Similarities and Differences of Mobility on Demand (MOD) and Mobility as a Service (MaaS)

By Susan Shaheen and Adam Cohen

I n cities around the world, innovative and emerging shared modes are offering residents, businesses, travelers, and other users more options to access mobility, goods, and services. As these shared modes build a network of services in many cities, consumers are increasingly engaging in more complex multimodal decision-making processes. Rather than making decisions between modes, travelers are "modal chaining" to optimize route, travel time, and cost. Additionally, digital information and fare integration are contributing to new on-demand access models for mobility and goods delivery.

On both sides of the Atlantic, two complementary approaches to multimodal access to public and private transportation services are evolving in parallel. In North America, consumers are assigning economic values to transportation services and making mobility decisions (including the decision not to travel and instead have a good or service delivered) based on cost, journey time, number of connections, convenience, and other attributes—a concept commonly referred to as mobility on demand (MOD). In Europe, services that allow travelers to sign up for mobility services in one bundled service are gaining popularity—a concept known as mobility as a service (MaaS). Practitioners are often faced with the questions: "What is MOD?" "What is MaaS?" and "How are MOD and MaaS similar and different?" This article aims to clarify these two concepts, explain their similarities and differences, and highlight a few public sector integrated mobility initiatives.

Mobility on Demand
MOD is a concept based on the principle that transportation is a commodity where modes have economic values that are distinguishable in terms of cost, journey time, wait time, number of connections, convenience, and other attributes. MOD enables consumers to access mobility, goods, and services on demand by dispatching or using shared mobility, delivery services, and public transportation strategies through an integrated and connected multimodal network. Passenger modes facilitated through MOD providers include: car-sharing; bike-sharing; ridesharing (carpooling and vanpooling); transportation network companies (TNCs, also known as ridesourcing and ridehailing); scooter sharing; microtransit; shuttle services; taxis; public transportation; and other emerging transportation strategies (i.e., shared automated vehicles, urban air mobility, etc.). The most advanced passenger services incorporate trip planning and booking, real-time information, and fare payment into a single user interface. The most advanced forms of MOD courier services incorporate robotic delivery; app-based courier network services (CNS); and unmanned aerial systems (i.e., delivery drones). In addition to MOD's emphasis on passenger mobility and goods delivery, MOD also emphasizes transportation systems management to optimize overall operations of the transportation network (i.e., supply and demand). The supply side of the marketplace consists of the providers, operators, and devices that offer transportation services for people or goods and service delivery. The demand side of the marketplace is comprised of travelers and goods, including their choices and preferences. At the center of the MOD ecosystem is multimodal transportation operations management that receives data from all aspects of the system, aggregates the data into an overall picture of current and predicted conditions, and identifies challenges considering a wide range of operational objectives applicable to the specific time period. Figure 1 illustrates the U.S. Department of Transportation's (USDOT) vision of an integrated and multimodal transportation operations management approach that can interact and/or influence the supply and the demand sides, as well as the key enablers and stakeholders of this multimodal ecosystem.

Mobility as a Service
In Europe, another multimodal transportation concept known as MaaS has emerged. MaaS is a mobility marketplace in which a traveler can access multiple transportation services over a single digital interface. Brokering travel with suppliers, repackaging, and reselling it as a bundled package is a distinguishing characteristic of MaaS. In Stockholm, Sweden, UbiGo is a transportation brokerage that provides member households a mobility subscription in place of car ownership. The monthly subscription allows households to pre-purchase mobility access in a variety of increments on multiple modes, operating like a multimodal "digital punch card" for a number of transportation services (including public transportation, carsharing, rental cars, and taxis) (Figure 2).

