THE LONG AND WINDING ROAD TO SMART INTEGRATION OF DOOR-TO-DOOR MOBILITY SERVICES: AN ANALYSIS OF THE HINDERING INFLUENCE OF INTRA-ROLE CONFLICTS

Research paper

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Abstract

Technical advances such as sensors and open data have enabled service integrators to offer smarter service packages. Door-to-door (D2D) mobility integrators now promise to provide smart (i.e., highly individualized, dynamic, and context-aware) services by packaging component mobility services provided by independent mobility providers, such as bus, car-sharing and train companies. However, this business model has inherent conflicts.

This research proposes a role framework for smart D2D mobility integrators and analyses intra-role conflicts to explain the low cooperation rate among public transport companies with D2D mobility integrators. Drawing on intermediary literature and role conflict theory, this study identifies how intra-role conflicts between D2D mobility integrators and transport and tariff associations (TTAs), the regional representations of public transport companies, lead to non-cooperation.

Our empirical results from the German mobility sector show strong intra-role conflicts within the logistical and customization role. Especially the TTAs' desire to provide D2D mobility themselves negatively influence their willingness to cooperate.

Keywords: Business Model, Intermediary, Mobility Service, Smart.

1 Introduction

The continuous rise of the Internet over the past 25 years has caused dramatic changes in the travel sector. Several new service integrators acting as intermediaries, such as Expedia and Opodo, use up-to-date technology to empower customers to book their travel without consulting a physical travel agent (Standing et al., 2014; Xiang et al., 2015). In classical travel itineraries, a number of different services need to be combined (flight and hotel, etc.) to meet customer needs. However, compared with door-to-door (D2D) mobility – a new global trend (Consulting4Drive and BSL Transportation Consultants, 2015) – the complexity of such a travel trip is manageable.

D2D mobility refers to individually arranged transport service from a defined starting-point to a defined end-point using different component mobility services, which are provided by independent mobility providers, such as bus, car-sharing, or train companies (Winter et al., 2012). Although D2D mobility services are expected to dominate the mobility market by 2020 (Consulting4Drive and BSL Transportation Consultants, 2015), they are currently not as easy to book as classical travel. In the absence of D2D mobility integrators, customers need to gather all relevant information about the variety of component mobility services on their own, which results in high search costs (Allen and Wu, 2010). This is one reason why people often use their private car, with significant negative effects like air and noise pollution (Barth and Boriboonsomsin, 2008), instead of a more sustainable combination of component mobility services (e.g., riding a rental bike and taking a train). Recently, D2D mobility integrators like Moovel and Qixxit have entered to field to address these shortcomings by offering D2D mobility without the high cost of searching through myriad alternatives (Willing et al., 2017a; 2017b).

However, integrating component mobility services and creating seamless D2D mobility is a complex endeavor. D2D trips are highly dynamic and need to react immediately to disruptions (Gogos and Letellier, 2016; Motta et al., 2013). In order to provide such on-trip services, D2D mobility integrators require access to real-time data such as cancellations or delays on local busses, subways, trains, etc. in the geographic location of the customer, which mobility providers are often unable or reluctant to provide. However, mobility providers and D2D mobility integrators can only provide smart D2D mobility by leveraging sensors, open data and new forms of connectivity and information exchange.

D2D mobility integrators like Moovel and Qixxit, which strive to offer smart D2D mobility (Willing et al., 2017a; 2017b), still struggle to motivate mobility providers to cooperate. In a recent study, Albrecht and Ehmke (2016) find that D2D mobility integrators are currently rarely able to integrate public transport services into D2D trips. The purpose of this paper is to facilitate the expansion of D2D mobility by adopting a mobility provider perspective. We presume that intra-role conflicts caused by incompatible requirements and expectations are the reason mobility providers do not cooperate with D2D mobility integrators and thus a cause of the limited efficiency and context-awareness of D2D mobility (de Reuver et al., 2009; Koch and Schultze, 2011; Subberwal, 2009). To investigate how intra-role conflicts enhance our understanding about the difficulties associated with D2D mobility, we put forth the following research question: *How do intra-role conflicts impede the ability of German D2D mobility integrators to offer D2D mobility comprehensively?*

We conducted interviews with twelve German TTAs (regional representations of public transport companies) which currently do not cooperate with D2D mobility integrators. We chose non-cooperators to find out which intra-role conflicts are factors leading to non-cooperation and thus limit D2D mobility integrators' ability to offer comprehensive smart D2D mobility.

The paper is structured as follows. After reviewing relevant literature focusing on evolving D2D mobility integrators and introducing role conflict theory, we discuss our research methodology and provide background on data collection and analysis. After presenting our results, we discuss their theoretical and practical implications, the limitations of our study, and opportunities for further research.

