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Information or integration? Supporting multimodal travelling through mobility apps

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Abstract

Digital tools like journey planners and mobile ticketing apps are adopted by more and more users and seen as key enablers to making multimodal travel choices easier. This paper looks at success factors for establishing a highly integrated mobility app. By analysing and comparing levels of integration across different axes for mobility apps as well as geographical coverage and user adoption figures, we identify common types and evolution paths. The findings suggest that vertically integrated apps tend to be limited to one mode and in terms of geographic coverage. Widely used apps often integrate travel information with other functions and have wider coverage, but show low vertical integration levels. If increased multimodal travel behaviour is linked to using mobility apps, then a strategy pursuing wide user adoption may be more successful than building strongly integrated platforms in the first place. This has implications for public and private initiatives looking to build their own app or sharing their data and cooperating with others.

Keywords: Journey planners; mobile ticketing apps; multimodal travelling; transport policy; integrated mobility

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1. Introduction

Governments and local authorities increasingly aim to encourage multimodal travel behaviour amongst citizens in order to increase sustainable and active travel mode share and cut congestion and pollution. Digital tools like journey planners and mobile ticketing apps are seen as key resources to making multimodal travel choices easier for citizens (see e.g. Foljanty (2013), VCD (2017)).

Today, people traveling from A to B within a country, region or city can use an increasing number of mobile and web applications – so-called mobility apps – to support their multi- and intermodal journeys. Some apps feature routing information for multiple transport modes (hereafter referred to as horizontal integration). Others cover only single transport modes but allow users to purchase tickets, for example for local public transport, or to request and pay for taxi rides (hereafter referred to as vertical integration). Few are delivering functionalities across both axes, enabling access to information, registration, booking and electronic payment, as well as operating across various transport modes, such as public transport, taxi, car clubs or bike hire services. Some apps even offer integrated fares or flat rate plans across different transport modes, conveniently combining separate transport services for passengers.

A sufficient level of physical integration in terms of space (e.g. mobility stations) and time (e.g. coordinated schedules and availabilities) is a basic requirement for actual transport services so that passengers can take multi- and especially intermodal journeys. Beyond physical integration, horizontally and vertically integrated mobility apps can provide travellers with a convenient single access point to plan and pay for their journey across various transport services, and to use mobility as a service (MaaS). High levels of both forms of integration combined in a mobility app can contribute substantially to creating seamless user experiences and approaching MaaS. It is widely assumed that these high levels of horizontal and vertical integration are also key to successful user adoption and achieving growth. However, since few existing apps are particularly deeply integrated, and some very successful apps offer particularly low integration levels, there seem to be several possible evolution paths to establish a successful mobility app.

With that in mind, governments are faced with the question of how they should act with regard to mobility apps if they want to encourage multimodal travel patterns (see e.g. VCD (2017), VDV (2017)). In order to determine a suitable policy, it is therefore crucial to know which different strategies mobility app providers currently pursue to achieve market success, and which of these are easier or more promising than others.

The paper compares international examples of currently operating applications for transport information and ticketing worldwide, including both private and public sector initiatives. In the sample we identify four common types of app models based on the type of organization, their business model and the development stage of the app. In addition, we analyse these apps regarding their geographical coverage and user adoption as well as vertical and horizontal integration. .

2. Comparative approach

This paper is based on the work and discussions while producing a study by Ecoplan/KCW (2017) for the Swiss Federal Office of Transport (FOT) on regulating public transport ticketing sales and options for allowing third parties to enter the ticketing market. As part of the study, the authors compared several mobility apps applying a basic framework for analysis with respect to business models, reach and horizontal and vertical integration, and identified four distinct app types. For this paper, the selection of apps has been adapted to include a wider variety of apps, with German and Austrian examples as well as international apps, as these can help to highlight differences in approach.

2.1. Comparison framework

To allow direct comparisons of the various apps on offer, we developed a comparison framework which consists of six different aspects: functions and features, reach, organization type for example public transport operators (PTO), public transport associations (PTA in this context; elsewhere PTA most often abbreviates public transport authorities), OEM or IT companies, business model and development stage.

With regard to functions and features, we distinguish two dimensions of integration (Fig. 1). On one axis, there are four levels of vertical integration, along which the functionalities of a mobility app can be represented: information, reservation, payment and integrated pricing.[2] The other axis, horizontal integration, corresponds to multimodality, with regards to the quantity of available transport modes in the app: public transport (PT), taxi/ridesharing, car rental, car clubs and bike hire, privately owned cars and bikes, and walking. The more transport modes are represented in an app, the higher, the fewer modes the lower the level of integration.

