Mobility on Demand (MOD) Business Models Synthesis Report

www.its.dot.gov/index.htm

Final Draft – January 2020

Publication Number: FHWA-JPO-20-798

U.S. Department of Transportation

Produced under
U.S. Department of Transportation
Office of the Assistant Secretary for Research and Technology
Federal Highway Administration, Intelligent Transportation Systems-Joint Program Office

Notice

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-20-798		

4. Title and Subtitle	5. Report Date
Mobility on Demand (MOD) Business Models Synthesis Report	January 2020
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Ellen Partridge, Colin Murphy, Rudy Faust, Kevin Karner (SUMC), Sonika Sethi (Leidos), Matthew Kaufman (UrbanTrans)	

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Leidos 11251 Roger Bacon Drive Reston, VA 20190	11. Contract or Grant No. DTFH6116D00053L

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation Federal Highway Administration 1200 New Jersey Avenue, SE Washington, DC 20590	14. Sponsoring Agency Code

15. Supplementary Notes

Kevin Adderly, Robert Sheehan

16. Abstract

This report summarizes key findings, lessons learned and recommendations from the effort to analyze and assess MOD business models, the critical elements that constitute a successful MOD business model and the planning approaches that agencies can take to plan and implement successful partnerships to meet public goals. Following the section for the practitioners, a new section looks to recent developments in both the private and public sectors of the mobility ecosystem, and how they might affect the business models of the former in the near future.

17. Keywords	18. Distribution Statement
Mobility-on-Demand, business models.	No restrictions.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	76	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Preface

The United States Department of Transportation (USDOT) uses the term Mobility on Demand (MOD) to represent its vision for future mobility. MOD envisions a safe, reliable and carefree mobility ecosystem that supports complete trips for all, both personalized mobility and goods delivery. USDOT achieves this vision by leveraging innovative technologies and facilitating public private partnerships to allow for a user-centric, mode-neutral, technology-enabled, and partnership-driven approach that improves mobility options for all travelers, and delivery of goods and services.

The research, development, and implementation to achieve the MOD vision is guided by the following principles:

- **User-centric** – promotes choice in personal mobility and utilizes universal design principles to satisfy the needs of all users.
- **Mode-neutral** – supports connectivity and interoperability where all modes of transportation work together to achieve the complete trip vision and efficient delivery of goods and services.
- **Technology-enabled** – leverages emerging and innovative use of technologies to enable and incentivize smart decision making by all users and operators in the mobility ecosystem.
- **Partnership-driven** – encourages partnerships, both public and private, to accelerate innovation and deployment of proven mobility solutions to benefit all.

The USDOT's MOD Program is a multimodal program initiated by the Intelligent Transportation Systems Joint Programs Office (ITS JPO), Federal Transit Administration (FTA) and the Federal Highway Administration (FHWA) to study emerging mobility services; public transportation networks and operations; goods delivery services; real-time data services; and ITS that can enhance access to mobility, goods, and services for all.

Technology, mobility, and societal trends are changing the way people travel and consume resources, disrupting both supply of mobility and delivery options and demand for all types of trips. A core component of MOD is the provision of a dynamic supply of transportation services, providing a wider variety of mobility and delivery options than ever before. Consumers can access mobility, goods, and services on demand by dispatching or using public transportation, shared mobility, courier services, and other innovative solutions.

The USDOT is eager to understand how the growth of transportation services and on-demand mobility coupled with a shift in travel behavior towards shared vehicle trips can help the nation reimagine the transportation network. The program's foundational research, the *MOD Operational Concept Report*, provides an overview of MOD and its evolution, a description of the MOD ecosystem, and reviews the key enablers of the mobility system, including business models and partnerships, land use and different urbanization scenarios, social equity and environmental justice, policies and standards, and enabling technologies.

The market for personal mobility is changing rapidly due, in part, to changing social and cultural trends as well as to technological advances, such as smart phones, information processing and widespread data

connectivity. New mobility concepts and solutions, from bike and car sharing systems to innovative demand response bus services, are providing travelers with new, flexible and tailored transportation options. These developments already are impacting the traditional transit market and could conceivably disrupt current business and funding models. The MOD Business Model Analysis project is part of a larger MOD joint research effort at USDOT that seeks to support transit agencies and communities as they navigate the dynamic, evolving landscape of personal mobility and integrated multimodal transportation networks. As part of this effort, the USDOT is pleased to present the *MOD Business Model Analysis Synthesis Report*. The report summarizes key findings, lessons learned and recommendations from the effort to analyze and assess MOD business models. It is important to note, however, that business models are rapidly evolving, which requires ongoing tracking and evaluation.

Table of Contents

List of Tables

List of Figures

List of Acronyms

ADA	Americans with Disabilities Act
B2B	business-to-business
B2C	business-to-consumer
B2G	business-to-government
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
GDM	goods delivery marketplace
IPO	initial public offering
MaaS	mobility as a service
MBTA	Massachusetts Bay Transportation Authority
MOD	mobility on demand
P3	public-private partnership
PSTA	Pinellas Suncoast Transit Authority
SEC	Security and Exchange Commission
SOV	single occupancy vehicle
USDOT	U.S. Department of Transportation
WAV	wheelchair accessible vehicle

Chapter 1. Introduction

The rise of technology-driven transportation options—from carsharing to new micromobility modes (e.g., e-scootersharing)—has revolutionized how people travel on a daily basis, providing options beyond the traditional single occupancy vehicle (SOV) and fixed-route transit trips. The U.S. Department of Transportation (USDOT) uses the term 'mobility on demand' (MOD) to represent its Vision for Future Mobility, where "a safe, reliable and carefree mobility ecosystem…. supports complete trips for all, both personalized mobility and goods delivery. USDOT achieves this vision by leveraging innovative technologies and facilitating public private partnerships to allow for a user-centric approach that might improve mobility options for all travelers and delivery of goods and services." The key concepts are highlighted as follows:

MOD Guiding Principles

- **User-centric** – promotes choice in personal mobility and utilizes universal design principles to satisfy the needs of all users.
- **Mode-neutral** – supports connectivity and interoperability where all modes of transportation work together to achieve the complete trip vision and efficient delivery of goods and services.
- **Technology-enabled** – leverages emerging and innovative use of technologies to enable and incentivize smart decision making by all users and operators in the mobility ecosystem.
- **Partnership driven** – encourages partnerships, both public and private, to accelerate innovation and deployment of proven mobility solutions to benefit all.

Source: USDOT, August 28, 2019, communication

The traveler-centric approach to transportation aligns with many of the new private mobility services in the larger mobility ecosystem, which includes all technology-enabled transportation platforms in both the public and private sectors. While the private sector has an important role in the mobility ecosystem, the services it provides may not necessarily conform to USDOT's guiding principles nor meet transportation goals of the wider public in an equitable manner. Public agencies and private companies have formed public-private partnerships (P3s) to implement projects that address wider public goals and achieve greater equity. However, even with P3s, there will be differences in goals and principles between public agencies and private businesses. Public agencies are construed broadly here to include local through state-level jurisdictions, including regional and county transit and transportation agencies. Entities at each of these levels have regulated and/or entered into partnerships with mobility providers.

In the private sector, business models capture the nature of a supplier's relationships to its customers and to other suppliers of goods and services that contribute to its products. It is the outline of how a company positions and sustains itself in the economic marketplace. In the mobility ecosystem, a business model describes the relationship of the provider to the customer (e.g., business to consumer or business to government) and the service provided (e.g., bikeshare or carshare).

Understanding the workings of business models in the mobility ecosystem and public agency goals—and how the two might best interact—can better equip public agencies to work with the private sector to enhance travel options and services. Public agencies can use the planning tools and descriptions of business models in this report to inform their decision-making process for the procurement of mobility services. Private partners can use this report to learn what public agencies hope to achieve with a MOD pilot or program, and they can refer to relevant case studies to learn how pilots designed to meet various public goals operate in other geographies.

Report Overview

This synthesis draws on published and unpublished reports in USDOT Intelligent Transportation Systems-Joint Program Office's MOD Business Model Analysis project, and it looks forward to what might emerge from current developments in the mobility ecosystem. These reports include an unpublished report that defined business models based on a literature review and analysis of MOD businesses (*MOD Business Models Assessment),* a report that described details of the business models elements *(MOD Business Models Elements)*, and a report that provided a method for integrating mobility services into public agencies' planning processes through needs assessments and scenario planning (*MOD Business Models Planning Template*).

Each of the above reports draws on and incorporates lessons learned from a number of projects of different scale that solve different kinds of transportation problems. The Federal Transit Administration (FTA) MOD Sandbox program—a MOD P3 "innovation knowledge accelerator"— awarded in 2016 figures prominently in these examples, although many projects described in this report are from outside the Sandbox.

This synthesis expands on insights gained from other tasks in the project and is organized as follows:

- Chapter 1 is the introduction. Key terms are defined in Appendix A.
- Chapter 2 introduces the business model, the organizing concept that a company uses to organize its relationships to its customers and to other suppliers of goods and services that contribute to its products. It is the outline of how a company positions and sustains itself in the economic marketplace. The chapter examines the elements that comprise the business model, as well as how a mobility provider's business model affects how it relates to its customers.
- Chapter 3 brings in the perspective of public agencies and outlines the relevant public goals that they might achieve through public-private partnerships with private mobility service providers. This chapter proposes the use of a needs assessment and scenario planning to determine if the agency should move to the next step of a partnership. Appendix B offers additional tools for conducting these exercises.
- Chapter 4 draws together the lessons of the previous chapters to offer a planning template for public agencies that also offers insights to other stakeholders. It uses case studies to show how public goals have affected business model elements and how business model elements have affected public goals. These lessons, in turn, should assist in the later steps of scenario planning. In addition to a scenario planning tool, the chapter presents a matrix that evaluates the different modes in the mobility ecosystem in relation to typical public agency goals. Stakeholders in public agencies can then make informed decisions before making choices regarding regulations,

partnerships through pilot projects and/or programs, or other non-MOD options, or a combination thereof to address public goals.

- Chapter 5 looks at current business developments and discusses how they are affecting regulations and partnerships. During this project, critical movement in some of the business model elements were observed. Namely, two ridesourcing companies, which were already merging with and acquiring other companies, made their initial public offerings (IPOs). Concurrently, the regulatory environment shifted in various ways. These changes will necessarily require the companies to adapt their business models. This chapter concludes by examining how these changes might affect the mobility ecosystem in the future. While the business models within the mobility ecosystem will surely change in the future, understanding how their elements work and interact with the public sector can inform how regulations and partnerships might better achieve public goals.
- Chapter 6 contains references used in support of this synthesis report.

Chapter 2. Business Models

What is a Business Model?

A business model encompasses all aspects of a private firm's operations. It is the predominant form of organizing and maintaining an overall strategy for a business at every stage of its life. Examining a business model allows public agencies to anticipate, prepare for, and adapt to changes in the marketplace.

Business models rose to prominence during the dot-com boom as a means for companies, consultants, and academics to describe the structures of a wide variety of firms that challenged conventional strategies. (Birkinshaw and Ansari, 2015) A company or observer can construct a business model through different ways, but the key concept as originally expressed in Alexander Osterwalder's Business Model Canvas is that the model consists of multiple elements that are dynamic and affect the model as a whole. (Osterwalder and Pigneur, 2010) Each of these elements must be monitored concurrently. Cynthia Ovans' 2015 *Harvard Business Review* article "What is a Business Model?" provides a brief overview of business models with an emphasis on their dynamic nature.

How Business Models Approach a Market

Ovans' (2015) overview looks at the basic ways in which a business model interacts with the market. She uses a table from Mark Johnson's "Seizing the white space: Business model innovation for growth and renewal" (2010) to show the breadth of business models available, which is abridged here (see table 1) for the relevant MOD business models. The models show the interplay of how a firm targets a market, offers a value proposition to the consumer, and earns money.

Table 1. Business model approaches.

Analogy	How it Works	Examples	MOD Example
Brokerage	Brings together buyers and sellers, charging a fee per transaction to one or another party	• Century 21 • Orbitz	• Goods delivery (e.g., Caviar) • Peer-to-peer carsharing
Bundling	Package related goods and services together	• Fast-food value meals • iPod/iTunes	• MaaS applications, where payment method remains the same for original services
Pay-as-you-go	Charge for actual metered usage	• Electric companies	• Ridesourcing • Dockless e-scooters and bikesharing • Free-floating carsharing • Microtransit operators

Analogy	How it Works	Examples	MOD Example
Product to Service	Rather than sell a product, sell the service the product performs	● Zipcar (note: Ovans and Johnson identify Zipcar as a peer-to-peer business model, although most MOD observers would identify it as business-to-consumer. (See table 2)	● Microtransit, when a business-to-government partnership for technology-only operation ● Peer-to-peer carsharing
Subscription	Charge a subscription fee to gain access to a service	● Netflix	● Docked bikesharing ● Roundtrip carsharing ● Public MaaS in some European examples

Adapted from Ovans, 2015 and Johnson, 2010.
MaaS = Mobility-as-a-service.

These models are not static. Regulation and competition spur a need for adaptation for a company to survive. Ovans cites Peter Drucker's observation:

> "…sooner or later, some assumption you have about what's critical to your company will turn out to be no longer true." (Ovans, 2015)

Particularly important to MOD partnerships is the examination of the dynamic nature of business models over time.

Mobility on Demand Business Models

A company that can successfully navigate changes to any of the business elements might plan better for the future and position itself better in a competitive marketplace. The business model may also be viewed as the relation of the company as a supplier to the marketplace. Just as this report has borrowed the terminology of Johnson and Ovans to describe the business model elements, it also uses the framework developed in USDOT's *Mobility on Demand Operational Concept Report* (Shaheen et al., 2017), and subsequently expanded in SAE International's Standard J3163 *Taxonomy and Definitions of Terms Related to Shared Mobility and Enabling Technologies* (2018), to characterize the primary commercial transaction underlying the business relationships between service provider and consumer (which these two documents term "MOD Business Models" and which this paper analyzes in more depth).

Those documents define the relationship between service providers and consumers and apply the definitions to applicable travel modes. Together, these elements form business models. The elements and how they are framed (see table 2) serve as a reference throughout this document.

Table 2. Mobility on demand business models.