2 Theoretical Background

An intermediary is defined as an actor who links two or more other actors who do not have a direct relationship (Giaglis et al., 2002). D2D mobility integrators act as intermediaries in that they integrate a variety of component mobility services offered by different mobility providers to create individual end-to-end transport services for their customers. In other words, they act as boundary spanners between mobility providers and customers (Leifer and Delbecq, 1978; Noble and Jones, 2006). This section first traces the evolution of intermediaries from traditional intermediaries (e.g., financial brokers, insurance brokers and wholesalers) to electronic commerce intermediaries (Alibaba, eBay, etc.), service integrators (e.g., Expedia and Opodo) and, ultimately, to smart integrators (e.g., D2D mobility integrators like Moovel and Qixxit). We then derive the roles of D2D mobility integrators from prior literature on electronic commerce intermediaries and introduce role conflict theory along with our initial assumptions about the role conflicts mobility providers may face.

2.1 The Evolution of Intermediaries

With the advent of the Internet and electronic commerce, a lively scientific discussion of the demise of traditional intermediaries (Berger and Gleisner, 2009; Sen and King, 2003; Tay and Chelliah, 2011, etc.), and the opportunities for new electronic commerce intermediaries, so-called '*e-intermediaries*' (e.g., Anderson and Anderson, 2002; Barnes and Hinton, 2007; Brousseau, 2002; Giaglis et al., 2002; Sarkar et al., 1995), ensued. In the past ten years, a variety of examples like Alibaba, Charles Schwab, eBay, and Marsh & McLennan have shown how advancements in information technology (IT) and customer demands contribute to the economic importance of e-intermediaries.

Recognizing that customer needs are not atomistic (Alt, 2016) and that a single company is rarely able to fulfill all of a customer's needs, several studies have investigated the collaboration of service providers (see e.g., Baumöl and Winter, 2001; Heinrich et al., 2011). Across various theoretical perspectives (Alt, 2016; Heinonen and Strandvik, 2015; Lusch and Nambisan, 2015), there is a broad consensus on the need for intermediaries able to coordinate existing service providers effectively and provide a unitary service to the customer.

The relevant literature has different terms for such intermediaries, including 'aggregators' (Baumöl and Winter, 2001), 'composition intermediaries' (Schulz et al., 2016), 'orchestrators' (van Liere et al., 2010), or 'service integrators' (Heinrich et al., 2011). In this paper, we use the term '*service integrator'*. According to Heinrich and Winter (2004, p. 4), "service integrators support complex end-consumer processes by aggregating reusable as well as specific service components". Travel agencies like Expedia and Opodo, for example, compile flight, hotel and rental car service into an individual service package.

Technical progress (access to data, sensors, etc.) will increasingly enable service integrators to become '*smart integrators'* that offer individual, context-aware and dynamic service packages. Smart D2D mobility integrators, for instance, will automatically reschedule or rebook individual component mobility services in reaction to unforeseen events on a trip (Gogos and Letellier, 2016; Motta et al., 2013). Analogous to concepts like 'smart home' (Rocznik et al., 2017), 'smart cities' or 'smart tourism' (Gretzel et al., 2015), smart D2D mobility can thus be defined as context-aware and dynamic service enabled by advanced IT. Services such as Google Maps™ already rely on such advanced IT to predict car traffic flow (Lu et al., 2011), which depends on influencing factors like time of the day, day of the week, and special events including accidents. Google Maps™ also provides real-time public transport information for a continuously growing number of countries and cities (Shalaik and Winstanley, 2011), making it possible to take cancellations into account. Another example is Uber's pricing model. Uber uses advanced IT to apply dynamic pricing methods to capitalize on demand increases in the case of big sporting events, holidays or inclement weather (Chen et al., 2015).

The evolution of intermediaries indicates that the expectations of and requirements placed on intermediaries, including their role and associated tasks, fluctuate over time. Presumably, D2D mobility integrators also have to fulfill specific roles in order to be able to provide D2D mobility.

2.2 Roles of D2D Mobility Integrators

Our review of relevant literature finds no discussion of the roles of smart integrators, but several role frameworks for e-intermediaries have been proposed (e.g., Anderson and Anderson, 2002; Bakos, 1998; Brousseau, 2002; Giaglis et al., 2002; Sarkar et al., 1995). The role framework proposed by Barnes and Hinton (2007) synthesizes previous approaches, identifying five roles that e-intermediaries are expected to fulfill. The following section discusses how these roles need to be reframed for D2D mobility integrators.

The **informational role** of a D2D mobility integrator is to provide detailed information about customers (e.g., trip date, number of passengers), mobility providers as well as their component mobility services. In particular, the D2D mobility integrator needs to provide superordinate information (Ehmke et al., 2016; Willing et al., 2017a), providing customers with D2D trip data (transfers, trip duration, etc.) and information about integrated component mobility services (e.g., mobility provider name, departure and arrival point).

