Door-to-Door Mobility Integrators as Keystone Organizations of Smart Ecosystems: Resources and Value Co-Creation – A Literature Review

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Abstract. Cities around the world face major mobility-related challenges, such as traffic congestion and air pollution. One primary cause of these challenges is the decision of citizens to use their private car instead of alternative mobility services such as public transport, car-sharing and bike-sharing. Technological progress offers new possibilities to address these challenges by making alternative mobility services easier and more convenient to use. This paper focuses on door-to-door (D2D) mobility integrators, which aim to offer citizens seamless D2D transport by packaging alternative mobility services. To better understand the practical barriers D2D mobility integrators face, this interdisciplinary literature review provides a holistic picture of their operand and operant resources, revealing significant gaps in our understanding of their capability to attract actors to their ecosystem and to manage value co-creation. Based on these gaps, we identify a potential avenue of future research.

Keywords: D2D Mobility Integrators, Literature Review, Operand Resources, Operant Resources, Value Co-Creation.

1 Introduction

Mobility is a basic need of modern society. Currently, most travel is achieved relying on private cars and motorbikes. For example, in Germany motorized private transport constitutes approximately 76% of the modal split of passenger transport [1]. One reason for the prevalence of private motorized transport is the (perceived) weaknesses of alternative mobility services. In the case of public transport, a lack of reliable information about the mobility service and the distance to a station are common perceived weaknesses [2]. Another reason for the prevalence of private motorized transport is that shared services, such as bike-sharing, car-sharing, or ride-sharing have only recently become more comfortable to use due to the increased digital connectivity of the population [3]. As a result, their modal split share has remained relatively low [1].

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However, the impact of such extensive use of motorized private transport is undeniable, especially in cities. Along with an expected rise in the share of people living in cities from 50% in 2015 to 66% by 2050 [4], the number of private cars worldwide is also expected to double by 2035 [5]. The predominant use of the private car causes air and noise pollution, which endangers the health and well-being of the citizens [6], and many cities already face serious traffic congestion and parking problems [7]. An expansion of the road and parking infrastructure is often impossible, prohibitively expensive, or not desirable because natural resources should be sustained. In order to meet these mobility-related challenges, a new mobility paradigm is needed. A promising approach is to combine different alternative mobility services, such as bike-sharing, car-sharing, and public transport, to ease door-to-door (D2D) mobility. This would involve providing up-to-date information about short-term cancellations and delays and adapting trip planning accordingly. If citizens didn't have to gather up-to-date information about multiple alternative mobility service options and undertake a complex comparison/combination and booking process themselves, they may use private cars less [7].

Providing integrated D2D mobility is only possible in an ecosystem of multiple mobility providers, whereby ecosystem is defined as a "system of mostly loosely coupled social and economic (resource-integrating) actors" [8, p. 161]. D2D mobility integrators act as important intermediaries between customers and these mobility providers [9]. Recently, D2D mobility integrators like Moovel (a subsidiary of Daimler AG) and Qixxit (founded by Deutsche Bahn AG) have entered the European mobility market. Their business relies heavily on advanced information technology (IT) and new methods such as business analytics [7, 10]. Analogous to concepts such as 'smart city', 'smart home' [11], or 'smart tourism' [12], the D2D mobility integrators aim to provide a smart service.

Extant research has focused mainly on describing and comparing the quality of different D2D mobility services [7, 10, 13]. Several studies indicate that D2D mobility services provided are often of inferior quality. For example, Albrecht and Ehmke [13] find that D2D mobility integrators struggle to integrate dynamic customer location data and it has been found that only a few mobility providers are willing to join their ecosystem [7, 13]. A valuable theoretical lens through which to investigate the common service provision of multiple actors is service-dominant (S-D) logic [14, 15]. One of the key assumptions of S-D logic is that all actors are engaged in value co-creation – the integration of resources and the exchange of service [15]. To date, however, insufficient attention has been paid to the operand and operant resources actors utilize to provide service in a digital environment [16, 17]. In the case of D2D mobility integrators, there is lack of holistic analysis of their resources and a lack of transparency about resource quality. As a result, it is difficult to appropriately guide the efforts of researchers and practitioners to provide higher quality D2D mobility service. To fill this gap, this study asks the research question:

RQ: What operand and operant resources do D2D mobility integrators utilize to provide D2D mobility services?

To answer this research question, we conduct an interdisciplinary literature review spanning information systems (IS), transportation management, service science and engineering.

The remainder of the paper is structured as follows. After a brief outline of the design of the literature review, we describe our findings. Based on the research gaps identified, we describe an avenue of possible future research. Finally, we discuss the limitations of our study and draw conclusions.

2 Design of the Literature Review

A rigorous and comprehensive literature review, according to Raghuram et al. [18, p. 984] can use "several methodologies such as meta-analysis, descriptive review, and bibliometrics approaches". Each methodology has advantages and disadvantages, giving it a unique "way of seeing [and] a way of not seeing" [19, p. 284]. In this literature review, we follow the guidelines proposed by Webster and Watson [20] in order to include qualitative studies, which are typical for research in emerging fields.