Business Model	Definition
B2C Services	B2C services provide individual consumers with access to business-owned and -operated transportation services, such as a fleet of vehicles, bicycles, scooters, or other travel modes. These services are typically provided through memberships, subscriptions, user fees, or a combination of pricing models
B2G Services	B2G services offer business-owned and -operated transportation services to a public agency. Pricing may include a fee-for-service contract, a per-transaction option, or some other pricing model. Microtransit providers often use this business model in their P3 partnerships
B2B Services	B2B services allow businesses to purchase access to business- or government-owned and -operated transportation services, either through usage fees or a fee-for-service. This type of service is typically offered to employees to complete work-related trips. First/last mile MOD partnerships for suburban work destinations (reverse commutes) have employed this model
P2P-MM Services	P2P-MM services offer a marketplace—usually as an online platform—to facilitate transactions among individual buyers and sellers of personally owned and operated mobility services in exchange for a transaction fee. Peer-to-peer carsharing services, such as Getaround and Turo, are the most prominent examples of this model
P2P-GDM Services	P2P-GDM services include courier network services, such as applications providing for-hire delivery for monetary compensation using an online application or platform (e.g., a website or smartphone application) to connect couriers using their personal vehicles, bicycles, or scooters with goods (e.g., packages, food, etc.). This can include two types of services: P2P Delivery Services: P2P delivery services are applications that enable private drivers to collect a fee for delivering cargo using their private vehicles. Food delivery and other courier services use this model. Ridesourcing companies have also expanded into this model for delivery partners using non-sharing modes (e.g., bikes, scooters, etc.) Paired On-Demand Courier Services: Paired on-demand courier services are applications that allow for-hire ride services to also conduct package deliveries. Ridesourcing companies have a delivery option for drivers, although they cannot operate concurrently
Fractional Ownership	Fractional ownership allows individuals to sub-lease or subscribe to access a motor vehicle or other travel mode owned by a third party. These individuals have “rights” to the shared service in exchange for taking on a portion of the ownership expense. Far less common than the other models, fractional ownership allows users to buy into a “library” of vehicles to be used for various purposes. Automobile manufacturers have experimented with the model

Table 2. Mobility on demand business models.

[1] Although these goods-delivery services are listed as P2P, there is a question as to whether this might better fit a B2C model, with the delivery persons as independent contractors, which more closely resembles the B2C model of ridesourcing companies.
B2B = business-to-business.
B2C = business-to-consumer.
B2G = business-to-government.
MOD = mobility on demand.
P2P = peer-to-peer.
P2P-GDM = peer-to-peer goods delivery marketplace.
P2P-MM = peer-to-peer mobility marketplace.
P3 = public-private partnership.

Mobility on Demand Business Model Elements

Elements are the core of any business model, and monitoring and adapting change in any element remains a challenge throughout the life of a company. Table 3 offers a snapshot of MOD business model elements. In addition to describing each element, the sections below include examples of how each element manifests itself prominently in the mobility ecosystem. In such cases, they are more likely to affect the other elements.

Table 3. Business model elements.

Business Model Elements	Description	Illustrative Examples
Value Proposition	For a service to gain customers and scale up, it needs a value proposition (i.e., what it is offering that is new, different, or better)	● Convenient rides at market rates ● Affordable first/last mile connections ● High-tech, on-time paratransit ● One-stop, multimodal information in a no-cost application
Capitalization and Revenue Sources	MOD is often funded with venture capital. In addition to venture capital, other revenue streams may also be involved	● Venture, start-up financing ● Users, riders, and members (subscriptions, fines, fees) ● Sponsorships and vehicle advertising ● State and Federal grants, subsidies, and contracts ● Innovative funding (e.g., public agency development of spin-off enterprises that continue to provide funds to the agency for new projects) ● Revenue-sharing and revenue generation
Customer Base	For a business to succeed, it needs to identify the various segments of its customer base and attract and retain them	● Participants in a peer-to-peer marketplace ● Transit agencies ● Transit users

Business Model Elements	Description	Illustrative Examples
How it is Regulated/ Authorized	A disruptive technology enters an incumbent regulatory environment. Any regulatory action in response has the potential to disrupt the model	● Early comprehensive regulation ● Ad-hoc regulation
Partnerships	Whether from launch or after agencies begin to regulate them, partnerships are a way for all parties to achieve their goals	● Contracts ● Non-exclusive regulatory permits or franchises ● Open call for unsolicited proposals ● Traditional bid process ● Grant-funded community-led mobility networks
Operational Characteristics	Transportation modes can operate in the mobility space in several ways	● One mode ● Multiple modes ● Mobility as a service ● Labor arrangements (e.g., nature of employment relationship – contract versus employee, collective bargaining provisions, and payment details)

MOD = mobility on demand.

Value Proposition

A firm that brings new technologies or products and services to market is offering a value proposition that satisfies an entirely new set of needs that customers previously did not perceive. Otherwise, a firm must make a value proposition by offering an improvement to some market service already available to a customer base. Strategies include leveraging quantitative improvements (e.g., lower price, unit cost, exposure to risk, or greater efficiency). Value can also take on more qualitative dimensions by responding to customer feelings around design, usability, or branding. (Osterwalder and Pigneur, 2010)

Mobility Ecosystem Value Propositions

Public agencies take on a number of jobs that have historically posed challenges, such as providing fast and convenient service over a wide variety of land use contexts or providing mobility for people with disabilities. On-demand service providers have built their value propositions around unmet consumer demand for features such as convenient trip planning and payment platforms that provide transparent price structures and lower-cost service than is available in the taxi market.

In recent years, P3s have emerged between public agencies and on-demand providers that leverage an overlap in customer bases to advance a public goal. (Schwieterman, 2018) Perhaps the most radical value proposition for both travelers and public agency partners in the mobility ecosystem is on-demand service for users of paratransit service. American with Disabilities Act (ADA) paratransit is currently the most expensive service per trip for most transit agencies, generally only available with a day-before reservation as required by the FTA, and sometimes not available at the desired times due to high demand. (Rudin, et al., 2019) The Massachusetts Bay Transportation Authority's (MBTA's) RIDE On-Demand program aims to increase access for persons with disabilities at a lower cost through

subsidized trips on Uber, Lyft, or the taxi provider Curbed. Each company uses a different operational model to fulfill rides on wheelchair accessible vehicles (WAVs), with Lyft contracting traditional shuttles throughout its service hours and Uber contracting WAV taxi vehicles on a per-trip basis. (SUMC, 2018) While the service has required additional subsidies from the Commonwealth to its WAV service, it remains a high-demand service. (SUMC, 2019) The value proposition for both customers and the Commonwealth is clear, but may change if demand rises considerably.

Capitalization and Revenue Sources

After a value proposition of a product or service is matched with a customer segment, the next concern in a business model is how that relationship can be turned to a profit. The underlying revenue model is perhaps the most significant component of a private sector business model, and ultimately differentiates it from a public agency's goals and operations. This section discusses the range of revenue models used by mobility services.

MOD Revenue and Capitalization

Seed and venture capital remain common mechanisms for capitalization of mobility services. Smaller-scale ventures in their early stages usually draw on seed funding from banks and angel investors. The use of venture capital generally denotes larger-scale investments in the tens of millions of dollars, generally for correspondingly larger-scale deployments. This is distinct from private equity as a means for capitalization, which is largely focused on established, publicly listed companies as a means for transfer of ownership. Grant funding from the public sector or non-governmental organizations can act as a substitute or complement to seed funding, depending on the degree of alignment with public goals.

While these are common mechanisms for mobility services in the beginning, the companies must ultimately rely on long-term predictable, sustainable, and efficient revenue streams. Revenue streams are generally either transaction-based from one-time use of a product or service, or reoccurring for ongoing access. (USDOT, 2019)

The rise and fall of widespread dockless bikesharing (without electric assistance) illustrates the importance of a working revenue model. The Chinese dockless bikeshare company Mobike was founded in 2015 with the goals of simplifying the bicycle rental process and providing a low-cost service for urban travelers making short, one-way trips. Through $3 million in seed funding, Mobike built a manufacturing plant for its custom-designed bikes and began trial operations in several Chinese cities, operating on a pay-as-you-go basis. Mobike officially launched as the country's first private bikeshare service in 2016. Their bikes were lighter and less expensive than the typical docked bike models in the United States and did not require the off-street stations that required balancing. Because of this, the company was able to quickly scale operations. (Cao et al., 2018; McKenzie, 2018) Through several funding rounds, Mobike raised more than $1 billion dollars from an international consortium of venture capital firms and multinational electronics manufacturing company, Foxconn. By the end of 2017, Mobike was operating in 170 cities across 5 countries, despite continuing to struggle with sustainable revenue through its rentals or data platform. (Yin and Tan, 2017) By early 2019, Mobike had pulled out of all of its international markets, and now operates exclusively in China where its parent company Meituan operates a wide range of transportation services. (Liao, 2019)

Incumbent firms can self-finance MOD projects. The German firm Daimler started the free-floating carshare service Car2go in 2008 as a means to leverage an underutilized asset—in this case, its line of underperforming Smart cars—to expand its brand to a different segment of consumers. (Ferrero et al.,

2015) Car2go, now merged with BMW's ReachNow and operating as SHARE NOW, continues to operate on a pay-as-you-go-by-the-minute basis, augmented by membership signup fees. These companies also require some form of regulation or P3 to operate in the public way. (MTC, 2018)

Partnerships also offer additional capitalization and revenue streams and are discussed in a separate section below.

Finally, regulation that enables peer-to-peer sharing opens another possible revenue stream. Revenue sharing remains a staple feature of the peer-to-peer mobility marketplace (P2P-MM; see table 2). Member-owners of services like Getaround and Turo leverage a combination of brokerage and product-to-service business models by providing short-term vehicle access to member renters, minus a transaction fee, through their mobile and desktop platforms. By leveraging vehicles from member-owners, these companies eliminate one of the main upfront costs associated with network expansion and may be more viable in lower-density settings. (Movmi, 2018)

Customer Base

From the perspective of a MOD business model, the customer base is simply the group of users who repeatedly use the network.

The basic metric of a customer base in a business model is a market segment**,** which is comprised of the people or organizations that are similar in terms of how they respond to a particular marketing mixture. Market segmentation is the identification of groups of customers or market segments that have similarities in characteristics or in needs and who are likely to exhibit similar purchase behavior and/or responses to changes in the marketing mixture. (Elmore-Yalch, 1998)

MOD Customer Base

There is significant debate as to whether some of the modes in the mobility ecosystem complement or cannibalize public transit ridership. (Hall, et al., 2018) While in the aggregate the modes might compete for the customer segment, an agency can choose how to approach these to either permit the operation, regulate to better achieve public goals, or partner with the private mobility providers to aim for similar goals. In cases where the mobility provider is not directly competing for the transit rider segment, the public agency might still partner with the private mobility provider to achieve some public goals.

Microtransit demonstrates how MOD might either extend the service of existing fixed-route lines through first/last mile service, as is the case with Seattle's Via to Transit service (SUMC, 2018), or reach customers directly as on-demand transit for low ridership routes as is the case with AC Transit's Flex service. (SUMC, 2015)

The mode has taken several forms since it first appeared in the mobility ecosystem in 2014. Some ventures, such as Lyft Shuttle and Chariot, both owned the vehicles, hired drivers, and operated on a business-to-consumer (B2C) basis. Others, such as Transloc, shifted away from B2C models by segmenting, positioning, and directly marketing their services to public agencies seeking alternatives to resource-intensive, fixed-route service in low-ridership service areas. Transloc currently provides the scheduling, dispatch, and routing platform for agency-operated service in a number of markets, including first/last mile-focused services for the Orange County Transportation Authority and Central Contra Costa Transit Authority, as well as paratransit for the San Joaquin Regional Transit District. (SUMC, 2017)

How it is Regulated/Authorized

This element is where the public and private stakeholders most directly interact. The mobility ecosystem itself is a prominent example of how regulations and partnerships influence the business model. When a new mode or technology enters a market, particularly larger deployments of B2C products and services, regulations provide a way to reconcile the business value proposition with the public interest, often by providing parity to standards in place for other business models (e.g., those that regulate taxis).

MOD Regulation/Authorization

When Uber entered early markets, regulation for the specific mode in the mobility ecosystem did not exist; therefore, the company deployed without explicit cooperation from the jurisdictions. In the case of Austin, Texas, and elsewhere, this led to proposed, and sometimes enacted, emergency ordinances to ban the service altogether. (SUMC, 2015, 2017) While the mode is not the business model, the operational characteristics element affected the regulations element, and the business model. This process would be repeated for dockless bikesharing and e-scootersharing, although local jurisdictions have adapted to the latter, following the lead of Santa Monica, California. The city passed an emergency ordinance, but followed it with a pilot program for broadly defined micromobility service. (SUMC, 2018) Other cities such as Chicago, Illinois, began with pilot programs which use the trial period to refine regulations and evaluate potential mobility providers. (SUMC, 2019)

The degree to which regulations affect a private mobility service provider can vary according to mode, size of deployment, and other circumstances. For public entities, regulatory leverage is primarily at the public right of way. This can be enforced through management of travel lanes, curb space, or other public facilities. In other circumstances, this can involve regulation of fleet size or service geography. In practice, the agencies have found reaching agreement over data sharing—whether for trip planning (real-time data) or enforcement and planning (historic data)—to be a stumbling block. (SUMC 2019)[1]

Partnerships

When a value proposition sufficiently overlaps with public goals, formalized partnerships through contracts or other means can help establish mutually beneficial arrangements. For a mobility provider, this might offer the benefit of reducing operational costs, bolstering a revenue stream, expanding a customer base, and ultimately scaling operations. A properly structured P3 involves sharing financial risk. (Miller, 2017) An additional level of risk is added to the partnership when the private mobility service is a start-up that might not have the capacity to implement and operate the project.

MOD Partnerships

Citi Bike in New York, New York, which signed a multiyear, $41-million-dollar contract with Citibank in exchange for naming and system branding, is an example of title sponsorship used for system-wide operational expenses. On a smaller scale, revenue for system expansions can come from dedicated advertising space at individual sites. (Toole Group, 2013)

[1] Datasharing is an unresolved subject. Regardless of the type of procurement, the agency and private provider should each be clear about their expectations regarding datasharing as they approach negotiations. The White Paper, *Objective-Based Data Needs Assessment and Data Sharing Approaches in Mobility Partnerships* (Gururaja, P. and Faust, R. [2019]), offers details on the contemporary state of datasharing agreements.

Operational Characteristics

Operational characteristics of a business model address the activities through which a value proposition is delivered to a customer base, as well as what resources and costs are key to supporting those activities.

Financial resources commonly include available lines of credit and other sources of capitalization previously discussed. Physical resources encompass all inventory and other tangible assets in a firm. For a mobility provider, this might include equipment in a production or supply chain, vehicles, real estate, or right-of-way access. Intellectual resources are the opposite of physical resources—intangible elements that encompass intellectual property, such as the algorithm behind an application or a proprietary vehicle design. Human resources generally denote labor arrangements within a firm. For mobility providers, human resources are generally split between management-level employee labor and contracted system operators, such as drivers or fleet re-balancers. Labor conditions for the latter group, like those for a number of other "gig economy" workers, have remained a point of contention and have raised conversations around the full lifecycle costs of the mobility ecosystem.