Figure 1. USDOT's Architecture for MOD and Multimodal Management.
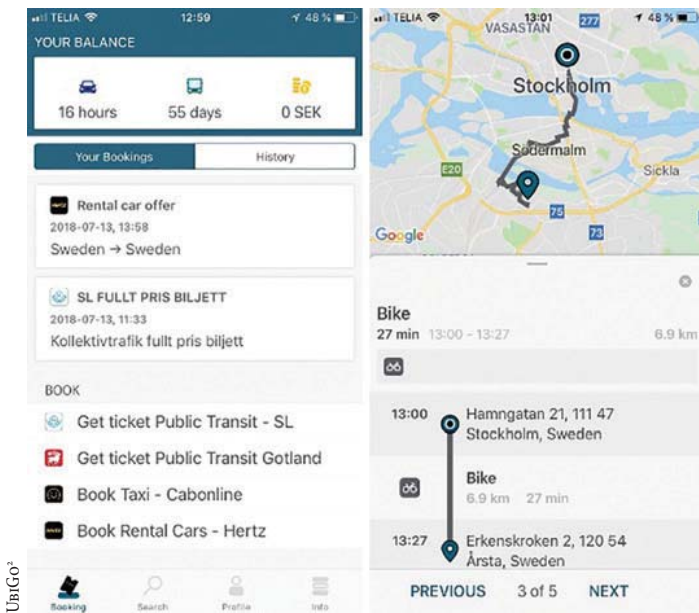
Figure 2. UbiGo Mobility as a Service Interface.

Similarities and Differences of MOD and MaaS

Although MOD and MaaS share a number of similarities, MaaS primarily emphasizes passenger mobility allowing travelers to seamlessly plan, book, and pay for a multimodal trip on a pay-as-you-go and/or subscription basis, whereas MOD emphasizes the commodification of passenger mobility, goods delivery, and transportation systems management. A key similarity between MOD and MaaS is their emphasis on physical, fare, and digital multimodal integration (Figure 3).
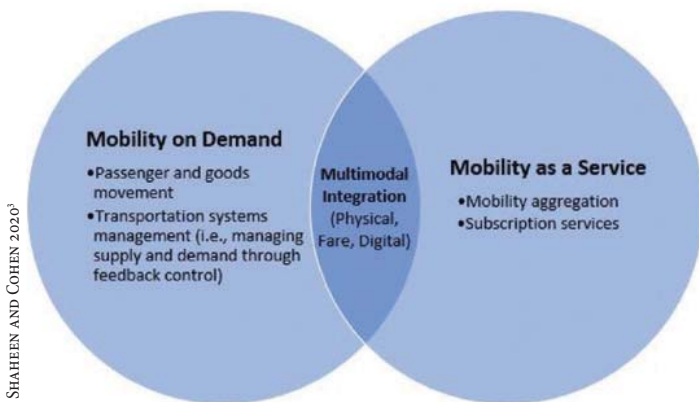
Figure 3. Similarities and Differences of MOD and MaaS.

As the public and private sectors increasingly emphasize concepts of integrated mobility, there could be a convergence between MOD and MaaS. A growing number of digital information and fare-payment services are increasingly offering seamless information and payment connectivity among different transportation modes. Increasingly travelers are: 1) searching routes,

schedules, near-term arrival predictions, and connections; 2) comparing travel times, connection information, distance, and costs across multiple routes and transportation modes; and 3) accessing real-time travel information across multiple modes. These services can help bridge information gaps, make multimodal travel and public transit more convenient, and enhance decision making with dynamic and real-time information throughout an entire journey. A variety of partnership models are evolving to support mobility integration. Three common integrated mobility public transportation partnership approaches include:

- **Trip planning partnerships** focus on developing and/or integrating multimodal trip planning into a single platform. Common goals of trip planning partnerships include: 1) increasing consumer trip planning convenience, 2) encouraging multimodal transportation, and 3) reducing barriers to public and active transportation use;
- **Fare integration partnerships** allow riders to easily pay for trips that span across public and private transportation modes and allow riders to either pay for: 1) each trip leg using the same fare medium or 2) trip legs employing a single fare (that is apportioned to each mobility provider that serves each trip leg on the backend); and
- **Data sharing partnerships** include partnering with the private sector to share a variety of data types that can enhance local transportation planning, operations, trip planning, and fare integration.