A D2D mobility integrator taking the **transactional role** enables one-stop purchases of D2D mobility and settles payments with mobility providers (Gogos and Letellier, 2016; Willing et al., 2017a; 2017b). As in the travel sector, they are embedded and can offer a price advantage over individual bookings. Several D2D mobility integrators do not currently fulfill this role (Albrecht and Ehmke, 2016), but instead forward the customer to individual mobility providers.

When acting in the **assurance role**, D2D mobility integrators have to ensure that a customer will receive the high quality D2D mobility they expect. In part, D2D mobility integrators automatically propose an alternative D2D trip if a component mobility service drops out (e.g., in the case of a delay) (Gogos and Letellier, 2016; Motta et al., 2013; Willing et al., 2017b). However, currently, D2D mobility integrators do not mediate between a customer and a mobility provider in cases when the expected quality is not provided (dirty seats, unfriendly drivers, etc.). Nevertheless, they ensure a specific kind of initial quality by screening mobility providers before cooperating with them. In addition, D2D mobility integrators have assure mobility providers that they will receive payment.

The **logistical role** of a D2D mobility integrator involves the continuous delivery of information to support a customer during the D2D trip and make adjustments in cases of unforeseen events. In order to enable seamless D2D mobility, also the provision of information about integrated self-services (e.g., how to walk from the train station to the bus stop) is necessary. Besides the supply of information, the logistical role includes, in particular, the delivery of service credentials such as tickets and reservations (Albrecht and Ehmke, 2016). Overall, the consecutive dependence on component mobility services distinguishes the logistical role of an e-intermediary from the logistical role of a D2D mobility integrator.

Within their **customization role**, D2D mobility integrators tailor D2D mobility to better meet customers' needs. Individualized D2D mobility is, by nature, customized because it consists of several component mobility services (Boero et al., 2016; Motta et al., 2013). A more advanced customization role is when D2D mobility integrators enable customers to specify the component mobility services before/after they are selected, for example, personalize their walking speed data, or prioritize taxi drivers with whom they were satisfied in the past.

In order to provide D2D mobility efficiently, D2D mobility integrators must thus perform the five roles described above. However, since mobility providers such as public transport companies may have conflicting role expectations, conflicts may arise as D2D mobility providers attempt to perform these roles. We turn to role conflict theory to better understand these conflicts, their origins and their effects.

2.3 Role Conflict Theory

Role conflict theory shows that when an actor performs one or more roles, "there is always a *potential* for differing and sometimes conflicting expectations of the conduct appropriate to a status-occupant [i.e., actor performing the roles]" (Merton, 1957, p. 112). Role expectations represent attitudes, beliefs, and norms with regard to a social position (e.g., a physician should wear a white coat) or a context (e.g., an audience should be quiet during an opera performance) (Biddle, 1979; Koch and Schultze, 2011). Perrone et al. (2003) argue that expectations also include goals and values assigned to a role.

A role conflict can be segregated into 'inter-role conflict' and 'intra-role conflict' (Subberwal, 2009). Whereas the former refers to conflicting expectations associated with multiple roles performed by one actor, for example, a D2D mobility integrator may perceived contradictory expectations concerning its transactional and logistical role, the latter describes a situation in which different actors (e.g., customers or mobility providers) have conflicting expectations of a focal role (D2D mobility integrator) (Merton, 1957). As a consequence, intra-role conflicts arise "when there is a lack of understanding about roles or they are mismanaged" (Subberwal, 2009, R11). In the past, role conflict theory was used in varying research fields (business administration, information systems, sociology, etc.) as well as at an individual (e.g., Allen et al., 2000; Allison, 1991; Sage and Loudermilk, 1979), group (e.g., Arumugam, 2013; Koch et al., 2014), and organizational level of analysis. In the following, we focus on studies at the organizational level.

At the organizational level, actors represent cooperating companies. The work of de Reuver et al. (2009) highlights the crucial importance of an acceptable division of roles, as perceived by the companies involved, for the success of a business model. A number of authors (e.g., Bengtsson and Kock, 2015; Dowling et al., 1996) further emphasize that cooperation simultaneously involves competition (referred as 'coopetition'). Walley (2007, p. 16) argues that "this requires firms to adopt conflicting roles". When role conflicts are not managed, they can limit interorganizational knowledge sharing and learning (Chowdhury et al., 2016; Walley, 2007), increase uncertainty, reduce stability, as well as cause costs for cooperating companies (Dowling et al., 1996). In terms of managing role conflicts, Bengtsson and Kock (2015) point out the high importance of role clarity and role stability.