These resources also represent costs to an organization, either fixed over a given period or variable in proportion to output. Costs that are variable can benefit from economies of scale and decrease on a per-unit basis with increases in production, while fixed costs can benefit from economies of scope when an organization leverages its resources to offer a wider array of services or products. In essence, an organization seeks to gain efficiencies as it scales up or adds a complementary mode to its operation.

MOD Operational Characteristics

Infrastructure-driven operational models that deploy a physical resource are often able to reduce costs through economies of scale and can, in turn, focus capitalization on wider deployment. Operational models that are more product-driven, such as mobile applications, inherently require greater emphasis on human resources because many key activities revolve around marketing and customer engagement. As mobility services mature, they have expanded to other modes through mergers and acquisitions, as will be discussed in chapter 5.

Chapter 3. Business Models and Public Agencies: The Role of Needs Assessment and Scenario Planning to Achieve Policy Goals

Public agencies must understand how their public goals interact with the objectives of the mobility service providers' business goals. While the two forces might not always be in opposition, they do affect each other. Knowing how public goals and business models relate to each other allows public agencies, as well as potential partners, to lay the preliminary groundwork for a partnership. This chapter discusses the public goals relevant to partnerships and includes case studies to show how MOD partnerships have addressed those goals. The chapter introduces the ways that public agencies might conduct a needs assessment to meet their goals and begin scenario planning for transportation solutions.

Public Goals

As discussed above, the business model of a private mobility provider tries to address what it perceives as a latent demand in the market. Sometimes, these new modes serendipitously address some of the public goals stated below, in which case the agency might focus on the ongoing public goal of rationalizing the facilities for safe operation. In other cases, the agency might consider partnering with an operator of the desired service, while keeping in mind that its business model might affect its willingness to partner.

The descriptions below note the primary public goals—mitigating congestion, providing additional mobility for goods and services, providing mobility for user trips, providing mobility for people with disabilities, and providing mobility in different land use contexts—that mobility services might address, and which business models might best address the challenges.

Congestion

Modes in the mobility ecosystem hold the potential to reduce congestion. Active transportation modes have a strong potential to provide congestion relief, but other regulatory, parking, and land use measures are also a key part of congestion relief. Studies have shown that carsharing results in lower private vehicle ownership and higher use of alternatives. (Cervero and Tsai, 2004) Agencies and carsharing operators (e.g., CalTrain and Zipcar) have formed business-to-government (B2G) partnerships for first/last mile connections between transit and high traffic residential areas. (SUMC, 2014)

For ridesourcing, evidence thus far does not suggest that it provides a congestion solution, at least during peak hours when congestion is at its worst. (Feigon and Murphy, 2018) Some studies are showing that ridesourcing may even increase congestion rather than reduce it. (Erhardt et al., 2019) B2G partnerships for first/last mile or off-hour service, by enabling greater reliance on transit, may have an indirect effect by helping reduce SOV reliance. Some agencies are using ridesourcing to encourage transit use during peak hours and ridesourcing use after service hours.

Smartphone applications that are used for trip planning (e.g., the Transit application) show the user multimodal transit and active transportation options. Because this reduces friction in planning non-SOV trips, it encourages mode shift through the use of transit and active modes that might reduce congestion. (Shaheen et al., 2016)

Similarly, bikesharing and scootersharing modes likely provide congestion relief by providing alternatives to modes that occupy the travel lanes. While docked bikesharing systems often operate as B2G partnerships, the other modes operate as B2C models with regulation. (SUMC, 2018)

Delivery of Goods and Services as Linked to Personal Mobility

While P3s generally do not address goods delivery services, MOD options are appearing in the private marketplace, such as ridesourcing drivers handling deliveries. With roundtrip and free-floating carsharing solutions, drivers can use the service for gig economy jobs, especially if they do not own their own vehicle. (Kokalitcheva, 2017) The most common business model is business-to-business (B2B)/B2C-goods delivery marketplace (GDM) (see table 2), which is essentially a B2B model with delivery staff working as independent contractors. The Swedish example in which the MOD operator Freelway has partnered with the municipality of Uppsala to create a ridesharing and parcel transporting service, with City Hall serving as a pickup point, has not yet been tried in the United States. It may, however, be a promising partnership to pilot for rural areas.

Providing More Mobility Options

Typically originating in the private sector with a view to fulfill an unmet customer need, nearly all mobility services contribute to providing more mobility options. Ridesourcing, for example, has disrupted the taxi industry and expanded to a wider area to increase consumer options. The potential business models that can support providing more mobility options include B2C, B2B, and B2G through any of the modes described throughout this report.

A public agency might create a more comprehensive option through mobility management, in which complete multimodal trips can be planned and paid for in a seamless fashion. If modes become consolidated under public agencies serving as mobility integrators, the easily available options for the consumer increase.

Mobility for People with Disabilities

Shared mobility modes have the potential to provide more mobility options to people with disabilities, if universally designed. For instance, some B2G microtransit systems use cutaway vans from the ADA paratransit fleet and can provide on-demand service to all users while supplementing ADA complementary paratransit, with the addition of the relevant technology. (SUMC, 2017)

ADA complementary paratransit is currently the most expensive per-trip cost for any transit agency. The Federal requirement is day-before booking; therefore, MOD offers additional mobility to customers through B2G partnerships with ridesourcing companies. Currently, some systems are piloting on-demand services for paratransit-eligible customers. An example is the MBTA project discussed in the case studies. Call centers can be made more efficient by offering users application-based technology, such as MBTA did when consolidating its call center operations. (SUMC, 2017)

New York City is taking a different B2G approach by creating a required pilot program for all ridesourcing companies in its jurisdiction. Every operator is required to have an escalating percentage of WAV in its fleet at all times. This will create a network that aims to have equivalent service for all users. (SUMC, 2018)

Agencies might encourage roundtrip and free-floating carsharing by placing non-ADA complementary paratransit WAVs (i.e., vans) at parking locations and other nodes in the network where they can provide mobility that would otherwise be provided by paratransit at a higher cost. (SFMTA, 2017)

Providing Mobility Services in Different Land Use Contexts

One of the challenges for any network-based system is how to operate in a lower density environment or an underserved area. For instance, docked bikesharing stations need to be reasonably close to be effective—likewise, for carsharing stations. Public-private partnerships can be used to extend service into lower density areas. The Vermont VTrans Go! Vermont trip planner, for example, connects transit, private, and human services transportation. All of these options to provide service in lower density or underserved areas may require subsidies or cross-subsidies. Additionally, these pilot projects serve particular geographic areas or populations, for instance a particular building, but they might not provide a systemic solution to the goals over an agency's service area.

Serving Low-Density Areas

Agencies can partner with private operators for needs such as first/last mile connections at transit stations and mobility for low-income populations. One example of a B2G partnership in this context is the Victor Valley Transportation Authority's Needles (California) Car Share. This partnership with Enterprise Car Rental places vehicles in the center of the town for shopping and errand trips. (SUMC, 2017)

In areas where demand is lower, ridesourcing can be used in place of fixed-route transit in a B2G partnership. A thoroughgoing example of this is found in Canada. Innisfil, Ontario is a Toronto exurb that partnered with Uber to replace its low-ridership transit system. Users are charged a flat fare for trips within the transit agency's service area. (SUMC, 2017)

Microtransit can also provide first/last mile service and encourage use of transit. An example of a microtransit B2G partnership being applied to different densities can be found in an agreement for technology between TransLoc and three agencies in California. Transloc provides the transit agencies—Orange County Transportation Authority, Central Contra Costa Transit Authority, and San Joaquin Regional Transit District—the technology platform for their microtransit programs. Orange County's program will focus on first/last mile solutions; Central Contra Costa County will form a modal link with other Bay Area transit, such as Bay Area Rapid Transit (BART); and the San Joaquin program will serve as a rural paratransit service. (SUMC, 2017)

Trip planners can be used to connect services in low-density areas. While some B2C applications already serve this use, some agencies are beginning to form B2G partnerships to move towards providing mobility as a service (MaaS). Go! Vermont aggregates data to enable trip planning across multiple urban and rural transit agencies and private providers, including both fixed-route and demand-responsive services. (SUMC, 2019)

Serving Underserved Areas or Populations

While the early bikesharing and carsharing operations were non-profit initiatives, later private start-up ventures needed to find markets immediately, and were not as focused on equity. Through planning, regulation, and partnerships, agencies have found ways to ensure that transit disadvantaged and low-income neighborhoods receive similar service to that offered in other areas. The more flexible on-street systems can be deployed in low-density areas more readily, but a host of supportive services need to accompany them. As with taxis, regulation for ridesourcing companies can require equitable geographic distribution to ensure access for underserved areas and populations. Larger markets may add surcharges to fund equity measures, as is the case with Chicago's surcharge on ridesourcing trips, which is used to fund Chicago Transit Authority capital projects. (SUMC, 2017)

Agencies can also look into extending carsharing services by requiring placement in underserved areas. The city of Sacramento, California's, B2G partnership with Zipcar provides free, on-demand access, with concierge service, to eight electric vehicles for hundreds of residents at three public housing sites to better serve low-income areas that might not have smartphone access. (SUMC, 2017)

For B2C models, the agencies can also include in their permitting process placement of vehicles in underserved areas as part of their rebalancing requirements.

Needs Assessment

The first step toward implementing a successful mobility service is developing a clear understanding of the community's needs. This requires a robust needs assessment before any steps are taken to decide the type of MOD business model to apply. Needs assessments help assure that MOD business models are applied to a community's mobility needs rather than forcing a community to adapt to a MOD business model.

In many cases, agencies have identified a mobility service of interest and subsequently worked to identify a situation in which the service could be applied. Without a needs assessment, this type of deployment can lead to services that may not operate in the most needed areas, routes, or at the best times; it may use technology that does not work for the community; or it may not be marketed in an optimal way, among other issues. A needs assessment helps address this by assuring that mobility services are matched to community needs rather than vice versa.

This chapter explains why needs assessments are important and provides an overview of the key steps and considerations to undertake a needs assessment.

The Importance of Needs Assessments

Needs assessments provide transportation agencies with a systematic process though which a community's mobility needs can be identified, and they can help prioritize where resources are needed to

address specific challenges. Besides identifying specific mobility needs, assessments can reveal important data about targeted communities that can assist implementation efforts; this includes information about language skills, disabilities that may impede use of mobility services, access to and familiarity with technology, and how people receive information about transportation options, among other things.

Results from the assessment will provide communities with information that will help them identify which MOD business models are best able to meet their needs and help communities agree on the specific outcomes they hope to achieve by implementing a mobility service.

A thorough needs assessment can also support the later evaluation of a mobility service. The process will define a clear goal and collect data that can be used as a baseline from which to determine whether the solution met the identified needs.

In many cases, communities have already conducted planning efforts to identify mobility needs. A needs assessment is not necessary if the community has identified current and near-term mobility needs that may be addressed with mobility services. Communities that do not have clearly defined mobility needs should conduct a needs-based planning effort prior to selecting a mobility service and mobility provider.

Conducting Needs Assessments

There is no single method for conducting a needs assessment. The guidance in this document is adapted from *Conducting Needs Assessments: A Multidisciplinary Approach* (Soriano, 2012) and modified to apply to needs assessments that are seeking possible mobility services. A five-step needs assessment process is outlined below.

1. Inventory existing conditions.
2. Determine the purpose of the needs assessment.
3. Assess available resources.
4. Know the community.
5. Conduct the analysis.

Step 1: Inventory Existing Conditions

It is important to understand the environment in which any mobility service will be offered. This includes information such as land use, density, existing and planned transportation services and infrastructure, travel patterns, political concerns and preferences, employment and demographic data, and key stakeholders. The list of key stakeholders may be large and include the target population, the agency conducting the assessment, potential funders, potential operators, and others who may assist with evaluating and implementing any services.

This inventory of existing conditions will provide context and data for the needs assessment. Information can be used to assist with identifying unmet mobility needs, understanding historical concerns and preferences, identifying mobility services, and recruiting partners for the implementation of mobility services.

Step 2: Determine the Purpose of the Needs Assessment

Clearly understanding why a needs assessment is being undertaken will feed into overall data collection and analysis. Thinking through the problem that is to be addressed (e.g., to provide a mobility service to improve access to jobs) will flow through to the information requirements for the needs assessment. If a mobility services is sought without identifying the purpose of the solution and those whom it is intended to serve, it will likely result in failed application.

Needs assessments should include goals and objectives. For example, a goal may be to conduct a needs assessment to determine the job access needs of low-income workers. Objectives of the study could be: (1) assess current levels of job access for low-income workers, (2) identify current transportation resources available to low-income workers, (3) determine where mismatches exist between potential workers and jobs, and (4) determine reasons for job-housing mismatches. The goals and objectives will impact which stakeholders are included in the study and what data are needed to conduct the study.

Step 3: Assess Available Resources

Available resources will control what can be accomplished during a needs assessment. Resources can include data, analysis tools, staffing, and relationships, among others. It may be necessary to scale back or otherwise rescope a needs assessment if adequate resources are not available. One area to seek resource savings is data collection and analysis. Data is generarely divided into two groups. The first, primary data, is any data collected directly by the study team. The second is secondary data, which are data that were collected by others and are available to the study team. Using secondary data can result in significant time and cost savings. Key stakeholders identified in step 1 can likely help identify and provide useful data sources. These stakeholders may also be capable of addressing other resources needs by supporting public outreach effort, conducting analysis or providing analysis tools, and providing funds.

Step 4: Know the Community

Simply collecting data or using secondary data is inadequate for the needs assessment analysis. If resources are available, getting out into the community and interviewing key stakeholders who know the community best will result in additional insights that can be missed through simple data analysis. This can take the form of attending neighborhood meetings and conducting focus groups and interviews with key influencers. Understanding the history of a targeted community can also help to provide additional insight to the travel habits and thought processes of members of a community. Potential key community stakeholders may include:

- Local transportation advocacy groups.
- Non-profit community groups.
- Neighborhood associations.
- Business owners.

Step 5: Conduct the Assessment

Generally, there are two types of assessments—qualitative and quantitative. More robust needs assessments will use a combination of the two types to support decision making and funding applications.

Quantitative methods can generate a more objective and generalized assessment, while qualitative methods can provide poignant stories to discover needs that may not be apparent through quantitative

data analysis. A mixed-method needs assessment may first use quantitative analysis to understand underlying trends and then use a qualitative method to understand if those underlying trends hold true and to get real-world examples.

The ultimate analysis should reveal specific information about the mobility needs. Continuing the example of an assessment of the job access needs of low-income individuals, it may be determined that: (1) there is a need to move residents between a high-poverty neighborhood and a major suburban employment center; (2) weekday needs can be meet with a first/last mile travel option between residents' homes and a nearby rail station, while weekend needs require some kind of direct service between residents' homes and the employment center; (3) those most in need are primarily non-English speakers with limited access to smartphones; and (4) approximately 1,500 residents could benefit from the mobility service.

