itsaustralia
Intelligent Transport Systems

25+ YEARS
Shaping Future Transport

Mobility as a Service in Australia

Customer insights and opportunities

ABOUT THIS REPORT

This report has been prepared by ITS Australia with research partners Institute for Choice at University of South Australia and through the iMOVE CRC. Our project partners and members of the iMOVE CRC are; Department of Transport WA, Royal Automobile Association SA, Roads and Maritime Services, Translink, Queensland Transport & Main Roads, Transport for NSW and Transport for Victoria.

ACKNOWLEDGEMENTS

ITS Australia and the project participants would like to thank the Steering Committee for their time, insights and support through the development of this research and report.

Steering Committee

Paul Buchanan – Director Product Management, Cubic Corporation

Segolene Deeley – Director Corporate Affairs, Keolis Downer

Hany Eldaly – Managing Director (Co-founder), Mobility as a Service, Australia

Narelle-Jay Z Fortescue – Director of Customer Insight and Advocacy, Queensland Transport and Main Roads

Richard Harris – Director Europe, Ohmio Automotion

Susan Harris – CEO, ITS Australia

Tagrid Kaddouri – New Markets Insights Advisor, Transdev Australasia

Jeff Kasparian – Programs Director, iMOVE CRC

Graham McCabe – Traffic and Transport Lead ACT & Southern NSW, GHD

Jonathan Myers – Head of Growth, Innovation and Partnerships, Keolis Downer

Brian Negus (Chair) – Ambassador ITS Australia and Chairman, CICA Group

Danika Thomas – Assistant Director, Transport Technology Futures Taskforce, Department of Infrastructure, Regional Development and Cities

Editorial Contributor

Stacey Ryan – Policy Manager
stacey.ryan@its-australia.com.au

Research Contributors

Akshay Vij – Senior Research Fellow

Spring Sampson – Research Associate

Joffre Swait – Director: Academic

Maria Lambides – Director: Commercial

Lesley Hine – Project Manager

ITS Australia
22/574 Plummer Street Port Melbourne
its-australia.com.au

Research partner:

Institute for Choice University of South Australia

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1 Executive summary

There's much discussion these days about once-in-a-generation change; digital disruption, major demographic and societal shifts, and mega-projects offering improvements unimagined by our grandparents or sometimes even parents.

What has not been seen before though is the kind of unprecedented potential for change in transport we are currently experiencing.

During interviews with more than 80 leaders in the transport and technology sectors, across government, industry and academia, a strong theme emerged; that not since the mass-production of private vehicles c1920 has there been such potential for revolutionary change in the transport sector.

Transport innovation like 'Mobility as a Service' (MaaS) offers the potential to drastically improve customer choices, reduce travel costs, increase network capacity and transport sustainability while improving social and environmental outcomes.

While the mass-production of private vehicles obviously had a stunning impact on society and the built environment, the advent of connected and automated vehicles and other revolutionary technologies offer the potential for even greater levels of disruption.

Concepts like MaaS and evolving our transport networks are ways we can adapt to and positively leverage societal and technological disruption.

46%

Based on survey data 46% of the population are predicted to be ready to adopt a MaaS pay-as-you-go scheme.

This research project was led by ITS Australia and made possible with funding support from project partners through the iMOVE CRC. Project partners were supported by a steering committee of industry and government experts from the following organisations collaborating on the project and providing invaluable advice and input: Cubic, HMI Technologies, Ohmio, Transdev, MaaS Australia, Department of Infrastructure, Regional Development and Cities, PTV, RACV, and Keolis Downer.

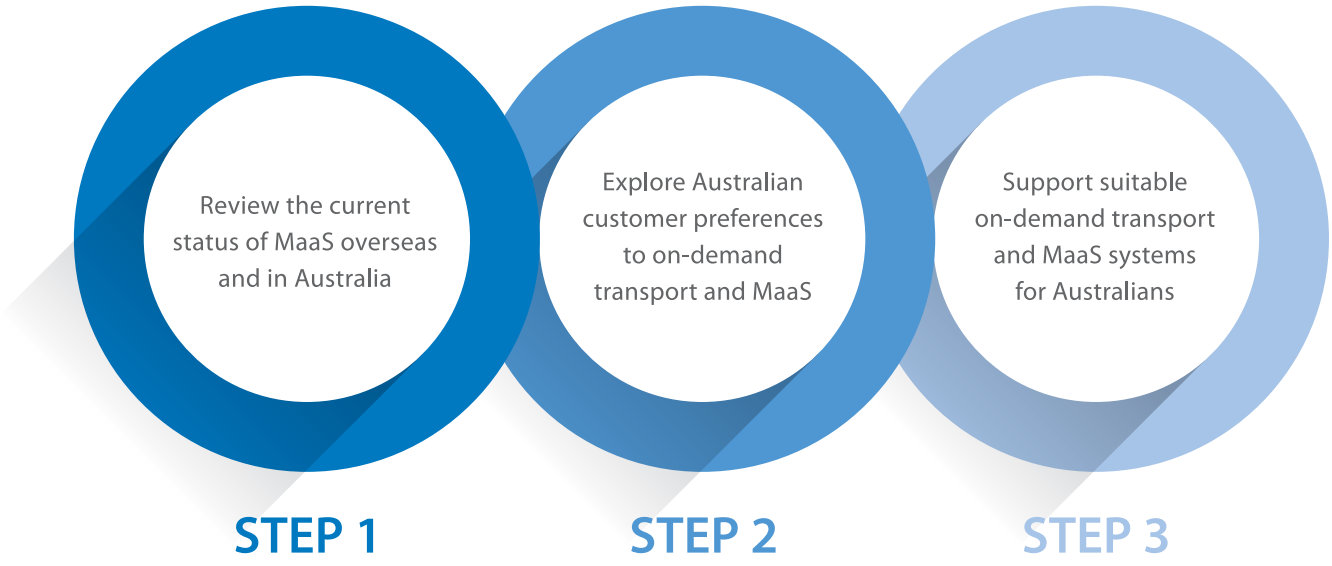
Through in-depth interviews with these and other experts, and of course the expertise of our project participants, the perspectives gathered enabled the development of a robust discrete choice customer survey to test the thoughts and expectations of a demographically representative sample of Australians.