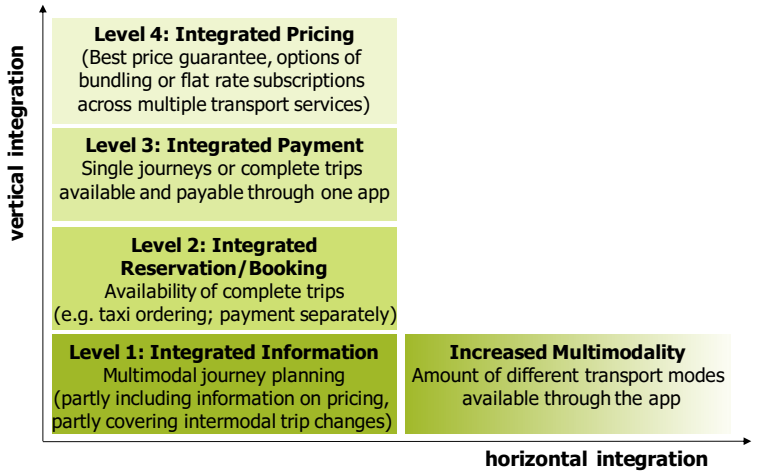

Fig. 1 Framework for analysing horizontal and vertical integration of mobility apps

To analyse the reach of an application (Fig. 2), we look at the geographical coverage of contained transport services on one hand, ranging from local over regional, national to international. We do not differentiate according to distances travelled, even though user needs may vary accordingly. On the other hand, we look at user adoption, measured by the number of downloads in the Google Play store.[3] The lack of comparable data on market penetration and app usage (i.e. active users) makes it difficult to evaluate and compare the overall success of the studied apps on a precise quantitative basis.

Fig. 2 Framework for analysing geographic coverage and user adoption of mobility apps

[2] For the purposes of this study, we take the existence of integrated tariffs within one transport mode for granted, even when more than one operator or service provider is involved, such as for integrated tariffs in a public transport association, allowing public transport rides with several transport operators on a single ticket. Thus, for monomodal apps, we speak of level 4 integration only when the integrated pricing goes beyond a common tariff, for example when offering a best price guarantee.

[3] We limited this to Android systems due to the lack of data for iOS.

2.2. Comparison of mobility apps

From the multitude of mobility apps currently available, we selected 19 apps both of European and international origin for further analysis. The selection reflects the wide variation of products available, differentiated by organisation type of the app initiator, the business model, development stage, level of vertical integration, transport modes covered (horizontal integration), coverage and user adoption (as of September 2017). The brands and their core functional differentiators are listed below in tables 1-4:

Table 1. Overview of selected mobility apps from Germany

Brand	Organisation type	Business model / revenue streams	Develop -ment stage	Vertical integration level	Transport modes	Coverage	m. Down -loads.
BVG	PTO	Ticketing channel	Released	Information, partly booking and payment*	PT, cycling, walking	Local	1-5
DB Navi-gator	PTO	Ticketing channel	Released	Information, reservation/ booking and payment**	Train, PT	National	10-50
easy.go	PTA***	Ticketing channel	Released	Information, partly booking and payment*	PT, car clubs, bike hire	Regional	< 0.5
HTD****	PTO***	Ticketing channel	Released	Information, booking and payment	PT	National	< 0.5
Leipzig mobil	PTO	Ticketing channel	Released	Information, reservation, booking and payment, integrated pricing	PT, car clubs, bike hire	Local	< 0.05
moovel	OEM / IT company	Funding by Daimler, booking channel, commissions	Released	Information, partly reservation/booking and payment*****	PT, car clubs, taxi, bike hire, train	National** ***	< 0.5
Öffi	IT company	Private donations	Released	Information	PT	National	5-10
RMV	PTA	Ticketing channel	Released	Information, partly booking and payment*	PT, walking, cycling, private car	Regional	1-5

* Booking and payment currently available only for PT tickets

** Booking and payment for local / regional PT tickets currently available only for 10 regional PTA in Germany

*** The app was developed and financed as a joint initiative by several regional PTA and PTO

**** Handyticket Deutschland

***** Information on bike hire currently only for selected providers and regions, reservation/booking and payment currently only for own products (car clubs, taxi), train tickets in Germany, and tickets for two regional PTA (Hamburg and Stuttgart)

