CUSTOMER-LED MOBILITY: A RESEARCH AGENDA FOR MOBILITY-AS-A-SERVICE (MAAS) ENABLEMENT

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ABSTRACT

Mobility-as-a-Service (MaaS) is a relatively new mobility paradigm that offers users a centralized, digital platform to register, plan, book, e-ticket, and pay for an entire chain of public and private, multimodal service offerings. As MaaS continues to gain traction globally in the customer-led economy, more attention is needed on the role of customers in MaaS enablement. This paper thus serves as a starting point for future research on customer-led mobility. After MaaS is briefly defined and explored using a short case study, this paper proceeds to lay out a research agenda for MaaS enablement, thereby setting the stage for future work on evolving customer behaviors and preferences in MaaS ecosystems.

KEYWORDS

Mobility-as-a-Service (MaaS); customers; integrated mobility; intelligent transport systems

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1. THE MOBILITY CHALLENGE

The Oxford English Dictionary (2018) defines mobility as "the ability to move or be moved freely and easily." In every day terms within the urban living environment, mobility means trains and buses carrying people to and from work and school; trucks delivering goods and carrying away garbage; cyclists zipping through traffic; people hailing taxis or booking an Uber at the touch of a digitized screen; and pedestrians walking down city blocks. Mobility is a critical element to a productive and efficient economy. It facilitates the movement of goods and it is synonymous with urban living for people to go about their everyday activities. What is defined as "successful" urban mobility then? Most will agree the criteria include safety, reliability, affordability, flexibility, and cleanliness (Susilo & Cats, 2014).

However, there is a recurring, common theme across all urban cities globally: true mobility is becoming an increasingly elusive goal. Governments, regulators and businesses are dealing with the consequences of growing congestion, pollution, noise and accessibility. The challenge is only likely to grow with the global population estimated to reach 13.2 billion by 2100 (United Nations, 2017), the number of people age 65 and over expected to increase by 150 percent over the next 35 years (He, Goodkind, & Kowal, 2016), and 66% of the global population projected to reside in urban areas by 2050 (Goodall et al., 2017). According to Arthur D. Little, an international management consultancy, urban journeys already account for nearly two-thirds of all kilometers travelled by people. On current trends, urban distance travelled each year will triple by 2050, and the average time urban drivers spend languishing in traffic jams is set to double to 106 hours a year.

Solving the mobility challenge will thus require bold, coordinated actions from the private and public sectors to meet the growing mobility demands placed on transport infrastructure. The traditional policy responses to congestion—build more roads and expand public transport—are not sufficient and the combined economic, social and environmental benefits will continue to diminish overtime. Complicating this, but with the potential to fast track these new plans, are two megatrends—the rapid and ongoing presence of technological disruption and the emerging demands of a customer-centric economy. In the age of technology, traditional mobility patterns are already undergoing dramatic change. Transport and the way we move through society is no longer a "one-size-fits-all." Consumers that are price-sensitive and time-rich, pensioners or undergraduate students perhaps, can trade time as if it were form of currency at the tap of a screen. The opposite can be said for consumers under certain time pressures, whom will be able to pay a premium for a faster, shorter, journey. Of course, this functionality is interchangeable and will vary given specific trip circumstances, but it ultimately provides consumers with streamlined mobility optionality.

Today, as more people shift to shared and on-demand transport modes, transport services around the world are becoming increasingly integrated to accommodate personalized mobility preferences (Viechnicki et al., 2015). The old transportation networks society has grown accustomed to effectively operate independently of one another; rarely is a dynamic, real-time, multimodal, trip planner available to commuters. The relative rigidity of these systems and their inability to meet consumers' end-to-end mobility needs has given rise to a new mobility concept, Mobility-as-a-Service (MaaS). Many consider MaaS "to be both a physical service provision and a medium for accessing this service" (Falconer et al., 2018: 5). The consumable travel is the mobility service while the medium for selecting travel is the mobility platform.

Taken together, these two features offer an integrated transport experience through Internet-of-Things (IoT) enabled devices.