The review process comprises three steps: (1) search leading journals for relevant articles, (2) backward search references in identified articles, and (3) forward search articles referring to the identified articles. In the first step, we searched the Senior Scholars' Basket of Journals of the Association for Information Systems, which contains the leading journals in the IS field. In addition, following the recommendation of Webster and Watson [20], we searched articles presented at the following five important IS conferences – International Conference on Information Systems (ICIS), European Conference on Information Systems (ECIS), Americas Conference on Information Systems (AMCIS), Pacific Asia Conference on Information Systems (PACIS), and Hawaii International Conference on System Sciences (HICSS). Beyond IS, we searched articles contained in the Science Direct and IEEE Xplore databases, which include journal and conference articles published in various fields, such as transportation management, service science, and engineering. Our cut-off date was February 19, 2018. Our keyword search list contained 36 terms in English, including 'intermodal mobility' and 'mobility as a service', as well as the names of well-known D2D mobility integrators (a complete list of keywords can be found in Table 1 of the Appendix).

In addition, we defined the following exclusion and inclusion criteria: (a) we included articles focusing on D2D mobility integrators as part of a digital ecosystem that aims to combine various mobility services. We thus excluded articles dealing with models of transport planning [21, etc.] or physical and organizational transport system integration [e.g., 22]; (b) we excluded articles that focus solely on combining public transport services (e.g., bus, subway, tram) because regional public transport is very often provided by different subsidiaries of the same company [7]. As a result, the parent company faces very different challenges than a D2D mobility integrator cooperating with independent mobility providers; and (c) we excluded theses and books.

Our initial keyword search yielded 4,635 potential articles, which we assessed manually in two rounds. First, we screened the title and, if necessary, the abstract of each article for potential relevance to our research question, selecting 200 articles. Second, we read each remaining article, excluding a further 146 articles. In our backward search, we reviewed the references of the 54 remaining articles, and in our forward search we used the 'cited by' function in Google Scholar (https://scholar.google.com). Ten relevant articles could be identified. Furthermore, the anonymous reviewers have proposed one additional article. In all, we identified 65 relevant articles. Figure 1 illustrates our literature review process.

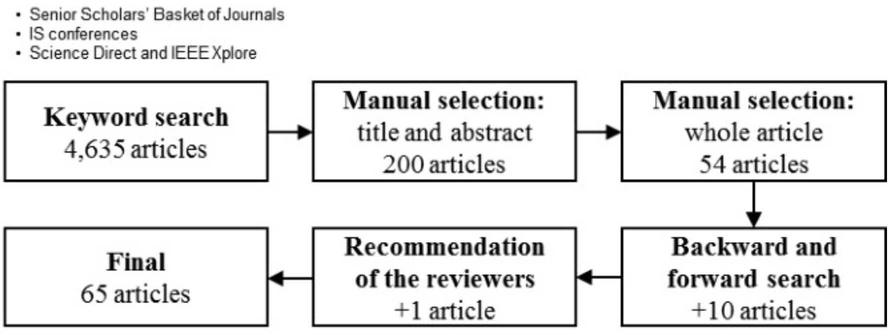

Figure 1. Overview of the literature review process.

We coded the selected articles using an iterative coding approach to ensure internal validity [23]. Our analysis focuses on two main coding categories: operand resources of D2D mobility integrators and operant resources of D2D mobility integrators.

3 Operand and Operant Resources of D2D Mobility Integrators

Operand resources are those "resources on which an operation or act is performed" (e.g., animal life, land, minerals), whereas operant resources "are employed to act on operand resources" (capabilities, competences, knowledge, organizational processes, skills, etc.) [14, p. 2, 24]. In order to provide a D2D mobility service, D2D mobility integrators rely on both types of resources. The classification as operand or operant resource depends on the evaluator's perspective [25]. Adopting a D2D mobility integrator perspective at the company level, an algorithm for determining the best combination of mobility services is an operand resource. But if the perspective of the algorithm itself is taken, it is an operant resource that adds or does not add a single mobility service to a D2D mobility service. This research adopts the first perspective. The next two sections present the resources of D2D mobility integrators discussed in scientific literature. The identified resources are italicized.

3.1 Operand Resources

Fourteen articles provide a kind of *blueprint* and colloquially describe the basic idea of the new D2D mobility integrator role [26-28]. Frequently, one or more characteristics of the provided D2D mobility service are also discussed in detail. These studies often originated from scientific research projects, as, for instance, in the case of Boero et al. [29], Gogos and Letellier [30], and Motta et al. [31]. Possibly for this reason, the contents of the blueprints differ widely in terms of geographic focus, ranging from a single city [31], to a larger region like Piedmont [32], up to the European Union [29, 30]. Moreover, the authors of the blueprints also adopt differing perspectives in assessing the added value of D2D mobility integrators and their D2D mobility service. Only a few authors [e.g., 30] take a mobility provider perspective, whereas a majority [e.g., 29, 33] take the perspective of citizens and city administrations. Perhaps as a result of these differences, the blueprints take a varying number of mobility services and mobility providers into account [see, e.g., 7, 27, 34]. Nevertheless, they often strive to offer D2D mobility services with similar characteristics, including providing real-time updates and booking and paying for trips through the D2D mobility integrator [35-38].

A further operand resource are *representations* of the *business model* of D2D mobility integrators. Beutel et al. [39] examine how existing business model frameworks are subject of change in the case of D2D mobility integrators and propose a new business model framework for D2D mobility integrators. A similar approach is chosen by Willing et al. [10], who adapt a business model framework to classify multiple D2D mobility integrators. In particular, they highlight the importance of business analytics. Schulz et al. [40] introduce a new model for the roles of D2D mobility integrators based on the roles of an intermediary in the electronic commerce era. Table 2 provides an overview of the operand resources of D2D mobility integrators.