Our project goals and methodology:

- Review the current status of MaaS overseas and in Australia
- Explore Australian customer preferences in relation to on-demand transport and MaaS
- To support the development of suitable on-demand transport and MaaS systems for the Australian community

The intent is this report can offer an evidence base to help prepare for the major changes anticipated in a way that cleverly builds on existing assets and delivers user-centric services that match the increasing expectations of customers.

In surveying 4000 demographically representative Australians across urban, regional and rural areas our survey sample closely matched the Australian Bureau of Statistics Census data.



PROJECT PARTICIPANTS

Intelligent Transport Systems Australia (ITS Australia) promotes the development and deployment of advanced technologies to deliver safer, more efficient and sustainable transport across all public and private modes – air, sea, road, and rail.

Established in 1992, ITS Australia is an independent not-for-profit incorporated membership organisation representing ITS suppliers, government authorities, academia and transport businesses and users. Affiliated with peak ITS organisations around the world, ITS Australia is a major contributor to the development of the industry.

As many would have anticipated, of those surveyed, there was a strong preference for younger respondents to be more interested in MaaS products than those over 65.

There was a large group interested in MaaS for social activities rather than general commuting, which generally reflects positively on the reliance of a public transport network and an unsurprising uncertainty of what MaaS might really be capable of highlighting an information gap and potential for behavioural change programs.

A smaller subset of people would be immediately interested in a full MaaS product. This group of early adopters is almost double the percentage of the early technology adoption rate we see more generally (see page 45). As early adopters have led the way with rapid expansion of smart phones and other technology in Australia there's potential to leverage these groups for similar opportunities with MaaS.

As found in the recent Transport for London report, 'Attitudes towards car ownership and MaaS', both Londoners and Australians strongly prefer a MaaS product that includes public transport. This indicates how important it is that relevant authorities explore how public and private offerings can be integrated effectively.

One mode where preferences diverge is bike-sharing, with Londoners finding it a positive inclusion in MaaS models as a convenient mode particularly for short trips, and Australians mostly rejecting any MaaS product with bike-sharing included. This suggests an opportunity to better explore the potential of bike-sharing and other active transport options for Australian customers.

Access to and integration of data was identified and acknowledged by the majority of industry experts as being a key early consideration to enable any effective MaaS product. With real-time information and potential personalisation for individual customers being highly valued by Australians surveyed, data sharing will play a vital role in an effective deployment of MaaS.

Therefore, data interoperability standards with privacy and security safeguards will need to be established.

Australians surveyed indicated no strong preference for either government or private operators to deliver MaaS products, yet there was more support for schemes where government oversight was indicated. This suggests that while customers are agnostic regarding who they purchase a MaaS product from they are generally more supportive with government playing an oversight role.

A key component of MaaS is the integration of planning, booking and payment into one seamless customer interface. This is a complex process involving many closed back-end systems and proprietary platforms. From the customer perspective this interaction will need to be simple and frictionless.

To enable competition for MaaS providers a level playing field should ensure reasonable access to potential players. This will require the standardisation of a range of systems that are currently closed or siloed.

This research and report does not aim to be definitive but rather provide a starting point and some initial insights to inform the development of MaaS and expand on-demand transport options that match the needs and expectations of Australians.

MaaS is of course a new transport concept to many Australians, yet there are a number of on-demand transport deployments around the country. So to minimise customer conflation of the two the survey instrument presents a series of questions regarding the two separately.

As we are in the embryonic stage of these new transport delivery models we anticipate that both perceptions and realities will evolve as we start to experience MaaS, and further advance on-demand transport in Australia.

Findings and opportunities arising from this research and subsequent customer survey have been detailed in Chapter 7 of this report.

Customer-centric, personalised transport options that enhance mobility and accessibility and improve network efficiency.

Efficient and effective use of public transport network and improved modal integration including active transport options.

Competitive market for public and private transport operators and other providers while ensuring accessibility to transport for customers.

Interoperability and integrated systems with secure data sharing principles in a framework regulated by government oversight.

STEERING COMMITTEE

Australian Government
Department of Infrastructure, Regional Development and Cities

PUBLIC TRANSPORT VICTORIA

CUBIC

RACV

maas|aus

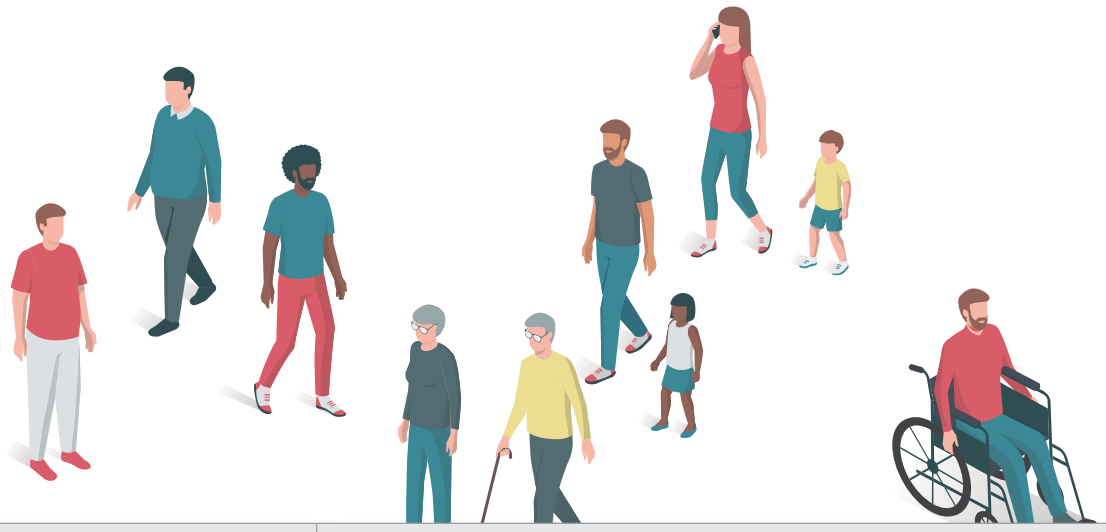
GHD

Keolis Downer

hmi

transdev

The iMOVE CRC is a consortium of 44 industry, government, and research partners engaged in a concerted 10 year effort to improve Australia's transport systems through collaborative R&D projects. It will help companies and Australia be more competitive, productive, and prosperous.