Table 2. Overview of selected mobility apps from Austria

Brand	Organi-sation type	Business model / revenue streams	Develop-ment stage	Vertical integration level	Transport modes	Coverage	m. Down-loads
Verkehrs-auskunft Öster-reich	PTA*	Public funding	Released	Information	Private car, cycling, PT, Park and Ride, car clubs, bike hire	National	< 1
Wien Mobil	PTO	Ticketing channel / public funding	Released	Information, reservation, forwarding for booking and payment	PT, cycling, car clubs, taxi, walking	Local	< 0.05

* The app was developed and funded as a joint initiative by several regional PTA.

Table 3. Overview of selected mobility apps from Switzerland

Brand	Organi-sation type	Business model / revenue streams	Develop-ment stage	Vertical integration level	Transport modes	Coverage	m. Down-loads
Fairtiq	IT company	Setup-fees, monthly fees, commissions*	Released	Only payment/ ticketing	PT	National**	< 0.05
SBB Reise-planer	PTO	Ticketing channel	Pre-view***	Information, partly reservation, booking and payment	PT, car clubs, bike hire	National	< 0.05
Schweiz-mobil	NGO	In clarification	Released	Information	Cycling, mountainbiking, skating, canoeing, walking, PT	National	< 0.5

* Fees and commissions charged to transport operators

** for 16 PTO in Switzerland (as of September 2017)

*** Full vertical integration up to reservation/booking and payment is planned. This app is supposed to replace the current booking app SBB Mobile in the future (>1 million downloads).

Table 4. Overview of selected mobility apps from other countries

Brand	Organi-sation type	Business model / revenue streams	Develop-ment stage	Vertical integration level	Transport modes	Coverage	m. Down-loads
Ally	IT company / other transport provider	Collection and monetization of traffic data	Released	Information	PT, car clubs, bike hire, taxi, walking	Internatio nal	< 0.5
City-mapper	IT company	Venture capital funding	Released	Information, forwarding for reservation/ booking	PT, bike hire, car clubs, cycling, walking, taxi	Internatio nal	1-5
Google maps	IT company	Advertising	Released	Information, forwarding for reservation/ booking	Private car, PT, cycling, walking, air traffic	Internatio nal	1000 - 5000
moovit	IT company	Venture capital funding	Released	Information	PT, bike hire	Internatio nal	10-50
WeChat	IT company	Online games, e-commerce fees, advertising, user data	Released	Information, reservation/booki ng, payment	Train, coach, PT, bike hire, taxi, private car, air travel	Internatio nal	100-500
Whim	IT company	Public funding and user subscriptions	Developm ent / testing	Information, reservation/booki ng, payment, integrated pricing	Taxi, rental car, car clubs, PT	Local / regional	< 0.001

Some apps offer information and journey planning functions combining multiple transport modes, but fall short of the same level of vertical integration for all modes, resulting in only partial reservation and payment functions. In these apps users would only be able to purchase tickets for public transport. Should they wish to use bike hire or car clubs they would have to turn to the relevant provider. A truly integrated multimodal experience for the user is not available through these apps. We therefore categorized these apps as multimodal but only on level 2 for vertical integration, highlighting the difference to apps that don't just provide information but also booking and payment functions across all modes.
In addition, some of the multimodal apps feature intermodal routing on the information level, allowing users to plan and combine multiple modes within a single journey. Since this was neither widespread among the apps nor seems to be a key feature, we did not highlight intermodal routing in the analysis.

2.3. Deduction of app archetypes

Based on the type of organisation or stakeholders who initiated the app, their business model and the development stage of the app, we deducted four app archetypes, which entail core aspects of market position and origin:

Type 1 is the Public Transport App operated and branded by local, regional or national public transport operators and/or public transport associations. These apps integrate information on timetables and routes as well as ticketing and fares of all PTO and other transport modes within the PTAs' jurisdiction. Some offer booking and payment options for their local PT services. These apps can also include services for other transport modes, particularly if these are either also run by or operating in partnership with the app initiator. An example with high vertical integration would be the Deutsche Bahn app DB Navigator, others are the BVG or Wien mobil app. Naturally, these apps often have only local or regional coverage.

