rise of new technologies and product improvements, Karagiannopoulos, Georgopoulos & Nikolopoulos (2005) argue that it is important for companies to adapt their strategy. This is confirmed by Teece (2010) who states that having a dynamic business model should be natural to companies, their business models "must morph over time as changing markets, technologies, and legal structures dictate and/or allow" (p.177). To explore how platform principles can be used by public transport companies to respond to the challenges discussed in the previous section, it is thus important to examine their strategies.

Henderson (1991) describes strategy as "the deliberate search for a plan of action that will develop a business's competitive advantage and compound it" (p.5). Strategy is thus about planning how to acquire a desired position in the market (Porter, 2008). This strategic positioning lets a company think about its position in the market with respect to its mission, vision and core resources (Hooley et al., 2001).

Eisenhardt and Sull (2001) outline three approaches to strategy: companies can either focus on position, resources, or simple rules as a starting point. Focusing on position is about defining where a company wants to be in the market, compared to its competitors, and then start working towards that position. The resource-based view, presented initially by Barney (1991), starts with the primary focus on the own unique resources of the company. So instead of focusing on the question 'Where should we be?' (position approach), the resource-based view focuses on the question 'What should we be?'. The third approach, Eisenhardt and Sull state, should be as simple as possible to enable companies to adapt to changes in the market quickly; therefore this approach focuses on creating a set of simple rules.

Because of several reasons, the resource-based perspective to strategy is applied in this thesis. Firstly, as the discussion of platform principles revealed, the collection, usage, and exchange of user data play a crucial role in the operations of online platforms. User data, therefore, is a crucial resource in considering how public transport can respond to the identified challenges by strategically applying platform principles. Secondly, considering the blurring boundaries between private and public

transport, it is essential for public transport companies to focus on what their own identity should be in this changing sector which requires for a long-term vision, typically associated with the resource-based view (Eisenhardt & Sull, 2001). Furthermore, as the transportation market is getting involved in the informatisation of society (through the rise of platforms and their accompanying principles of datafication and commodification), Kim and Mauborgne (1999) state that companies involved should focus on their own resources first, instead of focusing primarily on competition. Lastly, such focus on own resources first also suits the concession system in which there is no constant competition.

2.5 Business model innovation

To explore how public transport companies can strategically apply platform principles from a resource-based perspective, the focus lies on what resources public transport companies need to have for their strategic position and which resources they can use from third parties. As discussed above, this is in particular about the resource of user data. Acquiring user data is strongly connected to the value proposition that public transport companies offer to and the relationship they have with their customers.

To include these multiple factors within a company's strategy, the next step is to zoom in onto the concept of business models. These models can generally be seen as the translation of strategic concepts (Osterwalder & Pigneur, 2010) into "a conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money" (Osterwalder, 2004, p.15). In other words, a business model describes how a company can create and deliver value in a feasible way by applying its determined strategy.

To explore how platform principles can be used to innovate the business model of public transport companies, a framework that outlines the key elements of a business model is needed (Morris et al., 2005). Such maps of business models can then be used "to clarify the processes underlying them, which then allows them to become a source of experiments considering alternate combinations of the processes." (Chesbrough, 2010, p. 359). The framework used in this thesis is the Business Model Canvas developed by Osterwalder (2004). Figure 2.1 depicts the layout of this framework.

The framework splits the business model into nine components. The core of the canvas presents the company's value proposition. The upper left part of the framework represents how the proposed value is created by specifying the company's key resources, key activities, and key partners. The upper right part is about offering the proposed value to the customer. This is done by describing for whom the value is created (customer segments), by describing the channels through which the customer is reached, and by specifying the desired type of relationship with the customer. The bottom two components cover the financial part of the business model.

key partners	key activities	value proposition	customer relationship	customer segments
	key resources		distribution channels	

cost structure	revenue streams

Figure 2.1 - The Business Model Canvas as designed by Osterwalder (2004).

The framework that the business model canvas offers, is used to structure the explorative process that will allow for answering the research question. In the next session, the most relevant elements of this canvas are examined in more detail from the perspective of public transportation companies and the possible application of platform principles.

2.6 Central elements for adding value

Since the goal of this research is to examine how platform principles can be applied by public transport companies to add value for their customers, this section zooms in onto the business model canvas elements that address the customer side of the business model. The next, therefore, discuss the application of platform principles on the canvas elements of value proposition, customer relationships, channels, customer segments, and revenue streams. The remaining elements key partners, key activities, key resources, and cost structure focus what a company needs to produce the proposed value (Osterwalder & Pigneur, 2010). Since the focus of this research lies on what value can be added for the customer, this production side and its accompanying canvas elements are therefore not taken into account.

2.6.1 Customer segments

"When designing a commercially viable business model […] one needs to distil fundamental truths about customer desires, customer assessments, the nature and likely future behaviour of costs, and the capabilities of competitors." (Teece, 2010, p.187). In other words: to deliver value to the customer, it is necessary to gather knowledge about that customer. That is why together with the value proposition, the element of customer segments is the core of the business model (Osterwalder & Pigneur, 2010). Also noticed by Osterwalder and Pigneur is that this segmentation is often a multi-

sided process as many companies serve several types of customer, which is also the case for online platforms as discussed at the principle of commodification.

Application of platform principles onto this element can be accomplished through the principle of datafication. As discussed, the rise of online platforms is based on this principle which allows for personalising of advertisements. Application of datafication by online platforms is, in fact, an advanced way of customer segmentation and would comply with the mentioned urge for public transport companies to become more market-oriented which requires them to make (more) use of market intelligence (Molander et al., 2012; Van Lierop, 2017). At the same time also privacy is an important aspect to take into account since online platforms do not always behave according to laws and regulations (Fuchs et al. 2013; Van Dijck, 2013).

2.6.2 Value propositions
Value propositions are located at the core of the business model. It describes the value that a company offers in terms of the "technical, economic, service, and social benefits a customer receives" (Anderson & Narus, 1998, p.6). Value is here considered to be "an interactive relativistic preference experience" (Holbrook, 1999, p.5). The total value proposition of a company is the sum of all the different kinds of value that are experienced by the customer (Sandström et al., 2008).

In the explanation of the business model canvas, Osterwalder & Pigneur (2010) provide several examples of value propositions. Aspects that could offer benefit are for example design, brand or accessibility. The identified platform principles could add value to the total value proposition of public transport companies in several ways. These can be categorised in the following propositions:

Personalization
Within literature on consumer value, an emerging trend can be identified that emphasizes the user involvement in the process of creating value (Sandström et al., 2008), which is conceptualised by the concept of value-in-use by Vargo & Lusch (2004). Value-in-use is a co-creation between the consumer and the producer, which implies that resources from the producer "do not have value per se, but that value instead is co-created with the customers when resources are used" (Sandström et al., 2008, p.113). Given this role of the consumer, personalisation of the situations where value propositions can be experienced by the consumer are therefore of high importance.

Sandström et al. (2008) note that an increasing number of value propositions is based on technology. To conceptualise how these technology-based services relate to value proposition and value-in-use, they constructed the framework depicted in Figure 2.2. The application of platform principles can also be considered to contribute to technology-based services as they are grounded in the emergence of omnipresent internet availability. Within the presented framework this technology can be seen as the technical enablers of the value propositions.

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As the model depicts, individual and situational filters exist between the obtained value-in-use by the customer and the value propositions defined by the company. That is how platform principles can play a role. By applying the principle of datafication, public transport companies can obtain information about these filters applied by their customers. That information can, in turn, be used (selection principle), to improve the value proposition of the company, which in the end enriches the service experience and the amount of value-in-use obtained by the customer. A study by Kramer et al. (2014) shows for example how information about such individual filter enables Facebook to influence the user's mood (emotional outcome) by altering the composition of the Newsfeed.

The model by Sandström et al. also shows how personalisation is strongly connected to improving the customer experience. As increasing the obtained value in use is both about functional as well as less functional aspects related to travelling.
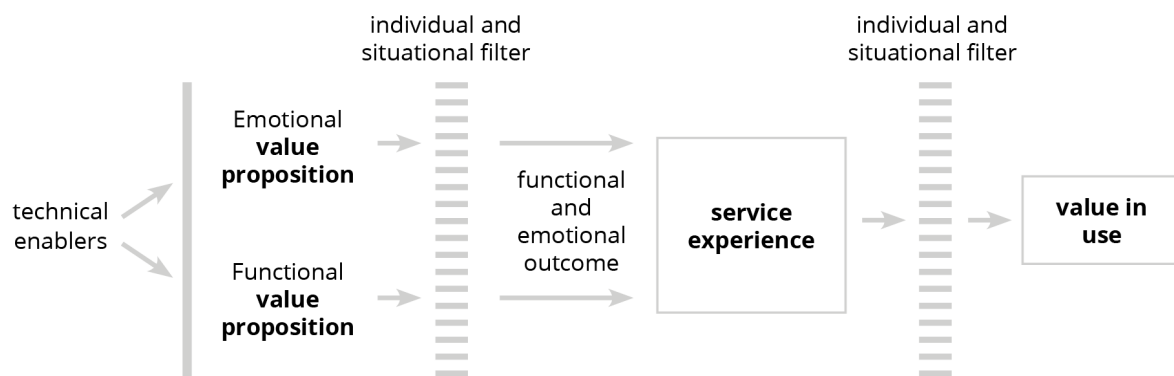

Figure 2.2 - A theoretical framework that explains the total technology-based service experience by Sandström et al. (2008).

Customer experience

Over the last decades, the public transport sector has been characterised by deregulation and increasing competition (Molander et al., 2012), forcing public transport companies and system to become more market-oriented (Fellesson & Friman, 2008). This requires more focus on the deliverance of service to the traveller (Molander et al., 2012).

Traditionally, objective trip characteristics, like costs, duration and distance were considered to be the primary drivers for mode choice and traveller satisfaction (Turcotte, 2011; Van Lierop, 2017). However, more recent research focuses more on the entire passenger experience by taking into account the 'non-utilitarian aspects' of travel. (Van Lierop, 2017). These include aspects like onboard experience, customer service, service delivery, waiting conditions, costs, quality of transfers, image, search resistance, and the perception of access and egress mode (KiM, 2016; Van Lierop et al., 2016).

Platform principles could be used for the creating additional value by focusing on such non-utilitarian aspects of travel. In particular, through the principle of interconnectedness, public transport

companies could add value by joining the ecosystem of platforms and connecting to services regarding for example payment or identification. Also, the principles of datafication and commodification are applicable since the availability of real-time data (datafication) or possibilities to examine different trip options (commodification) can be on the list of value additions, aspects that are all already implemented by shared mobility platforms that were identified to challenge PT companies. All of these applications are strongly linked to the previous proposition of personalisation since personalised improvements of the customer experience are likely to create more added value as shown by the model in Figure 2.2.