Findings	Opportunity
Australians strongly prefer a MaaS product that includes public transport.	MaaS enables full activation of the public transport network for customers through the enhanced coordination and integration of public transport services. This suggests how important it is that relevant authorities explore how public and private transport offerings can be integrated effectively. This was also found in the recent Transport for London report, 'Attitudes towards car ownership and MaaS', with Londoners strongly in favour of public transport as an integral offering in any MaaS product.
Real-time information and the potential for personalisation was highly valued by Australian's surveyed.	Data sharing will play a vital role in an effective deployment of MaaS so data interoperability standards with privacy and security safeguards will need to be established.
Seamless planning, booking and paying for MaaS was positively viewed in MaaS models chosen by customers.	Integration and interoperability of ticketing systems and other closed back-end functions would be the ultimate end-goal for both public and private sectors. Majority expert opinion was there are no unsurpassable technological barriers, as while complex and challenging, harmonisation and interoperability is possible with effective private and public sector collaboration.
Customers with higher self-reported transport costs strongly correlated with willingness to adopt MaaS.	Improving customer awareness of their real transport costs and adopting price signalling levers in MaaS products, as well as rewards systems for behavioral change could guard against increase of less efficient transport modes.
Majority respondents were interested in MaaS for social activities rather than general commuting.	This generally reflects on people's reliance of and habitual use of current private and public transport for commuting and an unsurprising uncertainty of what the potential for MaaS is in highlighting an information gap and behavioural change possibilities.
Bike sharing is the least preferred transport option for customers in MaaS products.	Many experts interviewed considered bike sharing and other active transport options to be a key consideration in an effective MaaS product. Survey findings see Australians rejecting any MaaS product with bike sharing included, with Londoners finding bike-share a positive inclusion in MaaS as a convenient mode particularly for short trips. This suggests behavioural change and customer engagement programs and pilots for bike sharing could better acclimate Australians to this imporant mode in MaaS products.

ITS Australia Vision Statement for MaaS

Mobility as a Service offers the potential to drastically improve customer choices, reduce travel costs, increase network capacity and transport sustainability while improving social and environmental outcomes. To support these goals ITS Australia undertakes to work with government and industry to shape opportunities for MaaS in Australia that:

1. Promotes the efficient movement of people and goods to improve safety, and productivity, and reduces congestion and environmental impacts.
2. Encourages a vibrant and competitive industry sector and supports effective MaaS deployment.
3. Builds on the existing public transport network and supports improved access to transport options for all customers.
4. Enhances transport access and mobility options to customers across metropolitan and regional centres that Australians live and work in.
5. Is inclusive and responsive to the socio-demographic and mobility needs of all customers, balancing innovation and improvements against equitable access for all Australians.
6. Offers interoperable open access solutions that encourage competition and enable effective data sharing while managing privacy and security concerns.
7. Aims to be more convenient than individual use of private vehicles.

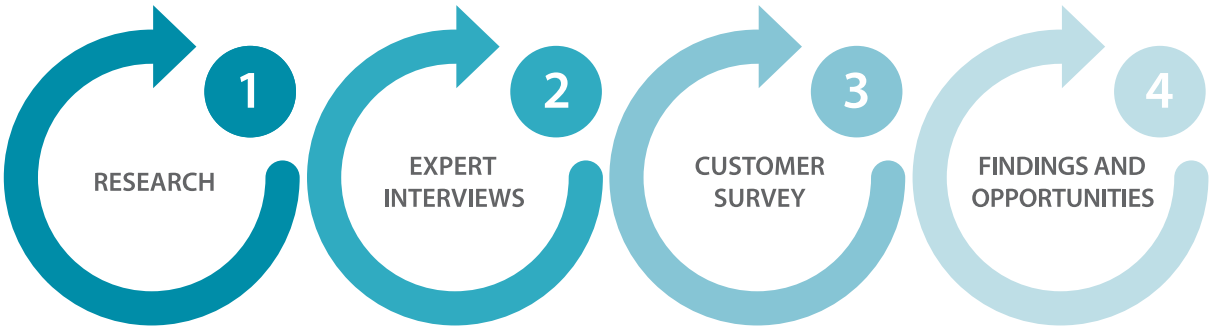
2 Introduction

This report and the research analysed within are building on the important work produced by academics, consultants, and government agencies around the world. There is no benefit nor desire for this report to duplicate the extensive work that has already been undertaken in this fast-moving space.

Rather the intent is to build on the existing body of work and practical applications and incorporate our primary research into that framework. This is to both develop an evidence base for better understanding the current Australian landscape, and to establish a foundation on which the public and private sector can make determinations on future transport decisions that are reflective of and factor in real customer understanding and expectations.

MaaS systems offer customers personalised access to multiple transport modes and services, owned and operated by different mobility service providers, through an integrated digital platform for planning, booking and payment.

MaaS as defined by the project participants for the purposes of this report.



Beginning by describing the broader context underlying the emergence of MaaS as a concept, this investigation led to the development of a definition of MaaS and to identify the key components that constitute a MaaS system.

A review of different MaaS systems currently in operation around the world, and how they compare with each other was part of this process.

More than 80 experts across a range of organisations within government, academia and industry were interviewed. Not just transport experts but people involved in planning, telecommunications, social equity and community transport.

These perspectives enabled a better understanding of the types of challenges they face, and to design the most appropriate questions to test the thoughts and expectations of a demographically representative sample of Australians.

Based on the hundreds of hours of interviews with these experts, and in partnership with our project steering committee, Institute for Choice developed a robust survey deploying a discrete choice model[1].

[1] In discrete choice models respondents are shown different products or services. In this case, rather than rating or ranking them, they are asked to select the one they would be most likely to purchase. For example, respondents might be shown three different internet or mobile phone packages and asked to indicate the one they would purchase. Discrete choice offers a range of advantages in considering customer preferences of a product like MaaS. For more detail on the survey demographic see Appendix B and Appendix C for the survey instrument deployed.

FRAMING THE MAAS RESEARCH PROJECT – KEY STAKEHOLDER INTERVIEWS

To facilitate analysis of the industry expert comments the interviews followed a structured format that was reviewed by the University of South Australia's ethics board and recorded for accuracy of reporting. While the interviews were all different in their own way, based on the particular area of expertise or interest of the interviewee, there was a strong convergence of thought on the potential for MaaS in Australia. This included future challenges, which was a positive finding across such a diverse collection of stakeholders.