A final report should summarize the study process, data collected, findings, and any stakeholder commitments that were made to assist with the funding and/or delivery of mobility services.

Additional information and resources for conducting needs assessments are included in Appendix B.

Scenario Planning

Overview of Scenario Planning

Agencies seeking to use mobility services to meet community needs must make decisions in an environment where technology, economic trends, regulation, business model capitalization, and other factors are changing. In addition, business models are rapidly adjusting and service providers are regularly moving into and out of the marketplace. Planners need a solution that allows them to consider how MOD business models may change in the near and long term, and what risks those changes pose. Scenario planning enables them to make informed decisions that include applicable risk mitigations.

Scenario planning offers a typology to planners and community members to identify plausible alternative futures, think about the impact of those futures, and propose actions that can be taken to address potentially negative future outcomes. Many planners have been exposed to scenario planning within the context of regional plans. Large transportation planning agencies use scenario planning to identify how transportation networks, investments, and operations interact with land use patterns (USDOT, 2011) and do so for time horizons of 30 years or more. (Chakraborty et al., 2011) In many cases, agencies develop "normative" scenarios that represent preferred and achievable end states. (Futrell, 2019) However, there is no single methodology or even specific outcome goal associated with scenario planning. Beyond normative plans, many scenario planning exercises are predictive or exploratory (i.e., they attempt to predict future conditions or explore various options of what could happen in the future). This inherent flexibility allows scenario planning to be adaptable to aiding in the selection of MOD business models to meet community needs. Arnab Chakraborty and Andrew McMillan reviewed and synthesized 63 articles and 25 projects from 2004 to 2014 that used or discussed scenario planning. (2015) The result of their synthesis was the creation of a scenario planning typology with nine key components, each with three subcomponents, that capture the important variations of scenario planning. Their typology can be used to consider how internal factors (items that a transportation agency can control) and external factors (items outside of the control of a transportation agency) can come together to impact the success of agency policies and decisions.

Below is a general scenario planning template adapted from the Chakraborty and McMillan typology. The elements should be considered as an outline; unique community goals and needs may necessitate or encourage different considerations. The final outcome of the scenario planning process is: (1) the creation of future scenarios that identify how conditions that affect the delivery of MOD business models may change, and (2) an understanding of how present-day decisions and policies regarding mobility service deployment may impact future outcomes.

Organization structure: Organizational structures impact the control that an agency has on the success of mobility services and are, therefore, important to scenario planning. For example, an agency with regulatory powers over mobility services can control when and how regulations impact mobility service delivery; an agency without such power could see their use of mobility services positively or negatively impacted by another agency's regulatory choices.

Scope: The scope of a typical MOD business model evaluation should focus on the single topic of how conditions (e.g., population change, technology innovation, regulatory changes, and economic trends) may impact the delivery of mobility services.

Scenario type: Planners should seek to generate multiple scenarios that are realistic versions of what may happen in the future.

Outcome: Planners should seek to understand how MOD business models may change based on the scenarios developed. For example, if the availability of venture capital suddenly decreases dramatically, what impact will that likely have on MOD business models? Understanding these potential outcomes will help with decisions about which business models, MOD policies, or mitigations should be pursued.

Stakeholder engagement: Stakeholder engagement focuses primarily on interest groups that can help with the development of scenarios and understanding outcomes. This will likely include mobility providers, transportation agencies, futurists, funders, and specific project partners.

Participation extent: Stakeholder engagement should focus on knowledge sharing to inform the development of scenarios and understanding of outcomes.

Engagement medium: In most cases, it will be easiest to collect needed information via face-to-face and other similar activities.

Scenario construction and analysis tools: Analysis of constructed scenarios will likely be qualitative and rely on input provided from stakeholders regarding how MOD business models may react to various market and other events.

Resources: Resources will vary depending on the planning process that is driving the evaluation of MOD business models.

The items above represent a preliminary view of a step-by-step process for conducting scenario planning (see Appendix C). Scenario planning originated with military planning during World War II and was subsequently adopted by the private sector in the late 1960s. (USDOT, 2015) Its adoption in the planning field is more recent and was aided, in part, by computer tools that simplify advanced land use and transportation system analyses. (Klosterman, 2014) Since 2004, the Federal Highway Administration (FHWA) has encouraged the use of scenario planning to enhance the traditional planning process.

(USDOT, 2011) As part of that effort, the agency has developed numerous resources, including the following:

- The *Scenario Planning Guidebook* (2011) assists transportation agencies with carrying out a scenario planning process from start to finish.
- The *Next Generation Scenario Planning: A Transportation Practitioner's Guide* (2017) profiles the next generation of scenario planning for transportation practitioners and summarizes the history, key benefits, and driving issues that warrant a scenario-based approach.
- The *Supporting Performance-Based Planning and Programming through Scenario Planning* (2016) presents a framework for connecting established scenario planning processes with the four phases of performance-based planning and programming.
- The Transportation Planning Capacity Building Scenario Planning Program (N.D.) provides an online toolkit with information for individuals seeking to integrate scenario planning into larger planning efforts.

Chapter 4 provides a template to help planners match identified mobility needs to applicable mobility services. Using the template requires conducting scenario planning.

Chapter 4. Planning Template

This chapter describes how results from needs assessments and scenario planning can be combined to identify possible mobility services to meet community needs, understand the potential risks associated with implementing models, and identify potential mitigations. The process consists of three steps and uses a matrix that summarizes information about MOD business models that includes business model elements and the ability of business models to address various community needs. Each step is illustrated with examples of either active or concluded partnerships that addressed the stated public goal. The information is based on data and business characteristics that were widely available at the time this document was created. Changes may have occurred given the evolving nature of the MOD market place. The matrix should be used as a tool but checked to assure its continued accuracy.

Step 1: Rank Prospective Mobility Services Based on their Ability to Meet Identified Needs

The first step is to determine how well available mobility services can address identified community needs. Section 1 of the planning matrix, shown later in this chapter, includes information on the value proposition various mobility services offer with regard to eight commonly identify community transportation needs:

- Reducing congestion.
- Enhancing mobility for services and goods.
- Expanding mobility options.
- Improving mobility for people with disabilities.
- Providing Mobility Options in Different Land Uses:
    - Providing solutions in low-density areas.
    - Serving underserved areas or populations.

Each MOD business model is scored *limited*, *potential*, or *high*, referring to the model's ability to address the respective need. A score of *potential* does not mean that the service is not capable of addressing a respective need, but rather, that sufficient data were not available at the time this document was created. Sometimes, an identified need may not be listed in the matrix. In these cases, planners will need to review available research and possibly make educated inferences to determine the likely ability of the MOD business model to meet the community need.

Reducing Congestion

Automobile-based modes in the mobility ecosystem might reduce car-ownership, indirectly affecting congestion and mode shift to non-automobile modes. It is the transit-supportive partnerships that might need closest consideration for reducing congestion.

Enhancing Mobility for Services and Goods

As of this writing, there are no partnerships for goods delivery. However, some jurisdictions (e.g., San Francisco) have created curb-space programs that rationalize loading zones for different mobility services. (SUMC, 2008) Chapter 5 discusses how some companies are adapting their business models for an expanded goods delivery presence in the mobility ecosystem.

Expanding Mobility Options

Application technologies for trip planning and fare payment form the core of the mobility ecosystem. As the above-mentioned technical memoranda have discussed, current business models prioritize movement of people over goods, although the latter might be integrated into future applications. As the private mobility service providers merge across modes, they are expanding use of applications. Likewise, public transit agencies are partnering with consultants to build multimodal trip planners and payment applications.

In their FTA MOD Sandbox project, awarded in 2016, the Portland, Oregon, area's TriMet transit agency partnered with several private consultants to create an OpenTripPlanner-platform-based multimodal trip planning application. The trip planner currently incorporates carsharing, a ridesourcing company, and the city's bikesharing sytem, along with options for walk-only and bike-only routes. The active modes also track calories. Payment for the private partners are through deep links to the native applications at this point. The TriMet application is open-source for other transit agencies to adapt for their use. (SUMC, Webinar 2016, 2019)

Mobility for People with Disabilities

Several examples illustrate MOD options that provide better service to people with disabilities. The Pinellas Suncoast Transit Authority (PSTA) is collaborating with several partners, including Lyft, United Taxi, and CareRide, for a pilot program, Paratransit Mobility on Demand Demonstration. The pilot program aims to provide more cost-effective, on-demand, and door-to-door paratransit service. The project will utilize a new centralized dispatching technology that will allow PSTA to offer a rider multiple transportation provider options, including transportation network companies, taxis, and wheelchair vans if necessary, based on estimated arrival time and cost. This pilot program is one of the FTA's MOD Sandbox program grant recipients. (SUMC, 2017)

The MBTA RIDE On-Demand pilot program offers subsidized rides to paratransit travelers in their service area, who can book trips using Uber and Lyft's native application or their call center. WAV rides are provided through subcontracted accessible taxicabs or human services providers. The pilot program has been extended multiple times. While it was originally designed to bring down costs, the additional mobility has brought additional trips. Therefore, while per-trip costs are down, the overall cost is about the same. The pilot has, however, brought additional mobility, especially to ambulatory travelers. The

Commonwealth has created additional funding to purchase WAVs to improve response time. (SUMC, 2018, 2019)

Of the available modes in the mobility ecosystem, microtransit is perhaps the best equipped to serve persons with disabilities without any modification to the business model. While ridesourcing partnerships like the MBTA RIDE On-Demand have improved mobility, especially for ambulatory paratransit travelers, WAV vehicles are still subcontracted as a separate service. While a causal link has not been made, WAV trips are often very low in the small sample size of these pilot programs. Microtransit P3 pilots might hold a possible solution to the lack of universal design. The Pickup by CapMetro pilot program in Austin, Texas, partnered with Via, LLC for the technology for rebranded, agency-operated cutaway vans from their paratransit program. While intended to meet the need of providing mobility services in different land use contexts, the operational lifts allowed wheelchair users to use the on-demand service. (SUMC, 2017)

The Wheels2U project in Norwalk, Connecticut, inverts the model and uses the transit agency's ADA complementary paratransit vehicles in the hours when they are not operating. The agency operates the fully accessible vehicles, on-demand, initially near commuter rail and the city's nightlife areas. Provided the lift is operational and the drivers are trained, this service can provide these recreational/non-work trips to wheelchair users, providing mobility to improve lifestyle. (SUMC 2019)

Providing Mobility Services in Different Land Use Contexts

Serving Low-Density Areas

Partnerships in low-density areas often cannot rely on the network of vehicles of denser areas.

A partnership that addresses accessibility in a low-density area can be found in San Bernadino County in California. Needles is a small city of 5,000 on the Nevada border. In 2016, the Victor Valley Transit Authority launched a carsharing program in partnership with Enterprise Car Rental in the city. Registered residents of the program can rent one of two cars (a sedan or minivan) to run errands and go to appointments for the discounted rate of $5 per hour. A car can be reserved online and picked up at its designated parking location. Over a quarter of the town's residents live below the poverty line, and this program offers mobility options for those unable to afford private cars. A gas card and liability insurance are included in the rental. This service offers access errand destinations across the river in Nevada. (SUMC, 2017)

Microtransit service in P3 operations either serves as route replacement for fixed-route public transit, usually on account of spatial issues (density/connectivity), or as a complement to it (first/last mile). The P3 service faces a conundrum. It is necessarily less efficient than traditional fixed-route transit by most metrics, but if it did meet those metrics, fixed-route transit would be merited. (SUMC, 2019)

Serving Underserved Areas or Populations

Seattle, Washington, created a partnership to reach underserved areas and populations with a free-floating carshare program that established incentives to ensure operators are distributing vehicles equitably throughout the city in exchange for larger fleet sizes. The program was expanded in January 2015 and updated metrics were released in 2016. Additionally, the program complements the Commute Trip Reduction state law and commuter benefits program by reducing the need for car ownership. (SUMC, 2019)

Planners should compare their identified needs to scoring for each business model. Business models that are scored as most able to address the identified needs should be carried forward for further analysis in step 2. A business model scored as *potential* or *limited* may still be worthy of further analysis. Unique local circumstances, available choices, and other factors should be considered when deciding which business models to carry forward.

Step 2: Identify the Business Model Elements

The second step is to determine which business models identified in step 1 are most applicable given desired business model elements. Section 2 of the planning matrix (table 3) lists business model characteristics for mobility services that were operating widely at the time this report was developed. The characteristics include the following:

- Customer base (B2C or B2G).
- Value proposition (what market need the service fills).
- Operational characteristics (number of modes addressed).
- Capitalization and revenue (options ranging from membership fees to grants and subsidies).
- Partnerships and regulations (contractual versus regulatory approaches).

Planners should use this section to further narrow down the MOD business models to those that fit their operational, funding, and contractual needs.

Step 3: Use Scenario Planning to Understand Potential Risks

The third step is to understand how the applicable MOD business models may perform under uncertain future conditions. This involves use of the scenario planning process that was outlined in chapter 3 and is further discussed in Appendix C.

At this point, MOD business models have been identified based on their ability to meet community needs within the confines of organizational limitations and goals, and there is an understanding of potential operational risks and available mitigations. It is now up to a community to determine which MOD business model, if any, is best able to meet its needs. The community also will need to consider the following factors, which can be charted on table 4:

- Service availability.
- Cost to the implementing agency and travelers.
- Time to implementation.
- Service provider quality and reviews.
- Service's ability to fully satisfy ridership/user projections.
- Ability to meet the mobility needs of disabled travelers.
- Ability of users and operators to effectively interact with the service's technology.

The possibility exists that no currently available MOD business model fits the community's needs. However, it is important to note that the matrix only reflects business models that were widely available at the time this document was created. New services and business models continue to emerge that address a wide range of community needs, and the marketplace should be reviewed to determine if models not listed in this document may be available and able to meet community needs.

An example scenario was developed that outlines how these planning steps can be used; it is provided in Appendix C.

Table 4. Mobility services and business models planning template.