Integration with other mobility services
Another way to create new value propositions is by making services available to customers (Osterwalder & Pigneur, 2010). Public transport companies could do so by addressing the identified trend of online platforms offering possibilities for integration with other mobility services that was discussed earlier in this chapter. Such offering of integrated services is strongly linked to the earlier introduced concept of Mobility as a Service (MaaS) and the four platform principles, in particular, the principle of interconnectedness. In such case, the value proposition would be about providing the customer with (access to) other mobility services next to the service of public transport.

Such integrated mobility services can be organised and delivered in several ways, allowing for different forms of business architectures (Ebrahimi et al., 2017). This provides public transport companies with different options on what their specific value proposition will be related to offering integrated mobility as a value to their customers. To structure these possibilities, Ebrahimi et al. (2017) distinguish two "crucial" dimensions, which are displayed in Figure 2.3. The first one deals with:

"whether transport operators should integrate the mobility services within one firm allowing for integrated decision making with respect to the provision of these services or adopt more independent provision of individual services with an intermediary that links the services while individual firms optimise their individual supply processes." (p.4)

The first dimension thus deals with the choice whether or not to start operating additional modalities. Ebrahimi et al. identify several aspects that can influence a company's decision regarding this dimension. From the perspective of the public transport company integration could save costs and effort regarding the investments on capitals (e.g. payment equipment) (Farsi et al., 2007).
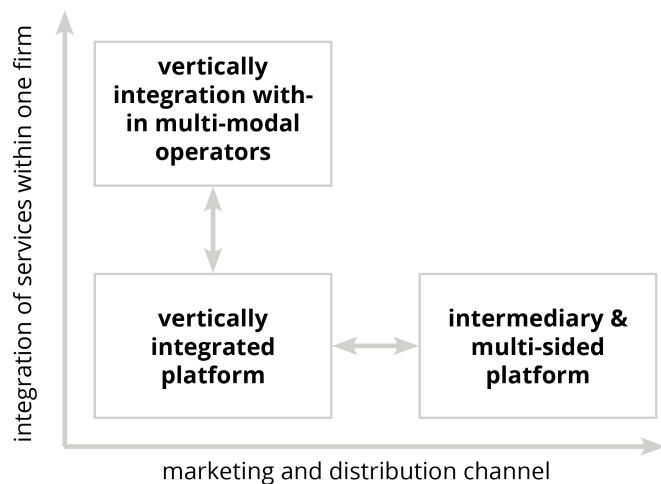
Figure 2.3 - The crucial dimensions for choosing a Business Architecture with respect to integrated mobility. Figure adopted from Ebrahimi et al. (2017).

Rather than having to be compatible with different types of equipment to be able to integrate with other parties, investing in one technology could save costs. This, however, also depends whether the different types of modes are complementary or substitutable to each other (Givoni & Banister, 2006; Economides & Salop, 1992). From the perspective of adding value for the customer, transaction costs (e.g. search for alternatives, amount of effort it takes to pay) and trust are two relevant factors to discuss. The authors state that integration of multiple services could lead to lower transaction costs for the traveller, which is especially the case for a market where these costs are typically high (Teece, 1982). Considering the concept of MaaS, however, it can be questioned to what extent this advantage still exists as the essence of MaaS is to lower the transaction costs of mobility by offering mobility via one platform regardless of how the operation of different modes is organised. Besides influencing the transaction costs, operating multiple services within one firm could also lead to higher trust as multi-service operators can respond better to disruptions in the timetables of specific services by making use other owned transport supply from other modalities (Ebrahimi et al., 2017).

The second dimension in organising integrated mobility on which public transport companies can choose to take a position is about the integration of distribution and marketing channels and involves the question of who will interact with the customer. This could be handled either by companies that also operate (one or more) modalities (vertical integration) like a PT company or by an independent external platform (Ebrahimi et al., 2017; Eckhardt et al., 2017). Considering the goal to add value for the customer, trying to become the platform allows for improving the communication with the customer (Ebrahimi et al., 2017) which at the same time allows the PT company to gain access to a broader audience.

Apart from the two discussed dimensions, another aspect that is important to consider in this process of taking a role in the organisation of offering integrated mobility is the earlier discussed challenge of who is in charge of matching the demand and supply (Van Dijck et al., 2016). Public

transport companies opposed to (most of the) fully commercial oriented mobility platforms are often bound by regulations from authorities to protect certain public values. Within public transport, accessibility is an important public value which can be defined as "the measure to which people have access to transport options and destinations as a means to participate in society" (Snellen & De Hollander, 2017, p.7). The emergence of many new mobility platforms has increased the amount of travel options people can choose from (Snellen & De Hollander, 2017; Van Dijck et al., 2016). Although this improves accessibility to mobility in general, it also causes for increased complexity which could endanger the public value of accessibility. When integrating public transport services with external (private) other services, is thus of major importance to clearly understand the platform principle of selection.

2.6.3 Customer relationships

This element of the business model requires companies to think about what kind of relationship they wish to have with their customers. Osterwalder and Pigneur (2010) give examples of types of relationships like focusing on dedicated personal assistance, self-service, automated services, or co-creation. Gebauer et al. (2010) emphasise the need for public transport companies to view the value exchanged in relationships with their customers to be value which is co-created. From the perspective of the earlier presented framework on technology-based service experience by Sandström et al. (2008), this means that companies should be aware of the personal and situational filters that are important in the creation of value in use through interaction between the value proposition and the customer. Within this relationship between company and customer, platform principles can be applied by focusing on two aspects:

Personal

In the past, tickets for public transport could be bought at a ticket office at stations and employees could help the traveller with travel information. Increasingly, these activities performed by employees have been replaced by self-service machines. Information can be found on websites and smartphone apps. However, as these technological interfaces can also cause for increased complexity, public transport companies should not try to replace the direct interaction with their customer with technology, but instead seek to improve this direct interaction making use of the possibilities that new technology offers (Meyronin, 2004). Linked to the value proposition of personalisation, public transport can apply platform principles to maintain the advantages of self-service while also reviving a more personal relationship with their customer by making use of the datafication and selection.

Co-creation

From the theoretical perspective of creating value-in-use, it is important to include the aspect of co-creation in the relationship between customer and company (Vargo & Lusch, 2004). This also goes

for public transport companies. As a result of a case study on the Swiss railway operator (SBB), Gebauer et al. (2010) state that:

"public-transport operators should increasingly open up their processes and systems to include the active participation of customers. In doing so, public-transport managers should base their customer relationship management primarily on knowledge of the customers (that is, the knowledge that customers possess), [...]. Managers should gain such knowledge directly from their customers, and then ensure that this knowledge is shared and expanded." (Gebauer et al. 2010, p.527)

Platform principles can be used to invite the traveller to share his knowledge with the company. Without user-generated content, most online platform would not exist. By facilitating the process of datafication, public transport companies can enable the traveller to provide input, which can be used by the company to create additional value (commodification). The mentioned rating system discussed in the section on platform principle selection is an example of such mechanism (Van Dijck et al., 2016). By allowing the users to rate each other, users help to create trust, which is an essential element of the social and economic traffic via platforms (Van Dijck et al., 2016).

2.6.4 Channels

"Finding the right mix of channels to satisfy how customers want to be reached is crucial in bringing a value proposition to the market" (Osterwalder & Pigneur, 2010, p.27). Next, to seeking how platform principles can be applied to customer segmentation, value propositions, and the relationship with the customer, the canvas element of channels is therefore included as well, with platforms being the type of channels that are examined. Related to the importance of user data and the identified trend of platforms becoming access points to mobility, the discussion here is not addressing the application of platform principles but instead deals with how strategy on ownership of platforms can facilitate application of platform principles onto other elements of the business model. How the customer accesses these platforms, e.g. via browser, app, smartphone or desktop computer, is not taken into account.

To structure the discussion on channel strategy, it is useful to make use of four functions of channels identified by Osterwalder & Pigneur (2010). The first function is informing, which is about raising awareness and providing the customer with the opportunity to evaluate the offered value propositions. The second function is about enabling the customer to buy specific products and services. Within public transportation, online platforms mainly carry out the first function but are likely also to include the second function soon (Lisson et al., 2017). The third function of channels is that of the actual delivery of value propositions. The discussed application of platform principles to create value propositions is often defining the channel strategy. Considering the value proposition of integration, the choice to offer value by being the owner of the marketing and distribution platform of

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integrated mobility services that consist of own products and services and that of other service operators is, in fact, a channel strategy. Also, the value proposition of personalisation and customer experience are connected to the channel strategy as data gathering is required to offer personalised and customer experience enhancing products and services. Data gathering on its turn relates to ownership of platforms (Van Dijck et al., 2016). Lastly, Osterwalder & Pigneur mention the provision of "post-purchase customer support" (p.27) as the fourth function of channels. Strategy regarding this function can be linked to the previously discussed feedback opportunities that application of platforms principles can facilitate.

To find the "right mix of channels" between offering own platforms or using that of third parties within the transportation sector, several aspects are worth mentioning. The earlier mentioned importance of knowing how supply and demand are matched is important to include, in particular regarding public values that are to be guaranteed by public transport. From such perspective, owning channels would provide more control over this matching process. Making use of partner platforms, on the other hand, could allow for an increased audience that is reached and also could add value to the customer because of the additional value that would be generated from combining the companies own value with that of the partner (Osterwalder & Pigneur, 2010). Another aspect is complexity for the customer. Adding additional layers such as offering products and services could increase complexity for the customer like Kracht & Wang (2010) noted within the tourism sector.

2.6.5 Revenue streams

Public transport companies typically obtain different kinds of revenue streams including revenues from ticketing, subsidies, and sales at stations (Buehler & Pucher, 2011). When trying to apply platform principles to create additional value for the customer, it is also crucial to think about how to capture the created value (Teece, 2010). This is not easy as the economic structures of online platforms pose fundamental questions about "how businesses deliver value to the customer and how they can capture value from delivering new information services that users often expect to receive without charge" (Teece, 2010, p.174).

Platform principles offer several opportunities for public transport companies to increase their revenue streams. Considering the principle of commodification, Van Dijck et al. (2016) list three ways online platforms create revenue: data commodification for personalised advertisements, charging the economic traffic between two parties on the platform and offering paid subscriptions for usage of a service. Public transport companies could apply all three ways. Using data commodification, the value proposition of personalisation could lead to more personalised offers and personalised advertisement could be implemented within the customer experience while travelling (Van Themsche, 2016). Related to MaaS, if PT companies decide to offer transport supply of other parties on their central platform, commissions could be charged (Eckhardt et al., 2017). In addition, rethinking the offering of subscriptions could be an option. In this case of being the platforms that

offers integrated mobility, also the fact that alternatives can be offered in case of disruptions can increase revenue (Eckhardt et al., 2017). Furthermore, the real-time aspect of datafication and interconnectedness can also be used to consider strategies like dynamic pricing, as used in the earlier mentioned example of Uber.