Type 2 is the Mobility Provider Apps, i.e. apps operated and branded by companies or other private initiatives offering mobility services that are not part of traditional public transport. Typically, they offer payment options for their own or associated transport offers and sometimes information on other modes, however not necessarily the function to purchase tickets for these. Apps could include those of car clubs, ride sharing and ride sourcing apps or an app like Daimler's moovel which offers its users deep vertical integration as well as multiple transport

modes. This type of app is rather uncommon - most mobility providers outside of classic public transport develop their own apps, but usually with limited functions and no integration of other transport modes.

Type 3 is the IT-Start-up App which is built and operated by new technology companies, for example start-ups that are not running or associated with actual transport operations or vehicle production. These companies show business models based on data and / or commissions. Some have developed highly distinct business models that aim to disrupt how public transport and mobility services are accessed, e.g. MaaS Global who offer mobility bundles through their app "Whim" which aims to fulfil all mobility needs of the user.

Type 4 is the Digital Service Platform which is built and operated by large technology companies and established national or global brands that do not currently operate or produce transportation services. These companies operate business models mostly based on generating income from user data for example through advertising. They may operate virtual ecosystems that include social media, e-mail, mapping, e-commerce, and search engines like Google[4] and WeChat.

2.4. Comparative Analysis

When comparing the coverage and user adoption among the selected apps (Fig. 3), unsurprisingly, the most widely adopted apps have at least national, if not international reach. This holds for the apps with more than 5 million users on Android systems. Only WeChat and Google Maps, both being Digital Service Platforms (type 4) have very high user counts of more than 100 million downloads on the Google Play store, both being available and usable worldwide, even though WeChat's main market is China.[5] On the local and regional level, some of the examples of Public Transport Apps (type 1), in large German metropolitan regions, have download figures of 1-5 million users, indicating that they can be very successful locally with high market penetration. The studied examples of Mobility Provider Apps (type 2) have wide geographical coverage, but rather few users. Depending on the type of mobility services they provide, coverage as well as user adoption may vary for this type of app. For the IT-Start-up Apps (type 3), download figures vary, but it seems that this type more often aims for international or at least national coverage, with a scalable business model.

Overall, we see a certain correlation between user adoption and coverage, which is naturally explained by the limited number of potential users in a limited geographical area.

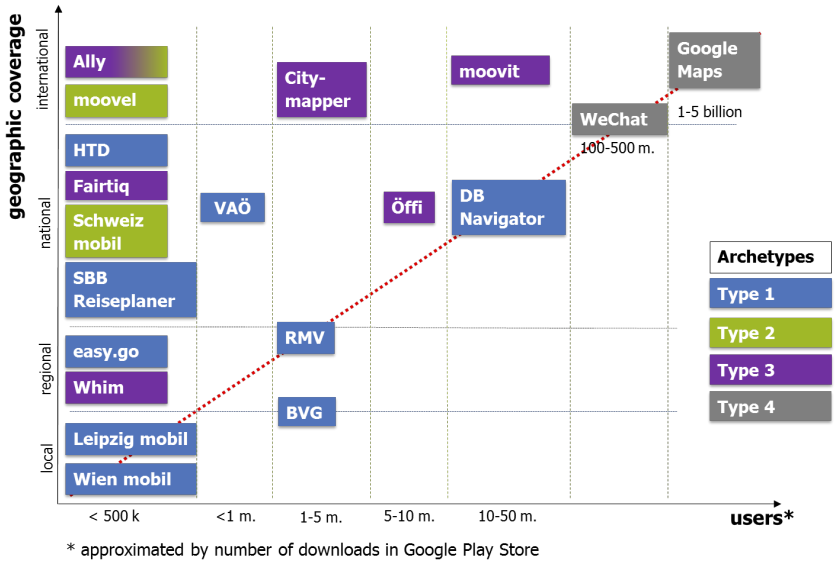

Fig. 3 Comparison of mobility apps by geographic reach and user numbers

[4] A company like Google who is developing self-driving vehicles would move from type 4 to type 2, once and if these autonomous mobility services are operating at scale and are bookable through a widely available app.

[5] Not all the functions and features, in particular those related to travel information, booking and payment, may be available to users outside of China.

When mapping the apps compared in this study on the two axes of integration (Fig. 4), from mono- to multimodal and from mere information to integrated pricing schemes, two main groups emerge.