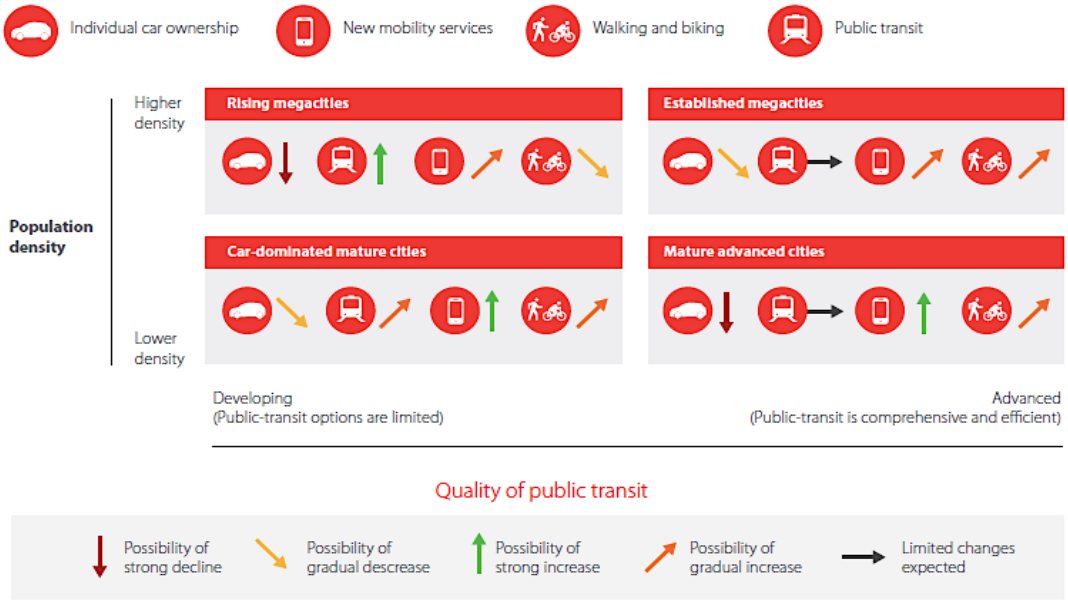
MaaS promises to drastically enhance the ability of people and goods to move freely and easily, anywhere, anytime. Yet, to date, the extant research examining this revolutionary mobility paradigm is still emerging. Some scholars have explored the societal imperative for MaaS (Wong et al., 2017), examined MaaS impacts on land use (Rantasila, 2015), investigated government interest in MaaS platforms (Heikkilä, 2014), explored integration opportunities (Kamargianni et al., 2016), and attempted to developed criteria for MaaS offerings (see, e.g. Li & Voege, 2017). Others have examined feasibility and enhancements to service (see, e.g. Kamargianni et al., 2015; Jittrapirom et al., 2017; Meurs et al., 2020; Storme et al., 2020; Wright et al., 2020; Singh, 2020), institutional requirements (Mukhtar-Landgren et al., 2016; Merkert et al., 2020; Karlsson et al., 2020), impacts on transport contracts (Hensher, 2017; Wong et al., 2020), scalability (Mulley, 2017), end user demand (Sochor, Karlsson, & Strömberg, 2016; Matyas and Kamargianni, 2017; Ho et al., 2018; Ho et al., 2020; Guidon et al., 2020; Mulley et al., 2020; Caiati et al., 2020), and business models for MaaS ecosystems (see, e.g. Kamargianni & Matyas, 2017; Polydoropoulou et al., 2020; Smith et al., 2020). Still others have explored evolving investment opportunities and stakeholder relationships related to MaaS networks (see, e.g. Datson, 2016; Transport for NSW, 2016; QIC, 2018; etc.). While this formative work in the field has been extremely valuable for understanding the potential impacts of MaaS on urban mobility and society, relatively little attention has been given to the role of customer receptiveness in the adoption and utilization of MaaS platforms (Sochor et al., 2015; Fioreze et al., 2019). Only recently has there been a more concerted focus on developments of MaaS and intelligent mobility from the user perspective (see, e.g. Hensher & Mulley, 2020). This paper, thus, aims to build on these emerging findings and conceptualize in clear and concise terms a customer-centric research agenda for MaaS enablement. In the following section, we begin by briefly defining Mobility-as-a-Service (MaaS). Next, we look at MaaS platforms in practice, using MaaS Global's Whim App as a short case study. Then, we articulate a research agenda for MaaS enablement based on customer expectations and behaviors. Finally, we conclude with a call for more research focused on the role customers play in MaaS enablement.