Table 2. Overview of operand resources of D2D mobility integrators.

Operand resource	**Authors**
Blueprint	[7]; [26]; [27]; [28]; [29]; [30]; [31]; [32]; [33]; [34]; [35]; [36]; [37]; [38]
Representation of the business model	[10]; [39]; [40]
Information system application	[41]; [42]; [43]
National framework architecture	[44]; [45]
Information system architecture	[46]; [47]; [48]; [49]; [50]; [51]; [52]; [53]; [54]; [55]; [56]; [57]; [58]; [59]; [60]; [61]; [62]; [63]
Interface	[64]; [65]
Model and algorithm	[66]; [67]; [68]; [69]; [70]; [71]; [72]; [73]; [74]
Compensation engine	[75]
Recommendation system	[76]; [77]; [78]; [79]

Other articles deal with operand resources which are technical in nature, such as the *information system application*. Based on the trip phases, Digmayer et al. [41] derive the activities of users and the support they require, drawing implications for app design, such as implementing a feedback feature. Stein et al. [42] designed an app, especially for the elderly. Based on their experience in the WISETRIP project, Spitadakis and

Fostieri [43] also make recommendations for improving the design of an app or a web interface.

A related operand resource is ARKTRANS, the *national framework architecture* for mobility information systems in Norway, which encompasses all transport modes and supports D2D mobility [44, 45].

Eighteen articles describe the *information system architecture* of a specific D2D mobility integrator. In line with our previous findings, most of the authors – with exception of Dotoli et al. [46], and Zoghlami et al. [47] – explain the architecture created within the time restraints of their scientific research projects [e.g., 48-51]. It should be noted that several articles focus on the architecture of the Mobility Broker project [52-54], and two articles each focus on the architecture of the IMA [55, 56], Instant Mobility [57, 58], and SMAll [59, 60] project. The authors apply varying architecture styles. For example, Hilgert et al. [61] use the concept of microservices, Motta et al. [62] adopt a service-oriented architecture – event driven architecture (SOA-EDA), whereas Evangelatos et al. [63] draw on the Super Travel API Architecture.

Natvig and Vennesland [64] emphasize the advantage of open *interfaces* for the provision of a D2D mobility service. They also describe the interface definition process and a pilot implementation. Kluth et al. [65] develop an interface that facilitates connecting the rental systems of car-sharing and bike-sharing providers with the information system of D2D mobility integrators. The new interface enables information exchange (e.g., vehicle data, price information) and the execution of bookings via D2D mobility integrators.

A *model* to map the transport system (train stations, bus lines, etc.) and an *algorithm* to identify the best combination of mobility services are further operand resources of D2D mobility integrators. The algorithms can determine the shortest [e.g., 66-69], the fastest [70, 71, etc.], the cheapest [71], the most energy-efficient [72], or the least complex [71] D2D trip. Some algorithms allow the selection from several criteria, while others are restricted to one criterion. In addition, the algorithms vary in terms of whether they work with real-time data [70, 72, etc.] or not [e.g., 71]. Another difference is the scope of mobility services taken into account. For example, Fahnenschreiber et al. [73] and Ma [74] focus on integrating ride-sharing services. Given long running times, the algorithms [e.g., 67, 68, 71] in part prove the basic feasibility of the optimization idea than its practical usability.

Rizzi et al. [75] provide a detailed description of one specific part of the information system, the so-called *compensation engine*, which is responsible for monitoring and re-scheduling the selected combination of mobility services. This technical component enables customers to switch to alternative mobility services in case of a delay or cancellation of a previously chosen mobility service.

While the articles in the last two sections deal with operand resources that are necessary to determine the optimal combination of mobility services based on pre-defined customer criteria, the following articles center on *recommendation systems*, which are deployed to measure and to learn customers' preferences. The framework developed by Samsel et al. [76] helps rate the possible combinations depending on the previously revealed preferences (e.g., tendency to choose the shortest trip), the context (weather, etc.), and the selection made by the crowd. A similar approach focusing on learning customers' preferences is described by Arentze [77], and Zhang and Arentze [78], whose customer criteria include, among others, travel time, monetary costs, environmental impact, and changeover safety. The authors also analyze mobility service preferences (bus, train, etc.). Poxrucker et al. [79] described a simulation tool that can be used to learn from customers' aggregated recommendations and selection. Such an approach is necessary to prevent a bus from overcrowding due to over-recommendation.

3.2 Operant Resources

In order to enable value co-creation, D2D mobility integrators also need different operant resources, such as capabilities, competences and organizational processes, to act on operand resources. Spickermann et al. [80] provide a strategic agenda that highlights the importance of pursuing a *transition strategy*. In particular, they emphasize the need for aspiring D2D mobility integrators to use advanced IT and change their business model. The necessity of a transition strategy is further demonstrated by the work of Sarasini et al. [81] suggesting a research agenda to examine the causes of change and inertia of business models.

Three articles deal with the *implementation process* of a D2D mobility concept. Smith et al. [82] analyze the procurement process of a Swedish public transport organization, which enables a successful bidder to act as a regional D2D mobility integrator. Their results identify seven topics, such as the allocation of responsibilities and technical integration that potential bidders consider important in creating an ecosystem. Khanna and Venters [83, 84] examine the implementation process in the case of the BeMobility project in Berlin. They focus on the D2D mobility integrator's designing an information system for integrating electric car-sharing into public transport infrastructure. Table 3 summarizes the identified operant resources of D2D mobility integrators.