Public Sector Integrated Mobility Initiatives

In the United States, USDOT has supported a number of initiatives aimed at enhancing the traveler experience, promoting on-demand mobility, and increasing transportation network efficiency through programs, such as the MOD Sandbox Demonstration, Integrated Mobility Innovation, and Accelerating Innovative Mobility (see sidebar on page 33). For example, the MOD Sandbox Demonstration includes a number of grantees that are piloting smartphone trip planners and app-based fare payment. For example, Dallas Area Rapid Transit (DART) in Texas, USA is piloting GoPass, a multi-agency trip planning and fare payment app to allow riders to transfer between modes and offer time-based passes (i.e., daily, monthly). As part of its Integrated Mobility Innovation program, the Federal Transit Administration (FTA) recently announced funding for a number of urban, suburban, and rural public agencies to develop trip planning and fare payment apps. In Georgia, USA, the Atlanta-Region Transit Link Authority will receive funding to develop a multimodal trip planning app that includes navigation and integrated payment options. In California, USA's Central Valley, the San Joaquin Regional Transit District will also receive funding to create payment integration and trip planning apps across local and regional public transit providers.

Federal Transit Administration Programs on Mobility Innovation

FTA MOD Sandbox Demonstration

The Federal Transit Administration (FTA) MOD Sandbox Demonstration Program provides a venue where MOD concepts and strategies, supported through local partnerships, are demonstrated in real-world settings. Key goals of the MOD Sandbox include:

- Improving transportation efficiency by promoting agile, responsive, accessible, and seamless multimodal service inclusive of public transit through enabling technologies and innovative partnerships.
- Increasing transportation effectiveness by ensuring that public transit is fully integrated and a vital element of a regional transport network that provides consistent, reliable, and accessible service to every traveler.
- Enhancing the customer experience by providing each individual equitable, accessible, traveler-centric service that leverages public transportation's long-standing capability and traditional role in this respect.

Eleven MOD Sandbox grantees are piloting a variety of MOD use cases and enabling technologies, such as smartphone trip planners, first- and last-mile programs using shared mobility, and paratransit service using innovative demand-responsive technologies. The MOD Sandbox Independent Evaluation, a review of the performance and impacts of the MOD Sandbox projects, will be completed in 2020.

Early lessons learned from the MOD Sandbox Demonstration sites include:

- Some public transit agencies liked the ability to name partners without a traditional procurement method, while others would have preferred to issue a request for proposal to solicit prospective vendors.

- Public agencies and private sector partners were ambitious in their initial MOD project designs. This resulted in the rescoping or downscaling of many pilot projects.
- Several public agencies noted challenges in working with private vendors, particularly related to contracting and data agreements. In some cases, partners were unable to agree to terms. In others, partners employed a range of techniques to more narrowly tailor data sharing requests to include: less frequent reporting, more aggregate data reporting, and higher levels of geospatial data to protect consumer and proprietary vendor information.
- A number of public agencies expressed ongoing concerns about the reliability of private sector partners such as 1) partners that overpromised and underdelivered; 2) partners that promised data but were unwilling to share sufficient data for the public agency to report key data metrics to FTA; and 3) partners whose business models evolved through the course of the pilot projects, causing project continuation post-MOD Sandbox to be challenging.
- Some project sites reported challenges transitioning from the Sandbox demonstration to regular post-demonstration service because of the drug and alcohol testing currently required by federally funded initiatives.
- Identifying sustainable business models and partnerships is key to enabling the continuation of successful programs post pilot.

For additional information, please visit https://www.transit.dot.gov/research-innovation/mobility-demand-mod-sandbox-program.

FTA's Integrated Mobility Innovation Program

FTA's Integrated Mobility Innovation (IMI) Program funds projects that demonstrate innovative and effective practices, partnerships, and technologies to enhance public transportation effectiveness, increase efficiency, expand quality, promote safety, and improve the traveler experience. FTA's IMI 2020 funding provides $20.3 million USD for demonstration projects focused on three areas of interest: Mobility on Demand, Strategic Transit Automation Research, and Mobility Payment Integration to:

- Explore new business approaches and technology strategies that support mobility,
- Enable communities to adopt innovative mobility strategies that enhance transportation efficiency and effectiveness, and
- Facilitate the widespread deployment of proven mobility strategies that expand personal mobility.

In March 2020, FTA announced the selection of 25 projects in 23 states to receive funding under the program. FTA received 104 eligible project proposals totaling approximately $107 million USD. For additional information, please visit https://www.transit.dot.gov/imi.

FTA's Accelerating Innovative Mobility Program

FTA's Accelerating Innovative Mobility (AIM) Program will provide $11 million USD in challenge grants to help public transit agencies experiment with innovative ways of doing business, such as exploring new service models that provide more efficient and frequent service. The AIM Program will drive transportation innovation by promoting forward-thinking approaches to finance, system design, and service. FTA announced a Notice of Funding Opportunity for the AIM Program in March 2020. For additional information, please visit https://www.transit.dot.gov/AIM.

