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The Connections between Mobility as a Service and Mobility Hubs in Urban Areas

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Abstract

In the context of growing urbanization and related challenges in the transport sector, concepts such as Mobility as a Service (MaaS) and mobility hubs are gaining increasing importance. This paper examines the interactions between the two approaches, with mobility hubs acting as physical interfaces interconnected by digital MaaS platforms. The aim is to promote sustainable, multimodal mobility solutions and reduce dependence on private cars. The article analyses the technological and infrastructural prerequisites for successful integration, highlights the potentials and challenges, and the interplay between the physical and digital levels. Using case studies in Berlin, Bremen and Munich, practical examples are presented that show how mobility hubs can contribute to the implementation of urban sustainability goals. Finally, recommendations for implementation are provided to create inclusive, resilient and future-proof urban mobility systems.

Keywords: application; mobility as a service; mobility hub; sustainable urban mobility plans; urban mobility

1. Introduction

The increasing urbanization and the associated challenges in the transportation sector call for innovative concepts to ensure sustainable and efficient urban mobility. In this context, Mobility as a Service (MaaS) and mobility hubs (MH) are gaining growing importance. MaaS and mobility hubs are central components of smart mobility, enabling seamless, efficient, and sustainable transportation through digital networking and physical integration, offering various modes of transport with planning, booking, and payment prior to journeys.

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By combining public and private mobility services, such as local public transport, car sharing, scooter and bike sharing, the use of transport services becomes more flexible, convenient, and environmentally friendly. Mobility hubs provide the necessary infrastructure at a single location, facilitating the interconnection of different modes of transport and thereby enhancing the efficiency and attractiveness of multimodal mobility solutions. With their strategic locations in urban and suburban areas, they help reduce dependence on private cars and encourage the shift toward sustainable modes of transport. The combination of MaaS and mobility hubs thus represents a key building block for the transportation transition, offering a sustainable mobility solution.

The aim of this paper is to analyse the relationship between these two concepts, highlight their potentials and challenges, and develop recommendations for successful implementation. Best practice examples from the cities of Berlin, Bremen and Munich will be presented, along with an outlook on the future development and trends of mobility hubs.

2. Synergies between mobility hubs and mobility as a service

In German cities it is clear how closely Mobility as a Service (MaaS) and Mobility Hubs (MH) intertwine. Geurs et al. (2023) proposed that mobility hubs can serve as neutral connectors within the mobility system, where different service providers collaborate, enabling seamless use of MaaS and increasing the coverage and density of mobility services. Sadati (2023) stated that mobility hubs support the expansion of shared mobility by creating spaces for shared vehicles, improving accessibility through their central locations and design, thereby saving public space in the long term and enhancing efficiency through the digital integration of MaaS. A MaaS application can also serve as a channel for the demand and supply of shared vehicles, enabling continuous feedback and system improvements. These effects are particularly visible in Berlin and Munich, where physical MH are directly connected to digital MaaS platforms such as Jelbi or MVGO. Slavulj et al. (2023) concluded that from user perspective, a comprehensive platform simplifies access to mobility information, trip planning, ticketing, and payments across multiple operators, such as the Jelbi app in Berlin.

Mobility as a Service (MaaS) and mobility hubs are two closely linked concepts that are shaping the future of urban transportation. Their relationship is highly interdependent, with mobility hubs playing a key role in strengthening and enabling the effective implementation of MaaS. Mobility hubs act as central nodes for the MaaS concept, offering centralized locations where different modes of transport converge. These hubs strengthen MaaS in several ways:

- Synergies between MaaS and mobility hubs enhance sustainable mobility;
- The interaction between physical hubs and digital MaaS platforms reinforces sustainability;
- A symbiosis of infrastructure and data is established.

Mobility hubs provide the physical infrastructure for shared mobility modes, while MaaS platforms collect real-time data to improve service coordination, as stated in Kennisplatform CROW (2021).

2.1. Digital and physical integration

While MaaS provides the digital platform for integrating various mobility services, mobility hubs offer the physical infrastructure needed to support this integration, reinforcing both. The combination of digital and physical elements creates a more comprehensive and user-friendly mobility ecosystem. Witte et al. (2021) suggest that integrating MaaS with mobility hubs has the potential to transform urban mobility by promoting intermodal travel, enabling efficient transportation, reducing dependence on private vehicles, and supporting the transformation of cities into more environmentally friendly and sustainable urban environments.