2. MOBILITY-AS-A-SERVICE (MAAS): A NEW MOBILITY PARADIGM

2.1 THE FUTURE OF MOBILITY

Population growth and aging, urbanization, and technological disruption represent a set of converging, mutually reinforcing megatrends that will, along with other global trends, drastically influence the future mobility landscape. Because "[i]ts not just one oar in the water—but lots of them, all pulling in the same direction," mobility changes will differ drastically depending on geographic traits (McKinsey & Company, 2016). Rising megacities, established metropolises, sprawling metropolitan areas, and mature urban centers will all experience different changes in their transport offerings (see Figure 1), such as private car ownership, public transit patronage, active transport usage (i.e. biking and walking), and new mobility service adoption (Bouton et al., 2015; Aapaoja et al., 2017). Within each archetype, government policies and regulations, emerging technologies, evolving consumer preferences,

and innovative business models will influence how different mobility states play out (Bouton et al., 2015).



Source: QIC (2018); Adapted from Bouton et al., (2015)

Figure 1: Mobility Changes by City Type

2.2 Defining Mobility-as-a-Service (MaaS)

No mobility paradigm is expected to dominate (Transport for NSW, 2016; McKinsey & Company, 2016; Smud et al., 2017). Rather, personal, shared, on-demand, active, and flexible transport services will co-exist and be tailored to location-specific conditions (Bouton et al., 2015). At the heart of this ongoing mobility transformation are new and emerging Mobility-as-a-Service (MaaS) ecosystems (Hensher, 2017; Hensher & Mulley, 2020). MaaS models aim to "bridge the gap between public and private transport operators on a city, intercity and national level" by integrating "currently fragmented tools and services a traveler needs to conduct a trip" (Kamargianni & Matyas, 2017). They offer users a centralized, digital platform to register, plan, book, e-ticket, and pay for an entire chain of public and private, multimodal service offerings (Kamargianni et al., 2015; Goodall et al., 2017). Figure 2 depicts a high-level MaaS framework (Huhtala-Jenks, 2017).

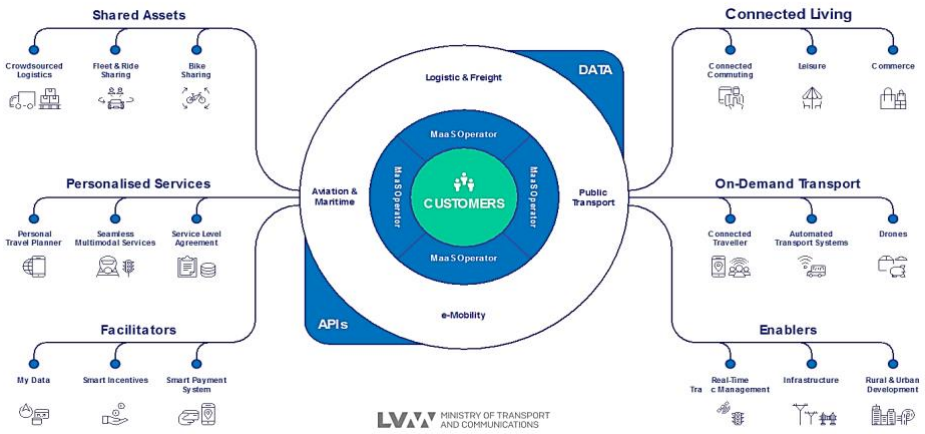


Figure 2: Illustrative MaaS Framework

At its core, MaaS functions through a digitally connected, customer-focused paradigm, empowered by the key enabling stakeholders and the ubiquity of smartphones (see Table 1).