There was of course also some divergence of opinion, predominately around the scale and scope of MaaS in Australia as well as when such products could be commercially available.

The interviews were guided by the following questions:

1. What are we all talking about?
2. What are the challenges we face?
3. What are the opportunities?
4. What are the potential impacts?
5. What are considerations for deployment?
6. What might customer expectations be?

To understand customer preferences and expectations for MaaS and on-demand transport, roughly 4,000 demographically and geographically representative Australians nationwide were surveyed. Survey participants were asked about their current travel behaviour, attitudes towards different modes of transport and preferences for different on-demand services and MaaS systems.

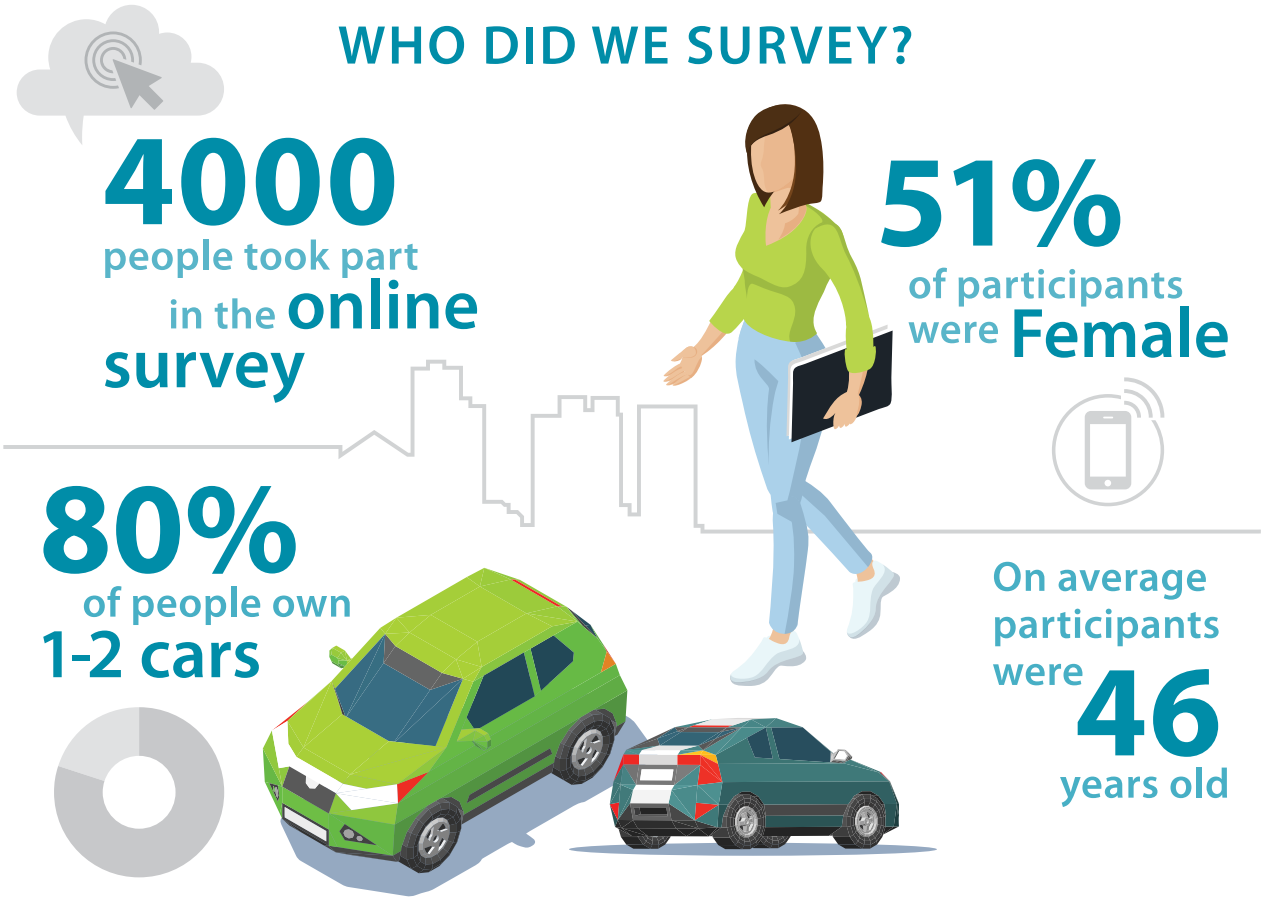
These survey responses were analysed based on demographic and ethnographic metrics and defined into persona types, used to describe Australian customers' preferences and expectations regarding MaaS systems with market segmentations and geographies indicated.

Finally, the survey was peer reviewed and approved by experts at the Bureau of Infrastructure, Transport and Regional Economics with the final survey instrument comprising the following five major sections:

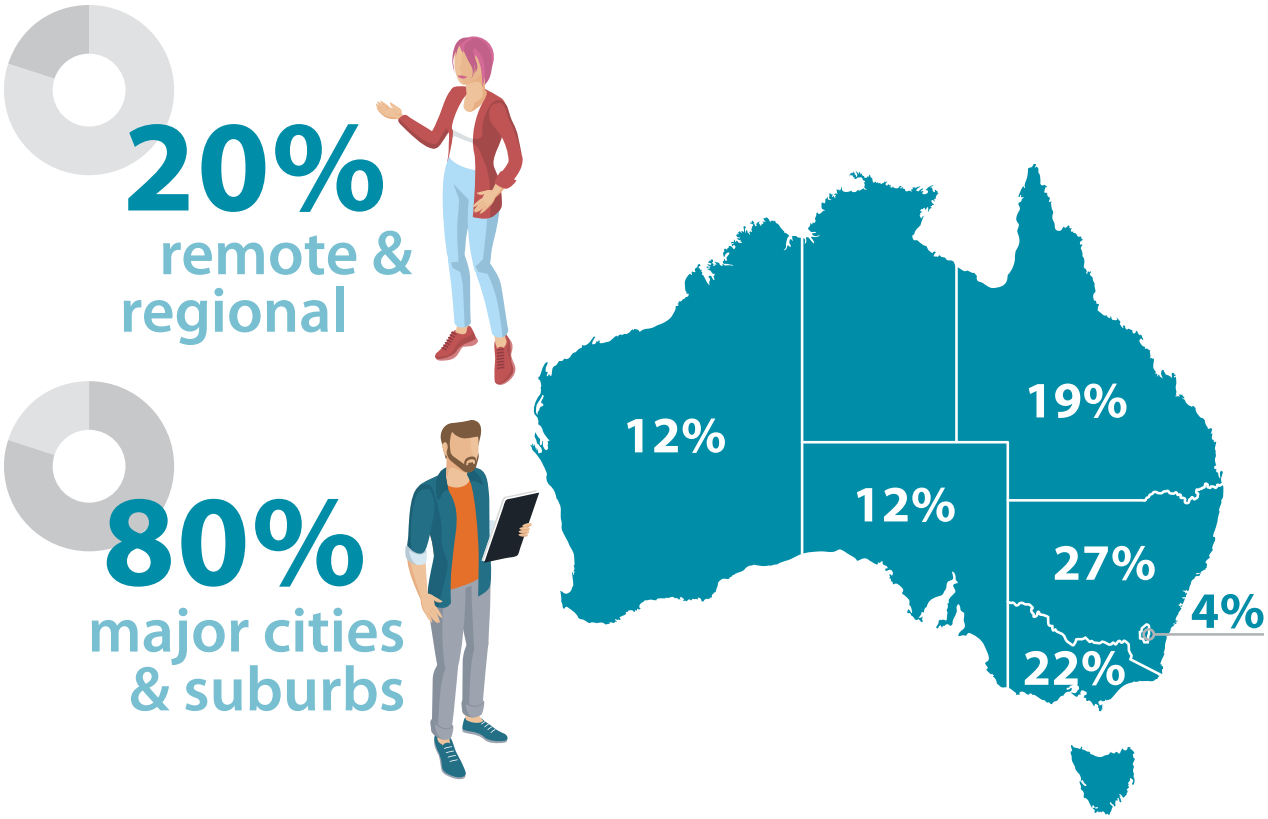
1. Current travel behaviour: Respondents were asked about their car and motorcycle ownership, frequency of use of different transport modes, dependence on mobility devices and household monthly travel expenditure.

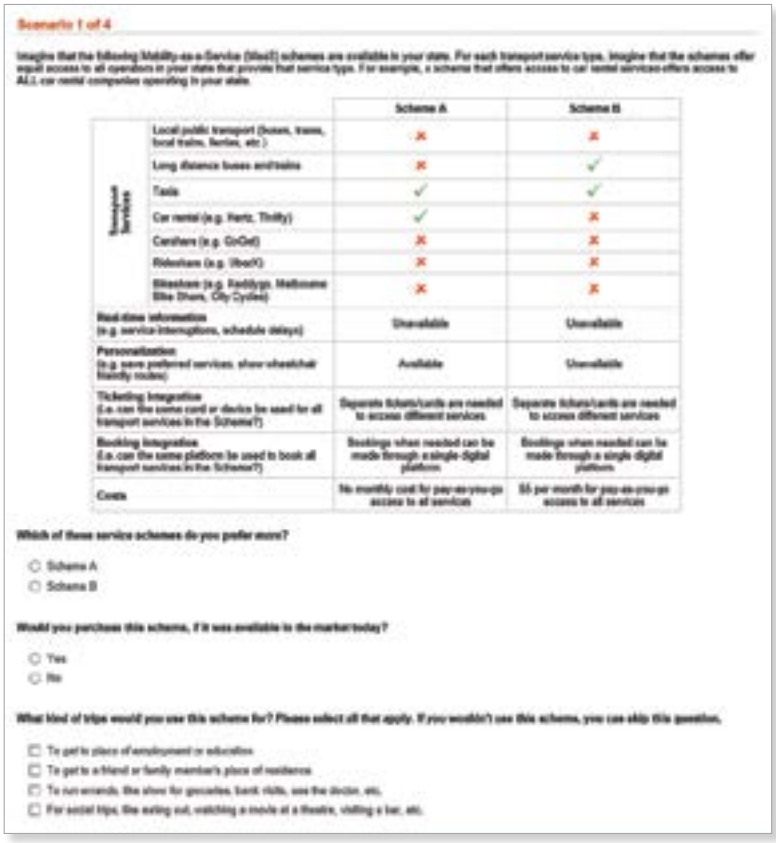
2. Preferences for on-demand transport: Respondents were asked about their awareness of and familiarity with on-demand transport. Each respondent was presented four different scenarios. Respondents were asked to imagine that they have access to the hypothetical on-demand service described in the scenario in terms of four attributes: price, vehicle sharing, booking and route information. The attributes were varied systematically across scenarios and respondents could take any of the values ascribed. Respondents were asked to indicate how frequently they would use such a service and for what kinds of trips.

3. Preferences for MaaS models: Respondents were asked about their awareness of and familiarity with MaaS. Each respondent was presented four different scenarios, such as the one shown in Figure 1. For each scenario respondents were presented two hypothetical MaaS schemes that differ from each other in terms of the transport services that they offer access to, level of ticketing and booking integration, degree of personalisation, availability of real-time information, subscription model, and price. The attributes were varied systematically across scenarios.



WHERE DO THEY LIVE?





Scenario 1 of 4

Imagine that the following Mobility-as-a-Service (MaaS) schemes are available in your state. For each transport service type, imagine that the schemes offer equal access to all operators in your state that provide that service type. If for example, a scheme that offers access to car rental services offers access to ALL car rental companies operating in your state.

		Scheme A	Scheme B
Transport Services	Local public transport (buses, trams, local trains, ferries, etc.)	✗	✗
	Long distance buses and trains	✗	✓
	Taxis	✓	✓
	Car rental (e.g. Hertz, Thrifty)	✓	✗
	Carshare (e.g. GoGet)	✗	✗
	Rideshare (e.g. UberX)	✗	✗
	Bikeshare (e.g. Reddybyn, Melbourne Bike Share, City Cycles)	✗	✗
Real-time information (e.g. service interruptions, schedule delays)		Unavailable	Unavailable
Personalisation (e.g. save preferred services, show wheelchair friendly routes)		Available	Unavailable
Ticketing integration (i.e. can the same card or device be used for all transport services in the Scheme?)		Separate tickets/cards are needed to access different services	Separate tickets/cards are needed to access different services
Booking integration (i.e. can the same platform be used to book all transport services in the Scheme?)		Bookings when needed can be made through a single digital platform	Bookings when needed can be made through a single digital platform
Costs		No monthly cost for pay-as-you-go access to all services	$5 per month for pay-as-you-go access to all services

Which of these service schemes do you prefer more?