In contrast, Havila (1992) explicitly focuses on intermediary companies in a triadic business relationship, illustrating that in three of four possible situations either the expectations of the supplier and/or the customer company are in conflict with those of the intermediary, which limits the intermediary's ability to perform its role. Koch and Schultze (2011, p. 123) use role conflict theory to analyze business-to-business electronic marketplaces (i.e., intermediaries) as the "conflicted middle" between market and hierarchy. Their results show that all companies involved, i.e., the intermediary as well as the buyers and suppliers, have their own role expectations leading to goal, behavior, and identity conflicts.

Concerning D2D mobility integrators, an intra-role conflict may concern the transactional role. For instance, de Reuver et al. (2009, p. 6) state that "both content providers and operators [i.e., mobility providers and D2D mobility integrators] will be interested in owning the customer, because billing customers provides advantages of additional revenues".

2.4 Summary and Initial Assumptions

D2D mobility integrators try to offer D2D mobility by integrating different component mobility services which are provided by independent mobility providers, such as bus, car-sharing, and train companies. Providing such D2D mobility implies expectations about the five underlying roles D2D mobility integrators need to fulfil, as depicted in Figure 1.

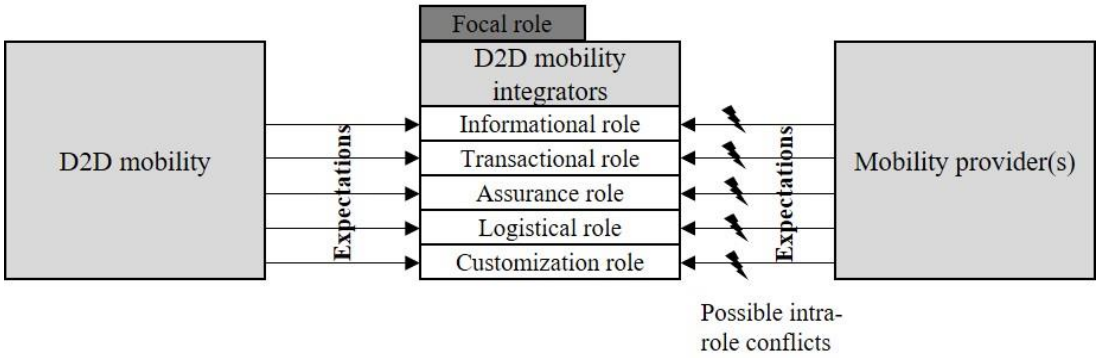

Figure 1. Intra-role conflicts stemming from diverging D2D mobility integrator role expectations.

Although D2D mobility is expected to be increasingly important (Consulting4Drive and BSL Transportation Consultants, 2015) and technical progress is paving the way for such smart services, D2D mobility integrators are often unable to fulfill the described roles. Ehmke et al. (2016), for instance, analyzed D2D mobility integrators in the German-speaking area and show that only nearly half of the D2D mobility integrators take dynamic customer data into account. Moreover, customers usually get separate invoices for each component mobility service which is included in a D2D mobility service package and are not able to modify these packages after purchase.

In this paper, we assume that these shortcomings may be caused by intra-role conflicts. Due to the intermediary position of D2D mobility integrators, there is a high probability that independent mobility providers have varying role expectations. More specifically, we argue that the underlying reasons for these intra-role conflicts are (a) general rejection of an intermediary position in the case of some of the roles of D2D mobility integrators, and/or (b) the current inability of D2D mobility integrators to act smart in these roles.

Although studies at the organizational level have demonstrated the strong impact of intra-role conflicts on cooperation between companies, there have been no such examinations of the relationship between intra-role conflicts and the cooperative behavior of mobility providers. We assume that the low degree of cooperation between mobility providers and D2D mobility integrators (Albrecht and Ehmke, 2016) is due to such intra-role conflicts.

3 Methodology

3.1 Research Context

As laid out above, the mobility sector is in a state of flux fuelled by technical progress (Münchner Kreis e.V., 2017). In recent years, different publicly funded projects such as the Intermodal Mobility Assistance for Megacities (Masuch et al., 2013), Mobility Broker (Beutel et al., 2014a; 2014b), and WISETRIP (Aditjandra et al., 2009) were initiated to offer D2D mobility by integrating different component mobility services. However, these projects have still not been implemented or have already been discontinued (Willing et al., 2017b). Simultaneously, numerous private companies emerged which try to act as D2D mobility integrators. An overview for the German-speaking area is offered by Albrecht and Ehmke (2016) and Willing et al. (2017a; 2017b). The most prominent examples are Moovel (founded by Daimler AG in 2012) and Qixxit (a subsidiary of Deutsche Bahn AG, in operation since

2013). All of these D2D mobility integrators are currently still in the start-up phase, attempting to find a sustainable business model (Willing et al., 2017a). Especially motivating a large number of mobility providers to cooperate, in order to be able to offer alternative D2D trips, seems to be the major challenge. Schulz and Überle (2018) identify different existing institutional arrangements in which mobility providers, such as car- and bike-sharing companies, are embedded that impede cooperation with D2D mobility integrators. Similarly, the results of Albrecht and Ehmke (2016) showed that, for example, only 44% of D2D mobility integrators in German-speaking Europe are able to integrate public transport services.