	Round-trip Carsharing	Free-floating Carsharing	Docked Bikesharing	Dockless Bikesharing	Scooter	Ridesourcing	Microtransit	Apps
Step 1: Rank Prospective Mobility Services Based on their Ability to Meet Identified Needs (1)								
Reducing Congestion	High	High	High	High	Potential	Limited	Potential	Potential
Enhancing Mobility for Services and Goods	High	High	Potential	Potential	Potential	High	Limited	Potential
Expanding Mobility Options	High	High	High	High	High	High	High	Potential
Mobility for People with Disabilities	High	High	Potential	Limited	Limited	High	High	Potential
Low Density Transportation Solutions	High	Limited	Limited	Potential	Limited	High	Limited	Limited
Serving Underserved Areas or Populations	High	High	Potential	Potential	Potential	High	HIgh	High
Step 2: Identify the Business Model Elements								
Customer Base	B2C/G	B2C	B2C/G	B2C	B2C	B2C	B2G	B2C/G
Operational Characteristics	One mode	One mode	One mode	One mode	One mode	One mode	One mode	Mobility as a Service
Capitalization & Revenue	- Riders, users, and members - Brokerage (peer-to-peer) - Venture capital - Grants and subsidies - Sponsorship and advertising	- Riders, users, and members - Venture Capital - Sponsorship and advertising	- Riders, users, and members - Venture Capital - Grants and subsidies - Sponsorship and advertising	- Riders, users, and members - Venture Capital - Grants and subsidies - Sponsorship and advertising	- Riders, users, and members - Venture Capital - Grants and subsidies - Sponsorship and advertising	- Riders, users, and members - Venture Capital	- Riders, users, and members - Venture Capital - Grants and subsidies - Sponsorship and advertising	- Riders, users, and members - Venture Capital - Sponsorship and advertising - Brokerage - Revenue sharing
Partnerships & Regulation (2)	- Regulation - Contract	- Regulation - Contract - Traditional bid process - Grant-funded community-led mobility network	- Regulation - Contract - Traditional bid process - Grant-funded community-led mobility network	- Regulation - Contract - Traditional bid process - Grant-funded community-led mobility network - Non-exclusive regulatory permits or franchises	- Regulation - Contract - Traditional bid process - Grant-funded community-led mobility network - Non-exclusive regulatory permits or franchises	- Regulation - Contract - Traditional bid process - Grant-funded community-led mobility network - Non-exclusive regulatory permits or franchises	- Regulation - Contract Traditional bid process -Grant-funded community-led mobility network - Non-exclusive regulatory permits or franchises	- Contract

.

	Round-trip Carsharing	Free-floating Carsharing	Docked Bikesharing	Dockless Bikesharing	Scooter	Ridesourcing	Microtransit	Apps
Step 3: Use Scenario Planning to Understand Potential Risks								
Scenario 1: Impacts and Mitigations	Insert results from process outlined in report section 4.3 into this section							
Scenario 2: Impacts and Mitigations	Insert results from process outlined in report section 4.3 into this section							
Scenario 3: Impacts and Mitigations	Insert results from process outlined in report section 4.3 into this section							

Notes: (1) Strategies are scored by their ability to address the respective need: *limited*, *potential*, and *high*.
(2) Community-specific.

Apps = applications.
B2C = business-to-consumer.
B2G = business-to-government.
FLM = first/last mile.
MOD = mobility on demand.

Chapter 5. Recent Developments in the Mobility on Demand Ecosystem and Conclusions

The largest companies in the mobility ecosystem are currently undergoing large changes to their business models since the expansion of the modes. The most dynamic business elements at this time are capitalization and revenue, regulation, and partnerships. The shifts within one element affect the others and should prompt both the company and its partners to examine the partnership. This chapter examines changes to all these elements in light of recent developments.

For the capitalization and revenue element, this section examines recent mergers and acquisitions within the mobility ecosystem along with IPOs of stock in mobility providers. Public documents of the IPOs show some of the changes to the business models that these companies anticipate. The companies express immediate concerns about the regulatory element, especially at the State level, in IPO documents. At the same time, some local jurisdictions are anticipating innovative modes and adapting their regulations to better integrate new models. The companies raise capital from their offering of shares on the open market. However, these offerings bring with them additional requirements, such as more transparency about a company's revenue and its governance, followed by quarterly reporting as long as it remains public.

The evolution of regulations has also changed the nature of partnerships. The trends in regulations and partnerships might converge in applications where public transit agencies, private aggregators, and the post-IPO companies are all creating multimodal applications. This section looks beyond the United States, drawing on the FHWA Global Benchmarking Program Report, *Shared Use Mobility: European Experience and Lessons Learned* (USDOT, 2019), to examine European programs that create mobility ecosystems on a large scale.

This chapter concludes with a brief discussion of the lessons learned from the projects that are synthesized in this report, along with the key takeways for stakeholders.

Mergers and Acquisitions and Initial Public Offerings

Initial Public Offerings (IPOs) by Ridesourcing Companies

The ridesourcing companies Lyft and Uber initiated the first major mergers and acquisitions in the mobility ecosystem, followed by the first IPOs — on March 29 and May 9, 2019, respectively. Generally, the trends move together. (Fahey, 2017) Both moves mark significant changes in the capitalization and revenue element of the companies' business models, and researchers have observed that mergers and acquisitions and IPOs tend to follow each other. (Hovakimian and Hutton, 2009; Celikyurt, Sevilir, and Shivdasani, 2010) Other observers of mergers and acquisitions in technology sectors suggest that

companies acquire others for their intellectual property. The merger prompts another round of innovation—essentially an immediate tactical return to the start-up/launch stage with a view to creating Strategic benefits. (Han, Jo, and Kang, 2018) In addition to the pre-IPO acquisitions by both companies, this might point to additional IPOs and mergers and acquisitions in the future, and perhaps new modes and/or business models. In their Security and Exchange Commission (SEC) filings, both Uber and Lyft list their growth strategies and their risk factors. The two companies share broad concerns about branding and competitive advantages, resulting from a highly competitive marketplace. However, they have different strategies for growth, which reveals the breadth of possible outcomes from similar business models.

Expansion of Ridesourcing Companies into Bike and Scootersharing

The most notable pre-IPO acquisitions in the year leading up to the IPOs were Uber's acquisition of the JUMP e-bikesharing company in April 2018 and Lyft's acquisition of the Motivate non-profit bikesharing operator in July of 2018. Uber would later launch e-scootersharing under the JUMP brand, and Lyft under its own brand. (Dickey, 2018; O'Kane, 2018) Both of these moves result in a lateral integration of services that were then bundled. (Johnson, 2010; Ovans, 2015) Lyft focused on its bikesharing and e-scootersharing acquisitions, with an eye towards gaining a larger share of the "rider transportation spend." (SEC, 2019) They see the traveler turning to the Lyft platform for a variety of transportation needs, after use of one of the options. In other words, the application will serve as a one-stop shop for the traveler. This is a different value proposition than the initial business model element for ridesourcing and will probably affect the other elements in the business model. The company is motivated by increasing its revenue. On the other hand, with the new services, it may directly compete with the trip planning and fare payment applications that transit agencies are building. If so, the competition between mobility applications might affect future partnerships.

Expansion of Ridesourcing Companies in the Goods Delivery Market

Although it has made similar acquisitions moves as Lyft, in its filing Uber explicitly mentioned only its acquisition of Careem ridesharing as part of its expansion into the Middle East. (SEC 2019) In general, their stated strategy is to expand into additional markets and to gain the largest market share for all of its modes to gain a "massive network" in which "billions" will use at least one of its services. Rather than offering a value proposition with a single application, Uber wants to have nodes that will serve as points of contact to "add more Drivers, consumers, restaurants, shippers, carriers, and dockless e-bikes and e-scooters." (SEC, 2019) The difference is perhaps best seen in Uber's emphasis in the filings of the growth of the Uber Freight and Uber Eats units in its SEC filing. Uber Freight, which exists outside of the traditional ridehailing application, expands their relationships in the GDM as a B2B relationship. (SEC, 2019)

Regulation

Two key ridesourcing companies (Uber and Lyft) view a shift in the regulatory environment as a risk factor. Specifically, in the words of Uber's SEC filing, its business **"**would be adversely affected if Drivers were classified as employees instead of independent contractors." (SEC, 2019) The risk is apparent in prominent cases on the local level in New York City (Hawkins, 2019; Fernández Campbell, 2018) and on the State level in California. (Ronayne and Thompson, 2019) In New York's case, the city required the companies to provide a minimum wage for drivers on the platform. California's law will change the status

of drivers from independent contractors to employees. Whether this is the existential threat that the companies perceive remains to be seen. At the same time, the companies are lobbying State-level governments to exercise preemptive regulatory authority over localities. (DuPuis et al, 2018)

Partnerships

Shared mobility P3s predate the MOD business models and existed in various generations of bikesharing, demand-responsive transit (the pre-cursor to microtransit), and carsharing. With emerging business models, private mobility providers and public transit agencies and local governments continue topartner as outlined above. Partnerships are already taking new forms, as local jurisdictions have adapted to new modes that are using the disruptive operational model of the ridesourcing companies.

Local jurisdictions have adapted to the arrival of new modes in the public right-of-way using the contractual terms of P3s as a means of regulation. The most prominent example of this trend is seen in the use of regulation and piloting of dockless e-scooters in Santa Monica, California. Recognizing the absence of an appropriate regulatory framework to execute partnerships with e-scooter companies when the opportunity arose, the City passed an emergency ordinance to regulate the mode. It then created a pilot program to permit operation of shared e-scooters. It also created a more general permanent ordinance that defines mobility devices broadly to include bikesharing, as well as modes it tries to anticipate. (SUMC, 2018) This hybrid form of P3—in which a pilot project is included in the local regulations for the operation of a new service—offers a model for new modes and business models. The local jurisdiction can adjust its requirements and offer the MOD companies a transparent means of evaluation for operation.

The consolidation of modes into a single application due to the mergers might also affect how mobility providers approach a P3. Both the Uber and Lyft applications currently include options to integrate transit legs into their trips in some markets, but as these larger mobility operators acquire additional modes within the mobility ecosystem, their apps are becoming multimodal trip planners that might compete with both public and private trip planners. For instance, larger mobility providers are removing some of their modes from private third-party mobility apps. (Spivack and Plitt, 2019) However, how mobility options are best incorporated into applications is a decision that agencies will continue to consider and pilot in the coming years.

Public agencies in other countries have used their broad reach to create MaaS environments that bundle public transit and private services. While mobility providers in other countries operate under different regulations, some of the innovative partnerships and revenue structures are worth exploring for partnership ideas, especially if private capitalization moves away from the United States mobility ecosystem. The FHWA Global Benchmarking Program Report, *Shared Use Mobility: European Experience and Lessons Learned* (FHWA, 2019), highlighted what it called “boundary-defying public-private partnerships and contracting methods.” (FHWA, 2019) The section on innovative funding examined RATP in France, Deutsche Bahn in Germany, and Wiener Stadtwerke in Austria. RATP created RATP Dev as a public venture capital firm, funding innovative mobility services. Deutsche Bahn Digital Ventures is an arm of Deutsche Bahn rail company, which is a private company wholly held by the German federal government. It also serves as a venture capital firm and forms partnerships with companies. Finally, the Wiener Stadtwerke GmbH in Austria works with municipalities to implement innovative mobility projects. Another example, on the regulatory side, is found in the Finnish federal government’s regulation to require a standard real-time, open-source data feed from all mobility

providers. This enables an open marketplace in which any developer can create a trip planning application to suit users' needs. On a local level in the United States, Los Angeles County Metro has created an open source Mobility Data Specification that creates a similar standard. (SUMC, 2018)

Variations on the European capitalization and regulatory models offer opportunities for transit agencies and jurisdictions to create a mobility ecosystem that is more open to competition and public involvement. Ultimately, a more open mobility ecosystem may have the potential to better meet public goals.

Other Trends

The future implementation of autonomous vehicle technology is seen as vital to long-term survival of the ridesharing segment of the mobility ecosystem. At this point, the technology has not matured, but any company with significant labor cost for operation (e.g., microtransit) will be affected.

Conclusion

The overall goal of this project is to examine the business models underpinning the mobility ecosystem, and see how, in better understanding those business models, mobility services might be leveraged to meet the public goals of addressing congestion, improving delivery of goods and services as linked to personal mobility, providing more mobility options, providing mobility for people with disabilities, providing mobility services in different land use contexts, serving low-density areas, or serving underserved areas or populations. Close observation of business model elements enables stakeholders at a public agency to better anticipate change in the mobility ecosystem. Local jurisdictions are now changing regulations to better adapt to current business models. These regulations affect the other business model elements, especially and most immediately the partnership element. But as recent developments show, changes in any element potentially affect the entire business model. The public agency stakeholders that understand business models and their elements can better adapt their partnerships and regulations to achieve the stated goals.

Chapter 6. References

1. American Planning Association. (Accessed June 2019) *Knowledgebase Collection: Scenario Planning.* https://www.planning.org/knowledgebase/scenarioplanning/.
2. Birkinshaw, J. and Ansari, S. (2015). "Understanding Management Models: Going Beyond "What" and "Why" and "How" Work Gets Done in Organizations." *Business Model Innovation, 85–92.*
3. Cao, G., Jin, G. Z., and Zhou, L. A. (2018). "Market expanding or market stealing? Platform competition in bike-sharing." *National Bureau of Economic Research*. *24938*. Available online at: <https://econpapers.repec.org/paper/esswpaper/id_3a12907.htm>.
4. Celikyurt, U., Sevilir, M., and Shivdasani, A. (2010). "Going public to acquire? The acquisition motive in IPOs." *Journal of Financial Economics. 96*(3), 345-363.
5. Cervero R., and Tsai, Y. (2004). "City CarShare in San Francisco, California: second-year travel demand and car ownership impacts." *Transportation Research Record*. *1887*(1), 117-127.
6. Chakraborty, A., Kaza, N., Knaap, G. J., and Deal, B. (2011). Robust plans and contingent plans: Scenario planning for an uncertain world. *Journal of the American Planning Association*, *77*(3), 251-266.
7. Chakraborty, A., and McMillan, A. (2015). Scenario planning for urban planners: Toward a practitioner's guide. *Journal of the American Planning Association*, *81*(1), 18-29.
8. Cohen, B., and Kietzmann, J. (2014). "Ride on! Mobility business models for the sharing economy." *Organization & Environment, 27(3), 279-296*.
9. Descant, S. (2018, May). "LA Metro Will Test the Feasibility of Micro Transit." *Government Technology*. Available online at: <https://www.govtech.com/fs/transportation/LA-Metro-Will-Test-the-Feasibility-of-Micro-Transit.html>.
10. Dickey, M. R. (2018, April 9). "Uber acquires bike-sharing startup JUMP." *Techcrunch*. Available online at: <https://techcrunch.com/2018/04/09/uber-acquires-bike-share-startup-jump/>.
11. DuPuis, N., Langan, T., McFarland, C., Panettieri, A., and Rainwater, B. (2018). "City rights in an era of preemption: a state by state analysis." *National League of Cities*. Available online at: <https://www.nlc.org/resource/city-rights-in-an-era-of-preemption-a-state-by-state-analysis>.
12. Elmore-Yalch, R. (1998). TCRP Research Report 36: *A Handbook: Using Market Segmentation to Increase Transit Ridership.* Transportation Research Board Transit Cooperative Research Program.
13. Erhardt, G. D., Roy, S., Cooper, D., Sana, B., Chen, M., and Castiglione, J. (2019). "Do transportation network companies decrease or increase congestion?" *Science Advances*, *5*(5), eaau2670. Available online at: <https://advances.sciencemag.org/content/5/5/eaau2670.full>.