Conditions	Stakeholders
1. Widespread smartphone penetration on 4G/5G networks 2. High levels of connectivity 3. Secure, dynamic, up-to-date information on travel options, schedules, and updates 4. Cashless payment systems	1. Mobility management players 2. Telecommunications companies 3. Payment processors 4. Public and private transport providers/operators 5. Local officials, managers and city planners

Source: Goodall et al., (2017)

Table 1: MaaS Enablers

Ongoing MaaS developments rely heavily on available travel options, system interoperability, and network sustainability (Giesecke et al., 2016; Polydoropoulou et al., 2020). Using data collected on consumer travel patterns and preferences across the transport system, MaaS platforms optimize the network for operators by calibrating supply and demand and deliver real benefits to travelers in the form of improved travel choice, time savings, cost reductions, and better service experiences (Smud et al., 2017). However, travelers are not the only ones to benefit from the adoption of MaaS. Policymakers, data providers, and transport operators all stand to benefit greatly from transport improvements, expanded service coverage, and more efficient network operation. Governments and policymakers are particularly well positioned to benefit from a system that ultimately cannot function without significant public sector involvement. MaaS will allow governments to gain valuable insights into the central nervous system of their cities through anonymized end-to-end trip data, as opposed to current data sets which are incomplete, and to a degree linear (point-to-point). The appeal of combining existing mass-transit schemes with a growing variety of private services is obvious. It potentially reduces the physical infrastructure task for governments and offers a new way to attract private capital into “public” transport. By enabling a closer link between supply and demand, MaaS platforms promise to increase the utilization and efficiency of mass transport (Guidon et al., 2020). This could lower congestion at peak hours as travelers are diverted from crowded routes to less-packed ones using dynamic, congestion pricing schemes. Moreover, MaaS mobile apps could be used to help governments achieve public health objectives as well. By tweaking various options in the platform, these apps could help encourage healthier choices, such as walking or cycling; potentially giving rise to greater personalization of healthcare and/or life insurance policies. Emissions of pollutants in urban areas are also expected to fall with MaaS as fewer vehicles hit the streets (Pangbourne et al., 2018). Helsinki thinks it can make its city center free of cars by 2025—not by banning them, but by building a transport system that renders them redundant.

Although all these benefits seem idyllic, MaaS platforms come with their own challenges (Li & Voege, 2017; Merkert et al., 2020; Karlsson et al., 2020; Schikofsky et al., 2020). In designing MaaS systems, policymakers often face an ongoing dilemma around regulatory oversight and/or intervention where onerous regulatory frameworks will stifle private sector participation and limited regulation may inadequately protect the public interest. This is particularly problematic with data because MaaS platforms rely on ubiquitous IoT devices which are seamlessly connected through a range of different stakeholders, including telecommunication retailers, data centers, governments, and private infrastructure providers. In 2016, there were 5 billion devices connected to the internet. By 2020, this number is expected to be 25-30 billion (Nordrum, 2016). The terabytes of data captured from these devices each day are key to unlocking unrealized efficiencies currently entrenched within existing transportation networks. However, sanitizing personal information that will be shared across multiple stakeholders complicates system viability. Too little information will make a MaaS platform inefficient while too much information could potentially compromise the privacy of its users. Although the rising prominence of blockchain (or distributed ledger technology) may help mitigate some of these information sharing issues, the resilience and security of MaaS systems remains a monumental challenge to the ultimate feasibility of wide-spread adoption.

3. MAAS IN PRACTICE

While there is no universal solution for MaaS enablement, one platform has shown early signs of success in integrating all means of travel from different transport providers into one mobile platform. Developed by MaaS Global Inc., this pioneering MaaS platform is known as Whim.

3.1.1 Case Study: Whim

To date, Whim is arguably the most prominent application of the MaaS concept. Developed around a carefully constructed mobility ecosystem of public and private transport services, Whim was released in 2016 in Helsinki, Finland after six years of planning with governments, cities, and industry stakeholders. Since its release, Whim has been recognized as one of the world's most advanced MaaS platforms currently available for public use.