German public transport is well-suited for studying intra-role conflicts for several reasons. First, public transport in Germany mainly is organized locally by so-called 'transport and tariff associations' (TTAs). While in the past the vast majority of TTAs consisted solely of independent transport companies (bus, subway, tram, and/or train), more recently regional authorities like federal states, districts, or cities act as (additional) shareholders (Reinhardt, 2012). Due to this organization structure, non-cooperation of TTAs causes a relatively large local blank spot on the map of D2D mobility integrators.

Second, German public transport companies are often considered less innovative than private transport companies (Monheim and Schroll, 2005). Hence, we would expect a high number of intra-role conflicts concerning cooperation with emerging D2D mobility integrators. On the other hand, in comparison with other regions of the world, the pre-existing infrastructure, a great public pressure, as well as institutional and legal conditions lead to the D2D mobility concept being more advanced in Europe, especially Germany (Marx et al., 2015; Willing et al., 2017b). Accordingly, German TTAs should be sufficiently familiar with the topic to answer our questions.

Third, a number of indicators emphasize the importance of public transport for the German population and authorities. In 2015, more than 10 billion rides were taken on German public transport systems. Nonetheless, the transport companies generated an overall loss of 3 billion euros (in 2014), a cost recovery ratio of 77% (Verband Deutscher Verkehrsunternehmen, 2016). As a result, regional authorities are often forced to provide financial support (financing of the mobility service, train funding, etc.) to guarantee public transport (Reinhardt, 2012).

Fourth, according to Watson et al. (2011) the mobility sector is one of the main sources of greenhouse gases, and subsequently a critical factor in global climate change. An understanding of intra-role conflicts inhibiting cooperation on behalf of public transport is especially useful because otherwise D2D mobility is greatly restricted to relatively high carbon emittance individual transport (e.g., car-sharing, taxi).

3.2 Data Collection and Analysis

In 2016, there were approximately 124 German TTAs (Reinhardt, 2012; Wikipedia, 2016). We used a theoretical sampling method (Flick, 2009; Glaser and Strauss, 1967) to select 45 TTAs in total that are typical with regard to the number of involved public transport companies and passengers they transport per year. The managing director (MD) of each TTA was chosen as contact person since s/he is responsible for strategic decisions such as a business cooperation with D2D mobility integrators. Furthermore, a snowball sampling (e.g., Su, 2013) was used to identify additional experts (project managers – PM, etc.). Overall, we received twelve interview confirmations from TTAs. When there were more than one expert for a TTA (e.g., in the case of MD6 and TP1), a joint interview was held. Table 1 provides interviewees' demographic data.

ID	Role / Function	Gender	Years in position	Number of public transport companies	Passengers per year (in millions) [a)]
MD1	Managing director	Male	5	≥ 40	≤ 400
MD2	Managing director	Male	4	≤ 10	≤ 300
MD3	Managing director	Female	6	≤ 30	≤ 200
MD4	Managing director	Female	11	≤ 20	≤ 50
MD5	Managing director	Male	6	≤ 10	≤ 50
MD6	Managing director	Male	2	≤ 30	≤ 50
TP1	Transport planning	Male	1		
MD7	(Deputy) Managing director	Male	12	≤ 10	n.a.
MD8	(Deputy) Managing director	Male	6	≤ 20	≤ 50
PM1	Project manager	Male	1		
AR1	Authorized representative	Female	6	≥ 40	≤ 300
TP2	Transport planning	Female	2		
PM2	Project manager [b)]	Male	2	≤ 20	≤ 200
PM3	Project manager	Male	6	≤ 30	≥ 700
OM1	Office manager	Male	1	≤ 20	≤ 50

a) Latest available figures.

b) Excluded from further analysis. The interviewee disclosed that the TTA had recently signed a letter of intent with a D2D mobility integrator.

Table 1. Overview of interviewees and their TTAs.

A semi-structured interview guideline was developed including questions on D2D mobility integrator roles and potential intra-role conflicts. The questions encompass technical (e.g., availability of electronic tickets) as well as more business-related topics like the general willingness of the TTA to sell tickets through D2D mobility integrators. In addition, secondary data (association reports, press releases, etc.) about the interviewed entities was collected through the website and via publicly available data sources before the interviews were conducted. These secondary data was used in order to make specific inquiries and to validate the statements of the experts. This data triangulation strategy follows the recommendation of Flick (2009) and Miles et al. (2014). The interviews took place between October and November 2016, and lasted between 40 and 75 minutes. All interviews were recorded and transcribed.