Table 3. Overview of operant resources of D2D mobility integrators.

Operant resource	**Authors**
Transition strategy	[80]; [81]
Implementation process	[82]; [83]; [84]
Capability to ensure security and privacy	[85]; [86]; [87]; [88]

A further important operant resource of D2D mobility integrators is their *capability* to ensure the *security and privacy* of ecosystem actors. Referring to the SMAll project, Callegati et al. [85] describe the most relevant weaknesses in terms of data reliability, integrity, and authenticity and propose mitigation approaches. For instance, they argue for the implementation of a customer rating system in order to evaluate data sources and enhance data trustworthiness. Further studies deal with insider threats as one of the most prominent security and privacy concerns [86, 87], providing a classification of insider threats. For example, a D2D mobility integrator must be aware of potentially fraudulent data manipulation on behalf of mobility providers. To mitigate insider threats, a networking architecture that based on gossip protocols is introduced. The high relevance of security and privacy is also demonstrated through customer evaluation of the information system of the Mobility Broker project [88].

4 Central Issues for Future Research

This section presents core issues for future research into the operand and operant resources of D2D mobility integrators. We expect that research on these issues will contribute to a deeper understanding of the role of D2D mobility integrators and enable recommendations to put value co-creation into practice.

Our literature review shows that most studies are concerned with the **operand resources** of D2D mobility integrators, such as their information system architecture [e.g., 46, 47], and algorithms for determining the best combination of different mobility services [66, 70, 72, etc.]. We note that D2D mobility integrators should generally be able to access the required operand resources, particularly those of a technical nature. However, many operand resources have only been developed for/used by D2D mobility integrators in the context of scientific research projects. Their real-world practical usefulness remains to be seen. For example, the running times of some of the algorithms [e.g., 67, 68, 71] make them impractical. It is also important to examine how technological progress affects individual technical resources. Currently, the extent to which state-of-the-art IT is taken into account varies greatly. For instance, whereas big data and business analytics are used in the case of the recommendation systems of Poxrucker et al. [79] and Samsel et al. [76], its impact on information system architecture remains unclear [50, 52, etc.].

In contrast, **operant resources** have been largely neglected by scientific research, or, as in the case of pursuing a transition strategy, their importance has only been emphasized in terms of a research agenda [81] or practical implications [80]. In particular, there are no broad insights into the *capability* of D2D mobility integrators *to manage value co-creation* (i.e., the integration of resources and the exchange of service [15]), in the ecosystem. Only three articles [82-84] shed light on the development phase of the ecosystem. The sparsity of research into operant resource needs points to several research gaps, for example what resources are needed in various ecosystem maturation phases, what models of value co-creation are possible in each phase, and how business model transitions can be best managed. Analogously, the phases of the value co-creation process between a D2D mobility integrator and an ecosystem actor (e.g., customer, mobility provider) should also be analyzed.

Since only a few mobility providers have joined an ecosystem of D2D mobility integrators to date [7, 13], future research should provide insights into their *capability to attract actors* – a sub-capability of value co-creation management. In order to explain non-membership, we propose determining the (perceived) value for the actors. As shown in our findings, extant literature predominantly reflects the view of researchers and practitioners adopting the role of D2D mobility integrators [e.g., 30, 37], or working on the development of a single operand resource [56, 65, etc.]. The customer or mobility provider perspective was only seldom considered [42, 43, 88]. However, according to Akaka and Chandler [89, p. 251] (social) roles are important resources for value co-creation "because they guide expectations for the exchange of service". To date, little scholarship is available into how actors evaluate the role of D2D mobility integrators and its related set of practices. One exception is Beutel et al. [88], who find that providing price bundles is often evaluated negatively by customers due to data security and privacy concerns. Overall, we believe that identifying the divergent expectations of actors about the role of D2D mobility integrators can help to better understand what motivates their decision to join or not join a D2D mobility ecosystem.

The capability of D2D mobility integrators to attract actors to their ecosystem depends not only on whether they fulfill the expectations of potential customers and mobility providers. As seen through the lens of S-D logic [14, 15], which assumes that all actors are engaged in value co-creation, every actor is already embedded in multiple ecosystems coordinated by a set of rules, norms and beliefs, known as institutions, and higher-order collections of these institutions, known as institutional arrangements [15]. For instance, German mobility providers that provide bus and tram transport are often integrated into the ecosystem of a municipal utility which is acting as parent company [7]. Hence, the decision of potential customers and mobility providers on membership in the D2D mobility integrator ecosystem is influenced by the actors of their existing ecosystems.

This literature review indicates that no research has been done on this topic. One avenue of possible future research is how the existing institutional arrangements of potential customers and mobility providers influence their decision whether or not to join the ecosystem of D2D mobility integrators. This might be viewed through the theoretical lens of legitimacy [90]. A potential study could consider the interests and authority of all actors of established ecosystems, such as parent companies, city administrations and industry associations in terms of preventing or mandating collaboration with D2D mobility integrators. Relying on power-based theory [91], this approach would help D2D mobility integrators better understand the relevant actors and their interests, and adapt their role and the institutional arrangements established in the ecosystem to increase value co-creation.