- ○ Scheme A
- ○ Scheme B

Would you purchase this scheme, if it was available in the market today?

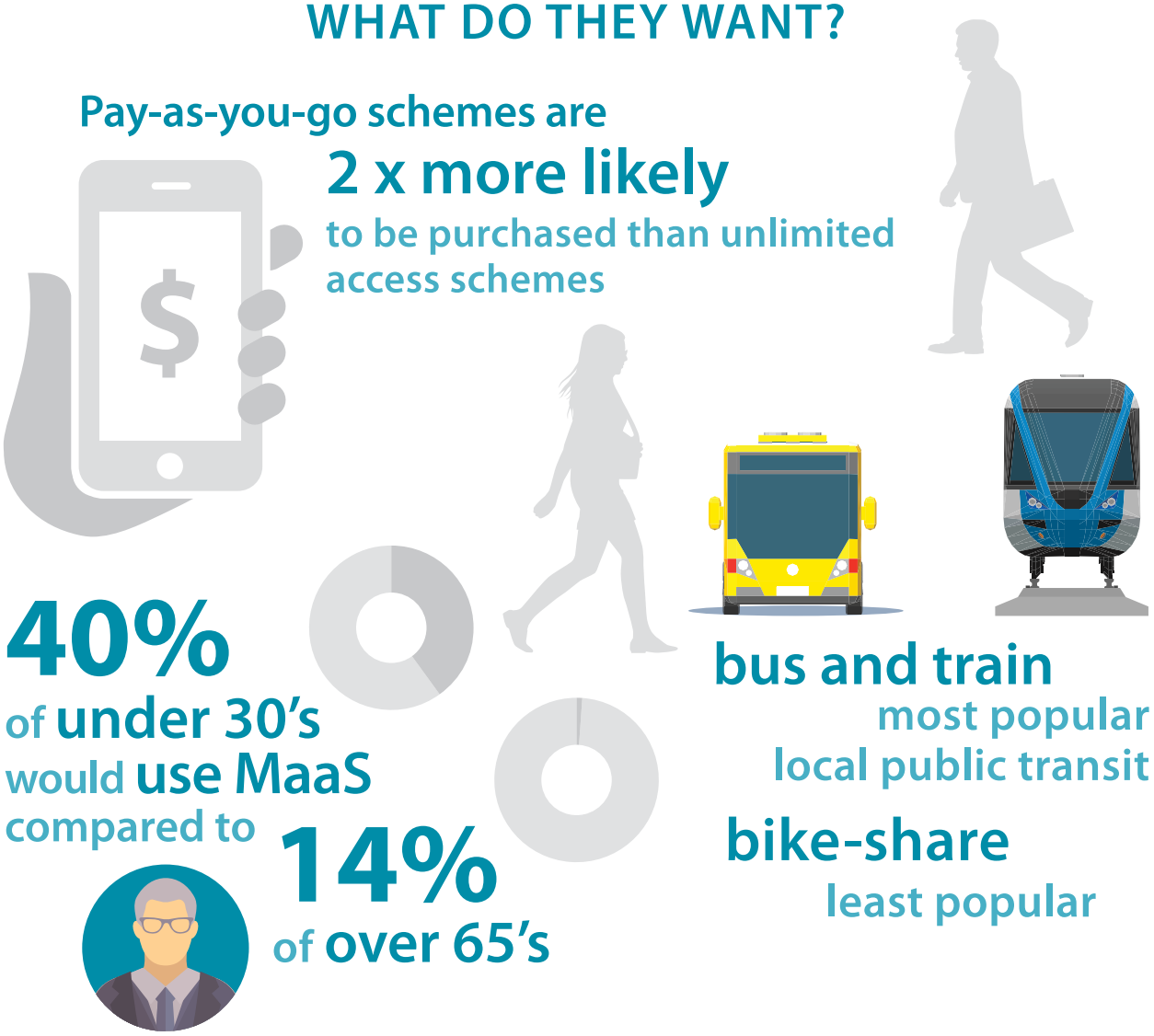
- ○ Yes
- ○ No

What kind of trips would you use this scheme for? Please select all that apply. If you wouldn't use this scheme, you can skip this question.

- ☐ To get to place of employment or education
- ☐ To get to a friend or family member's place of residence
- ☐ To run errands, like shop for groceries, bank visits, see the doctor, etc.
- ☐ For social trips, like eating out, watching a movie at a theatre, visiting a bar, etc.

Figure 1: Example screenshot of hypothetical scenario to elicit customer preferences for different MaaS schemes.

WHAT DO THEY WANT?



State/Territory	Sample		ABS proportion
	Size	Proportion	
New South Wales	1108	28.0%	31.9%
Victoria	893	22.6%	25.7%
Queensland	790	20.0%	20.0%
South Australia	514	13.0%	7.0%
Western Australia	517	13.1%	10.5%
Northern Territory	0	0.0%	1.0%
Tasmania	0	0.0%	2.1%
Australian Capital Territory	130	3.3%	1.7%

Table 1: Sample distribution across states and how it compares with the ABS population distribution.

Pay-as-you-go schemes had nominal monthly subscription rates which were systematically varied across scenarios and respondents between $0, $5 and $10 per month, for pay-as-you-go access to one or more transport modes. Monthly subscription costs for access to features such as ticketing, booking and payment integration, access to real-time information and personalisation. It was explained to survey respondents that any costs associated with actual transport mode use were in addition to the subscription rates.

Prepaid schemes offer unlimited access to one or more transport modes, but for significantly higher costs. Price points for different schemes were determined based on the priority ordering of transport modes which was drawn up in close consultation with transport service providers and policy-makers on the steering committee. For example, a scheme that offers unlimited access only to bike-share services was priced between $10 to $30 per month.