2.7 Conceptual model

To conclude this chapter, the discussed literature in this chapter can be summarised in the conceptual model displayed in Figure 2.4. This model provides an overview of how this chapter has examined relevant theory to discuss the story of public transport companies being challenged by the rise of online platforms. It lists three ways in which online platforms interact with (public) transport and by exploring several principles according to which online platforms and their practices can be characterised. Next, the need for public transport companies to innovate their strategies is outlined, which is further specified in the necessity of business model innovation. Lastly, the business model canvas is used as a framework to investigate directions for how specific innovation can be accomplished.

online platforms in public transport

- platforms as access points
- platforms as catalyst for shared mobility
- platforms as integrator

platform principles

- interconnectedness
- datafication
- commodification
- selection

need for innovation
add value for the traveller by using platform principles

business model innovation
business model canvas

customer segments
datafication
privacy

value proposition
personalization
customer experience
integration

customer relationship
personal
co-creation

channels
channel functions:
- informing
- sales and payment
- delivering value prop.
- customer support

revenue streams
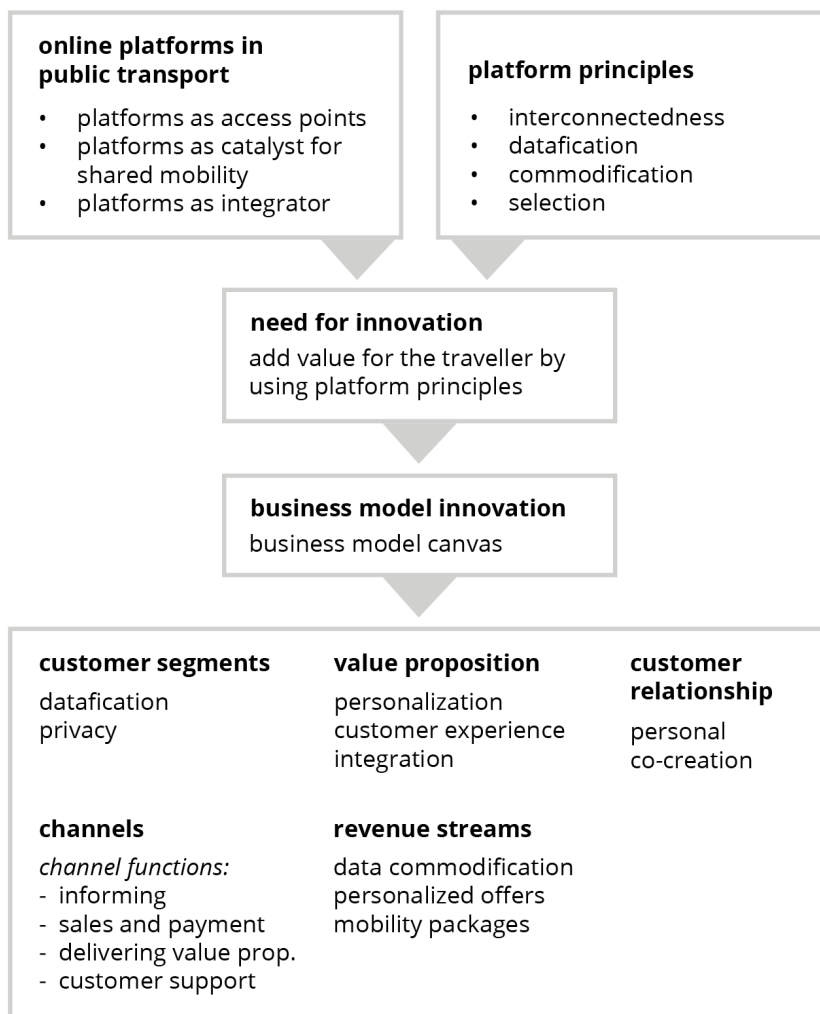data commodification
personalized offers
mobility packages

Figure 2.4 - The conceptual framework

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3 – Methods

This chapter explains how the research question posed in the first chapter will be answered. First, an argumentation is provided on the usage of a qualitative approach and more specifically, expert interviews as a research method. Next, the design of the research is outlined after which the separate elements from the design are discussed in more detail.

3.1 Qualitative research

To answer the research question and its sub-questions, a qualitative approach was chosen because of several reasons. In the first place, given the current state of research on platform principles in the sector of public transportation, qualitative research can be used as an explorative manner to "grasp what is going on in the field" (Boeije, 2010, p.11). In addition, a qualitative approach is suitable in particular to gather data from that field which is not institutionalised yet (Fielding & Thomas, 2008). Applying a quantitative approach would not be satisfactory in such case as this research is not aiming at finding one objective reality, but instead seeks to examine numerous subjective truths (Lee & Al-Hawamdeh, 2002). Using qualitative research provides for the required amount of openness and flexibility to look for ways of applying platform principles in public transportation (Bryman, 2012).

3.2 Expert interviews

To be able to examine the numerous subjective truths, experts interviews were chosen as a method to collect data. Experts provide a 'unique source' of in-depth information on current developments and opportunities in their field (Dorussen, Lenz & Blavoukos, 2005; Rubin & Rubin, 2005) which include the strategic application of platform principles. Besides, given the complex interaction between public and commercial interests between different stakeholders in the public transportation sector, expert interviews are favoured over case studies as they allow for data collection from the perspectives of different stakeholders rather than just those of public transport companies.

3.3 Research design

The setup of the research consists of several steps that enable for conducting the expert interviews. Following Yin (2009), the research design is considered to be "the logic that links the data to be collected and the conclusions to be drawn to the initial questions of the study" (p.24). A schematic overview of the research design is depicted in Figure 3.1. The first step consists preparation for the interviews by constructing an interview guide and a sample of experts. Next, the semi-structured interviews were conducted. Thirdly, the collected data were analysed using thematic analysis and structured using the framework of business model canvas elements from the conceptual model. Each of these elements highlighted in Figure 3.1 is discussed in more detail in the next sections.

Figure 3.1 - Outline of the research design indicating the different steps that were included to use experts interviews as a research method.

3.4 Operationalization: Interview guide

From the literature study in the previous chapter, the theoretical concepts from the conceptual model are operationalised by constructing the interview guide. To reduce the involvement of the researcher's own (subjective) "cultural endowment" (Fielding & Thomas, 2008) in this process of operationalisation, the structure of the interview guide resembles that of the conceptual model and uses the business model elements and its sub-elements as main- and sub-themes. That way, the importance to design the research with the type of analysis in mind (Rubin & Rubin, 2005) is taken into account, since using the same framework as the conceptual model allows for a more systematic comparison between both the results of different interviews as well as between the results and the theoretical concepts. Such systematic approach also increases the reliability of this research.

Besides the usage of the conceptual model as a guiding structure, probe topics from the theoretical framework are added to each interview question "to achieve depth of answer in terms of penetration, exploration, and explanation" (Legard, Keegan, & Ward, 2003, p.141). Table 3.1 presents an overview of the operationalised concepts.

Table 3.1 - Operationalization

Element	Platform principles	Measured by question(s):
Customer segments		
Datafication	Datafication	In what way could public transport companies collect data about their customers? – Why? Probes: Current practices, personal data, access to data, privacy, links to other platforms, increased need for data collection
Value proposition		
Personalization	Datafication Selection	In which ways could personalisation be used by PT companies to add value to their products and services for passengers?

		Probes: Data gathering to personalise offers, real-time data, travel information
Customer experience	Datafication Commodification Selection	How could data-gathering and interaction with data be used to enrich the customer experience? – Why?
	Interconnectedness Selection	How could connecting to other services or online platforms be used to enrich the customer experience? – Why? Probes: Non-utilitarian aspects of travel: onboard experience, customer service, service delivery, waiting conditions, costs, quality of transfers, image, search resistance, and the perception of access and egress mode
Integration	Interconnectedness Datafication Commodification Selection	How could PT companies cooperate with other parties that want to organise Mobility as a Service? – Why? Probes: Integration of services with that of mobility platforms, different interests regarding the match between demand and supply, becoming integration platform yourself, role of the type of modality, customer convenience, experienced complexity

Customer relationships

Personal	Datafication Selection	How could PT companies make use of data to improve the relationships with their customer? – Why? Probes: Personalized interaction, personal situation, the role of self-service
Co-creation	Datafication Selection	How could PT companies involve customers in the development of products and services? – Why? Probes: Feedback, real-time information, rating systems

Channels

Channels	Datafication Interconnectedness Commodification Selection	How could PT companies incorporate online platforms in their strategy? – Why? Probes: Ownership of platforms, ownership of data, match of demand and supply, complexity, channel functions: communication (travel information), sales, customer support, payment and ticketing

Revenue streams

Revenue streams	Interconnectedness Datafication Commodification Selection	How could gathered data and personalised products or services lead to additional revenue streams? – Why?
		Probes: Dynamic pricing, discount, personalised advertisements, subscriptions, special offers, platform fee

3.5 Sampling

To be able to collect data through expert interviews, a sample of experts was constructed by applying the principle of purposive sampling. This means that selected cases, experts in this case, were chosen specifically because they "can teach […] a lot about the issues that are of importance to the research" (Boeije, 2010, p.35). Sample sizes for this kind of research typically remain small (Boeije, 2010; Yin, 2011). Preferably they are determined by the point of saturation (Dworking, 2012; Mason, 2010). However, concerning the feasibility of this Master thesis, the sampling process resulted in a sample of ten experts.

Experts in this research are considered as what Meuser and Nagel (2009) define as a person who "has knowledge, which she or he may not necessarily possess alone, but which is not accessible to anybody in the field of action under study" (p.18). Within the scope of this research, this knowledge or expertise should be related to strategy in public transportation. In addition, Meuser and Nagel note that not every individual that is identified as an expert is a "potential informant" per se. A person can be considered an expert when he "possesses an institutionalised authority to construct reality" (Hitzler, Honer & Maeder, 1994 as cited in Meuser & Nagel, 2009. p.19). In other words, an expert should not only have in-depth knowledge in the field of strategy in public transportation but also hold a position to exert a particular influence within that field. These two characteristics were used as criteria in the sampling process.

Other criteria relate to the explained importance of variety by Yin (2013) as variety provides for different viewpoints on the subject of the research. As mentioned previously, expert interviews were chosen as a method to incorporate the variety of stakeholders within the sector of public transport. Variety within the sample covering these different perspectives is thus included as criteria. More specific, this variety is included in two ways. In the first place, by requiring that the sample should consist of experts that work for PT companies as well as of experts that work for other sector related parties. Since the PT company is the research object of this research, the majority of the sample (7/10) consists of experts working for PT companies. Secondly, to create variety within the group of experts working for PT companies, the included PT companies should vary in the type of operations (modes of transport) and/or operating scale (local, regional, national).

Table 3.2 presents the list of interviews experts. Contacting the selected experts was arranged using the network of two public transport-oriented TU Delft professors within the personal network of the researcher, or else via contacting relevant organisations via social media or websites.