For our qualitative data analysis, we used the software program NVivo 10. In the first round, we scanned and coded the data parallel to data collection. The coding categories were derived from the roles for D2D mobility integrators as described above. When gaps were discovered, the interview guideline was adjusted. During a second round of analysis, the codes from the single interviews were related to each other (Miles et al., 2014). Data collection and analysis was completed after incremental learning about the roles and intra-role conflicts was minimal, as recommended by Yin (2014).

4 Analysis Results

Following D2D mobility integrator roles, we analyzed what intra-role conflicts inhibit TTAs cooperation. In only one case, TP2, could an intra-role conflict be identified that related to the **informational role**. Overall, the interviewees confirmed that a D2D mobility integrator should inform customers about single component mobility services, the overall D2D trip, as well as suitable alternatives (MD1, MD2, MD4, MD8, PM3). Customers *"need good, clear information"* (MD3), and *"should also get information about mobility platforms [of D2D mobility integrators] which may have nothing directly to do with us"* (MD4). It was noted that advanced IT makes this information *"very comfortable and easy to image [e.g., transfers, trip duration]"* (OM1). Overall, it is important that a customer *"gets the information where s/he looks for it"* (MD2). In line with the definition of the informational role, the interviewees also stressed that they wished to receive information about customers. Examples include motion

profiles (MD4), requested routings (MD4, MD6), different sales figures like proportion of public transport sales to total sales of a D2D mobility integrator (MD3), and socio-demographic data (AR1, PM1), which can be used in order to improve traffic planning and, as a result, component mobility services (MD1, MD4, MD7, PM1).

In contrast, expectations towards the **transactional role** reveal differentiated results. Although most interviewees (MD3, MD5, MD7, PM1, TP1) agree that providing one-stop purchasing would be the optimal solution for the customer, only a few (PM1, TP1) would favor D2D mobility integrators handling this task without constraints. The interviewees mentioned several reasons for their reluctance. MD5 compares the situation with that in the hotel sector, fearing dependency and financial disadvantage, stating that *"a customer does not book a hotel directly, but rather through a portal which charges the hotel. […]. [However,] formerly, the hotelier received this money. Prices cannot be easily increased due to intensified competition […, and] direct comparison"*. The same is true for public transport companies, which increasingly compete with new market entrants such as car-sharing, and ride-sharing companies. In this context, interviewees point out that the TTA has a strong competitive disadvantage because *"tariffs must be approved two weeks in advance"* (MD4) and zone tariffs are used instead of pure distance prices (MD1). Similarly, MD4 (comparable AR1) challenges the transactional role – *"I must say: Tickets will not be sold externally"* – because the interviewee struggles to answer the question *"how does the business model work? This is what I quite honestly do not understand at this point"*. More specifically, s/he is unable to understand how D2D mobility integrators *"can sell tickets at a 50% discount rate […, and simultaneously guarantee] the full price"* for the TTA. In terms of costs, interviewees didn't expect significant savings due to sales by D2D mobility integrators. MD4 (similar MD2) does *"not believe that s/he will be able to close a different distribution channel at some point because paper tickets will be around for a very long time"*. Against this background, MD5 added that at least in the case of its own mobile ticketing the sales commission is very high and *"public transport companies have lower earnings than through other distribution channels"*. MD1 describes an *"optimal ticketing solution"* of D2D mobility integrators as a be-in/be-out system where the customers *"do not have to do anything"*. *"Any devices available in the bus as well as […] on the body [e.g., smartphone] can record that you just took the bus from A to B"* (MD1). Subsequently, this data could be used to generate a monthly invoice. However, the interviewees do not expect such an advanced solution in the foreseeable future, mainly because the TTAs themselves are unable to provide the necessary technical equipment (AR1, MD8). It can be summarized that nearly all TTAs, at least in part, reject the transactional role of D2D mobility integrators.

MD1 and MD7 confirm that the guarantee of payment is an essential part of the **assurance role**. Two TTAs prefer to retain the assurance role for themselves to ensure information quality before customers make a purchase. For example, MD2 (similar to MD4) expressed the desire to ensure the information quality of its component mobility services because s/he distrusts the *"data finishing processes [of D2D mobility integrators], where customers are confronted with information […] which has been altered"* and expects *"to be held responsible"* for the misinformation. In this context, however, is worth mentioning that almost all interviewees (e.g., AR1, MD3, MD4, OM1, TP1) state that some of their public transport companies are unable to provide real-time timetable data. In addition, in cases when (expected) quality is not provided (delay, dirty seats, etc.), the TTAs (MD6, MD8, TP1) want customers to interact directly with the TTA or the public transport company and not the D2D mobility integrator. The main reason for this is that in the case of indirect distribution such as through D2D mobility integrators, if a quality complaint *"goes to court, the customer and the public transport company will be at the table"* (AR1, see also MD1, MD8, TP1). As a result, TTAs strive to retain full control about the complaint management process because they fear the negative effects of *"Chinese whispers"* (TP1).