At the other end of the spectrum, a scheme that offers unlimited access to long distance public transport (i.e. buses and trains to regional and remote areas) was priced between $500 and $1,000 per month, regardless of whether or not the scheme offers access to additional transport modes (since all other modes are lower priority). While these prices might appear high, they are comparable to similar MaaS schemes that are commercially available in Europe, such as Whim, which offers unlimited access to taxi, car-share and ride-share services for a monthly cost of €499 ($AUD775.00).

The MaaS scheme attributes were varied systematically across scenarios and respondents. Respondents were asked to indicate which scheme they prefer, if they would purchase the preferred scheme if it were available in the market today and for what kinds of trips would they use the scheme.

4. Attitudes: Respondents were asked to state their level of agreement or disagreement with statements measuring their attitudes towards driving, car ownership, public transport, car sharing, on-demand transport, MaaS and new technologies and services in general.

5. Demographics: Respondents were asked about their age, gender, education, employment, place of residence, household size and structure, and income.

All survey respondents were 18 years or older, with a good spread over all age groups, including older adults (18 per cent of the sample is 65 years and older). In terms of other demographic characteristics, such as gender, education, employment, household size and structure, and income, the sample is roughly representative of the national population.

A sample of the survey questions is in Appendix B, with detailed sample distributions across different demographic characteristics and how they compare with Australian Bureau of Statistics (ABS) distributions found in Appendix C.

3 Background and context

MaaS was first trialled in Gothenburg, Sweden in 2013. Since then, similar services have been introduced in Finland, England, Germany, Austria, France, Italy and Switzerland. In addition to existing products there are a number of trials and pilots. The following chapter provides a sample of current MaaS products and their attributes, with more detailed descriptions of each found in Appendix A.

MaaS is the concept that people can plan, book, and pay for all their transport needs through a single platform. This can include all local public transport modes available in their area as well as car-share, ride-share and active transport modes like bike-share and walking. You wouldn't need to know about the availability of any of these individually or create an account with each of the service providers. The customer would just need to choose a MaaS provider and access all of those services as and when they need.

Both internationally and locally this is a complex and challenging space. With many stakeholders, technological advances are however increasing opportunities to fundamentally change the way we offer and access transport services.

No integrated, full service MaaS offering exists as-yet in Australia, although as in those other jurisdictions, we have the information infrastructure in place and our transport networks are well developed, and managed. While there are perhaps cultural differences between Australia and other jurisdictions where MaaS exists, this report attempts to identify what behavioural and societal considerations may need to be addressed.

There is a potential step-change that can prepare and introduce both our transport network and customers to the possibilities of MaaS. This includes on-demand transport; on-demand transport includes a taxi, charter vehicle or regular passenger transport, that provides customers with flexibility around the route they take and the time they travel.

With on-demand services you could book a vehicle to pick you up and drop you off at either your destination or an interchange to other public transport modes. Similar to a taxi or ridesourcing platform like Uber or Lyft which can be individually booked or a shared service with other passengers.

Examples of on-demand services currently operating in Australia include Telebus in Melbourne, Roam Zone in Adelaide and Flexibus in Canberra as well as a number of deployments currently on offer in Sydney and regional NSW.

Both in reviewing international papers and research and in interviews with experts for this report there is an acknowledgement of behavioural issues posing potential barriers to customer acceptance.

On-demand transport and MaaS have the potential to significantly improve user-experience and customer outcomes and through effective deployment of trial services and pilot programs improved understanding of these benefits can be more widely experienced and shared.

Drivers of change

The international experience, particularly in Europe, has seen the rise of collaborative consumption and the growth in business and customer interest in shared mobility services reflecting a broader transition from an ownership-based economy to an access-based economy (Belk, 2014).

This has resulted in the emergence of new forms of shared mobility services, including short-term car-share, ride-share, public bike sharing services, and other on-demand transport services, that are changing how customers use the transportation system (Shaheen et al., 2017).

The turn of the twenty-first century has also seen impacts in private car ownership, with changing and even declining levels of private car ownership across much of the developed world (Goodwin and Van Dender, 2013), including Australia.

Studies have ascribed the apparent decline in private car dependence to a combination of economic factors, such as a recessionary global economy and rising oil prices, and demographic factors; ageing populations, rising higher education enrollment rates, an increase in the average age of entry into the labour market and the decision to start a family at a later age (see, for example, Vij et al., 2017 and McDonald, 2015).

DIGITAL ECONOMY	Rapid advances in e-commerce platforms, communications services, entertainment streaming services, emerging digital health services (e.g. telehealth), online distance learning, as well as online employment opportunities or the 'gig economy' are changing patterns and motivations for travel and potentially how we build communities and cities.
COLLABORATIVE CONSUMPTION	The popularity of online platforms for the sharing of privately owned assets, such as homes (e.g. Airbnb, VRBO), cars (e.g. GoGet, Uber), offer potential transition from an ownership-based economy to an access-based economy. Changing generational attitudes and numbers of 18-25 y/o attaining drivers licences is decreasing extensively across Australia highlights potential for this growth.
DEMOGRAPHIC SHIFTS	Changes in demography, such as an ageing national population, rising higher education enrollment rates, increases in the average age of entry into the labour market, and the decision to start a family at a later age, are changing personal mobility requirements.
CLIMATE CHANGE	The transport sector is the second largest contributor to GHG emissions; climate change concerns have emphasized the need for sustainable forms of transport and renewed public interest in alternative modes, such as walking, bicycling and public transport.
URBANISATION	Cities are the major centers of employment and population growth worldwide; high population densities can support modes of transport other than privately owned cars.
AUTOMATION	Connected and autonomous vehicle technology is projected by some to be potentially commercially available in the next 5-10 years, this technology could dramatically change the economic model for transport services in particular for point-to-point transport. Other major developments in automation will also potentially impact mass and private transport from the workplace to the home.

Figure 2: Mega trends that are reshaping the mobility landscape.

Changing rates of licence acquisition is also being noticed across Australia, with nearly ~23% of the of 16-24 year-olds in NSW and Victoria being currently unlicenced, this figure jumps to 41% in Western Australia. While there are multiple potential reasons for this generational shift it does suggest an opportunity to change transport behaviours that are already diverging from the previous generational groupings that traditionally attained their licence at the earliest possible age they legally could.