Table 3.2 - List of interviewed experts

#	Name Function	Date interviewed
1	**Ronald Coelman** Product manager travel information at HTM	February 9, 2018
2	**Heimen van Duinkerken** Project manager digital projects at Keolis Nederland and CFO at Keolis Mobilities	February 7, 2018
3	**Theo IJdema** Product manager at Arriva	February 1, 2018
4	**Alexander Kreule** E-commerce manager at Arriva	February 1, 2018
5	**Peter Krumm** Director Strategy & Development at Transdev	February 7, 2018
6	**Joost van der Made** Head of Concept Design & Innovation at Dutch Railways (NS)	January 26, 2018
7	**Niels van Oort** Assistant professor public transport at TU Delft	January 31, 2018
8	**Bas van Os** CEO at Open Ticketing Institute	January 31, 2018
9	**Daniel Paarlberg** Team manager Marketing & Verkoop Reizigers at HTM	February 9, 2018
10	**Marc Stemerding** Program manager mobility services at Goudappel Coffeng	January 29, 2018

3.6 Data collection: Interviews

The interviews took place within three weeks, on average lasting around 65 minutes. The interviews were conducted in a semi-structured way to ensure that the amount of data offered by the expert was not limited by the setup of the interview (Fielding & Thomas, 2008). To that purpose, the interviews were conducted face-to-face as much as possible, which, due to the personal aspect and the fact that it is synchronous, leads to a more effective and useful conversation (Opdenakker, 2006). One interview was conducted via telephone. Several probes for each of the concepts listed in the interview guide were prepared, allowing the researcher to guide the conversation while at the same time give the

respondent the opportunity to expose the maximum potential of his knowledge. To maximise this exposed knowledge, all interviews were conducted in Dutch.

To prevent data loss as much as possible as well as to prevent the researcher from disturbing the interview by the need to make notes extensively (Hermanowicz, 2002; Fielding & Thomas, 2008), all interviews were recorded. Afterwards, the data was transcribed verbatim as quick as possible since the understanding of possible ambiguous statement by the experts will still be fresh in mind. Additionally, verbatim transcription, in comparison to selective transcription, minimises loss of data that could turn out to be valuable in the analysis later in the research process (Fielding & Thomas, 2008). As the interviews were conducted in Dutch, the transcriptions are in Dutch as well. Useful quotes to describe the results are translated as accurate as possible.

Approval of the respondents was gathered in two ways. In the first place approval was gathered by asking experts to sign an informed consent form. Besides approval was gathered, only if preferred by the experts, either by sending the paraphrased statements and used quotes or by sending the transcript for final approval.

3.7 Data analysis

To be able to answer the research question by using the collected data, a deductive thematic analysis was applied. In a deductive approach, the theoretical concepts listed in the interview guide are used as a guide during the process of analysis (Braun & Clarke, 2006). As this research seeks to apply existing theory on digital platforms onto a new field, guidance by theoretical concepts is preferred. Furthermore, a deductive thematic analysis was chosen because it allows for segmentation of the data in a systematic way (Boeije, 2010), which contributes to the reliability of this research.

Given this approach, the data was coded "by viewing the data through a certain theoretical lens" (Boeije, 2010, p.88), also known as 'theoretical sensitivity'. This means that first, the data were grouped into segments, each based on a different theoretical concept from the framework (i.e. the selected elements from the business model canvas) according to which the interview guide was also constructed.

For each of these segments, the data was then coded: all data was carefully read and split into fragments tagged with a code (Boeije, 2010). Axial coding was applied as a next step, aiming to group codes that showed similarity. At that point, within each segment of the framework, data of different experts on the same concept was compared and converted into emerging patterns. Finally, these patterns are connected to their theoretical concept in attempting to "make sense of what is happening in the field" (Boeije, 2010, p.114). The coding process was conducted using the spreadsheet software Google Sheets which allowed for easy organising and comparing of codes and categories.

The results of the coding process produce an in-theory-embedded overview of important aspects and patterns that occur in the data. They are presented in the next chapter.

4 – Results

Following the structure of the conceptual model, this chapter discusses the results that emerged from analysing the interviews. For each element of the business model canvas from the conceptual model, patterns that emerged from combining the answers of the experts are presented.

4.1 Customer segments

As discussed in the theoretical framework, customer segmentation deals with acquiring information about the customer which links predominantly with the platform principle of datafication. In analysing how public transport (PT) companies could make use of datafication, three subthemes emerged from the interviews: data types and sources, getting access to data and the role of customer segmentation.

Data types and sources

Concerning customer data gathering in the public transport sector, several types of data related to passengers emerged during the interviews. Travel data was found to be the most important and most abundant available type of data and was mentioned by all experts. This data, as Van Os illustrates can be split into historical travel data, planned travel data and prospective travel data. Particularly the data that are generated by the OV chip card system were raised during all interviews. For the case of the Netherlands, historical travel data is acquired automatically, mainly through the tap-in tap-out system of the OV chip card. This provides PT companies with a "huge amount of data" (Van der Made). Also Van Oort, Stemerding, Paarlberg, and IJdema explicitly mentioned OV chip card data as the most significant source.

   The second type of data that was distinguished by the experts relates to profile or personal information (e.g. name, age, interests) and was mentioned during six interviews. Most of these experts explain that although these data are in many cases also present via the OV chip card system, they are not accessible for PT operators because of privacy regulations. Like several experts explained, travel data is therefore at the moment only used as aggregated data on travel flows to improve the transport supply of the PT operator. The following quote by Krumm illustrates this usage:

> *"I am allowed to look at the thickness of the flows. […] But I am not allowed to, you know, look if they are then young people or elderly, although I am allowed to know that based on the type of subscription, but I am not allowed to look at the age of those people"* (Krumm).

Besides travel data and profile data, other types of data that were mentioned during only one or a few interviews involve data on channel usage (session data, location) (Van Duinkerken, Van der Made) and panel data (Van Oort).

Getting access to customer data

From the interviews, application of datafication by PT companies appeared to be not so much about finding or creating new data sources. The majority of the experts mention that a significant amount of data is collected already and has a high potential. This goes especially for the OV chip card data which like stated before, in many cases contains both travel data and profile data. Getting access to particularly profile data, however, emerged as the biggest challenge for a successful application of datafication. In the first place, this is because PT companies often "have many legacy systems that are not connected with each other yet" (Van der Made). Four experts from PT companies explained how their companies are working on building more advanced customer relationship management (CRM) systems to improve their data governance. That enables them to "make data from data that you already have" (Van der Made).

In the second place, six of the experts mention the importance of the public perception of PT companies, which is also reflected in politics and regulations, as an important factor with respect to accessing profile data. Accessing passengers' personal data is not publicly accepted because PT companies are considered just to deliver a public service. This is also reflected in the privacy regulations that particularly limit the access to profile data of OV chip cards, mentioned by the majority of the experts. The following quote by Krumm illustrates the limiting effect of how PT companies are perceived:

> *"Well, in fact, we are just some sort of water company [...] If it would come out that we collect data as Albert Heijn does with the bonus card, I can tell you that it would be discussed in the House of Representatives this afternoon".* (Krumm)

In other words: being a company with a public function seems to limit the extent to which datafication can be applied by PT companies.

A third element that emerged to play an important role concerning the potential of datafication is the willingness to share. Since accessing profile data via the OV chip card system is limited, six experts explained that asking people to share personal data is an interesting option to gain access to personal data without violating the regulations that protect the access to this data via OV chip card usage. These experts mentioned several aspects that influence people's willingness to share. Coelman, Krumm, and Kreule note that people are in fact just not willing to share that much. Besides, multiple experts explain that this has to do with the perceived relevance of sharing, which is firmly connected to the value proposition which is discussed in the next section. One's willingness to share personal

data is also influenced by one's age (IJdema, Kreule). Younger people are generally more willing to share some of their personal data. Furthermore, three experts add that one's willingness to share also depends on what value the customer gets in return. IJdema illustrates this by showing the logic on what is acceptable to share of current products:

> *"If you buy a year-card of 1800 euros or 1600 euros, then you are not surprised that you're required to deliver some data, your email address etc. However, in case of an e-ticket, a ticket of € 3,50, you are not really eager to provide your entire, your address and your phone number, things like that."* (IJdema)

The role of customer segmentation

Despite the large potential of collecting customer data, several experts noticed how the PT sector is struggling with the role of customer segmentation. On the one hand, the majority of the experts describes the need for PT companies to focus more on their individual proposition towards their customer, which requires the gathering of (more) personal data. On the other hand, the importance of relevance for sharing was reflected on by several experts during the interviews. Why should customers be willing to share their personal data and why do PT companies need it? Paarlberg's explanation illustrates this reflection:

> *"To let your customer segmentation thrive, you should approach it with the end in mind. So you should ask yourself, which aspects of our services can we personalise? Next, would that be useful? Does it add value for the traveller? [...] Often, this is done the other way around [...]. It all sounds exciting then, but in the end, you are not able to make a distinction between passengers in your services, which makes it useless"* (Paarlberg).

An example by Kreule furthermore shows how some personal details are often not necessary to be collected:

> *"Because in the end, do you have to tell that you are mister Jansen, you live at King's Road 1, and you are disabled and have this and that? Or do you say no, on that line there's someone travelling who's in a wheelchair. Because in principle, that should be enough information"* (Kreule).

In other words, it is important to take a step back and review whether and why PT companies should be willing to collect personal data about its passengers, what should be the perceived relevance and more in general: what should be the role of customer segmentation within a PT company.

No consensus emerged among the experts on what the exact role of customer segmentation should be for PT companies. However, what did emerge from the interviews is that the role of customer segmentation is strongly linked to the value propositions of a PT company, which resembles relationship between the two elements in the business model canvas. To get the role of customer segmentation clear, it should be clear what the value propositions are.

To summarise the results on customer segmentation, it can be stated that the experts, in general, agree with the necessity for public transport companies to increase their use of market intelligence, as stated by Molander et al. (2012) and Van Lierop (2017). Application of datafication shows to have a large potential, but for this moment remains limited due privacy regulations and the perceived relevance of sharing for customers. To determine the role of customer segmentation, it is crucial for PT companies to consider what relevance they can offer to the customer. This is in fact what the value propositions of a company are about. They are discussed in the next section.

4.2 Value proposition

4.2.1 Personalization

Corresponding with the presented model of Sandström et al. (2008) in the theoretical framework, all experts recognised, to different extents, that adding personalisation to products and services produces adds value. IJdema, for example, notes that as more and more customers like to contact PT companies via one-on-one communication channels like WhatsApp or Facebook Messenger, PT companies should adapt to this attitude by trying to tailor their products and services to respond to this preference of the customer for interaction on a more personal level. Besides, Van der Made illustrates:

> *"If you want to reach a higher 7 [customer satisfaction score], then you should go for appreciation. That means that people feel appreciated when they are approached personally. Personal travel information in your app instead of generic information that is too far away and constantly scrolling"* (Van der Made).