14. Fahey, M. (2017, January 6). *Why buyouts are blowing away IPOs when investors want to 'cash out'*. Available online at: <https://www.cnbc.com/2017/01/06/ipos-vs-mergers-buyouts-blow-away-ipos-when-investors-cash-out.html>.

15. Falconer, R., Zhou, T., and Felder, M. (2018). *Mobility-as-a-Service: The value proposition for the public and our urban systems*. MaRS Discovery District. Available online at: <https://taf.ca/mobility-service-urban-systems/>.

16. Feigon, S. and Murphy, C. (2018). TCRP Research Report 195*: Broadening Understanding of the Interplay among Public Transit, Shared Mobility, and Personal Automobiles*. Transportation Research Board Transit Cooperative Research Program. Available online at: <http://www.trb.org/Main/Blurbs/177112.aspx>.

17. Fernández Campbell, A. (2018, December 5). *New York City passes nation's first minimum pay rate for Uber and Lyft drivers*. Available online at: <https://www.vox.com/2018/12/5/18127208/new-york-uber-lyft-minimum-wage>.

18. Ferrero, F., Perboli, G., Vesco, A., Musso, S., and Pacifici, A. (2015). Car-sharing services–part b business and service models. *Tech. Rep.*

19. Futrell, J. (July-August 2019). *How to design your scenario planning process*. PAS Memorandum. American Planning Association. Available online at: <https://www.planning.org/publications/document/9180327/>.

20. Gururaja, P. and Faust, R. (2019). *Objective-Based Data Needs Assessment and Data Sharing Approaches in Mobility Partnerships*. Available online at: <https://learn.sharedusemobilitycenter.org/overview/white-paper-objective-driven-data-sharing-for-transit-agencies-in-mobility-partnerships/>.

21. Hall, J. D., Palsson, C., and Price, J. (2018). "Is Uber a substitute or complement for public transit?" *Journal of Urban Economics*, *108*, 36-50.

22. Han, J., Jo, G., and Kang, J. (2018). "Is high-quality knowledge always beneficial? Knowledge overlap and innovation performance in technological mergers and acquisitions." *Journal of Management & Organization*, *24*(2), 258-278. doi:10.1017/jmo.2016.35.

23. Hawkins, J. (2019, February). "Uber sues to overturn New York City's cap on new ride-hail drivers." *The Verge*. Available online at: <https://www.theverge.com/2019/2/15/18226599/uber-nyc-driver-cap-lawsuit-de-blasio>.

24. Hovakimian, A., and Hutton, I. (2009). *Merger-Motivated IPOs*. SSRN Papers 1145535. Available online at: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1145535>.

25. Irfan, U. (2018, September). "Electric scooters' sudden invasion of American cities, explained." *Vox*. Available online at: <https://www.vox.com/2018/8/27/17676670/electric-scooter-rental-bird-lime-skip-spin-cities>.

26. Johnson, M. W. (2010). "Seizing the white space: Business model innovation for growth and renewal." Harvard Business Press.

27. Klosterman, R.E. (2014). Lessons learned about planning. Journal of the American Planning Association. 79(2), 161-169Kokalitcheva, K. (2017, August 30). "The rise of car rentals for the 'gig economy.'" *Axios*. Available online at: <https://www.axios.com/the-rise-of-car-rentals-for-the-gig-economy-1513305149-658c3738-431d-4587-b094-f87ffc1a0647.html>.

28. Liao, R. (2019, March 11). “Meituan Confirms Mobike’s retreat from most overseas markets.” *Techcrunch*. Available online at: <https://techcrunch.com/2019/03/11/mobike-confirms-retreat-from-most-foreign-markets/)>.

29. Liebl, Franz. (2002). The anatomy of complex societal problems and its implication for OR. *Journal of the Operational Research Society.* 53(2), 161-184.

30. McKenzie, G. (2018). “Docked vs. Dockless Bike-sharing: Contrasting Spatiotemporal Patterns (Short Paper).” In *10th International Conference on Geographic Information Science (GIScience 2018)*. Schloss Dagstuhl-Leibniz-Zentrum fuer Informatik.

31. Metropolitan Transportation Commission (MTC). (2018). *Bay Area Carsharing Implementation Strategy*. Available online at: <https://learn.sharedusemobilitycenter.org/wp-content/uploads/MTC-carsharing_report_vfinal_06.21.18.pdf>.

32. Miller, P. M. (2017, September 26). “P3 Contracting and Risk: An Introduction to Public-Private Partnerships for U.S. Transactions.” *Faegre Baker Daniels Insight.* Available online at: <https://www.faegrebd.com/en/insights/publications/2017/9/p3-contracting-and-risk-an-introduction-to-publicprivate-partnerships-for-us-transactions>.

33. Movmi. (February, 2018). *Understanding the Car Sharing Business Model and How to Build Yours*. Available online at: <http://movmi.net/car-sharing-business-model/>.

34. O’Kane, S. (2018, July 2). “Lyft buys the biggest bike-sharing company in the US.” *The Verge*. Available online at: <https://www.theverge.com/2018/7/2/17526892/lyft-buys-motivate-bike-sharing-expansion>.

35. Osterwalder, A., and Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers*. John Wiley & Sons.

36. Ovans, A. (2015, January 23*).* “What is a business model?” *Harvard Business Review.*

37. Portland Bureau of Transportation (2018). 2018 *E-Scooter Findings Report.* Available online at: <https://www.portlandoregon.gov/transportation/article/709348>.

38. Ronayne, K., and Thompson, D. (2019, September 11). *Uber vows to keep fighting sweeping California labor bill*. Available online at: <https://www.apnews.com/4066e95bf69d4bc397092f3aa922045d>.

39. SAE International (2018). *Taxonomy and Definitions of Terms Related to Shared Mobility and Enabling Technologies*. Standard J3163. Available online at: <https://www.sae.org/standards/content/j3163_201809/>.

40. San Fransisco Municipal Transportation Agency (SFMTA). (2017, January). *On-Street Car Sharing Pilot Program.* Evaluation Report. Available online at: <https://secureservercdn.net/166.62.112.193/i19.61f.myftpupload.com/wp-content/uploads/policy-documents-4/SF_Carshare_eval_final_Jan17.pdf?time=1566252085>.

41. Schwieterman, J., Livingston, M., and Van Der Slot, S. (2018). *Partners in Transit: A Review of Partnerships between Transportation Network Companies and Public Agencies in the United States*.

42. Security and Exchange Commission (SEC). (2019). Form S-1 registration statement under the Securities Act of 1933.

Lyft. Available online at: <https://www.sec.gov/Archives/edgar/data/1759509/000119312519059849/d633517ds1.htm>.

Uber. Available online at: <https://www.sec.gov/Archives/edgar/data/1543151/000119312519103850/d647752ds1.htm>.

43. Shaheen, S., Cohen, A., Martin, E., and Finson, R. (2012). *Public Bikesharing in North America During a Period of Rapid Expansion: Understanding Business Models, Industry Trends and User Impacts*. Mineta Transportation Institute.

44. Shaheen, S., Cohen, A., Zohdy, I., and Kock, B. (2016). *Smartphone Applications to Influence Travel Choices: Practices and Policies.* FHWA-HOP-16-023. Available online at: <https://ops.fhwa.dot.gov/publications/fhwahop16023/fhwahop16023.pdf>.

45. Shaheen, S., Cohen, A., Yelchuru, B., and Sarkhili, S. (2017). *Mobility on Demand Operational Concept Report.* Report prepared for US Department of Transportation Intelligent Transportation Systems Joint Program Office, Washington, DC.

46. Shared-Use Mobility Center (SUMC) (various). Mobility on Demand Learning Center.

AC Transit RFP for Demand Responsive Flex Service, Alameda and Contra Costa Counties, California. (2015). Available online at: <https://learn.sharedusemobilitycenter.org/overview/ac-transit-rfp-for-demand-responsive-flex-service-alameda-and-contra-costa-counties-california-2015/>.

BlueLA Electric Vehicle Car Sharing Partnership, Los Angeles, California. (2017). Available online at: <https://learn.sharedusemobilitycenter.org/overview/bluela-electric-vehicle-car-sharing-partnership-los-angeles-california-2017/>.

Caltrain and Zipcar Partnership, California. (2014). Available online at: <https://learn.sharedusemobilitycenter.org/overview/caltrain-and-zipcar-partnership-california-2014/>.

Carsharing Program for Low-Income Residents, Needles, California. (2017). Available online at: <https://learn.sharedusemobilitycenter.org/overview/carsharing-program-for-low-income-residents-needles-ca-2016/>.

Case Study: MBTA RIDE P3 partnerships: Lyft/Uber and Centralized Call and Control Center for Paratransit Services. (2018). Available online at: <https://learn.sharedusemobilitycenter.org/casestudy/mbta-ride-p3-partnerships-lyft-uber-and-centralized-call-control-center-for-paratransit-services/>.

Case Study: Seattle Bikeshare Program and Permit Process. (2019). Available online at: <https://learn.sharedusemobilitycenter.org/casestudy/seattle-bikeshare-program-permit-process/>.

Case Study: Vermont Flexible Trip Planner: Bringing Fixed and Flexible Transit Together on a Single Platform. (2019). Available online at: <https://learn.sharedusemobilitycenter.org/casestudy/vermont-flexible-trip-planner-bringing-fixed-and-flexible-transit-together-on-a-single-platform/>.

Color Curbs Program, San Francisco, California. (2008). Available online at: <https://learn.sharedusemobilitycenter.org/overview/color-curbs-program-san-francisco-california-2008/>.

Electric and Equitable Learning from the BlueLA Carsharing Pilot, Los Angeles, California. (2019). Available online at: <https://learn.sharedusemobilitycenter.org/overview/case-study-electric-and-equitable-learning-from-the-bluela-carsharing-pilot-los-angeles-ca-2019/>.

Emergency Ordinance and Pilot Program for Shared Mobility Devices, Santa Monica, California. (2018). Available online at: <https://learn.sharedusemobilitycenter.org/overview/emergency-ordinance-and-pilot-program-for-shared-mobility-devices-santa-monica-california-2018/>.

*Go Dublin Rideshare Partnershi*p, Dublin, California. (2017). Available online at: <https://learn.sharedusemobilitycenter.org/overview/go-dublin-rideshare-partnership-dublin-california-2017/>.

King County Metro, Sound Transit, the City of Seattle, and Via Partner for "Via to Transit," Southeast Seattle and Tukwila, Washington. (2019). Available online at: <https://learn.sharedusemobilitycenter.org/overview/king-county-metro-sound-transit-the-city-of-seattle-and-via-partner-for-via-to-transit-southeast-seattle-tukwila-wa-2019/>.

Learning Module: Carsharing. (2019). Available online at: <https://learn.sharedusemobilitycenter.org/learning_module/carsharing/>.

Learning Module: Microtransit. (2019). Available online at: <https://learn.sharedusemobilitycenter.org/learning_module/microtransit/>.

Legislation Regulating Transportation Network Companies, Texas. (2017). Available online at: <https://learn.sharedusemobilitycenter.org/overview/legislation-regulating-transportation-network-companies-tnc-texas-2017/>.

Licensing and Regulation of High-Volume For-Hire Transportation Services, New York, New York. (2018). Available online at: <https://learn.sharedusemobilitycenter.org/overview/licensing-and-regulation-of-high-volume-for-hire-transportation-services-new-york-new-york-2018/>.

MassDOT and MBTA partner with Uber and Lyft for accessible rides, Boston, Massachusetts. (2019). Available online at: <https://learn.sharedusemobilitycenter.org/overview/massdot-and-mbta-partner-with-uber-and-lyft-for-accessible-rides-boston-ma-2019/>.

National Mobility as a Service (MaaS) Policy, Finland. (2018). Available online at: <https://learn.sharedusemobilitycenter.org/overview/national-mobility-as-a-service-maas-policy-finland-2018/>.

Nice Ride Dockless Service, Minneapolis, Minnesota. (2018). Available online at: <https://learn.sharedusemobilitycenter.org/overview/nice-ride-dockless-service-minneapolis-minnesota-2018/>.

On-Demand Transit Partnership with Uber, Innisfil, Ontario, Canada. (2017). Available online at: <https://learn.sharedusemobilitycenter.org/overview/on-demand-transit-partnership-with-uber-innisfil-ontario-canada-2017/>.

Paratransit Mobility on Demand Demonstration, Pinellas County, Florida. (2017). Available online at: <https://learn.sharedusemobilitycenter.org/overview/paratransit-mobility-on-demand-demonstration-pinellas-county-florida-2017/>.

Pickup by Capital Metro, Austin, Texas. (2017). Available online at: <https://learn.sharedusemobilitycenter.org/overview/pickup-by-capital-metro-austin-texas-2017/>.

Emergency Ordinance and Pilot Program for Shared Mobility Devices, Santa Monica, California. (2018). Available online at: <https://learn.sharedusemobilitycenter.org/overview/emergency-ordinance-and-pilot-program-for-shared-mobility-devices-santa-monica-california-2018/>.

Transportation Network Companies Operation Termination Ordinance, Austin, Texas. (2015). Available online at: <https://learn.sharedusemobilitycenter.org/overview/tnc-operation-termination-ordinance-austin-texas-2015/>.

TransLoc partners with three California transportation agencies to provide technology for microtransit service. (2017). Available online at: <https://learn.sharedusemobilitycenter.org/overview/transloc-partners-with-three-california-transportation-agencies-to-provide-technology-for-microtransit-service-2017/>.

TriMet Trip Planner adds Uber, SHARE NOW, and BIKETOWN, Portland, Oregon. (2019). Available online at: <https://learn.sharedusemobilitycenter.org/overview/trimet-trip-planner-adds-uber-share-now-and-biketown-portland-oregon-2019/>.

Twin Cities EV Community Mobility Network, St. Paul, Minnesota. (2019). Available online at: <https://learn.sharedusemobilitycenter.org/overview/twin-cities-ev-community-mobility-network-st-paul-minnesota-2019/>.

Valley Metro Mobility Platform, Phoenix, Arizona. (2016). Available online at: <https://learn.sharedusemobilitycenter.org/overview/valley-metro-mobility-platform-phoenix-az-2016/>.

Webinar: App-Based Solutions for an Integrated Transportation Network. (2016). https://learn.sharedusemobilitycenter.org/multimedia/webinar-app-based-solutions-for-an-integrated-transportation-network/>.