Interviewees clearly expect a much smarter assurance role before they enter a cooperation and delegate quality management. PM1 suggested a possible future technical solution, *"whereby a smart software program could identify which public transport company is responsible based on the location of the quality failure [e.g., a delay]",* which would help solve the problem of statutory responsibility.

The fact that TTAs referring to legal complexities for their non-cooperation also show that they currently primarily adopt an inside-out rather than an outside-in perspective. Wording like *"if there is a delay at*

the destination train station the only thing one can do is say: Okay, this is in the field of responsibility of the feeder bus company and if it offers no compensation […], so the customer simply had bad luck" (MD2) illustrates that the interviewees are narrowly focused on the design of their own component mobility services. This inside-out thinking, however, is an all but obsolete relict from the period before alternative mobility offerings (car-sharing, etc.) gained prominence when TTAs enjoyed local monopolies. Today, customers expect a more integrated D2D mobility including a continuous compensation system.

The **logistical role** is characterized by an intra-role conflict resulting from the inability of many, but particularly small and medium TTAs (e.g., MD4, MD6, OM1) to deliver electronic and/or mobile credentials such as tickets and reservations. As a result, D2D mobility integrators are unable to conduct a simple integration of IT. The reasons for the non-implementation of advanced IT are primary economic and organizational in nature. According to MD6, investments are not profitable because *"[ticket] sales costs are often identical to the amount of sales, and that cannot be the case"*. Similarly, MD4 emphasized that a mobile solution *"is a permanent cost factor"* without *"additional revenue"*. In addition, TTAs struggle to deliver mobile credentials – *"just short of implementation, but it failed again, sadly"* (AR1) – because the current tariff system is very complex and existing *"IT is not capable of supporting"* (AR1) implementation (also mentioned by OM1). The interviews did not provide any further indications of intra-role conflicts at the logistical role, probably mainly because additional documents and their verification (driver's license, etc.) are not needed to ride public transport.

Lastly, an important intra-role conflict arose in the analysis of the **customization role**. Although the context-aware and dynamic integration of component mobility services is regarded as a key characteristic of smart D2D mobility integrators, nearly all of the interviewees strongly emphasized their desire to take on this role themselves: *"I say as a TTA we are the intermediary that offers customers alternative mobility"* (MD4). Apparently, TTAs have invested significant resources into solutions to provide D2D mobility themselves. However, to date, the majority of projects are still in an early stage and focus only on local D2D trips (MD3, MD5, MD7, MD8, PM1). By contrast, the interviewees (e.g., MD2, MD5, MD7) assume that a Germany-wide offer would only attract *"a handful of customers"* (MD2). These statements show that there is apparently a large information asymmetry between some of the TTAs and D2D mobility integrators concerning the mobility market and its future development. As a result of the differing expectations of TTAs, a cooperation does not appear to be mandatory for economic reasons (branding, sales, etc.). But not all interviewees shared this pessimistic view or considered D2D mobility integrators as competitors to their own local D2D mobility solutions. As PM3 (see also e.g., MD1, MD3) stated *"we need to strengthen our own platform, but we must also be present on other platforms [such as these from D2D mobility integrators]"*.

In summary, as depicted in Figure 2, a high number of intra-role conflicts inhibit the cooperation of TTAs with D2D mobility integrators. Quotations by each interviewee served as basis for our categorization (clear, partial, and no conflict). A clear conflict is characterized by a complete rejection of a role, whereas in the case of a partial conflict there are arguments for and against acceptance of a role.

Figure 2. Intra-role conflicts inhibiting cooperation.

The clearest and, thus, presumably the most persistent conflicts related to the logistical and the customization role. Especially the strong preference on the part of TTAs to take the customization role themselves makes it difficult to expect that D2D mobility integrators will realize large-scale cooperation quickly. This expectation is strengthened by the frequent rejection of the logistical role because TTAs are at least currently unable to provide the IT necessary for integration. Conversely, few intra-role conflicts stem from TTAs' expectation that D2D mobility integrators should offer smarter D2D mobility.

5 Implications

Our results have several implications for research and practice. First, this paper contributes to the stream of smart integrator research, which is in the fledging stage and where the need for research is great (Alt et al., 2016; Beverungen et al., 2016; Willing et al., 2017b). Initially, we illustrated the evolution of intermediaries. In this context, we argued that due to technical progress (access to data, sensors, etc.) service integrators will become 'smarter' in future. Based on existing literature (e.g., Gretzel et al., 2015; Rocznik et al., 2017), we defined intermediaries that offer individual, context-aware and dynamic service packages as '*smart integrators'*.

Second, we show that the role framework provided by Barnes and Hinton (2007) can be adapted to analyze the roles of D2D mobility integrators, which are a subgroup of smart integrators. All interviewees underscored the significance of these roles and the associated tasks when thinking about the position of D2D mobility integrators in the mobility market.