In summary, we argue for a two-step analysis to enhance our knowledge about the capability of D2D mobility integrators to attract actors to their ecosystem – the evaluation of the fulfillment of the role expectations by D2D mobility integrators and the actors' embeddedness in existing ecosystems. We assume that this approach can also be used to investigate the capability of D2D mobility integrators to manage value co-creation in the later phases of the ecosystem and better understand why mobility providers, for instance, provide real-time timetable data but are not able or willing to participate in a common ticketing.

5 Conclusion

In this paper, we conduct a literature review on the operand and operant resources required by D2D mobility integrators. Based on our findings, we propose several avenues of future research, including analyzing the operand resources used by D2D mobility integrators outside the project environment, D2D mobility integrators' capability to manage value co-creation in the different phases of the ecosystem, and the sub-capability of D2D mobility integrators to attract actors to their ecosystem in the first phase.

By reviewing scientific literature and deriving avenues of future research, our study contributes to IS and S-D logic literature in several ways. First, it provides a holistic view on research on the operand and operant resources of D2D mobility integrators. Our study integrates previously unrelated studies focusing on a single resource. This overview of the current state of research and, to a degree, practice, enables us to identify research gaps and practical challenges, which serve as the basis for developing avenues of future research. Practitioners can benefit from our work by understanding the resources necessary to put value co-creation into practice.

Our study is subject to some limitations. First, despite our backward and forward searches, our selection of outlets and keywords may have excluded some relevant scholarship. Second, the level of granularity and aggregation we choose in terms of analyzing resources may have excluded some insights into additional resources.

Appendix

Table 1. Keywords.

Allryder	GoEuro	Mobility Map	Multimodal mobility
Citymapper	Integrated mobility	Mobility marketplace	Multimodal travel
Connected mobility	Intermodal mobility	Mobility markets	Networked mobility
D2D mobility	Intermodal Mobility Assistance for Megacities (IMA)	Mobility network	Qixxit
Door 2 Door mobility	Intermodal travel	Mobility on demand	Rome2rio
Door2door	MeMobility	Mobility platform	RouteRANK
Door-to-door mobility	Mobility as a service	Modular mobility	Smart mobility
FromAtoB	Mobility Broker Project	Moovel	Transit App
Future mobility	Mobility ecosystem	Moovit	Waymate

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References

1. Bundesministerium für Verkehr und digitale Infrastruktur: Verkehr in Zahlen 2016/2017 (2016).
2. Beirão, G., Cabral, J.A.S.: Understanding Attitudes Towards Public Transport and Private Car: A Qualitative Study. Transport Policy 14, 478-489 (2007).
3. Puschmann, T., Alt, R.: Sharing Economy. Business & Information Systems Engineering 58, 93-99 (2016).
4. United Nations Department of Economic and Social Affairs: World Urbanization Prospects (2015).
5. International Energy Agency: World Energy Outlook 2012 (2012).
6. Barth, M., Boriboonsomsin, K.: Real-World Carbon Dioxide Impacts of Traffic Congestion. Transportation Research Record: Journal of the Transportation Research Board, 163-171 (2008).
7. Willing, C., Brandt, T., Neumann, D.: Intermodal Mobility. Business & Information Systems Engineering 59, 173-179 (2017).
8. Lusch, R.F., Nambisan, S.: Service Innovation: A Service-Dominant Logic Perspective. MIS Quarterly 39, 155-175 (2015).
9. Agarwal, N., Soh, C., Yeow, A.: Value Co-Creation in Service Ecosystems: A Member Perspective. In: International Conference on Information Systems (2016).
10. Willing, C., Brandt, T., Neumann, D.: Electronic Mobility Market Platforms – A Review of the Current State and Applications of Business Analytics. Electronic Markets 27, 267-282 (2017).
11. Rocznik, D., Goffart, K., Wiesche, M., Krcmar, H.: Towards Identifying User-Centered Requirements for Smart In-House Mobility Services. KI-Künstliche Intelligenz 31, 249-256 (2017).
12. Gretzel, U., Sigala, M., Xiang, Z., Koo, C.: Smart Tourism: Foundations and Developments. Electronic Markets 25, 179-188 (2015).
13. Albrecht, L., Ehmke, J.F.: Innovative Services in der Mobilitätsbranche: Eine Marktanalyse multimodaler Mobilitätsmanager. In: Multikonferenz Wirtschaftsinformatik (2016).
14. Vargo, S.L., Lusch, R.F.: Evolving to a New Dominant Logic for Marketing. Journal of Marketing 68, 1-17 (2004).
15. Vargo, S.L., Lusch, R.F.: Service-Dominant Logic 2025. International Journal of Research in Marketing 34, 46-67 (2017).
16. Lenka, S., Parida, V., Wincent, J.: Digitalization Capabilities as Enablers of Value Co-Creation in Servitizing Firms. Psychology & Marketing 34, 92-100 (2017).
17. Brust, L., Breidbach, C.F., Antons, D., Salge, T.O.: Service-Dominant Logic and Information Systems Research: A Review and Analysis Using Topic Modeling. In: International Conference on Information Systems (2017).
18. Raghuram, S., Tuertscher, P., Garud, R.: Research Note - Mapping the Field of Virtual Work: A Cocitation Analysis. Information Systems Research 21, 983-999 (2010).
19. Poggi, G.: A Main Theme of Contemporary Sociological Analysis: Its Achievements and Limitations. British Journal of Sociology 16, 283-294 (1965).
20. Webster, J., Watson, R.T.: Analyzing the Past to Prepare for the Future: Writing a Literature Review. MIS Quarterly 26, xiii-xxiii (2002).
21. Hoogendoorn-Lanser, S., van Nes, R., Hoogendoorn, S.P., Bovy, P.: Home-Activity Approach to Multimodal Travel Choice Modeling. Transportation Research Record: Journal of the Transportation Research Board, 180-187 (2006).