2.2. Integration of multiple modes of transport

Mobility hubs in German cities integrate various shared mobility services at defined locations, enabling smooth connections between different transport modes. They are key to the MaaS concept, which allows users to plan, book,

and pay for multiple services on one platform. These hubs such as those in Bremen and Berlin, improve connectivity for the first and last mile, addressing a major MaaS challenge by enhancing public transport connections. Additionally, they promote shared and electric mobility by offering spaces for shared vehicles and charging stations, supporting sustainable transport as pointed out by Anderson et al. (2017), Coenegrachts et al. (2021).

Key challenges in implementing mobility hubs (MH) include limited urban space (CROW, 2021) and the technical integration of various providers without uniform standards (Geurs et al., 2023). In addition, social barriers to access exist, such as a lack of digital skills (Miramontes et al., 2017; König, 2019). High costs require stable financing models and cooperation (UITP, 2023). Successful implementation ultimately depends on coordinated city management, as the example of Bremen shows (VCD, 2024).

3. Technological and infrastructure components

Mobility hubs have emerged as a key concept in urban transportation, integrating different modes of transport and services to create efficient, sustainable, and user-centred urban mobility solutions in a single location.

Smart city technologies are crucial for the successful implementation of mobility hubs. These technologies include mobile applications for seamless access to services, real-time information systems, and Internet of Things (IoT) devices. The integration of these technologies, as stated by Sadati (2023), enables the creation of Mobility-as-a-Service (MaaS) platforms, providing users with a unified interface for planning, booking, and paying for various transport options.

Mobility hubs are an interdisciplinary topic that can be examined from economic, technological, socio-cultural, and ecological perspectives. Building infrastructure for urban mobility is expensive, given the limited public space available for vehicles and bicycles in cities, while at the same time, the sharing economy and technological innovations are changing user behaviour toward shared mobility and efficient transport solutions.

3.1. Multimodality and digital integration

Mobility hubs aim to integrate various modes of transportation, including public transport, shared mobility services, and active mobility options. The Smart Hubs Integration Ladder concept proposes three dimensions of integration: physical (spatial factors), digital (platform), and democratic (participatory) integration. Geurs et al. (2023) emphasize that this multidimensional approach suggests that the smarter a shared mobility hub is in terms of physical, digital, and democratic integration, the greater the user and societal value it can potentially create.

Fig. 1. (a) mobility hub locations in Berlin; (b) vehicle availability at location; (c) public transport availability at location in Munich; (d) bike sharing prices at location.

Digital integration enables the combination of information from various service providers into a single platform, allowing users to plan trips, book services, and make payments within one application. Miramontes et al. concluded

that Mobility as a Service (MaaS) plays a critical role for mobility hubs by facilitating access to different modes of transport and enhancing the use of services offered through a centralized digital platform. The opinion of Deloitte (2022) is that mobility hubs are increasingly seen as the physical manifestation of MaaS, with the link between physical infrastructure and digital platforms creating synergies that promote services through applications and digital incentives such as rewards for using shared bicycles.

Alongside physical accessibility, digital accessibility is becoming increasingly important, as mobility services rely more on digital interfaces. Socioeconomic, demographic, and functional barriers can limit access, and thus digital inclusion must be considered essential to avoid exacerbating inequalities, as stated by Miramontes et al. (2017) and König (2019).

Fig. 1 shows displays of the Jelbi mobile application from Berlin in (a) and (b), and the "MVGO" application from Munich in (c) and (d), which, in addition to allowing vehicle rental bookings and payments, displays nearby mobility hubs based on the user's current location, the vehicles offered by each individual hub, vehicles outside the hubs, and information about each vehicle (rental price per kilometer or time unit, battery status).

MaaS is characterized by five levels of digital integration, ranging from no integration (Level 0) to the integration of societal goals (Level 4), outlined by European Regional Development Fund (2020). The stages move from providing separate services to integrating information, bookings, and payments, linking services, and finally integrating political goals and incentives into mobility services. Miramontes et al. (2017) observed that the topology of MaaS has been extended to include digital accessibility and universal design, recognizing that designing accessible mobility services at hubs is crucial to include diverse user groups despite socioeconomic, demographic, and functional barriers.

3.2. Goals of mobility hubs

Integrating mobility hubs into their environments requires careful consideration of their socioeconomic benefits and a flexible, adaptable design to maximize sustainability and ensure resilience to rapid market, societal, and political changes. The goals of mobility hubs according to coverage area are shown in Table 1.