Whim covers everything from journey planning and routes to tickets and payments. Its user interface is simple: enter a destination, and the application will suggest a route using all available means of transportation based on your personal preferences. It combines a mix of brand-new cars, taxis, buses, trains and bike sharing into a single, streamlined, mobile application and adjusts the level of service offered to customers based on their monthly subscription, in effect like a mobile telephone plan. Monthly subscription costs vary from as little as USD$0 per month on a "pay-as-you-go" basis to roughly USD$565 per month for unlimited use of trains, buses, taxis and rideshare. Intermediate options are available for regular travellers who occasionally need the flexibility of a taxi or car.

Whim's business model is like many well-known tech start-ups. While specifics of its operations are not public, Whim appears to negotiate discounted tickets/fees for its users while capturing the difference between the discounted price and the RRP. As Whim's user base and market power continue to grow, greater wholesale discounts and higher margins are expected. However, Whim could struggle in the long run to gain the level of market penetration it needs to become a "global company" with expanded service offerings such as air travel. Although

initial traction within Helsinki has been positive, and Whim has extended its capability to West Midlands, UK, Antwerp, Belgium, Turku, Finland, Singapore, Greater Tokyo in Japan, and Vienna, Austria, Whim's bundling of "all modes within a mobility bundle may not be the best strategy" when the "greatest profitability can be achieved by only bundling the higher valuation [willingness to pay] (WTP) options and allowing the lower valuation WTP options to be taken on a pay as you go basis" (Guidon et al., 2020; as cited by Hensher & Mulley, 2020: 1). Moreover, Sampo Hietanen, the CEO of MaaS Global Inc., notes that "seamless user experience means much more than just a cool app" (Kwan, 2016). There is still a lot to be done in delivering customer-centric service, and the development of a business model that is scalable to different cities and/or countries remains the MaaS industry's greatest challenge.

3.1.2 Other MaaS Pilots

Although Whim is notable for being the first all-inclusive mobility service, a range of MaaS platforms offering personalized transport options, flexible payments, ease of transactions, and dynamic journey management have already been deployed worldwide (Datson, 2016). Singapore, Gothenburg, Montpellier, Vienna, Hanover, Barcelona, Boston, San Francisco, Los Angeles, and many other cities are piloting a spectrum of MaaS offerings (see Table 2).

Project	Service Description	Run By	Scope
whim	• Subscription-based integrated mobility app, offering access to a variety of transport options • App learns preferences & syncs with calendars	MaaS Global	Helsinki
UbiGo	• Fully integrated mobility service, combining public transport, carsharing, rental cars, taxi services, and a bicycle system	Lindholmen Science Park, with industry, academia, & gov. / co-funded by Vinnova	80 households: approximately 200 users in city of Gothenburg
Qixxit Einfach. Unterwegs.	• Using 21+ service providers, this app offers carsharing, ridesharing, and bikesharing options while displaying all user travel possibilities	Deutsche Bahn	Germany
moovel	• Enables user searches, booking, and paying for car2go, mytaxi, and Deutsche Bahn in a one app	Daimler	Germany; testing in Boston, Portland, & Helsinki
Beeline	• Crowdsourced bus services where users book seats on privately operated buses • New routes are sourced base on user demand	Infocomm Development Authority; Land Transport Authority; gov. & providers	Commuters in Singapore
smile simply mobile	• Offers wide range of transport options, including information, booking, payment, usage, and billing under a standardised interface	Wiener Stadtwerke; Wiener Linien; Austrian Federal Railways, & providers	1,000 pilot participants in Vienna
BRIDJ BETTER TRANSIT. FOR EVERYONE.	• Flexible, on-demand shuttle service which optimizes pick-ups and drop offs and routing based on user demand	Bridj Inc.	Boston, Kansas City, and Washington, DC commuters
Communauto	• Local government offers mobility packages using Bixi bikesharing & Communauto carsharing	Communauto/Bixi	Cities in Quebec, Canada
chariot	• Offers crowdsourced commuter, charter, and enterprise van services with flexible routing based on user demand	Chariot Transit Inc.	San Francisco, New York, Austin, Seattle (coming soon)
Transport	• Government is piloting on-demand bus services within a 15-km radius of major transport hubs or shopping centres	NSW Transport; Transdev, Keolis Downer, & Transit Systems	Commuters in Sydney's

Table 2: Selected MaaS Pilots from Around the World

Although the capabilities, functionalities, and level of service integration within each of these pilots varies, these localized mobility solutions all embody the MaaS concept by operating with existing transport assets and service providers. In each of these trials, only time will tell which MaaS platforms are widely adopted.