22. Li, L., Loo, B.P.Y.: Towards People-centered Integrated Transport: A Case Study of Shanghai Hongqiao Comprehensive Transport Hub. Cities 58, 50-58 (2016).
23. Strauss, A.L., Corbin, J.M.: Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory. SAGE Publications, Thousand Oaks (1998).
24. Madhavaram, S.R., Hunt, S.D.: The Service-Dominant Logic and a Hierarchy of Operant Resources: Developing Masterful Operant Resources and Implications for Marketing Strategy. Journal of the Academy of Marketing Science 36, 67-82 (2008).
25. Spohrer, J., Vargo, S.L., Caswell, N., Maglio, P.P.: The Service System is the Basic Abstraction of Service Science. In: Hawaii International Conference on System Sciences (2008).
26. Giesecke, R., Surakka, T., Hakonen, M.: Conceptualising Mobility as a Service: A User Centric View on Key Issues of Mobility Services. In: Conference on Ecological Vehicles and Renewable Energies (2016).
27. Kamargianni, M., Li, W., Matyas, M., Schäfer, A.: A Critical Review of New Mobility Services for Urban Transport. Transportation Research Procedia 14, 3294-3303 (2016).
28. Kamargianni, M., Matyas, M.: The Business Ecosystem of Mobility-as-a-Service. In: Transportation Research Board (2017).
29. Boero, M., Garré, M., Fernandez, J., Persi, S., Quesada, D., Jakob, M.: MyWay Personal Mobility: From Journey Planners to Mobility Resource Management. Transportation Research Procedia 14, 1154-1163 (2016).
30. Gogos, S., Letellier, X.: IT2Rail: Information Technologies for Shift to Rail. Transportation Research Procedia 14, 3218-3227 (2016).
31. Motta, G., Sacco, D., Belloni, A., You, L.: A System for Green Personal Integrated Mobility: A Research in Progress. In: International Conference on Service Operations and Logistics, and Informatics (2013).
32. Arneodo, F., Castelli, R., Botta, D.: Towards a "Smart Region" Paradigm: Beyond Smart Cities Borders: Piedmont Region Experience. In: International Conference of Electrical and Electronic Technologies for Automotive (2017).
33. Motta, G., Ferrara, A., Sacco, D., You, L., Cugola, G.: Integrated Mobility: A Research in Progress. Journal of Software Engineering and Applications 6, 97-101 (2013).
34. Jittrapirom, P., Caiati, V., Feneri, A.-M., Ebrahimigharehbaghi, S., Alonso-González, M.J., Narayan, J.: Mobility as a Service: A Critical Review of Definitions, Assessments of Schemes, and Key Challenges. Urban Planning 2, 13-25 (2017).
35. Deniaud, I., Quiguer, S., Breuil, D., Le Maguet, P., Lecourt, J., Pourcel, C., Ruault, J.-R., Somat, A.: Interoperability Dimensions for Multimodal Mobility Management. In: IFAC Symposium on Information Control Problems in Manufacturing (2012).
36. Melis, A., Mirri, S., Prandi, C., Prandini, M., Salomoni, P., Callegati, F.: Integrating Personalized and Accessible Itineraries in MaaS Ecosystems Through Microservices. Mobile Networks and Applications 23, 167-176 (2017).
37. Beutel, M.C., Krempels, K.-H.: Encompassing Payment for Heterogeneous Travelling: Design Implications for a Virtual Currency based Payment Mechanism for Intermodal Public Transport. In: International Conference on Smart Grids and Green IT Systems (2014).
38. Ambrosino, G., Nelson, J.D., Boero, M., Pettinelli, I.: Enabling Intermodal Urban Transport through Complementary Services: From Flexible Mobility Services to the Shared Use Mobility Agency: Workshop 4. Developing Inter-Modal Transport Systems. Research in Transportation Economics 59, 179-184 (2016).
39. Beutel, M.C., Samsel, C., Mensing, M., Krempels, K.-H.: Business Model Framework to Provide Heterogeneous Mobility Services on Virtual Markets. In: International Conference on e-Business (2014).