There are monomodal apps across levels 1 to 4, as well as those apps with partial reservation and payment as described above. These offer information on multiple modes, but booking or payment only on one mode and are therefore categorized on level 2. Most of these apps are Public Transport Apps (type 1), functioning locally, regionally or nation-wide, sometimes with high user adoption within their geographical coverage. The only example of a monomodal app with integrated pricing is Fairtiq, which offers users a best price guarantee to, i.e. price caps, but limits its functions to pricing, ticketing and payment with no journey planning information.

There are multimodal apps which may include information on pricing of the different modes, but do not offer the function to book or purchase tickets for any mode. They can be used in a relatively large geographical area. These mere information apps include established global players like Google Maps (type 4), new start-ups like Ally (covering around 30 German cities) or Citymapper (covering around 40 global cities) (both type 3), or nationwide routing platforms such as Schweiz mobil or the group of apps based on Verkehrsauskunft Österreich, a joint effort by PTA and other public and transport-related institutions.

Apps offering level 3 payment functions or even level 4 integrated pricing schemes across multiple modes are rare. Interestingly however, we find examples from each of the archetypes here, all of which are particular in some way, or in early stage development and hence limited. One example for a level 3 multimodal app is WeChat (Chinese social network and e-commerce ecosystem), which has developed its own electronic payment system that has been widely adopted by retailers and transport providers in China due to WeChat's extensive reach. Another one is moovel, which so far offers its complete set of functions only in two cities in Germany. The third example on level 3 is Wien Mobil, which aims at very high multimodal and vertical integration locally. It was released in mid-2017 by Upstream, an IT company founded by the local PTO Wiener Linien specifically for this purpose, after years of testing and development as part of the research project Smile. Therefore, user adoption is yet low, and coverage is limited to the city of Vienna, although stakeholders from Graz and Linz were also involved in the previous research project.

On level 4 and covering multiple modes we found just two apps, Leipzig mobil and Whim, where the first is a wholly integrated offer for the transport services provided directly by Leipzig PTO, and the latter is a start-up providing a platform that bundles the services of several cooperating mobility providers, though still in pilot phase. Both have a local focus.

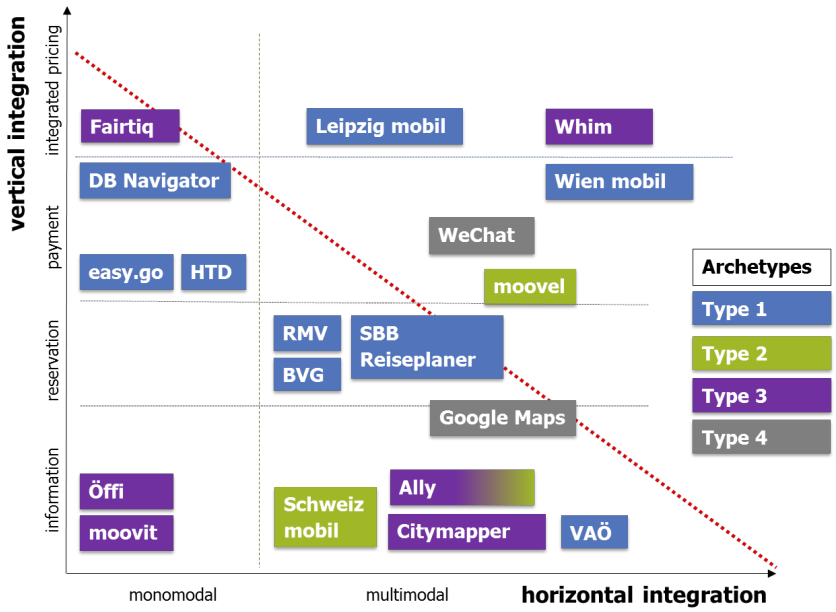

Fig. 4 Comparison of mobility apps after horizontal and vertical integration

Overall, looking at the apps with high reach in terms of coverage and user adoption (Google Maps, WeChat, moovit, DB Navigator, Öffi, Citymapper, BVG, RMV and VAÖ in descending order), either vertical integration levels or horizontal integration levels or even both are very low. Many of these are monomodal or address only few modes, so vertical integration seems to be more important in this group than including more modes. The one exception is WeChat, where integration of many modes on the payment level might have been widely facilitated by its own electronic payment system.

The apps featuring higher vertical integration are almost exclusively monomodal Public Transport Apps of type 1, with the few exceptions described above. Although mostly limited in coverage, they may have high user adoption within their locality.