Moving forward, as the global intelligent mobility market grows from USD$180 billion a year to over USD$1.15 trillion by 2025, market-driven, publicly-controlled, and public-private MaaS platforms will continue to emerge and disrupt legacy transport networks (Smith et al.,

2017; Transport Systems Catapult, 2017). While the scope, usage, and access of MaaS will depend on local infrastructure conditions and transport service quality, the value offered to customers remains the ultimate enabler of MaaS ubiquity (Giesecke et al., 2016). Thus, a clear research agenda on customer-led mobility is required for MaaS enablement. After all, MaaS is driven by and to the benefit of customers.

4. CUSTOMER-LED MOBILITY: A NEW RESEARCH AGENDA FOR MAAS ENABLEMENT

4.1 DEFINING CUSTOMER-LED MOBILITY

MaaS is a customer-led mobility solution. But what does it mean to be "customer-led?" The rise of the customer-led economy helps shed light on this question. Today, social media, cloud computing, and IoT have empowered customers more than ever before. These better informed, better connected customers now expect consistent and continuous multi-channel service offerings. In response, businesses throughout the economy are transforming, putting customers at the center of their operations. Companies offering more holistic, end-to-end experiences for their customers through personalized, real-time, one-to-one connections are starting to tap into a new economy built around novel, technology-driven behavioral norms. As the boundaries that exist today both within and between sectors erode (see, e.g. Amazon), businesses that do not let customer preferences inform their business models likely face strong headwinds in a society that places growing emphasis on choice (McKinsey & Company, 2016).

Transport infrastructure facilities, traditionally regarded as monopolistic assets, are not immune to these changes. A quantitative online study of 1,000 Australians conducted by Newgate Research as part of the University of Sydney's *Better Infrastructure Initiative* found that only 34% and 36% of respondents respectively viewed operators of non-tolled main roads and tolled motorways as customer focused. Conversely, 87% of respondents characterized ridesharing companies as customer focused (NAB, 2017). These results highlight the growing pressure placed on traditional transport assets to meet more personalized customer needs based on convenience, comfort, quality, accessibility, cost, and sustainability. If transport stakeholders, particularly investors, are going to meet these growing customer expectations and transform static, physical infrastructure assets into dynamic transport networks which are suitable for MaaS platforms, a clearer understanding of user behaviors and customer expectations is required. The following research agenda aims to succinctly summarize the requirements for MaaS enablement.

4.2 OUTLINING A RESEARCH AGENDA FOR MAAS ENABLEMENT

Naturally, any customer focused research agenda (see Figure 3) for Maas enablement should begin with demand side considerations. Such research should expand on existing studies of WTP (Caiati et al. 2020), develop decision support systems for MaaS developers/innovators to assess market potential (Ho et al. 2020), examine the contextual value of different mobility bundles (Guidon et al. 2020), and investigate MaaS sustainability issues (Mulley et al., 2020), including the need for travelers to internalize congestion externalities (Beheshtian et al., 2020).

On the supply side, future research should improve business model identification that enables MaaS operators to create, deliver and capture value (Polydoropoulou et al., 2020). Business related services offered by Intermediary MaaS Integrators (IMI)—i.e. the entities

between actors offering personal transport services and MaaS operators—may be particularly important for such value creation (Smith et al., 2020). Additionally, shared goals, risk limitation, trust, and knowledge acquisition are likely to be key for supplier alliance formation (Meurs et al., 2020), especially when transitions to MaaS type offerings are more complex than currently appreciated (Storme et al., 2020; Wright et al., 2020).