47. Soriano, F. I. (2012). *Conducting Needs Assessments: A Multidisciplinary Approach* (Vol. 68). Sage.

48. Spivak, C. & Plitt, A. (2019, September 30). “Transit app slams Lyft’s attempts to ‘take over mobility.’” *Curbed New York*. Available online at: <https://ny.curbed.com/2019/9/30/20891536/nyc-transit-app-lyft-citi-bike>.

49. Toole Design Group. (2013). Philadelphia Bike Share Strategic Business Plan. Available online at: <http://www.bikesharephiladelphia.org/philastudy/completebusinessplan.pdf>.

50. U.S. Department of Transportation Federal Highway Administration. Federal Highway Administration.

Advancing Transportation Systems Management and Operations Through Scenario Planning (Report number: FHWA-HOP-16-016). (2015). Available online at: <https://ops.fhwa.dot.gov/publications/fhwahop16016/fhwahop16016.pdf>

51. *FHWA Scenario Planning Guidebook*. (2011). Available online at: <https://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/scenario_planning_guidebook_2011/>.

52. *Global Benchmarking Program Report: Shared Use Mobility: European Experience and Lessons Learned* (Report number: FHWA-PL-18-026). (2019). Available online at: <https://international.fhwa.dot.gov/sum/fhwapl18026.pdf>.

53. *Next Generation Scenario Planning: A Transportation Practitioner’s Guide*. (2017). Available online at:

<https://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/publications/next_gen/fhwahep17099.pdf/>.

54. *Supporting Performance-Based Planning and Programming through Scenario Planning (Report number:* FHWA-HEP-16-068. (2016). Available online at: <https://www.fhwa.dot.gov/planning/scenario_and_visualization/scenario_planning/scenario_planning_guidebook/fhwahep16068.pdf>.

Technical Support for Mobility on Demand – Mobility Marketplace Connecting Travelers: Technical Memorandum #1 – Review of the Current MOD Marketplace. (2019).

Technical Support for Mobility on Demand – Mobility Marketplace Connecting Travelers: Technical Memorandum #2 – Delivering On-Demand Multimodal Mobility. (2019).

55. (joint program with Federal Transit Administration). Transportation Planning Capacity Building Scenario Planning Program (N.D.). Homepage available online at: <https://www.planning.dot.gov>.

56. Yin, D. & Tan, Xiaomei, T. (2017, November). Bike-sharing Data and Cities: Lessons from China's Experience.*NewSecurityBeat*. Available online at: <https://www.newsecuritybeat.org/2017/11/bike-sharing-data-cities-lessons-chinas-experience/>.

Appendix A: Key Definitions

This report draws on business model literature to expand upon the categories of modes and revenue models used as examples in the framework developed in U.S. Department of Transportation's (USDOT's) *MOD Operational Concept Report* (Shaheen et al., 2017) and in SAE International's Standard J3163, *Taxonomy and Definitions for Terms Related to Shared Mobility and Enabling Technologies*. (2018) This framework characterizes the primary commercial transaction underlying the business relationships between service provider and consumer, such as business-to-consumer or business-to-government. This report provides a deeper analysis of the intersection of particular modes and revenue models under the broad categories defined thus far in published literature.

While the above-referenced documents provide a complete set of definitions of terms used frequently in shared mobility and mobility on demand (MOD) literature and parlance, this section includes definitions of terms (often abbreviated) used frequently in the synthesis report. These definitions have been largely adapted from SAE International's *Taxonomy and Definitions of Terms Related to Shared Mobility and Enabling Technologies*. (2018)

- **Bikesharing** provides users with on-demand access to bicycles at a variety of pickup and drop-off locations for one-way (point-to-point) or roundtrip travel. Bikesharing fleets are commonly deployed in a network within a metropolitan region, city, neighborhood, employment center, and/or university campus. Users access bicycles on an as-needed basis for one-way (point-to-point) or roundtrip use. The majority of bikesharing providers cover the costs of bicycle maintenance, storage, and parking.
    - Station-based or **docked bikesharing** kiosks typically are unattended, concentrated in urban settings, and offer one-way station-based access (bicycles can be returned to any kiosk). Generally, trips of less than 30 min are included within the membership fees. Users join the bikesharing organization on an annual, monthly, daily, or per-trip basis.
    - Free-floating or **dockless bikesharing** offers users the ability to check-out a bicycle and return it to any location within a predefined geographic region. Bikesharing provides a variety of pickup and drop-off locations.
- **Carsharing** offers members access to vehicles by joining an organization that provides and maintains a fleet of cars and/or light trucks. These vehicles may be located within neighborhoods, public transit stations, employment centers, universities, etc. The carsharing organization typically provides insurance, gasoline, parking, and maintenance. Members who join a carsharing organization typically pay a fee each time they use a vehicle.
    - **Roundtrip carsharing** requires users to borrow and return vehicles at the same location. Multiple carshare vehicles or groups of vehicles may be available within just a few block radii, while in lower density areas, roundtrip carshare vehicles are strategically placed to capitalize on locations that have higher demand, such as pockets of dense housing, rail stations, and employment centers.

  - **Peer-to-peer (P2P) carsharing** is a brokerage model where the vehicles for P2P carsharing are provided by owner-members who make available to renter-members their privately owned vehicles available for sharing. The carsharing provider provides the application-hosting and on-board vehicle technology necessary for operation.
  - **One-way carsharing** includes two types:
    - In **free-floating carshare**, a fleet of one-way vehicles can be located and reserved by an application, then picked up or parked at any legal parking spot within a specific geographic zone (often an entire municipality).
    - In **point-to-point carsharing**, users park at any of a number of designated locations, either on- or off-street. (Shared Use Mobility Center, 2019)

- **Courier network services (CNSs)** provide for-hire delivery services for monetary compensation using an online application or platform (e.g., a website or smartphone application) to connect couriers using their personal vehicles, bicycles, or scooters with freight (e.g., packages, food, etc.). CNSs are also referred to as flexible goods delivery.
- **Microtransit** is defined as a privately or publicly operated, technology-enabled transit service that typically uses multipassenger/pooled shuttles or vans to provide on-demand or fixed-schedule services with either dynamic or fixed routing. (SUMC, 2019)
- **Mobility as a service (MaaS)** entered the MOD vernacular in 2014 through pilots in Germany, Sweden, and Finland. MaaS offers digital platforms that facilitate real-time trip planning and payment for a suite of private and public modes of service. For the public sector and other mobility services, MaaS platforms market their value as filling gaps in the transit network, reaching different customer bases through a wider suite of options and offering a means of entry to the MOD marketplace. (Falconer et al., 2018) Instead of a brokerage or pay-as-you-go revenue stream, MaaS ventures are notable for the use of hybrid subscription-based access to bundled packages providing varying levels of flexible use. While some MaaS ventures have been led by the public sector in an effort to complement service on an open platform, most have been through private companies overseeing the integration of public and private modes on a proprietary application. MaaS Global's Whim, a for-profit Finnish venture, remains the most notable provider, giving users access to a set number of trips per month on public transit, regional rail, microtransit, carsharing, car rental, taxis and bikesharing. (FHWA, 2018)

  The United States Department of Transportation (USDOT) uses the term **mobility on demand (MOD)** to represent its vision for future mobility. MOD envisions a safe, reliable, and carefree mobility ecosystem that supports complete trips for all, both personalized mobility and goods delivery. USDOT achieves this vision by leveraging innovative technologies and facilitating public private partnerships to allow for a user-centric approach that improves mobility options for all travelers, and delivery of goods and services.
- A **MOD marketplace** is a digital platform where multimodal supply for personal mobility and goods delivery services are integrated into a trusted venue for consumers to plan, reserve, and purchase services that meet their current needs. Consumer demand for these services is matched with supply provided by transportation agencies and operations managers, as well as private mobility and goods delivery providers. A MOD marketplace is enabled by strong data governance, integrated payment processing, and shared transactional specifications.
- **Ridesharing** (also known as carpooling and vanpooling) is defined as the formal or informal sharing of rides between drivers and passengers with similar origin-destination pairings. Ridesharing includes vanpooling, which consists of 7 to 15 passengers who share the cost of a van and operating expenses, and may share driving responsibility.

- **Ridesourcing**, also called "ridehailing" or transportation network companies services, are prearranged and on-demand transportation services for compensation in which drivers and passengers connect via digital applications. Digital applications are typically used for booking, electronic payment, and ratings.
- **Scootersharing** allows individuals access to scooters by joining an organization that maintains a fleet of scooters at various locations. Scootersharing models can include a variety of motorized and non-motorized scooter types. These systems are accessed via a smartphone application; users typically pay a fee each time they use a scooter.
    - With **dockless e-scooters**, users of these vehicles, also called kick scooters, stand (with either a foot rest or seat) on the scooter, which has smaller wheels than an e-bike—typically less than 16 inches. They begin the trip under human propulsion with a kick, which they can choose to either continue to use, or opt to throttle via electric motor.
    - With **traditional scootershare**, the scooter service provider typically provides gasoline or charge (in the case of motorized scooters), maintenance, and may include parking as part of the service. The scooters contain all of the electronics and locking mechanisms and can be tracked by the user, provider, and, if relevant, the regulating agency. (Portland Bureau of Transportation, 2018)
- **Shared mobility** is defined as the shared use of a vehicle, motorcycle, scooter, bicycle, or other travel mode. It provides users with short-term access to a vehicle on an as-needed basis. Ideally, these modes can also be used by multiple people at the same time.
- **Shuttles** are shared vehicles (typically vans or buses) that connect passengers from a common origin or destination to public transit, retail, hospitality, or employment centers. Shuttles are typically operated by professional drivers, and many provide complementary services to the passengers.
- **Taxi services** provide prearranged and on-demand transportation services for compensation through a negotiated price, zone pricing, or taximeter (either traditional or global positioning system-based). Passengers can schedule trips in advance (booked through a phone dispatch, website, or smartphone app), street hail (by raising a hand on the street, standing at a taxi stand, or specified loading zone), or e-hail (by dispatching a driver on-demand using a smartphone application).

Appendix B: Needs Assessment Resources

Data Sources

A number of data sources exist to assist with needs assessments. A quantitative needs assessment utilizes primary and secondary data sources. Applicable data sources that are universally available for quantitative needs assessment analysis include:

- American Community Survey data: an annual survey that provides information on household income, demographics, and commuting to work by mode of transportation.
- Longitudinal Employer-Household Dynamics data: available through an online resource called OnTheMap. It provides an interactive online tool to understand employment, commute patterns and flows, and undertake origin and destination analysis.

Applicable secondary data sources that might be available to local agencies for a needs assessment include:

- Geographic information system information to identify available transportation services and infrastructure and services. Many regional planning agencies and local governments have an online database where users can download geospatial files with roadway, bike network, sidewalk, land use, and other data.
- Transit agencies might have available ridership and route data, which can provide a snapshot of routes with high ridership and gaps in the transit network where a new service may be valuable.
- Data on available shared mobility providers and use rates might be available from cities that regulate the services or directly from service provider websites.
- Crowd-sourced data from tools like Strava and Moves can support decision making for the location of new services.
- Data on traffic deaths and injuries by location are often available from city governments, and departments of transportation can indicate where safety concerns may exist.

Additional Resources

This discussion touches on how to develop a needs assessment; however, it is not intended to be exhaustive or comprehensive. The following resources are available to help support the planning and implementation of a needs assessment:

- The Community Tool Box developed by the Center for Community Health and Development at the University of Kansas is an in-depth online tool that includes further information and tools for assessing community needs and resources.[2]
- The Center for Disease Control compiled a Community Needs Assessment document in 2013 that provides additional guidance on how to undertake a needs assessment.[3]

There are a many examples of mobility needs assessments conducted by communities. A few examples follow:

- Boulder County Mobility for All Needs Assessment and Action Plan (2016) provides an example of a county-wide mobility needs assessment.[4]
- Living Cully Plaza/Las Adelitas (Portland, Oregon) Community Mobility Needs Assessment (2018) provides an example of a small area mobility needs assessment.[5]
- Community-Based Assessment of Smart Transportation Needs in the City of Portland, 2018, National Institute for Transportation and Communities provides an overview of developing needs assessments for smart transportation across a city.[6]

[2] Community Toolbox, available online at: <https://ctb.ku.edu/en/assessing-community-needs-and-resources>.
[3] Center for Disease Control Community Needs Assessment, available online at: <https://www.cdc.gov/globalhealth/healthprotection/fetp/training_modules/15/community-needs_pw_final_9252013.pdf>.
[4] Boulder County Mobility for All Needs Assessment and Action Plan, available online at: <https://assets.bouldercounty.org/wp-content/uploads/2017/03/mobility-for-all-needs-assessment.pdf>.
[5] Living Cully Plaza/Las Adelitas Community Mobility Needs Assessment, available online at: <https://static1.squarespace.com/static/57bf2cf2bebafb692dd3505c/t/5bd379377817f7ea5f6943ae/1540585788699/Verde+Mobility+Assessment.pdf>.
[6] Community-Based Assessment of Smart Transportation Needs in the City of Portland (requires a free account), available online at: <https://ppms.trec.pdx.edu/media/project_files/NITC_RR__1163_SmartTransportationNeeds_PortlandOR_Accessible.pdf>.

Appendix C: Scenario Development

Scenarios should be created that allow for the evaluation of mobility on demand (MOD) business models based on multiple realistic futures. The goal is to identify potential future conditions and events in which a MOD business model will need to operate. While future conditions should be realistic, participants in the process are cautioned against being overly constrained; planners frequently confront unanticipated situations, and scenario plans may exclude complex developments and trends because they are deemed logically impossible or inconsistent. (Lieble, 2002) This risk is likely greater with respect to MOD business services given the significant fluctuation occurring in the marketplace.

To create scenarios, planners should:

1. Establish an appropriate timeframe.
2. Identify internal and external factors.
3. Make predictions about external factors.
4. Determine the likelihood that a prediction will occur within the scenario timeframe and the likely impact of the prediction on mobility service delivery.
5. Predict how mobility services will react to the most impactful and likely predictions.

These five steps, which are dependent and interact with one another, are discussed below.

Step 1: Establish a Timeframe

A timeframe for the scenario plan should be established, and it should be equal to the likely operational period of the mobility service. For example, if one is seeking to use a mobility service to address the mobility needs of low-income households during a major roadway construction project, scenarios that have a time horizon that extends through the period of roadway construction should be created. The timeframe of the scenarios should be lengthened if the project is considered a pilot that may be expanded after roadway construction ends.

Step 2: Identify Internal and External Factors

Scenarios are the result of the interaction of internal and external factors. Internal factors are things an agency can control. Within this process, internal factors are the MOD business models and services that an agency can choose to address community needs. Chapter 4 provides a process and associated matrix that agencies can use to identify MOD business models and services that may be applicable to their transportation needs. Potential MOD business models and services need to be identified before the scenario-planning process can be completed.