In addition, states are supporting digital and fare multimodal integration initiatives. The California State Transportation Agency (CalSTA), Caltrans, and intercity rail and local public transit agencies are partnering together in an effort to develop an easy, accessible transportation and payment system throughout the state through the California Integrated Travel Project (Cal-ITP). Cal-ITP seeks to seamlessly integrate four travel phases: trip planning, transaction, journey, and post-journey by leveraging regulation, policy, advocacy, and procurement processes through statewide stakeholder collaboration. Cal-ITP intends to achieve these goals by focusing on:

- Improving efficiencies that lower costs and barriers to trip planning and payment for public transit, including regional and interregional journeys, and
- Enhancing the customer experience for accurate and convenient trip planning and payment.

Conclusion

In recent years, travelers are making more on-demand journeys in response to a greater ecosystem of mobility choices. MOD emphasizes the commodification of transportation where consumers make mobility and delivery decisions based on cost, journey time, number of connections, convenience, and other attributes. In contrast, MaaS primarily focuses on passenger mobility aggregation and subscription services. Increasingly, the public sector is supporting MOD and MaaS through a variety of initiatives. Trip planning, fare integration, and data sharing partnerships represent some of the most common ways the public sector can support and leverage the potential opportunities for MOD and MaaS. In particular, digital and fare payment integration can improve traveler information and mitigate multimodal pain points (i.e., multiple fare media, missed connections, long wait times, etc.). By enhancing traveler convenience, multimodal trip planning and fare payment initiatives have the potential to serve as a "multimodal multiplier" where technology magnifies the effectiveness of active and public transportation. **itej**

Additional Resources

Susan Shaheen and Adam Cohen co-authored the U.S. Department of Transportation's *Mobility on Demand Operational Concept* and *Mobility on Demand Planning and Implementation: Current Practices, Innovations, and Emerging Mobility Futures*. These resources are available at:

- *Mobility on Demand Operational Concept* - https://rosap.ntl.bts.gov/view/dot/34258
- *Mobility on Demand Planning and Implementation: Current Practices, Innovations, and Emerging Mobility Futures* – Available soon at https://www.its.dot.gov/research_areas/ mod/index.htm

More resources include:

- Cohen, Adam and Susan Shaheen (2016). "Planning for Shared Mobility." Planning Advisory Service (PAS) 583, American Planning Association, Washington, D.C. July, 106 pages. Available at https://planning.org/publications/ book/9107556/.
- Shaheen, Susan, Adam Cohen, Michael Randolph, Emily Farrar, Richard Davis, and Aqshems Nichols (2019). "Shared Mobility Policy Playbook" UC Berkeley: Transportation Sustainability Research Center. Berkeley, CA, December, 224 pages. Available at https://escholarship.org/content/ qt9678b4xs/qt9678b4xs.pdf?t=q3qu5m&v=lg.

Acknowledgments

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1. Shaheen, Susan, Adam Cohen, Balaji Yelchuru, and Sara Sarkhili. "Mobility on Demand Operational Concept Report." U.S. Department of Transportation, 2017. Report # FHWA- JPO-18-611. Available at: https:// rosap.ntl.bts.gov/view/dot/34258. (Accessed April 28, 2020).
2. Ubigo, 2020. https://www.ubigo.me/. (Accessed April 28, 2020).
3. Shaheen, Susan, and Adam Cohen. Chapter 3 - Mobility on demand (MOD) and mobility as a service (MaaS): early understanding of shared mobility impacts and public transit partnerships. In *Demand for Emerging Transportation Systems: Modeling Adoption, Satisfaction, and Mobility Patterns*, 2020. Location: Elsevier. UC Berkeley: Transportation Sustainability Research Center. https://escholarship.org/uc/ item/5030f0cd. (Accessed April 28, 2020).

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TRB Executive Committee in 2020. She is the founding chair of the subcommittee for Shared-Use Vehicle Public Transport Systems of TRB. She also is a member of the Mobile Source Technical Review Subcommittee to the U.S. Environmental Protection Agency's Clean Air Act Advisory Committee.

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