40. Schulz, T., Rockmann, R., Weeger, A.: Service Composition in Networks – Towards a Typology of Intermediaries. In: Americas Conference on Information Systems (2016).
41. Digmayer, C., Vogelsang, S., Jakobs, E.-M.: Designing Mobility Apps to Support Intermodal Travel Chains. In: International Conference on the Design of Communication (2015).
42. Stein, M., Meurer, J., Boden, A., Wulf, V.: Mobility in Later Life - Appropriation of an Integrated Transportation Platform. In: Conference on Human Factors in Computing Systems (2017).
43. Spitadakis, V., Fostieri, M.: WISETRIP - International Multimodal Journey Planning and Delivery of Personalized Trip Information. Procedia - Social and Behavioral Sciences 48, 1294-1303 (2012).
44. Natvig, M.K., Westerheim, H.: National Multimodal Travel Information – A Strategy based on Stakeholder Involvement and Intelligent Transportation System Architecture. IET Intelligent Transport Systems 1, 102-109 (2007).
45. Natvig, M.K., Westerheim, H.: Refinement and Evaluation of the ARKTRANS Framework Through Use in Travel Information Services. In: World Congress on Intelligent Transport Systems and ITS America's 2008 Annual Meeting (2008).
46. Dotoli, M., Zgaya, H., Russo, C., Hammadi, S.: A Multi-Agent Advanced Traveler Information System for Optimal Trip Planning in a Co-Modal Framework. IEEE Transactions on Intelligent Transportation Systems 18, 2397-2412 (2017).
47. Zoghlami, N., Jeribi, K., Merlo, C., Zgaya, H., Hammadi, S.: A Multi-Agent Architecture for a Co-Modal Transport System. Journal of Modern Engineering Research 4, 60-78 (2014).
48. Fiorentino, A., De Gioia, C., Gaido, M., Conti, G., Magliocchetti, D., De Amicis, R., Kipp, W.: Mobile Integration Platform Concept: The Naples Pilot Test Site. Procedia - Social and Behavioral Sciences 48, 1855-1864 (2012).
49. Eryilmaz, E., Kagerbauer, M., Schuster, T., Wolf, O.: Collaborative Management of Intermodal Mobility. In: Working Conference on Virtual Enterprises (2014).
50. Solar, A., Marqués, A.: ENHANCED WISETRIP: Wide Scale Multimodal and Intelligent Journey Planning. Procedia-Social and Behavioral Sciences 48, 2940-2949 (2012).
51. Zografos, K., Madas, M.: Optimizing Intermodal Trip Planning Decisions in Interurban Networks. Transportation Research Record: Journal of the Transportation Research Board 61-69 (2003).
52. Beutel, M.C., Gökay, S., Kluth, W., Krempels, K.-H., Samsel, C., Terwelp, C.: Product Oriented Integration of Heterogeneous Mobility Services. In: International Conference on Intelligent Transportation Systems (2014).
53. Beutel, M.C., Gökay, S., Kluth, W., Krempels, K.-H., Ohler, F., Samsel, C., Terwelp, C., Wiederhold, M.: Information Integration for Advanced Travel Information Systems. Journal of Traffic and Transportation Engineering 4, 177-185 (2016).
54. Beutel, M.C., Gökay, S., Kluth, W., Krempels, K.-H., Samsel, C., Terwelp, C., Wiederhold, M.: Heterogeneous Travel Information Exchange. In: International Conference on Mobility in IoT (2016).
55. Masuch, N., Lützenberger, M., Keiser, J.: An Open Extensible Platform for Intermodal Mobility Assistance. Procedia Computer Science 19, 396-403 (2013).
56. Keiser, J., Masuch, N., Lützenberger, M., Grunewald, D., Kern, M., Trollmann, F., Acar, E., Salma, Ç.A., Dang, X.-T., Kuster, C.: IMA - An Adaptable and Dynamic Service Platform for Intermodal Mobility Assistance. In: International Conference on Intelligent Transportation Systems (2014).

57. Zargayouna, M., Zeddini, B., Scemama, G., Othman, A.: Simulating the Impact of Future Internet on Multimodal Mobility. In: International Conference on Computer Systems and Applications (2014).
58. Zargayouna, M., Scemama, G., Zeddini, B., Kompfner, P., Gatellier, P., Constant, P., Beckman, D.: Future Internet for a Personal Travel Companion Service. In: ITS World Congress (2012).
59. Callegati, F., Delnevo, G., Melis, A., Mirri, S., Prandini, M., Salomoni, P.: I Want to Ride My Bicycle: A Microservice-Based Use Case for a MaaS Architecture. In: IEEE Symposium on Computers and Communications (2017).
60. Callegati, F., Gabbrielli, M., Giallorenzo, S., Melis, A., Prandini, M.: Smart Mobility for All: A Global Federated Market for Mobility-as-a-Service Operators. In: International Conference on Intelligent Transportation (2017).
61. Hilgert, T., Kagerbauer, M., Schuster, T., Becker, C.: Optimization of Individual Travel Behavior through Customized Mobility Services and their Effects on Travel Demand and Transportation Systems. Transportation Research Procedia 19, 58-69 (2016).
62. Motta, G., Sacco, D., Ma, T., You, L., Liu, K.: Personal Mobility Service System in Urban Areas: The IRMA Project. In: IEEE Symposium on Service-Oriented System Engineering (2015).
63. Evangelatos, S., Kalampoukis, Z., Fergadioti, I., Christofi, S., Karakostas, B., Zorgios, Y.: Service Availability Analysis of a Multimodal Travel Planner Using Stochastic Automata. In: IEEE Symposium on Computers and Communications (2017).
64. Natvig, M.K., Vennesland, A.: Flexible Organisation of Multimodal Travel Information Services. IET Intelligent Transport Systems 4, 401-412 (2010).
65. Kluth, W., Beutel, M.C., Gökay, S., Krempels, K.-H., Samsel, C., Terwelp, C.: IXSI - Interface for X-Sharing Information. In: International Conference on Web Information Systems and Technologies (2015).
66. Delling, D., Pajor, T., Wagner, D.: Accelerating Multi-Modal Route Planning by Access-Nodes. In: European Symposium on Algorithms (2009).
67. Zhang, J., Liao, F., Arentze, T., Timmermans, H.: A Multimodal Transport Network Model for Advanced Traveler Information Systems. Procedia - Social and Behavioral Sciences 20, 313-322 (2011).
68. Zhang, J., Liao, F., Arentze, T., Timmermans, H.: A Multimodal Transport Network Model for Advanced Traveler Information Systems. Procedia Computer Science 5, 912-919 (2011).
69. Hrncir, J., Jakob, M.: Generalised Time-Dependent Graphs for Fully Multimodal Journey Planning. In: International IEEE Conference on Intelligent Transportation Systems (2013).
70. Rouhieh, B., Alecsandru, C.: Optimizing Route Choice in Multimodal Transportation Networks. Canadian Journal of Civil Engineering 41, 800-810 (2014).
71. Yu, H., Lu, F.: A Multi-Modal Route Planning Approach With an Improved Genetic Algorithm. In: International Conference on Theory, Data Handling and Modelling in GeoSpatial Information Science (2010).
72. Prandtstetter, M., Straub, M., Puchinger, J.: On the Way to a Multi-Modal Energy-Efficient Route. In: Conference of the IEEE Industrial Electronics Society (2013).
73. Fahnenschreiber, S., Gündling, F., Keyhani, M.H., Schnee, M.: A Multi-Modal Routing Approach Combining Dynamic Ride-Sharing and Public Transport. Transportation Research Procedia 13, 176-183 (2016).
74. Ma, T.-Y.: On-Demand Dynamic Bi-/Multi-Modal Ride-Sharing Using Optimal Passenger-Vehicle Assignments. In: IEEE International Conference on Environment and Electrical Engineering and IEEE Industrial and Commercial Power Systems Europe (2017).