Third, we applied role conflict theory (e.g., Koch and Schultze, 2011; Merton, 1957) to examine the relationship between intra-role conflicts and the inability of D2D mobility integrators to offer D2D mobility comprehensively. Our results illustrate that intra-role conflicts negatively influence the willingness of TTAs to cooperate and hence the business model of D2D mobility integrators. Thus, the approach used may help to understand the "underlying mechanisms and phenomena of business model success and failure" as demanded by Veit et al. (2014, p. 50). More specifically, our results provide evidence of the frequent rejection of an intermediary position of D2D mobility integrators by TTAs. This is in line with the previous literature concerning e-intermediaries (e.g., Tay and Chelliah, 2011). On the other hand, the results indicate that TTAs only partially expect D2D mobility integrators to offer smarter D2D mobility. One reason for this is that they themselves are often unable to provide the required component mobility services (with real-time timetable data, etc.) due to insufficient IT capability. Nevertheless, the interviewees expect that the application of advanced IT can be used to remove some barriers to cooperation.

Apart from this, there are numerous more practical implications. Our results suggest that German D2D mobility integrators are likely to remain stuck in business models that rely primarily on taking the informational role if they wish to gain the cooperation of TTAs. This could be seen as a result of the lack of advanced IT capabilities. TTAs are often not able to recognize and reap the potential benefits provided when D2D mobility integrators act as smart integrators. For example, their revenues could increase through dynamic pricing (Kannan and Kopalle, 2001), or business area optimization (Willing et al., 2017a). Against this background, especially policy makers (e.g., cities, districts, federal states), as frequent shareholders of TTAs, should question their financing behavior. This also applies to TTAs' attempts to defend their 'local empires' by offering own D2D mobility. A fragmented landscape of local projects is unable to provide D2D mobility which is a real alternative to private car use. Given the fact that the mobility sector is one of the primary sources of greenhouse gases (Watson et al., 2011), a corresponding rethinking could be a crucial factor in slowing or stopping global warming.

Conversely, D2D mobility integrators should prove how business models can be developed based on the informational role, such as by including information about additional services (dining, entertainment, etc.) or by monetizing location-based advertising. In addition, they should try to provide consistently high-quality information. Given the inability of many TTAs to provide real-time timetable information for all of their public transport companies, D2D mobility integrators should examine alternative data sources. One approach could be to integrate dynamic data available through passengers' smartphones, following the lead of Google Maps™.

6 Limitations and Future Research

Our study has some limitations which should be addressed in future research. First of all, it is limited to the mobility sector. Although this sector is considered an important area for smart integrators (Alt et al., 2016; Beverungen et al., 2016), further research should expand the focus. Interesting examples may be found in the medical tourism sector where (smart) integrators package component services such as accommodation, surgery, and transfer (Connell, 2006). Second, our study was limited to German TTAs. Even though public transport companies are very important in providing valuable D2D mobility, alternative mobility providers (e.g., car-sharing, and taxi companies) as well as additional countries should also be analyzed. While the results are expected to be at least transferable to European countries with a similar organisational structure (Austria, Switzerland, etc.) they cannot easily be transferred, for example, to developing countries (Marx et al., 2015). In addition, customer expectations on D2D mobility integrator roles should be examined to identify and solve possible intra-role conflicts. Third, the roles of D2D mobility integrators were only indirectly derived from existing literature (Albrecht and Ehmke, 2016; Barnes and Hinton, 2007; Willing et al., 2017a; 2017b, etc.). Future research should be conducted with D2D mobility integrators to confirm the adapted role framework, as well as to identify possible inter-role conflicts (i.e., the conflicts between different roles of a D2D mobility integrator) inhibiting the business model. Moreover, an overarching role framework for smart integrators which recognizes the technical progress of IT should be drawn up. Lastly, interviewing experts is a good starting point for understudied research topics like smart integrators, in general, and D2D mobility integrators, in particular. However, further quantitative analyses are needed to ensure validity of the results.

7 Conclusion

We examined how intra-role conflicts impede the ability of D2D mobility integrators to offer smart D2D mobility. Our approach is novel in its adaptation of an existing role framework for e-intermediaries to account for D2D mobility integrators and the analysis of intra-role conflicts.

We conducted qualitative interviews with experts from twelve German TTAs to evaluate their views concerning the roles of D2D mobility integrators and to reveal intra-role conflicts, identifying the most important ones with regard to the logistical and the customization role. We found that most TTAs are unable to support the delivery of electronic/mobile credentials (i.e., tickets and reservations) as they lack sophisticated IT solutions. We also found that TTAs often prefer to take an exclusive customization role when they initiate their own D2D mobility projects. Due to changes in customer demand as well as rising political pressure, such a non-cooperation behavior is not expected to be sustainable.

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