Collectively, these demand and supply side considerations will also benefit from more large-scale modelling studies on the efficiency gains of MaaS adoption (Becker et al., 2020) and first/last mile service demand (Franco et al., 2020). This systemic perspective should be informed by critical governance considerations of potential MaaS delivery model arrangements (Wong et al., 2020; Beheshtian et al., 2020). Focus should specifically be placed on institutional integration that enables public and private operators to offer seamless, multimodal journeys (Merkert et al., 2020). However, such integration will only come if macro-, meso- and micro-level factors impinging the development and implementation of MaaS are addressed (Karlsson et al., 2020).

Finally, because MaaS has been accused by some as being a 'lot of hot air,' future rhetoric surrounding MaaS debates will critically affect its delivery and governance (Pangbourne et al., 2020). Understanding both user barriers and enabling factors for MaaS will fundamentally define the language game governing the future 'mobility revolution' (Lyons et al., 2019).

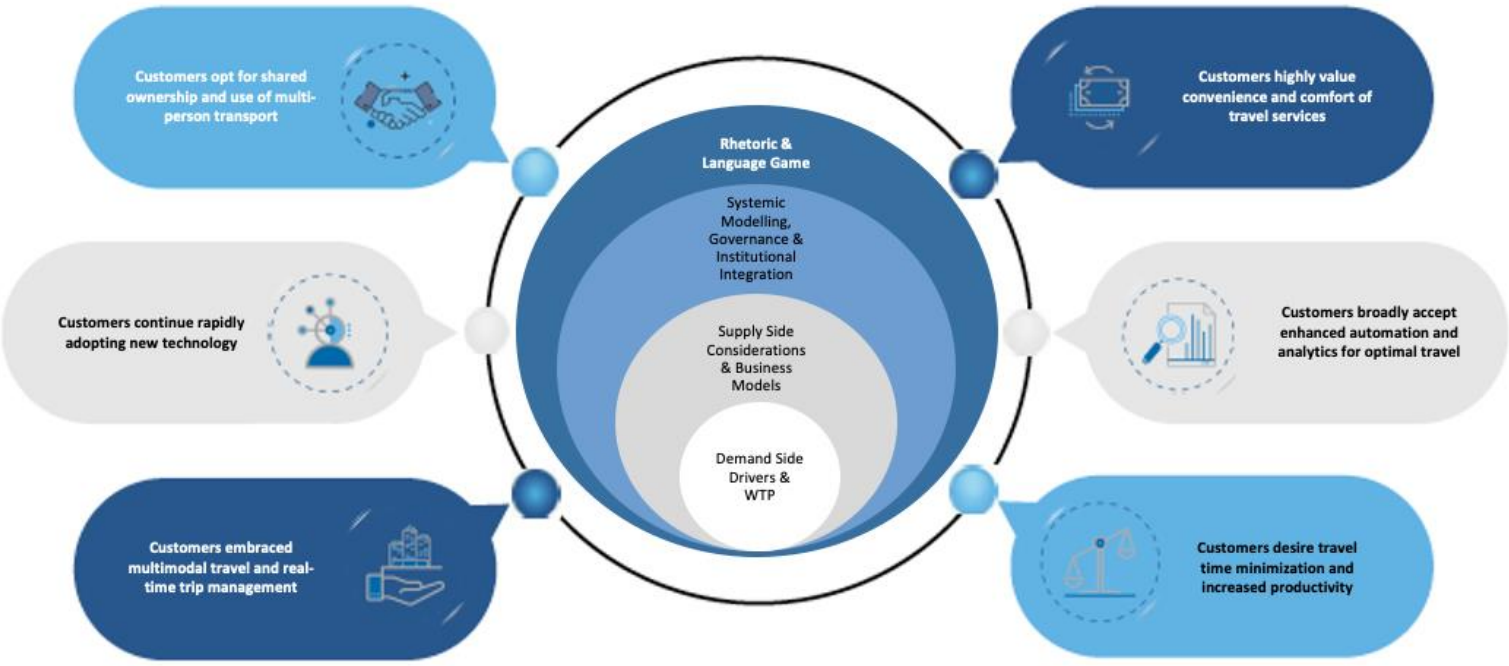


Figure 3: Research Agenda for MaaS Enablement

Ultimately, the entire research agenda presented above will be informed by what motivates customers to potentially adopt a MaaS product (Schikofsky et al., 2020). Accessibility, comfort, convenience, and cost trends driving the demand for shared, on-demand transport offerings and real-time trip management may be just some of the underlying causes or hedonic motivations for MaaS adoption. However, meeting customer expectations is more easily said than done. Although "demographic trends and advances in technology and social attitudes seem to be propelling the world toward a new transportation revolution built on driverless