Looking at ways to personalise the propositions of PT companies, a significant limiting factor that emerged as a pattern in the data is the low flexibility of personalising the physical transportation aspect. As Paarlberg explains: "public transport is a one-size-fits-all product par excellence", designed as a mass-product. Replacing all trams with small vans that would offer people more personalised routes would never be able to be as efficient as dedicated mass-transit lines. In addition, Van Duinkerken mentions the fact that public transport is a capital-intensive industry; vehicles are not upgraded every year. So apart from slightly adjusting timetables and routes based on collected data, personalisation on an individual level is hard to accomplish within the mass forms of public transport

itself. However, in the situation where public transport service is not about being a mass product but rather a public service, such as low-density areas, four experts see possibilities on how personalisation of the physical transportation could add value to the travellers. This goes especially in combination with supplementary forms of public transport like taxi-vans for disabled or elderly.

Most potential of personalisation, however, is recognised by the experts to be in the direction of travel information, as it fits better with the digital domain of platform principles. To use the words of Paarlberg: "public transport gets you from where you are not, to where you do not want to go to" (but close to your origin and destination). Experts explained that information on how this trip within a trip fits in a travellers personal journey is an essential element. The example by Kreule perfectly illustrates this complementary function of personalised travel information:

> *"Look, very basic example of a bus, if 50 persons fit in that bus, I am not able to add an extra chair out of the blue. While with an app, I can say: 'Hi, the next bus is fully occupied, and I notice that you are not able to be standing that long, maybe you'd better wait for one bus'. That's where [personalisation] has added value"* (Kreule).

Related examples that were mentioned included information adapted to the individual and situational context of the traveller and ranged from route navigation on stations to automatically in advance generated alternatives in case of disruptions.

Relevance emerged as a key requirement for successful personalisation. Several experts mention that a personalisation feature can quickly turn into a dissatisfier if the relevance of a product or service is not clear to a customer. On the hand, this can be the case when a feature is too personal like Van Duinkerken describes with the example of the technical possibility to send passengers a receipt via their smartphone app when they pay a ticket by pin in the bus.

> *"There is always a dilemma between making full use of it [technical features] and the relationship you have with that person. Because possible he gets scared and thinks 'Wow, how do you know all this? How can you suddenly, on my phone ...? I only just paid by card.' And maybe that person then won't pay by card anymore because he thinks you will do all kinds of scary things with it." (Van Duinkerken)*

On the other hand, it could also be the case that a personalised product or service is not relevant at all and therefore becomes annoying. This could be due to missing essential information which is illustrated by Kreule the following example:

> *"Because how many people would appreciate it if a PT company says: 'Hey, I notice this appointment in your agenda, why not take the train?' Maybe you've already put in your*

agenda that you need to be there because of football and you have already arranged to go
carpooling. So well 'just leave me alone'. So relevance is very important in such cases."
(Kreule)

The fact that personalisation features can quickly turn into dissatisfiers leads four experts to express a slightly sceptical attitude towards the feasibility of personalisation. Even though overall the experts recognise that personalisation can add value, Paarlberg, for example, doubts whether the amount of added value can be large enough. Coelman illustrates the notion that PT companies should also keep in mind their public function which implies "being there for everybody". PT companies should thus be careful not to discriminate specific customer segments by only making personalisation features accessible to specific groups of customers.

To summarise the results on personalisation, it can in the first place be stated that experts seem to confirm the potential of applying the platform principle of selection to add value to the traveller. Particularly the domain of (digital) travel information suits the ability of selection to anticipate to the individual and situational filters from the model by Sandström et al. (2008) that was presented in the theoretical framework. However, the extent to which personalisation can be implemented remains debatable as relevance and caution with respect to implementation emerged as crucial requirements for successful implementation of personalisation. This links to the strong relationship between the platform principles of datafication and selection as the ability to be relevant is strongly dependent on the availability of personal data. As discussed in the section on customer segmentation, people are only willing to share this information if they get a service or product in return that is relevant to them. A company's strategy on offering personalised features is thus strongly linked to a company's strategy on customer segmentation.

4.2.2 Customer experience

When discussing how PT companies could include platform principles in their strategies regarding customer experience, five of the ten experts mentioned the model of the pyramid of customer needs to explain how features that add value to the customer experience can be used. This pyramid is derived from Maslow's hierarchy of needs, a model in psychology that ranks the needs of customers and provides insight into the position of this value proposition compared to others. The basic requirements of a customer are located at the bottom. For public transport, Van der Made explains that these are about safety and security. "Uncertainty is killing" (Paarlberg). Passengers want to be secure that they are on the right platform, waiting on the right train etcetera. To fulfil these needs, providing smooth operations is the main concern for a PT company (Coelman). Customer experience is located all the way on the other side, at the top of the pyramid. As IJdema explains:

"The average customer satisfaction is a 7.5 at the moment, and by means of some functional aspects, we want to get to that 8.0. And if your customer satisfaction scores that 8, then it is about the experience. So then should start adding experience elements." (IJdema)

It is thus essential to first focus on smooth operations, e.g. no delays, offer clear travel information, the 'functional aspects' before adding aspects that (just) focus on improving the passenger experience. Or as Van Oort puts it: "the pyramid collapses without a bottom." Linking this with the value proposition of personalisation from the previous section, this means that personalisation of functional aspects like providing relevant travel information should come before providing (personalised) "fun" data on how many kilometres someone travelled by train last month (an example by Van der Made).

The experts were not always in agreement with each other about whether PT companies should adopt such experience features. On the one hand, five of the ten experts expressed themselves not being against PT companies offering such features. Van der Made explains that it "works" to support a passenger's journey with contextual relevant "funny" data. Examples that were mentioned included gamification (adding game elements to travelling in PT), dashboarding (presenting interesting statistics about a passengers travel behaviour), loyalty programs and features to enhance social safety. Krumm also adds that such features can help to tell the story of your company.

On the other hand, three experts were critical towards the adoption of such experience features. Coelman illustrates this criticism. He explains that a PT company is not the type of company that should include such features:

"Look, in that sense, we are not a normal commercial company, we are no Ikea you know. [...] It is not that we are Apple, a perfect fancy brand that can just do such innovative things when they like. No, we are ordered to get people from A to B. Well let's just do that properly first." (Coelman)

According to Coelman, PT companies should thus focus on their core business as they are, in most cases, funded with public money. Kreule agrees, stating that a PT company should not become "some fancy marketing company that also does something with busses." Furthermore, IJdema, referring to a pilot with PT-miles derived from the popular air-miles concept, notes that public transport, in general, is quite a "low-interest product". People look at it in a very functional way. Adding features to make it more fun or feel more luxurious would, therefore, would have a low chance to succeed. Kreule agrees on this and also mentions that experience features can quickly become dissatisfiers: "If the bus doesn't show up, then it's very nice that there would have been Netflix and free coffee in it, but that's useless then." (Kreule). Besides, he remarks that "You see a lot of half things among operators. The idea is good, but often it does not come any further than a simple basis, lacking additional value".

Apart from critical notes, just like for personalisation, relevance emerged as an important factor to include. The majority of the experts mentioned that an additional feature should only be offered when the relevance to passengers is clear. As relevance differs per (type of) traveller, offering added value to the customer experience is thus linked to the value proposition of personalisation. Side-information during a journey could, for example, be interesting for tourists, but for commuters that make that same trip each day, such side-information could quickly become a dissatisfier. Kreule adds that in some cases a PT company can also be relevant by referring passengers to partners:

> *"...by referring you can be relevant. When you say something like: 'this app can show you all the nice bars and cafés, and well that is a nice place to book your restaurant'. But then it's out of your own domain, and that's where it ends. So you pass them to others, and vice versa they could do that as well." (Kreule)*

Such strategy of offering relevance via linking with partners would be a perfect application of the platform principle interconnectedness.

To summarise the results on customer experience, it can be stated that platform principles can add value to the customer experience but that it is essential to take into account the ranking of customer needs. Thus, concerning the addressed need to focus more on non-utilitarian aspects by Van Lierop (2017) in the theoretical framework, experts stress the importance of perceived relevance, which again resembles the individual and situational filters from the model by Sandström et al. (2008). As experts note that people commonly perceive public transport as rather low-interest and functional, customer experience features seem to be designed best in a way that is on the boundary of functionality and enhancing experience.

4.2.3 Integration with other mobility services

As discussed in the theoretical framework, mobility platforms could make the traditional divide between public and private transport disappear in the future (Snellen & De Hollander, 2017). This presents public transport companies with the big challenge to consider their strategy towards this new integrated organisation of mobility and to think about how integration can be used to add value.

The added value of integration

Overall, the experts recognise the potential of integrating public transport with other modalities, which was discussed during the interview by using the concept of mobility as a service (MaaS). As discussed with the customer pyramid, one of the primary aspects people seek when travelling with public transport is security, particularly in the way that they have consulted the right travel information. Especially for the case of using public transport, the trip is often multi-modal. This means that in most cases, the traveller needs to acquire extra information about the access and egress

trip. By integrating the offered mobility services into tailored mobility options, allowing for "seamless mobility" as a service, a lot of added value can be created. As Van Oort describes: "The dream is that a device helps you exactly the way you want it to do".

Predominantly, the experts were positive about the concept of Mobility as a Service (MaaS). However, for the majority of the experts, this positive attitude towards the concept was accompanied with scepticism about the extent to which MaaS could become a reality. Van Oort, for example, states that "it will not be the case that, like some predicate, MaaS will completely turn everything upside down". Paarlberg reflects on MaaS having become a buzzword. He has the impression that MaaS is "a bit of a fashion-term as the sector lacks other innovations". In other words, MaaS solutions that integrate some modalities will be developed in the future, but to offer passengers a service that integrates "everything" will remain a utopia according to Van Duinkerken.

As was discussed in the theoretical framework, the organisation of MaaS allows for different business architectures (Ebrahimi et al., 2017), which provide different roles and ways to add value for public transport companies. From the interviews, experts presented arguments that advocate for several roles and ways to add value. These are discussed below by using the framework with two crucial dimensions from Ebrahimi et al. (2017).

Integration of mobility services within one firm
The first dimension deals with the question whether public transport companies should aim at integrating other types of mobility services (modes) within their firms. To organise Mobility as a Service, multiple modes should be available, and public transport companies naturally already obtain the role as operator of public transport modes. From the interviews, no clear answer to this question on adopting the operation of additional modes emerged. Instead, the experts distinguished several aspects that are of importance to answer such strategic question.

In the first place, the technical aspects of getting access and payment were identified by five experts to play an important role. Paarlberg explains that to enable mobility, four additional requirements have to be met: gaining information, (if necessary) making a reservation, payment, and getting access. Regarding Mobility as a Service, the experts note that getting access is the biggest problem to solve. To accomplish seamless mobility, all different modes should preferably be accessible via the same technology which also deals with the payment aspect. The technical issues regarding payment and validation emerged as an important reason for PT companies to incorporate the service of other modalities within their firm. Van Duinkerken illustrates this by providing the example of shared bike systems. At the moment different technologies for accessing the bikes are used within the market, each company has his own technology to access a bike. Offering integrated public transport and shared bicycles could in such case add value for the traveller since having to use only one type of technology increases customer convenience. Besides, several experts note that in

case of partnering, a company could lose some of its competitive advantage, which can also be linked to the role of the concession system.