75. Rizzi, F., Motta, G., Sacco, D.: A System for Green Personal Integrated Mobility: Compensation Engine. International Journal of Computer Applications 105, 5-11 (2014).
76. Samsel, C., Garbereder, G., Krempels, K.-H.: Personalized, Context-aware Intermodal Travel Information. In: International Conference on Web Information Systems and Technologies (2016).
77. Arentze, T.A.: Adaptive Personalized Travel Information Systems: A Bayesian Method to Learn Users' Personal Preferences in Multimodal Transport Networks. IEEE Transactions on Intelligent Transportation Systems 14, 1957-1966 (2013).
78. Zhang, J., Arentze, T.A.: Personalized Multi-Modal Route Planning: A Preference-Measurement and Learning-Based Approach. In: International Conference on Mobile and Ubiquitous Systems: Computing, Networking and Services (2014).
79. Poxrucker, A., Bahle, G., Lukowicz, P.: Simulating Adaptive, Personalized, Multi-Modal Mobility in Smart Cities. In: EAI International Summit Smart City 360° (2016).
80. Spickermann, A., Grienitz, V., von der Gracht, H.A.: Heading Towards a Multimodal City of the Future?: Multi-stakeholder Scenarios for Urban Mobility. Technological Forecasting and Social Change 89, 201-221 (2014).
81. Sarasini, S., Linder, M., Langeland, O., Julsrud, T.-E.: Integrating a Business Model Perspective into Sustainability Transitions: A Research Agenda based on Servitised Mobility. In: International Sustainability Transitions Conference (2016).
82. Smith, G., Sochor, J., Karlsson, M.: Procuring Mobility as a Service: Exploring Dialogues with Potential Bidders in West Sweden. In: ITS World Congress (2017).
83. Khanna, A., Venters, W.: The Role of Intermediaries in Designing Information Infrastructures in Strategic Niches: The Case of a Sustainable Mobility Infrastructure Experiment in Berlin. In: European Conference on Information Systems (2013).
84. Khanna, A., Venters, W.: Exploring the Rhythms of Information Infrastructure Coordination for Smart Cities: The Case of Building a Mobility Infrastructure in Berlin. In: European Conference on Information Systems (2014).
85. Callegati, F., Giallorenzo, S., Melis, A., Prandini, M.: Data Security Issues in MaaS-Enabling Platforms. In: International Forum on Research and Technologies for Society and Industry Leveraging a better tomorrow (2016).
86. Callegati, F., Giallorenzo, S., Melis, A., Prandini, M.: Insider Threats in Emerging Mobility-as-a-Service Scenarios. In: Hawaii International Conference on System Sciences (2017).
87. Callegati, F., Giallorenzo, S., Melis, A., Prandini, M.: Cloud-of-Things meets Mobility-as-a-Service: An Insider Threat Perspective. Computers & Security 74, 277-295 (2018).
88. Beutel, M.C., Zaunbrecher, B.S., Himmel, S., Krempels, K.-H., Ziefle, M.: Evaluation of an Integrated Intermodal Travel Service. In: International Conference on Smart Cities and Green ICT Systems (2016).
89. Akaka, M.A., Chandler, J.D.: Roles as Resources: A Social Roles Perspective of Change in Value Networks. Marketing Theory 11, 243-260 (2011).
90. Dacin, M.T., Oliver, C., Roy, J.P.: The Legitimacy of Strategic Alliances: An Institutional Perspective. Strategic Management Journal 28, 169-187 (2007).
91. Rodríguez, C., Langley, A., Béland, F., Denis, J.-L.: Governance, Power, and Mandated Collaboration in an Interorganizational Network. Administration & Society 39, 150-193 (2007).