Table 1. Goals of mobility hubs according to coverage area by UITP (2023).

Coverage area	Goals of mobility hubs
Urban	Increase multimodal travel, walking, cycling, and use of public transport Reduce private car use Improve the offer of sustainable modes of transport
Suburban	Reduce the need for a second car Improve first-mile/last-mile connectivity Enhance the public space
Rural	Connect to intercity public transport Improve accessibility and attractiveness Strengthen/create first-mile/last-mile connections Offer on-demand services
National and international	Provide transfers for intercity door-to-door mobility services

3.3. Types of mobility hubs

The typology of mobility hubs distinguishes them by the complexity of transportation, services, and facilities (equipment), as well as by geographic location, with the recognition that different types of hubs may coexist in the same area. The types of mobility hubs are community centre hub, neighbourhood centre hub, suburban hub, urban edge hub, urban district hub, and city centre hub (Fig 2).

Neighbourhood hubs offer shared (electric) cars, bicycles, and mopeds in combination with public transport by a mobile app (Fig. 3). They are located within walking distance and near neighbourhood amenities such as grocery

stores, providing local services like parcel pickup points. They are characterized by greater complexity in services and facilities, but lower diversity and complexity of transport modes compared to suburban hubs, as pointed out by Witte et al. (2021).

Suburban hubs serve suburban development areas. Equipped with bus stops or small train stations, they often require the use of private vehicles to access them. Therefore, they offer many parking spaces and feature lower complexity in transportation, services, and facilities, which is stated by Kennisplatform CROW (2021).

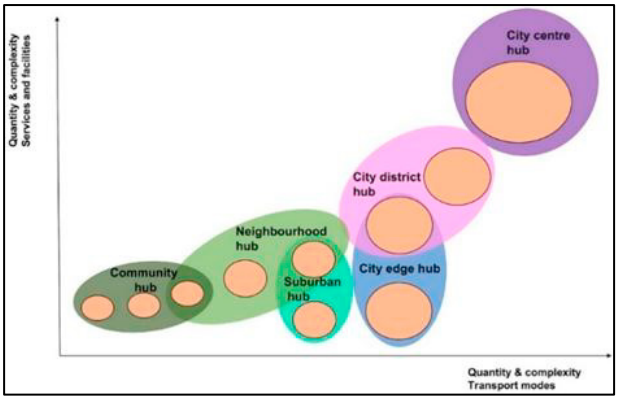

Fig. 2. Constructed types in the conceptual framework by Weustenenk and Mingardo (2023).

According to Witte et al. (2021), Kennisplatform CROW (2021), urban district hubs aim to enhance quality of life and combine functions to promote urban development by integrating different transport modes with small retail outlets and parcel pickup stations, thus ensuring accessibility while reducing congestion in urban areas.

Urban edge hubs are characterized by an (inter)regional scale and are typically developed as Park & Ride locations, offering basic services for the transition between private vehicles and public transport modes such as shuttle buses or trams, concluded by Arntzen et al. (2020), Witte et al. (2021).

City centre mobility hubs are characterized by high-quality public transport, high accessibility through active mobility, and availability of various transport modes. Due to their central location and public amenities, Kennisplatform CROW (2021) states that land prices are often high, limiting space availability for parking. Collaborative Mobility UK (2019) recommends that a mobility hub should ideally serve 1,000 residents in rural areas or 2,000 residents in urban areas.

4. Good practice examples in German cities

The more mobility hubs there are, the more options can be offered to visitors and residents, and the greater the city coverage. The density of hubs ensures that various services are available quickly and easily, while the distance people are willing to walk to reach one of the transport options at a mobility hub is up to a 5-minute walk in urban areas.

4.1. Berlin, Germany

Berlin has a network of mobility hubs (one of them shown in Fig. 3) and smaller mobility points under the unified brand Jelbi, managed by BVG (Berlin Public Transport Company), combining public and private shared mobility services through a multimodal mobility app. Jelbi stations offer different transport modes such as buses, bicycles, e-scooters, and taxis, which can be booked, rented, and paid for via the Jelbi MaaS app, including digital no-parking zones for micromobility sharing. Components of the mobility hub include, according to BVG Berlin (2024):

- Jelbi Stations: users can rent, return, and charge vehicles including e-scooters, shared bikes, mopeds, car shares, taxis, and bus services; currently, there are 22 of them;

- Jelbi Points: these are smaller centres where users can rent, return, and charge two-wheeled vehicles such as e-scooters, shared bikes, mopeds, and cargo bikes; there are currently 110 of them;
- Jelbi Clusters: they consist of several points and stations within a neighbourhood, and users can rent, return, and charge vehicles including e-scooters, shared bikes, cargo bikes, mopeds, car clubs, taxis, and bus services;
- Integrated Mobility Vision: Jelbi's integrated mobility vision aims to include on-demand transport to users' homes, electric vehicle charging infrastructure, Jelbi points for micromobility sharing, on-demand bus services, parcel stations, bicycle storage, and battery charging facilities; in addition, it plans access to autonomous vehicles, information services, and sustainable urban furniture and green spaces.