Apart from the technical barriers that can play a role, experts listed several aspects regarding the capability of PT companies that are of importance for strategic choices on integrating the operation of multiple modes. Among these aspects, expertise emerged to be a central topic. Six experts mentioned arguments that related to the expertise of a company. PT companies should, within their existing role as operator of PT modes in the first place facilitate integration possibilities of their own modalities with other modes. Next then comes the question whether a company would want to operate additional modes by integrating them into their firm (Paarlberg). The required amount of expertise is also related to the type of mode that is to be integrated. Companies should try to avoid to "reinvent the wheel" (Coelman) and from that perspective creating partnerships seems to be favoured over integration within the own firm. Also because in the end, the passenger gets more value if each partner can deliver value according to its expertise. Van der Made explains this by illustrating the attitude of NS towards other shared biking plans:

> *"So we could say like, look the OV fiets is very popular, and it's not our core business, we'd rather see that we could, next to the OV fiets, also offer bikes of three other parties, [...] because no OV fiets is also negative for us. If we could help you make use of a competitor of OV fiets and you take an Urbi bike, but your experience is great, then that is also positive for us." (Van der Made)*

Parties that provide other modalities should be considered as "partners in providing proper mobility" (Van der Made).

All in all, technical details and the capability of public transport companies emerged as main aspects to play a role in the decision for PT companies to integrate the operation of other modalities. Integration from the technical perspective could offer additional value because of increased customer convenience, which is in agreement with the relevance of lower transaction costs for the customer and the investment costs for the company noted by Ebrahimi et al. (2017) and Farsi et al. (2007). However, the ability to add value through the integration of operating multiple modes appears to be heavily dependent on the capability of the PT company. Partnering and "leaving it to the market" (Paarlberg) and allowing "individual firms to optimise their supply processes" (Ebrahimi et al., 2017, p.4) could therefore also be a relevant opportunity for public transport companies to maximise the obtained value for their customers.

Distribution and marketing

For the dimension on distribution and marketing channels, the strategic dilemma discussed during the interviews was whether a PT company should aim at integrating these communicational aspects of

integrated mobility options within their firms or just stay with a role as operator and leave the interaction with the traveller to a third-party intermediary platform. To be clear, the distribution and marketing discussed relate to the offering of integrated mobility products, which would be existing next to a public transport companies "common" channels to offer their own public transport products.

Several names were used by the experts to describe the role of the party that takes the role of communicator in offering integrated mobility products; these included "travel guide", "director", "MaaS operator", "MaaS provider", "the platform", and "mobility account provider". Different names that, to a general extent, all come down to the same concept. The term mobility account provider will be used in the rests of this section to describe this role. The definition by Van Os clearly explains this role. He defines the role of mobility account provider as to help the passenger "to make optimal use of mobility services with minimal effort through a single account". The provider of such account owns all interaction with the passenger which includes managing the passenger's personal data and building and maintaining the customer relationship. Three experts drew the analogy between the market for mobile network providers and the organisation of MaaS to explain the plausible presence of several mobility account providers.

Within the discussion on whether or not to pursue this role as mobility account provider, four arguments emerged as main patterns in the data. Predominantly, experts presented reasons why PT companies would try to claim the role of mobility account provider, next to their existing role as operator of public transport as mobility service. In the first place, five of the ten experts mention owning and thus controlling the customer relationship as an important reason to do so. IJdema illustrates this importance for a PT company to be in control over the relationship with the passenger:

> *"Because if we have that relationship, then there is a perfect interaction and then sometimes you can quickly offer services that are demanded. If you just focus on "I'm going to operate here, and someone else manages the customer relationships and the data collection", then at a certain moment you're starting to build a wall that deteriorates the entire customer experience" (IJdema)*

To be able to deliver the highest value to the passenger, it is thus important for PT companies to stay in control over the relationship with the customer.

Secondly, multiple experts remarked that this desire to stay in control over the customer relationship is also caused by uncertainty about how MaaS could to change the mobility sector. Comparisons were made with industries that have already been impacted by online platforms like *thuisbezorgd.nl* (Van Duinkerken) and *booking.com* (IJdema). External online platforms have become very dominant in these sectors and in many cases, the hotels and restaurants are not happy with that because the platforms can start making demands. As long as the future configuration of the market is unclear Coelman illustrates:

"I think that, well yes, if you don't know what the market will do. If there is a change that a party emerges that will get an unhealthy amount of power, yes then you should arm yourself against that, yes. And that could be by then trying to control the chain." (Coelman)

So from that perspective, aiming for the role of mobility account provider can be seen as a protective measure.

Competition in the concession system was mentioned by six experts and emerged as a third reason why public transport companies would aim for the role of mobility account provider. To win a concession, each PT company wants to present their proposition as complete as possible, which results in each company trying to build advanced apps themselves. Kreule illustrates this by explaining that each company wants to have something unique "to score extra points" and the account provider role provides the opportunity for a PT company to broaden its value proposition:

"Also from a strategic perspective, look, if tomorrow there will be two super apps that are capable of doing everything, then you're crazy if you still invest in such features yourself. However, as long as those do not exist, I can distinguish myself and then it's in your companies interest to be distinguished in a positive way. So that's also a bit what you can see in the innovation process, everybody is quickly trying a few things because it is still possible." (Kreule)

In other words: the protective attitude to stay in control at the same time can be used as a chance to stand out from the rest. Besides trying to stand out through taking the initiative for the role of mobility account provider, experts report that the authorities who grant the concessions are also increasingly demanding that the concession for public transport "becomes a kind of mobility concession" (Krumm) instead of merely a public transport concession. So PT companies in that sense are forced to start looking for integration of multiple modes which requires the coordinating role as mobility account provider.

Related to the concession system and its competition, four experts mention a fourth argument on why it seems logical for public transport companies to aim for the role as mobility account provider. It is because public transport can be seen as "the backbone" of Mobility as a Service (Van Oort). Once a PT company has been granted a certain concession area, considering the non-private modes, the company operates the "main form of transport" within that area (Kreule). In other words, within the roleplay of Mobility as a Service, a public transport operator is often the biggest operator in a concession area (next to for example present shared bike or shared cars operators), which makes it plausible to take the initiative in facilitating an integrated mobility offer to the passenger.

Contrary to the arguments that explain why PT companies should take up the role as mobility account provider, several critical side nodes were made as well. Stemerding wonders whether this would be the best case scenario for the passenger, claiming that PT companies might focus too much on their own services in providing mobility services to the passenger or as Van Os puts it: "sub-optimise over their own commercial interests". Krumm and Van Duinkerken however, claim that such behaviour is not likely since customers would immediately notice and leave the platform:

> *"If I deliver a poor product, if you have an insurance website, a site where you can compare insurances and each time you finish up on rubbish company X: "This is nonsense!" You know, another website. Now if I make an app that sends you to the bus each time, you know, people won't use it" (Krumm)*

Furthermore, part of the critical opinions relates to the capability of PT companies to take up the role of mobility service provider. No clear patterns emerged among these capabilities. Size was mentioned as an important factor influencing this capability by three experts. Van der Made illustrates that the bigger a PT company is, the easier it can take over successful concepts of start-ups, which also relates to the size of the operational area. For a small concession area, it could not be feasible to invest in the role of mobility account provider. This correlates with the amount of knowledge and expertise that was mentioned by four experts to play a role in determining the capability for taking up a provider role, which links to a comment made by Kreule in the section on customer experience on PT companies often doing things "half". PT companies should only take up a role if they are fully capable of doing so. Furthermore, Van Os mentions identity and ambition as a factor that also influences whether or not to take up the role as mobility account provider. Lastly, a more contextual factor was added by Coelman, as he notices the difference in competition among the different concession areas. The fiercer competition, the likelier a PT company will strengthen its proposition with MaaS features. All in all, the decision, whether a public transport company should aim for owning the access point to integrated mobility services thus remains case dependent.

Everything considered, staying in control of the communication with the customer (Ebrahimi et al. 2017) seems to be the main argument for PT companies to aim for the role of mobility account provider. On the one hand, this is to offer the customer the best product, but at the same time also because of strategic positioning related to winning concessions and uncertainty towards the future of the mobility landscape. Besides, several essential characteristics can be distinguished that influence whether is it realistic for PT companies to have the intention to become the access point for the customer with respect to integrated mobility products.

Commercial interests and public values

The strategic possibilities for PT companies regarding integration as added value are also influenced by the government. Their influence was frequently mentioned during the interviews. As PT companies are funded with public money, authorities play an important role in the interaction between commercial interests and public values that accompanies the organisation of integrated mobility services. Remarks by the experts can be split in positive and negative influence on the opportunities of public transport companies to provide added value.

Four experts mentioned the ability of the authority to initiate collaboration constructions which PT companies themselves would not initiate because of commercial interests, even if such construction would, in the end, be more beneficial from a public perspective as well as from the commercial perspectives of the companies. Van Duinkerken illustrates:

> *"Look, from the perspective of a PT company, it is very hard to standardise. Off course that would be the best way, [...] to create some sort of layer in between [...] which would be functioning like: 'Okay if you sell tickets you can plug in onto that system, and if you want to sell tickets you can also plug in onto that system.' That is very interesting, but so far, it is is not happening [...] and I don't know if it will happen. I think the commercial interests are too important. PT companies don't have room to invest in such system, [...] they won't do that of their own accord."* (Van Duinkerken).

Initiation of collaboration by the government is illustrated by Van Os by including the role of scheme provider:

> *"So an additional role comes into play [...], there should be a scheme provider that guides the roleplay. Otherwise, you get some sort of technical solutions that nobody owns where commercial interests will eventually decide what will happen."* (Van Os)

Thus, a scheme provider can create the right environment by initiating or imposing specific collaboration or rules. This way the scheme provider can also protect these parties and prevent the emergence of (unwanted) dominant platforms.

On the other hand, several experts mentioned how the authorities limit the further development of MaaS and the strategic development of public transport companies. Even though Van Os describes the need for a "rudimentary government" he also acknowledges that current "authorities do not have their focus yet on this new digital system that will come". Krumm adds that in the end, regulations will adapt. Besides, four experts noted the limitations of the OV chip card as an "inflexible system" (Van Duinkerken). This, in turn, can, as discussed before, lead to a company preferring integration of other modalities with the own firm over creating partnerships.

All in all, the potential of adding value through offering integrated mobility services from the theoretical framework is confirmed by the data. To facilitate integration, interconnectedness between several modalities is required. In the first place, internal factors related to capability, size and ambition emerged to be significant with respect to which role(s) PT companies should be willing to take within such connected ecosystem that enables such integrated mobility service. Commercial interests appeared to possibly limit the opportunities for cooperation, which would lead to argumentation for integration within the firm to optimise the additional value for the travellers. At the same time, strong intervention from the government influences the strategic choice options of PT companies as well by, on the one hand, being able to break the deadlock between commercial parties but on the other hand also by limiting the speed of innovation due to inertia.