3. Discussion: Possible success paths

A curious pattern emerges from the analysis showing two distinct groups of apps: the first providing strong horizontal integration, the second offering deep vertical integration. The latter however seem to achieve only limited success in terms of user adoption, whereas some of the mere information platforms are more successful.

The lack of integration across both axes could be due to the complexity of getting multiple stakeholders to collaborate on one platform. Each has different interests and requirements. The complexity and necessary coordination, particularly for vertical integration across multiple modes, affect costs and potential business models, and often implies a very limited coverage. If subsequently only few people register as users (as is the case for many of the analysed examples) the apps' viability is at stake.

There are two possible evolution paths that are commonly followed by the studied apps:

- Either the app first integrates fully both horizontally, with as many transport modes as possible, and vertically, to create a completely integrated user experience, to provide an appealing one-stop-shop for the user. With this rationale the aim is to provide an enticing integrated offer that convinces users and therefore leads to growth. This path is taken mainly by the apps of type 1 (Public Transport Apps) and 3 (IT Start-ups),
- or the app aims for scale, first tackling wide user adoption, by expanding geographically and possibly by integrating transport information with other convenient functions, such as messaging or mapping. In this case, vertical integration is not necessarily implemented, but high market penetration might create momentum to reach high vertical integration later. In this case, horizontal integration is not a must-have either, but can be one convenient feature, among other features that may lie beyond mere routing and transportation. This strategy is followed mainly by apps of type 2 (Mobility Provider Apps) and 4 (Digital Service Platforms), with some apps of type 3 (IT-Start-ups).

Our analysis suggests that the second strategy, aiming for wide adoption and possibly integrating other functions later, could be more successful in the race for market penetration in the long run. This becomes particularly clear when the customer's perspective is taken. From a customer's point of view, the information on the available multimodal route options is primarily relevant for a multimodal journey, which is often the case for short-distance travel, local scope and/or involving the first and last mile. The vertical integration can only increase the comfort of multimodal travel by making it possible to book through a single platform. At the same time however, vertical integration increases complexity and costs due to the greater number of stakeholders involved, making those apps harder to achieve.

Peculiarly, most of the apps developed by stakeholders from the public sector seem to pursue the first evolution path. The public sector in Austria as well as Germany is spending significant funds to develop multimodal mobility apps with both deep horizontal and vertical integration hoping to foster multimodal mobility. Given the challenges and cost in setting up horizontally and especially vertically integrated platforms, it has to be proven that these platforms work better in achieving their aims, i.e. more multimodal journeys. Apps that concentrate on driving user numbers up first, without strong vertical integration, may in the long term be better positioned to deliver on the aims as well as offer more sustainable business models.

Rather than developing deeply integrated platforms, public money might be better spent ensuring access to the necessary data sets and interfaces for third parties. This could be facilitated by implementing Open Data policies

for transport operators, allowing third parties to access transport data easily and to integrate these into their applications worldwide. By allowing data from public transportation and other transport modes supporting multimodal travel behaviour to find their way into widely used apps - travel related or not -, the barrier to easy multimodal travel might be lowered even more easily than with highly integrated apps. The competition among the apps will then lead to increased comfort for the users and increased vertical integration.

4. Summary and conclusions

By analysing and comparing levels of vertical and horizontal integration for mobility apps as well as geographic coverage and user adoption figures, we have identified common types and evolution paths for mobility apps. The findings suggest that vertically integrated apps tend to be monomodal and limited in terms of coverage. Also, widely used apps often integrate travel information with other functions and have wider coverage, but show low vertical integration levels. If best supporting multimodal travel behaviour with regard to mobility apps could mean that intensive usage is aimed at, then a strategy pursuing wide user adoption first, possibly with some horizontal integration, may be more successful than building deep, vertically integrated apps. In addition, the variety of involved stakeholders adds to the complexity and cost of the latter.

Some open question for further research on user preferences and adoption behaviour emerge: Do users really want extensive vertical integration, across modes? How important is horizontal integration really to users, and how much of it is needed? If, as often stated, users would love a fully integrated one-stop-shop, then why don‘t they download the apps closest to achieving that but rather the ones with the lowest vertical integration? Both qualitative research as well as more concise quantitative research on market penetration for mobility apps will be necessary to answer these questions. More importantly, the actual effectiveness of mobility apps in supporting multimodal travel behaviour needs to be studied: Which apps, if any, lead to an increase in multimodal travel behaviour and by whom?

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