ridesharing, seamless multimodal travel, and other new types of mobility," persistent uncertainty about the future of mobility is still hindering the proliferation of MaaS (Krawiec & White, 2017). The enormous scope, complexity, and obsolescence risks associated with mobility transformation have left governments waiting to see "which approach works" (EIU, 2013). Additionally, "[j]ust because a [MaaS] technology offers benefits 'on paper' does not mean customers will ultimately embrace it" (Pankratz et al., 2017). For instance, Fioreze et al. (2019: 790) recently found the "likelihood of extensively using MaaS is low, but curiosity about it is promising." Moreover, because skewed customer perceptions, relative uncertainty, cognitive biases, and imperfect user behaviors remain impediments to widespread user acceptance of ongoing mobility changes, the added value of MaaS needs to be better highlighted (Fioreze et al., 2019). Moving forward, transport planning must find a flexible and technology-neutral, regulatory "sweet spot" that works with imperfect customer behaviors to promote mobility innovation, strategic public-private partnerships, and proactive "future-proofing" of transport systems across the mobility ecosystem (Smith et al., 2017; Krawiec & White, 2017). Doing so will enable MaaS offerings to sufficiently meet rising customer expectations.

5. CONCLUSIONS

Customer preferences for mobility based on time, comfort, cost, and/or convenience are expected to become more personalized and less homogenous with technology. Today, technology is continuing to disrupt industries from financial services, manufacturing, and media to energy, retail, healthcare, and transport in unpredictable ways. In transport, ridesharing/carsharing, autonomous vehicles, mobile payments, data analytics, blockchain, quantum computing, and IoT are beginning to transform inflexible transport networks into dynamic, personalized transport systems. Concepts such as on-demand service, door-to-door service, shared mobility, "one-stop" shop service, and dynamic/surge pricing are already commonplace in modern mobility vocabulary. As the pace of innovation grows and more "smart" solutions are deployed into increasingly integrated transport networks, the viability, cost, and up-take of emerging technologies will only further complicate future mobility states (Transport for NSW, 2017a, 2017b). Faced with this ongoing unpredictability in technology adoption and behavioral change, public and private sector actors are now working to make customers the center of their transport offerings.

As a result, mobility is moving into uncharted territory. With a variety of converging trends, both social and technological, placing large demands on transport infrastructure, major urban centers around the world are becoming more susceptible to mobility disruption. The rise of Mobility-as-a-Service (MaaS) is playing a leading role in this emerging mobility transformation. Driven by technology-empowered customers looking for seamless transport offerings to meet their personalized needs, MaaS offerings have the potential to upend a roughly USD$7 trillion mobility market (Burgstaller et al., 2017). The resulting implications will be felt not just by transport but also by insurers, technology firms, telecom companies, energy providers, contractors, investors, and governments at all levels (Corwin et al., 2016). Moving forward, many of these stakeholders have a key role to play in developing transport infrastructure as a form of integrated service delivery, not just a physical asset (NAB, 2017). This involves thinking holistically, drawing inspiration from other industries, straying attuned

to what's on the horizon, forming strategic partnerships, applying technology across the transport value chain, and effectively stewarding new opportunities that enhance the safety, productivity, and efficiency of transport services (Transport for NSW, 2016; Raffaele at al., 2017). More importantly, unlocking customer value through enhanced choice and flexibility in transport service delivery requires careful consideration of evolving customer behaviors and perspectives. Fortunately, the research agenda developed in this paper offers a clear path forward for MaaS enablement. However, because MaaS is a customer-led mobility solution, the eventuation of universal MaaS adoption ultimately rests in the hands of customers. If MaaS ecosystems are going to become ubiquitous globally, transport must take a new approach, one that is customer-led.

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