External factors are things that an agency cannot control. It is important to note that factors that may be within the control of one agency may be outside the control of another. Clearly defining the organizational structure at the beginning of the scenario planning process will help clarify what constitutes an external factor. Examples of external factors follow:

- Population change (e.g., increases in employment that may affect service demand).
- Technology innovation (e.g., developments that may affect the features, delivery, or type of services available).
- Political change (e.g., electoral changes that impact support for service).
- Regulatory changes (e.g., policies enacted at any level of government that impact service availability, cost, or delivery).
- Economic trends (e.g., income or employment increases or decreases that affect how people travel and the number of people who may need to travel).
- Social trends (e.g., societal preferences for certain travel modes or safety concerns about specific modes).
- Environmental trends and events (e.g., increases in temperatures that affect travelers' willingness to use or wait for services or major storms that impact service delivery).
- MOD business model changes (e.g., decisions by service providers to cease service or focus service delivery on a new market).
- Energy/fuel costs (e.g., increases or decreases in fuel cost that impact demand for non-automobile travel).
- Funding (e.g., decreases in tax revenue or loss of grant funds).

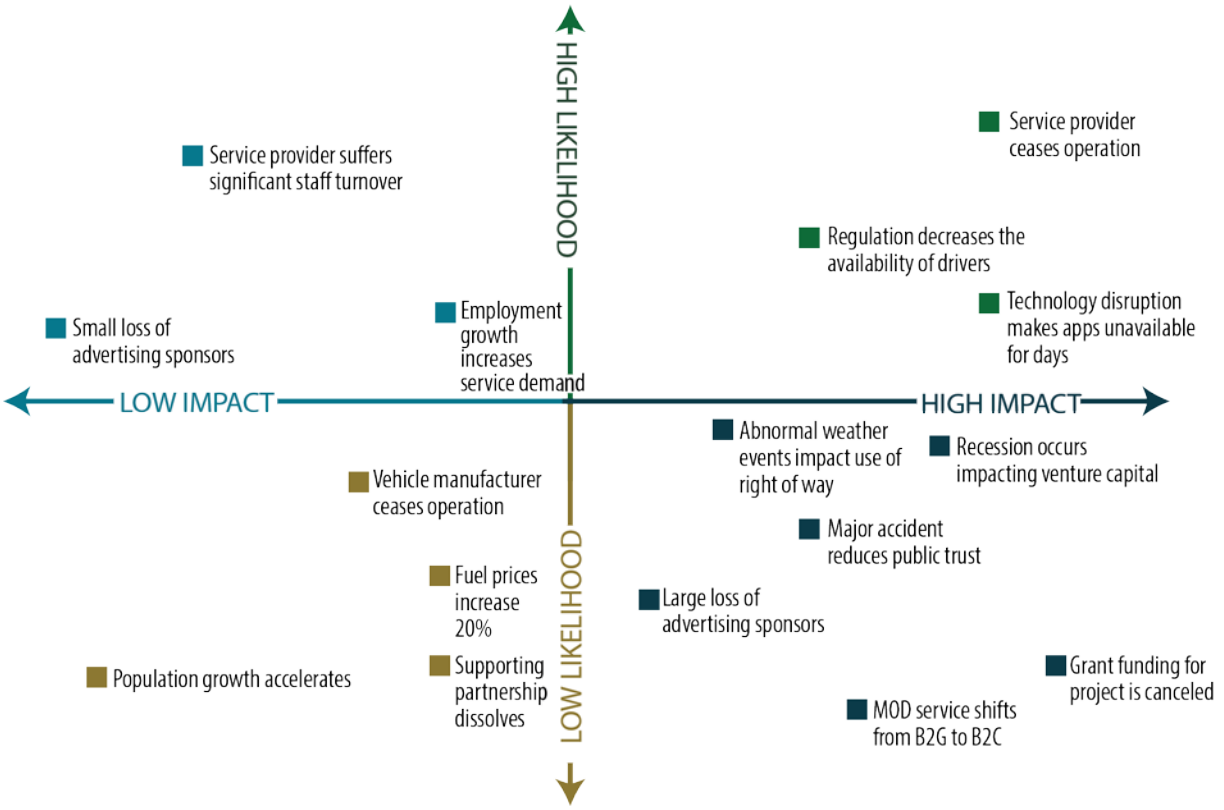
Only factors that are likely to have an impact on mobility services within the scenario timeline should be considered. Environmental trends and events provide a good example of this issue. If the timeframe is 1 to 2 years, then environmental trends are unlikely to be a factor affecting mobility services; however, if the timeframe is 10 to 20 years, environmental trends may be an issue. Regardless of timeframe, environmental events such as major floods and snow storms could be an issue. Applicable factors can be identified based on stakeholder input and other data-gathering efforts.

Step 3: Make Predictions about External Factors

Predictions about the future state of external factors must be made. For example, if economic trends are identified as a factor that may impact mobility services within the established timeline, how will economic trends change, if at all? One prediction may be that employment within a planning area will increase 20 percent due to expansion by a major employer. Another prediction may be that business model changes will cause certain mobility providers to shift their business model from business-to-government (B2G) to business-to-consumer.

Step 4: Determine the Likelihood and Impact of Predictions

A large number of predictions may be identified in the scenario-planning process. The number should be narrowed so that only predictions that are likely to occur *and* have a significant impact are further considered. Figure 1 exemplifies this process. The vertical axis depicts the general likelihood that a factor will occur during the scenario timeframe. The horizontal axis depicts the impact the factor would have if it did occur. All predictions should be graphed based on their relative impact and likelihood. Information gathered from stakeholder engagement can be used to decide the appropriate location of the predictions. Predictions that fall within the upper-right quadrant are of most concern and will be considered in step 5.



Source: UrbanTrans North America
apps = applications.
B2C = business-to-consumer.
B2G = business-to-government.
MOD = mobility on demand.

Figure 1. Graph. Prediction likelihood and impact analysis.

Note that figure 1 is provided purely for conceptual purposes. The factors that each community identifies should vary based on the MOD business models being analyzed and unique community needs. In addition, the likelihood of various factors occurring and the impact they will have will vary by community.

Step 5: Predict Impacts and Reactions

This step is used to determine the specific impact that predictions will have on mobility services and to identify how an agency or community may respond to those impacts. This step is most easily guided by a matrix that shows internal options (i.e., mobility services) versus predictions. Table 5 provides an example of predictions and associated impacts. MOD business models/services that could potentially address community needs are shown on the vertical axis on the left. Across the top horizontal axis are the predictions that were determined to be both likely and impactful. Each paired MOD business model and prediction has information on the impact of the prediction on the service model and information on how a community could mitigate the effect. Table 5 is provided only as an example. Additional information on how to develop a similar matrix and integrate it into a full analysis of MOD options is provided in the forthcoming FHWA report titied "MOD Business Models Scenario Planning Template and Example."

Planners should repeat this process for their own scenarios. The resulting information will help stakeholders understand the risks associated with pursuing mobility services to address community mobility needs. The mitigation portion of the process may also help communities identify policy, contractual, and operational actions they may want to take to minimize negative impacts or to maximize benefits.

Table 5. Factors that could impact mobility service delivery.

Factor	Prediction
Population Change	Enrollment drops significantly at the university
Political Change	Elections at the city cause loss of support for the pilot service
Economic Trends	A recession impacts the city and/or university's ability to fund the pilot A tight labor market makes it difficult for mobility services to recruit and retain employees
Social Trends	A major crash and/or information on social media or in the news creates significant concerns about the safety of riding bikes
Environmental Events	Winter snowfall significantly exceeds historical averages
Mobility on Demand Business Model Changes	The service provider ceases operation
Fuel Costs	Gasoline costs increase by 25 percent or more
Other	Technology disruption prevents travelers from using the service provider's application for multiple days

Example Scenario

This discussion exemplifies how the information within this document can be used. While the example is fictitious, it was designed to be relevant to many planning agencies and to provide insights into the MOD planning process and the use of the various templates within this document.

Scenario Background

For the example, the planning geography is assumed to be a mixed-use area that includes single family and multiunit residential; a mid-sized university campus with approximately 10,000 students; and a

mixture of retail, food, and entertainment businesses that primarily serve university students, faculty, and staff, and nearby residents.

The planning area is adjacent to a rail station with service that connects to other major employment, housing, entertainment, and shopping districts. The rail station's placement on the periphery of the planning area requires walking relatively long distances to access the campus. No services currently exist to move travelers between the rail station and the campus.

Area stakeholders include the city, university, an organized neighborhood group, and residents. The neighborhood group and residents have told the city and university that too many students, faculty, and staff drive and park on residential streets.

Approximately 2 years ago, the city developed a station area master plan. The document focused on how to encourage denser development around the station and how to better connect the station to surrounding land uses. The planning process included nearby residents, business owners, university representatives, and the transit agency. Three community meetings were conducted to seek input on the plan, and a survey was distributed that could be completed by anyone who worked, lived, attended school, or visited the area. The plan also included an inventory of existing transportation infrastructure and services.

Among the plan's recommendations was the provision of a transportation service to help travelers move between the rail station and the nearby university and businesses. No specific recommendation was made regarding the type of transportation service that should be provided.

While the city was working on the station area master plan, the university developed a campus mobility plan. The university's planning effort focused on how to increase the number of students, faculty, and staff who use non-drive-alone travel options to get to and from the campus. The university also desired to minimize its impact on nearby residential neighborhoods.

The university analyzed the home locations of students, faculty, and staff to determine what travel options they have to get to and from campus. The analysis showed that as many as 2,000 students, faculty, or staff members could be commuting by rail but only 500 were doing so. Focus groups revealed that many people were not commuting by rail because they perceived the distance between the rail station and the campus as being too far to walk. A resulting recommendation was that the university invest in mobility options to make moving between the rail station and campus easier and quicker. A specific option was not identified, but the university set aside funds to implement a mobility pilot.

Numerous resources were identified during and after the planning efforts that are applicable to the design and implementation of a mobility pilot, including:

- The city is willing to make small infrastructure investments and develop or adjust regulations to support a mobility service.
- The city is willing to solicit mobility service providers and is capable of managing a mobility pilot. It is also willing to contribute a small amount of funding.
- The university set aside funds for a mobility pilot.

- The university is willing to solicit mobility service providers and is capable of managing a mobility pilot.
- The university has internal resources to market mobility services to students, faculty, and staff.

After discussion, the university and city decide to pursue a joint MOD pilot in which the city will conduct activities associated with securing and managing the service. It will also provide a small amount of funding to support the service. The university will provide the bulk of funding in exchange for its students, faculty, and staff being able to ride the service for free. The university will market the selected service to potential riders. Both entities have agreed to fund a service for up to 2 years. The university and city must now determine if a MOD business model exists that will meet their identified needs.

Step 1: Match the Value Proposition of Mobility Services with Identified Needs

As is the case in many communities, significant planning has already occurred, and the city and its stakeholder groups have a defined and agreed-upon need. Both the city and university have identified the need for a first/last mile solution to make travel between the rail station and the nearby university and businesses easier and more convenient. As many as 500 existing transit riders who work or attend classes at the university may use the service. Additional demand may exist from nearby businesses and the 1,500 university workers and students who could use transit based on their home locations.

Planners can use Section 1 of table 3 to match MOD business models to the desired value proposition. In this case, the stakeholders are seeking a MOD business model that can address first/last mile travel needs. Docked bikeshare, dockless bikeshare, scooters, ridesourcing, microtransit, and applications all have a high potential to address first/last mile travel needs.

Step 2: Identify Potential Mobility on Demand Business Models

Numerous MOD business models are able to meet the identified transportation need. Planners must now analyze the identified business models to determine which include business elements that most meet their operational, funding, and contractual needs. This is done by comparing the business model elements summarized in Section 2 of table 3 to the stakeholders' needs.

Customer base: The city plans to directly oversee the selected mobility service. As such, it would prefer a business model that focuses its customer base on B2G.

Operational characteristics: The city has no preference with respect to the operational characteristics of the business model. It simply needs a solution.

Capitalization and revenue: The university has agreed to fund the service with minimal assistance from the city. The city and university do not require advertising, sponsorships, or grants to offset the cost of the service. As such, this category has no impact on the decision process.

Partnerships and regulation: The city wants to procure the service and desires to do so through a traditional bid/contracting process.

Of the business models able to address first/last mile travel, only docked bikesharing and microtransit have business model elements that meet the needs of the stakeholders.

Step 3: Use Scenario Planning to Understand Potential Risks

The stakeholders have determined that bikesharing and microtransit are most able to meet their needs. They must now consider how external factors (those beyond their control) could impact the successful delivery of a mobility service. The city and university have committed to funding the pilot for up to 2 years. As a result, they should consider external factors that could impact the pilot within the 2-year timeframe.

Planners, after working with key stakeholders, determine that the factors listed in table 6 could impact the pilot. Each factor includes a prediction that can be used to develop scenarios.

After considering the likelihood and potential impacts of the various predictions, planners determine that those most likely to impact the pilot are: (1) a tight labor market makes it difficult for mobility services to recruit and retain employees, (2) winter snowfall significantly exceeds historical averages, and (3) the service provider ceases operation. Table 5 summarizes the likely impacts the predictions would have on the identified business models and the mitigations available to the city and university.

Table 6. Example of internal options versus external factors.

Internal Options	External Factors/Predictions			
	Tight labor market makes it difficult to recruit and retain employees	Winter snowfall significantly exceeds historical averages	Service provider ceases operation	
Microtransit	Rider wait times increase due to a reduction in the number of vehicles in operation.	Service may operate behind schedule due to roadway congestion associated with snow.	Service will cease.	Impacts
	Minimal options	Increase snow plow service along the route.	Go out to bid for new service provider. May take weeks to months. Secure agreement with the local transit agency to provide interim call and ride service.	Mitigations
Docked Bikeshare	Bicycles may not be rebalanced regularly leading to empty stations during periods of high demand. Bicycle maintenance backlog may occur reducing the number of available bicycles.	Bike paths and lanes may be covered in snow forcing cyclist onto unsafe roadways and/or bicycles will not be safe to use due to ice.	Service will cease.	Impacts
	University maintenance staff could be reassigned to support the bikeshare system.	Purchase additional snow removal equipment to service bicycle routes and paths.	Go out to bid for new service provider. Attempt to secure a contractual agreement that will allow the city or another party to operate the service using existing infrastructure through the end of the contract period.	Mitigations

The city considers the potential impacts and available mitigations and decides that it is most comfortable pursuing a microtransit mobility service.

U.S. Department of Transportation
ITS Joint Program Office – HOIT
1200 New Jersey Avenue, SE
Washington, DC 20590

Toll-Free “Help Line” 866-367-7487

www.its.dot.gov

FHWA-JPO-20-798

U.S. Department of Transportation