4.3 Customer relationships

Personal relationship

As was discussed with the value proposition of personalisation, experts recognised the added value of a personalised proposition which can be created through data collection. To communicate such proposition, a more personal relationship is required. From the interviews, two aspects were distinguished to be important for creating such relationship. In the first place, four experts brought up the importance of knowing what the customer expects from a company, which is strongly connected to customer segmentation. IJdema, for example, mentions how the use of more personal channels influences the expectations of customers on what type of contact they can have with the PT company. Overall, he claims, people also expect PT companies to act more personal and PT companies should "do something with that".

The second important aspect is relevance, which was mentioned by the majority of the experts. This is strongly linked to the importance of relevance discussed in the section on customer segmentation and the value proposition of personalisation. Concerning relevance within the customer relationship, it is in particular about the fact that the passenger should trust the PT company to be relevant. Therefore, Stemerding illustrates, it is relevant for the company to interact with the passenger to check for its relevance. When a company is trusted to be relevant, this also impacts the willingness to share at the data collection side.

Co-creation of products and services

Four experts explained how asking for feedback from the passenger is an obvious thing to do when offering more individually tailored propositions. Experts were also asked in what ways passengers could be involved in the creation of products and services. Examples that were mentioned included

different kinds of feedback that could be used to co-create travel information (Coelman) or to improve the cleanliness of vehicles and stations (Van der Made and Van Duinkerken).

Besides, similarities emerged with the discussed aspects in the section on customer experience. Half of the experts explained that including the passenger via asking for feedback, links with the top of the customer need pyramid. It can thus be used to make customer satisfaction go from good to great. A few experts also mentioned criticism. This criticism is reflected in the comment by Paarlberg as he notices that the added value could be relatively low compared to the effort it costs to create such feedback system for co-creation and that therefore it is better to work on more fundamental aspects that are located more towards the bottom of the pyramid. The potential of co-creation as identified by Gebauer et al. (2010) in the theoretical framework, was thus not supported that strong by the experts.

4.4 Channels

Concerning the identified trend of online platforms starting to play an important role as access point to mobility, including public transport, during the interviews channel strategies of public transport companies were addressed as well. The experts predominantly emphasised that to reach the customer "you have to be where they are" (Kreule), which advocates for the use of multiple channels. The main argument to do so: customer convenience. Knowing the customer (via datafication) can help to find out at which channel the customer wants to be reached. As Van Duinkerken illustrates, the strategy would not be "as much as possible [channels], but rather try to get close to our customer as much as possible".

Apart from the presence on external channels, five experts explained the importance of operating own channels as well, in particular from the perspective of public transport being public service. Coelman emphasises this importance of staying in control:

> "For the pure core [basic information on timetables etc.], you should try to depend on other parties at least as possible. You know, you do not have control over Google. Of course, it [offering you information via Google channels] is very valuable and maybe you can use it in a nice way, but you always have to keep in mind like: "Wait a minute, we should not become completely dependent on them".[...] So I think you always need to have your own channel as well." (Coelman)

So with respect to the value of accessibility, full dependency on external (commercial) parties is to be avoided.

Besides three experts add that own channels can often be much more specific which increases the experience value by the passenger. This applies in particular to the informing function of channels as PT companies in the Netherlands are obliged to share their basic operational data on timetables, real-

time vehicle data, and fares to a public database. That information can thus be accessed via other platforms as well. The own channel can, however, offer extra information which could add value for the passenger.

The importance of keeping control also emerged to be relevant for the function of channels as providers of post-purchase customer support. Complying with adapting to "where the customer is", this importance of control, however, does not always imply focusing on own channels. As multiple experts explained, social media channels can also be used to obtain the more personal relationship with the customer, while the relevant data can still be fed into a CRM system. Also, the request from the concession providing authority to deliver data on customer satisfaction was mentioned as a reason to keep in control over the channel obtaining this function.

Corresponding to the moderate observed potential for co-creation in the customer relationship, the potency of rating systems that are used at several online platforms (Van Dijck et al. 2016) was not found to be relevant for the practice of public transport. This is clarified by an example from Kreule:

> In that case [Uber] you have very specific complaints, and in principle, you order an Arriva bus and not a specific driver. While with Uber [...] it's much more the person that has influence. However, you know we send a bus, and today Pietje drives and tomorrow it will be Kees en then Henk, and they all drive the same routes, so in that case, the person is less ... that's the difference. But it could be the case that your trash can is full or broken whatever and that's more doing something with your operation. So when you report that to Uber, the car was dirty, no one from Uber will come and clean the car. So that way I think it is logical to do as much as possible in-house such that you can respond to it." (Kreule)

In other words: Uber, in this case, acts as a marketplace and is not responsible for the services of the transport supplier. In case of public transport, the PT company is the transport supplier (and could also take the role of a marketplace).

Regarding the function of channels enabling sales of products and services, a strong link with the discussion on the value proposition of integration emerged. Concerning the facilitation of seamless (integrated) mobility, six experts remarked that seamless ways of paying for the used mobility products are required. As public transport often is used in a multi-modal trip, integration of payment for the different parts of such trip using multiple modes can provide a significant amount of added value for the traveller. It thus seems essential for public transport companies to look, apart from their own sales channels, for ways to integrate the sale of their products into channels of third-parties. As Van Duinkerken remarks:

> "We realise that we can't serve the entire market with our own application. So I think you should offer a broader distribution across multiple channels." (Van Duinkerken)

Furthermore, the importance of the payment channel was frequently linked to the possibilities of delivering value propositions like personalisation. Several experts noted that the current OV chip card system is "a relative reactive system" (Van Os) that "hinders further innovation" (Van Duinkerken). The configuration of the OV chip card system does not allow for the offering of flexible (personalised) products but is however prescribed by the concession authority. Van Duinkerken illustrates this:

> *"It's complicated. If we, you cannot just develop another product for the OV chip card, that costs a serious amount of money and a lot of time. If you look outside right now and think 'Oh, the weather is nice, so probably there are no people in the bus', then it's possible for us to raise a discount offer onto our applications within 5 minutes. But if we would want to develop that for the OV chip card, that would take at least three months, and by that time the weather has changed."* (Van Duinkerken)

The concept of account based travelling was addressed by five experts as a future development to overcome this problem of OV chip card. The example of NS business card was frequently mentioned as an example of how paying afterwards can "remove barriers between modes" (IJdema). Account based travelling is grounded in the concept of seamless mobility. The traveller should be able to use the different modes, while the several involved operators "arrange everything" (Van der Made) in the back office. For business travellers, NS business card provides this way of travelling already to some extent for business travellers. With such card, a traveller can make use of all partnered modes and a summarising bill is constructed afterwards and sent on a monthly basis.

To summarise the results on channels, the importance of using multiple channels to maximise customer convenience emerged as an overall result. This stresses the importance of interconnectedness with third-party online platforms. Customer convenience appeared to be more important than possibilities for datafication, which corresponds to the importance of reducing complexity for the customer by Kracht & Wang (2010). Besides seeking interconnectedness, however, staying in control over at least one channel was found to be of importance as well. This relates to the relationship of PT companies with the concession authority and the accompanying public values it protects.

4.5 Revenue streams

As mentioned in the theoretical framework, besides creating value propositions, it is also relevant for PT companies to consider how the created value can be captured (Teece, 2010). During the interviews, several options for creating additional revenue streams were discussed.

Fares

In the first place, considering the standard fares in public transport, it appeared to be hard to create additional revenue streams. Multiple experts explained that fare differentiation based on data, either real-time or historical, is hard to arrange within public transport because of regulations from the government. Proposed fares by the PT company are officially approved at a specific moment each year, and changes can hardly be made throughout that period. This seems reasonable, as individually based offers regarding fares are hard to combine with the public values of equality and accessibility that are guarded by the authorities.

On the other hand, four experts note that through the (current) availability of different types of subscription-based products, personalisation is to some extent already offered. Related to this fact, several times the experts provided a similar example of a scenario in which the customer would be notified when the costs of his travel behaviour could be lower when buying, for instance, a month card instead of buying separate tickets each time. Investing in the relationship with the customer through such personalised advice could yield more profit for a PT company in the long term, as is illustrated by Van Duinkerken:

> *"If you, for a short term, let's say January, February, March, take the bus a few times because of bad weather. You pay a higher price. It could be the case then that we can tell you that you can travel cheaper and in the meantime, we hope that you enjoy the convenience and start thinking 'you know I'm just always going to take the bus'. And then you use the bus the full year, also when the weather is less bad, or maybe even when the weather is nice. That's where our extra [revenue] will be then."* (Van Duinkerken)

So although applying personalisation to the fares offered is difficult, personalisation can be applied to helping customers to choose the products that suit their situation best.

Apart from the standard fares that a PT company has to discuss with the authorities, several experts mentioned that the role as mobility account provider offers opportunities for additional revenue streams. Four experts mention the platform fee that was also proposed by Eckhardt et al. (2017) as a possibility. Such fee would be charged to partners that want to sell their mobility service via the platform of the mobility account provider. Besides, mobility account providers could, rather than just combining and passing through the fares from linked operators, also start offering its own products. For instance via buying single tickets at a partnered operator and selling those within a subscription package to the customer (Van Os). Stemerding illustrates how MaaS start-up Whim offers a monthly plan with a bundle of services; different plans include different amounts of points which can be spent by the customer on different modalities.

Data commodification

Besides creating new revenue streams via fares, also possibilities for data commodification as theorised by Van Dijck et al. (2016) were discussed. In the first place, six experts mentioned how customers could be enticed into making additional trips via special personalised offers. This could yield additional revenue streams in the way that extra passengers use the public transport that was operating anyhow. Secondly, in the case of a PT company choosing to operate an integrated mobility platform, a platform fee was logically mentioned by many experts as another way to create an additional revenue stream. That would work in the way that based on collected customer data a PT company as mobility account provider, could create a personalised offer for its customer to make a trip by using a mode of a partnered operator. A fee could then be charged for being the access point for the services of the other operator.

In the third place, also personalised offers related to third-parties was discussed several times during the interviews. IJdema, Krumm and Van Duinkerken mention the current (successful) practice of offering combination tickets for having a day out, which is not personalised at the moment. By applying personalisation, however, such deals with local partners could become more tailor-made to the customer. Van Duinkerken illustrates this by explaining how a PT company can offer its passengers coffee coupon that can be used at local partners at locations that are relevant to the passenger, which is based on knowing from where to where the passenger travels.

Concerning the extent to which PT companies should engage in data commodification, different opinions emerged from the interviews. Three experts saw possibilities for PT companies to create revenue streams from offering third-party advertisements to their customers. Relevance for the customer, however, was mentioned as a key requirement for successful application of platform principles. Advertisements, Van Os illustrates:

> *"[advertisements] surely fit, but not as advertisements. [...]. The traveller should take the initiative, he should be liking it and should learn by experience that he gets the right information. He reveals that he is interested in culture and that he is willing to know location-based what is happening at a certain location. "Would you like to be informed of events on your route?" "Yes". Well, then I can request a fee for such service. [...] So as mobility account provider you should excel in that. If I'm going to push advertisements that are experienced as broadcasting, the passenger will quit." (Van Os)*

On the other hand, five experts did not fully agree with this potential of presenting third-party offerings to the customer that was also proposed by Van Themsche (2016). Paarlberg and Van Duinkerken doubt whether the added value of relevant, personalised offers from external parties will be significant to the customer and whether it outweighs the effort it takes to create the facilities to enable such offering. Also frequently mentioned was the fact that a PT company is not the type of

company to engage with (albeit super personalised) advertisements. Kreule puts it as an "odd mismatch". This is also related to the perception of PT companies that people have, which also played a role in customer segmentation.