To achieve the objectives of SUMP (Sustainable Urban Mobility Plans), Berlin has several plans, updated every few years to meet current demands: the City Transport Development Plan 2025, the Mobility Master Plan, and the Berlin Mobility Act.

Fig. 3. Nollendorfplatz mobility hub in Berlin by BVG Berlin (2024).

4.2. Bremen, Germany

In Bremen, ten major mobility hubs (example in Fig. 4) with car-sharing vehicles have been set up at central public transport locations, along with small mobility points at decentralized locations with car-sharing vehicles and bicycle parking, with planned hubs to close existing gaps and reduce the distance between stations to a maximum of 300 meters. A study by Verkehrsclub Deutschland (2024) shows that each car-sharing vehicle in Bremen replaces, on average, 16 private cars, resulting in about 5,000 fewer vehicles on the road and significant traffic reduction.

The mobility stations encourage a shift toward sustainable transport, reduce car ownership, and lower the mileage driven by car-sharing households by more than 50%, while creating space for accessibility, pedestrian zones, and future urban expansion. The combination of car-sharing, bike rental, and other eco-friendly mobility options supports Bremen's climate goals and enables sustainable urban development with fewer parking spaces needed in new building projects.

According to Collaborative Mobility UK (2021), awareness of car sharing and mobility stations in Bremen is high, with 85% of respondents familiar with the offer promoted under the motto Use it, don't own it, sending a clear message that transportation should be used for travel, instead of ownership.

Freie Hansestadt Bremen (2024) recommends that smaller stations will be placed with only 2–3 vehicles in neighbourhoods and streets where parking demand is particularly high. Ideally, they should be located near critical intersections to organize parking with sidewalks and at the same time facilitate access for garbage trucks and fire engines. Pedestrians benefit from cleared spaces, and cyclists find bicycle racks for safe parking.

Bremen has developed a new Sustainable Urban Mobility Plan (SUMP) that sets goals for the next 10 to 15 years, such as social inclusion, road safety, optimized alternatives to cars, improved system connectivity, economic empowerment, and the reduction of traffic’s impact on the environment and health. These goals could influence the future design of mobility stations.

Fig. 4. A mobility hub in Bremen by Bundesverband Carsharing (2025).

4.3. Munich, Germany

Mobility hubs in Munich, as stated by Münchner VerkehrsVerbund (2025), are marked by unique information pillars and logos throughout the area, facilitating the easy use of shared mobility options (Fig. 5). These services are integrated into the MVV information service and MVV and MVGO mobile apps, making it easy to check the availability of transport options at mobility hubs in real time.

Public events, such as the mobility workshop encompassing SUMP principles, have been used to discuss Munich's transport plans and goals with stakeholders, shaping future mobility and developing solutions for better traffic planning.

Fig. 5. A mobility hub in Munich by Verkehrsclub Deutschland (2025).

5. Conclusion

Mobility hubs provide the infrastructure for multiple transportation modes, integrating with MaaS digital services to reduce car use, lower emissions, and promote urban sustainability. They offer a unified platform for urban mobility, enhancing inclusivity by providing access for all users, including those with disabilities. Integrated with Sustainable Urban Mobility Plans (SUMPs), mobility hubs can transform cities by promoting efficient, sustainable transport.

Successful implementation of mobility hubs requires addressing challenges like site selection, long-term impacts, and user behavior. Exploring technologies like AI can optimize hub operations and enhance user experiences. A coordinated approach involving public-private partnerships and careful funding is essential to creating flexible, sustainable, and inclusive urban transport systems. The analysis confirms key findings from the literature, such as those by Geurs et al. (2023), on the importance of connecting digital and physical infrastructure, which Berlin and Bremen exemplify. These examples illustrate that MaaS is only effective with accessible infrastructure – a core idea of the integration ladder model. The empirical findings thus concretize existing theoretical approaches in the German context.

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