> *"For our current offers, people already have to permit that they want to be able to receive our special offers. And in that case, they would receive an offer of a third-party via us. So actually we would have already had to communicate that data to that other party via special agreements of which we actually should have informed the individual customers. […] Well, yes, those are routes that we are not yet working on." (IJdema)*

As IJdema explains, data collection is already a rather big issue. So third-party advertisements are, for the moment, a step too far. However, IJdema also mentions that as people get more used to personalised propositions, which is also affected by the use of personalisation on other platforms, eventually, relevant offering of personalised "advertisements" could be an interesting option.

5 – Conclusion

This research examines how public transport companies can innovate their business models by investigating how platform principles could be used to add value to their customers. Platform principles are basic concepts that explain general characteristics and practices of online platforms. The increased usage of online platforms has impacted various industries, disrupting existing business models and market structures. With respect to public transport and mobility in general, online platform are becoming the main access points to mobility while at the same time also facilitating new forms of mobility and integrating these with existing types of transport. Given the growing importance of online platforms in today's society (Parker et al., 2016; Van Dijck et al., 2016) and their potential to rearrange the way mobility is organised (Snellen & De Hollander, 2017) it is thus important for public transport companies to reconsider their strategies. The research question therefore is:

How can public transport companies in the Netherlands strategically make use of platform principles to innovate their business models?

5.1 Significant findings and theoretical implications

An answer to this question can be split into two parts. The first part focuses on how platform principles can be applied to the core practice of public transport companies: selling and operating the service of (public) transport. The second part is centred around the platform principle of interconnectedness and examines how this core practice can be connected and integrated with platforms and services of third-parties.

5.1.1 Relevant personalisation of travel information

Concerning the core practice of public transport, the data supports the identified need for increased focus on delivering service to the customer by Molander et al. (2012). The platform principle of selection can increase the amount of delivered value to the customer by adapting the offered service to the personal situation of the customer. Such personalisation was found to be implemented best in the domain of travel information, matching the nature of online platforms as media innovation. This is due to the way public transport is commonly designed. Operating according to fixed departure times and routes requires the traveller in most cases to use additional modes of transport to complete his entire trip. Travel information on how a ride with public transport fits within this trip is always personal. Much added value can be created through the application of selection, which means that only relevant travel information can be communicated to the traveller.

For the successful application of such personalisation, relevance was found to be a key requirement. Personalisation features can quickly turn into dissatisfiers when they are not perceived as relevant. Relevance emerged to be strongly connected to the customer's perception of a public transport company. The results show that public transport is commonly perceived as functional and as a low-interest product and that public transport companies are generally considered to be an inflexible public utility. When applying personalisation, initial applications thus seem best to be focusing on personalisation of functional information rather than that of less functional information that focuses more on experience.

In addition, to accomplish relevant personalisation, availability of personal data of the traveller is crucial which implies the application of datafication. As possibilities for the automated gathering of personal data are limited because of laws and regulations, given consent by the customer is key to access these personal data. The customer's perception of public transport companies was found to play an important role here as well since the customer's willingness to share his data is strongly connected to the perceived relevance of that sharing. Combining this fact with the mentioned low-interest perception gives a low willingness to share. In other words: people prefer not to share their data with public transport companies because they do not see what added benefit they get in return.

All in all, application of platform principles within public transport itself is thus in particular about datafication and selection which enable personalisation of travel information. Potentially this can generate added benefit for the customer. This potential, however, appears to be limited by the way public transport companies and their services are perceived. To realise this potential, it is therefore essential for public transport companies to focus on carefully building a more personal relationship with their customers through which trust to be relevant can slowly be improved. That way, also the perception of public transport products and the willingness to share can shift towards a more fruitful situation in which personalisation can truly add value to the customer. Over time, this trust to be relevant provides additional possibilities for public transport companies to capture this value on its turn, by including relevant third-party offers.

5.1.2 Interconnectedness

The second part of an answer to the research question addresses the identified trend of platforms integrating different kinds of mobility, which could rearrange the way public and private transportation are traditionally separated (Snellen & De Hollander, 2017). Following its marketplace structure, online platforms could offer integrated mobility packages by combining the services of different modalities, including that of public transport. Such deliverance of mobility as a service (MaaS) that can be accessed via one platform provides a large amount of added benefit to the traveller and, besides, requires for cooperation between several parties, including public transport companies. Different business architectures, including several roles, can be distinguished to organise such system (Ebrahimi et al. 2017; Eckhardt et al., 2017).

Within the organisation of integrated door-to-door mobility service, public companies can take up different roles that correspond with different ways of contributing to the total added value of delivering mobility as a service. In other words: the platform principle of interconnectedness can be applied in different ways. In the first place, as a primary strategic application, it was found that public transport companies should ensure the integrability of their products. Related to the requirements that emerged in the data to enable mobility, this facilitating of integrability, in particular, relates to payment and validation as the integrability of information provision is already covered due to the obligatory sharing of operational data.

Secondly, public transport companies can, besides their role as operator and seller of their own public transport products, choose to take up additional roles within the organisation of mobility as a service. This includes the role of operator of additional modes of transport such as shared bike systems or taxi services, and the directing role of owning the integrating platform as mobility account provider. These roles both allow for the creation of additional revenue streams. Concerning whether or not to aim for such additional role, several factors were found to be of importance.

In the first place, uncertainty about how the organisation of mobility as a service will constitute and fear for the emerge of a dominant platform, revealed the desire of public transport companies to stay in control over their relationship with the customer. This could be achieved by obtaining a role of mobility account provider. This uncertainty and perceived need to protect themselves is also caused by the absence of rules according to which the game of integrating mobility is going to be played. Authorities, who are likely to take up such role from the viewpoint of organising mobility from a societal perspective, are still considering their approach as well. At the same time, even though the organisation of MaaS goes beyond the concession system for public transport, concession competition is also influencing the choice for PT companies to take up the role of mobility account provider. As authorities more and more request integration of modalities as concession requirement, PT companies are to some extent forced to take up a directing role in the integration process.

Apart from these external factors dealing with the market configuration, case-specific company characteristics emerged to be the determinant factor on whether a public transport company really can aim for additional roles. Depending on ambition, identity, size, related available expertise and knowledge, and market share, PT companies can decide to broaden their value propositions by becoming the director, start operating additional modes of transport, or just stay with operating PT services and add value through optimising the integrability of those services with third-party platforms and modalities.

All in all, there is thus no universal best application of interconnectedness for public transport companies. Instead, this research mapped relevant factors that play a role in this application. Starting from assuring integrability, it depends per company what application of interconnectedness fits best, which also relates to the degree of application of datafication and selection in the previous section. If a company manages to build a strong personal relationship, this would create an appropriate basis for

obtaining a more directing role in offering integrated mobility. Again, however, this on its turn also depends on market share and available expertise.

Everything considered, it can be stated that application of platform principles by public transport companies has the potential to create a significant amount of added benefit for passengers. As public transport is generally operating according to fixed routes and timetables, tailored communication and help on how such inflexible type of transportation fits one's personal needs can truly add value. Where public transport companies typically tended to focus on efficiency of their operations, platform principles provide the means to shift towards a more passenger centred view and respond to increasing importance of platforms within the mobility sector.

Regarding the strategic viewpoint of whether or not to include these principles in the business model, the results show that implementing personalisation features within the core product of public transport companies is a logical thing to do. Those features appear to be the low-hanging fruit from the application of platform principles as they are relatively easy to implement. Whether or not and in what way to aim for contributing to the integration of public transport with other types of mobility emerges to be much more complicated. In particular, this is due to the interplay between the interests of different stakeholders and the resources public transport companies have or want to invest in.

5.2 Limitations of the study

This research and its findings are limited in several ways. In the first place, focusing on the Dutch public transport sector introduced a number of context-specific aspects that influence the results of this study. As was mentioned in the introduction, the increasing importance of online platforms puts pressure on the protection of public values in societies (Van Dijck et al., 2016). However, the results show that with respect to public transport in the Netherlands, the government still has a powerful influence which makes the market structure more complicated than for instance that of the hotel sector, where dominant commercial platforms have appeared. This influence of the government emerged to affect the application of platform principles in multiple ways, ranging from direct influence via regulation limiting chip card data usage to indirect influence by making demands within the concession system. The risk of transportation-related public values being threatened by external online platforms thus seems to be small. However, the identified possibilities for application of platform principles onto the strategies of public transport companies are also affected by this way mobility is organised in the Netherlands, and in particular by the amount of control that the government has over the regulation of this market.

In addition, focusing on the Netherlands incorporates a specific cultural viewpoint which can affect the discussed possibilities of using platform principles. In particular, the perception of privacy could play a role. As mentioned in the theoretical framework, the biggest online platforms originate in

the United States. Differences in the perception of privacy between the US culture, where the platform principles were "invented", and European points of view is likely to affect the findings of this research.

Furthermore, the applied research method provides limitations to this research. The richness of data is limited when using experts, and by focussing on specific elements of the business model canvas, other elements are excluded. Also, the choice to use the business model canvas as a framework provided one specific way to examine the strategic application of platform principles by public transport companies.

5.3 Recommendations for further research

Given the findings and limitations of this study, several recommendations for further research can be listed. First of all, regarding the identified importance of the interplay between authorities and public transport companies, research focussing on different countries than the Netherlands is recommended. In particular, countries with less strict regulations for public transport companies concerning data gathering, ticket fares and operation areas could offer different perspectives for the application of platform principles and the accompanying impact on public values. Dynamic pricing for instance already exists within the British railway market.

Secondly, case studies on how the researched application of platform principles manifests itself for specific (groups of) public transport companies are suggested as further research. As mentioned above, this study mapped several relevant factors that influence to which extent public transport companies can apply platform principles, especially concerning the participation in integrated mobility. Case studies would allow for additional research which, compared to the expert interviews used in this study, can provide more focus on the details of how successful application can be achieved.

Besides, case studies could be used to contribute to further research about the arrangement of mobility as a service. As was found in this study, the organisation of integrated mobility is complex due to the involvement of multiple stakeholders, including public transport companies. Case studies on how such complex interplay can be arranged could be used as initial steps towards more general theory about the concept of mobility as a service.

Lastly, linking to the process of connecting multiple stakeholders that accompanies the nature of online platforms, further research could also address the application of platform principles within the transportation sector from the perspective of other actors than public transport companies. Especially the perspective of authorities would be relevant given the mix of interests that play a role in the emerging platform society.

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