Climate change concerns have contributed to a renewed interest in alternative sustainable modes of transport (Creutzig et al., 2015). The transport sector contributes 17 per cent to greenhouse gas emissions in Australia; private car use for passenger transport constitutes roughly half of the total emissions from the transport sector (DE, 2015).

Urbanisation has enabled the provision of more sustainable modes of transport, particularly mass public transport services that require high population densities to be economically feasible (Guerra and Cervero, 2011). Cities are currently home to half of the world's population and are expected to comprise two-thirds of the world's population by 2050 (UN DESA, 2014). This is a particularly relevant trend in Australia with our highly urbanised population.

It is against this larger backdrop that the concept of MaaS was proposed in Helsinki, Finland following discussions between the Helsinki City Planning Department, the Aalto University School of Engineering, and ITS Finland (Heikkilä, 2014).

"The vision is to see the whole transport sector as a cooperative, interconnected ecosystem, providing services reflecting the needs of customers. The boundaries between different transport modes are blurred or disappear completely."

Sampo Hietanen CEO,
ITS Finland

Currently third party logistics providers offer integrated operation, warehousing and transportation services to manufacturing firms, with varying degrees of scalability and customisation, subject to the firm's requirements and market conditions. MaaS applies these same service-based principles to the provision of passenger transport, with the objective of offering integrated mobility solutions that are tailored to the needs of individual customers.

The 'as-a-service' model has previously been adopted by other industries with success, notably in the software space. Products previously purchased and shipped are now available only online often through a subscription model. This is increasingly how customers are accessing previously privately owned and held products and services, from software to entertainment.

The transport 'as-a-service' model offers potential for even more substantial disruption along with customer-centred improvements, with similar major societal changes and impacts on government and industry to consider.

4 MaaS – What does it do and where is it?

While a universally agreed upon definition of MaaS is yet to emerge (Smith et al., 2017) there is of course a substantial amount of consensus on what MaaS could be and what it could offer customers. Factoring in these assessments and based on a comprehensive review of academic studies, industry papers, and stakeholder interviews, we have adopted the following definition for this report:

MaaS systems offer customers personalised access to multiple transport modes and services, owned and operated by different mobility service providers, through an integrated digital platform for planning, booking and payment.

Ours builds on earlier definitions proposed by Kamargianni et al. (2016), König et al. (2016), Kamargianni and Matyas (2017) and MaaS Alliance (2017) that regard integration across different transport operators, payment and ticketing systems, and information and communication technologies as necessary to the provision of MaaS.

While MaaS providers typically offer additional features, such as real-time trip information, travel incentives, personalisation tools, and with these being increasingly expected by customers, they are not necessarily guaranteed to be included at this juncture or universally found in the MaaS offerings we reviewed.

Figure 3 illustrates these key components as developed by MaaS Australia which is broadly representative of a number of similar MaaS ecosystems developed by subject matter experts in the public and private sector in Australia and internationally.

The provision of MaaS has been motivated largely in the context of passenger transport, and for the purposes of this report we will be limiting our attention to this context only. It is interesting to reflect though on some studies that have argued the integration of passenger and freight transport could be an additional selling point to potential customers (JPI Urban Europe, 2017). In particular, MaaS systems could help address first and last-mile connectivity problems in the context of goods delivery (König et al., 2016).

While not to be confused with MaaS, on-demand transport services may be viewed as an intermediate form of public transport. Services that fall between fixed route and fixed schedule public transport services, such as most public transport networks operating in metropolitan regions and fully flexible point-to-point transport services, such as taxis and ride sharing services.

On-demand services are flexible in the routes that they take and the exact route to be taken is usually finalised close to the time of operation (Brake et al., 2004). MaaS systems may or may not include access to these additional on-demand services, just as they may or may not include access to public transport services or point-to-point transport services. The definition of MaaS does not view access to a particular mode of transport as essential, but a range of modal options is generally a key component.

MaaS system	Service region	Modes offered	Planning	Booking	Payment model	Governance
UbiGo	Gothenburg, Sweden	Local public transport, car rental, car-share, taxi and bike-share	Full integration across modes	Full integration across modes	Personalized monthly subscription, with top-ups	Public-led
Whim	Helsinki, Finland; West Midlands, UK	Local public transport, car rental and taxi	Full integration across modes	Full integration across modes	Pay-as-you-go and fixed monthly subscriptions	Private-led
Moovel	Stuttgart and Hamburg, Germany	Local public transport, national rail, car-share, taxi and bike-share	Full integration across modes	Full integration across modes	Pay-as-you-go	Private-led
WienMobil	Vienna, Austria	Local public transport, car-share, taxi, car park and bike-share	Full integration across modes	Partial integration across modes	Pay-as-you-go	Public-led
EMMA	Montpelier, France	Local public transport, car-share, car park, on-street parking, bike-share and bike parking	Full integration across modes	Full integration across modes	Fixed monthly and yearly subscriptions	Public-private partnership
Mobility Shop	Hannover, Germany	Local public transport, national rail service, car-share and taxi	Full integration across modes	Partial integration across modes	Pay-as-you-go	Public-private partnership
HelloGo	Utrecht, Netherlands	Selected local, regional and national public transport, car rental, taxi and bike-share	Full integration across modes	Full integration across modes	Pay-as-you-go	Private-led
Didi	China	Ride-share and bike-share	Full integration across modes	Full integration across modes	Pay-as-you-go	Private-led
myCicero	Nationwide across Italy	Local, regional and national public transport and car parking	Partial integration across modes	Partial integration across modes	Pay-as-you-go	Private-led
PostBus	Nationwide across Switzerland	Local, regional and national public transport	Full integration across modes	Full integration across modes	Pay-as-you-go	Public-led
Choice and Ride Mate	Auckland and Queenstown, New Zealand	Buses, taxis, ride-share providers, water taxis, shuttles, active transport modes (walking and cycling)	Personalised planning and real-time information, booking in advance, cost estimates and comparisons, ETA to destination, real time ski field information	Integrated across modes	No charge for customers or providers to use the platform, payments trial launching within next six months	Public sector led and funded
Compte Mobilite	Mulhouse, France	Local public transport, car-share, car park, on-street parking, bike-share, long rent bike and bike parking	Full integration across modes	Full integration across modes	Pay-as-you-go	Public-private partnership

Table 2: MaaS matrix of existing products indicative of the range of options; a sample rather than an exhaustive list.

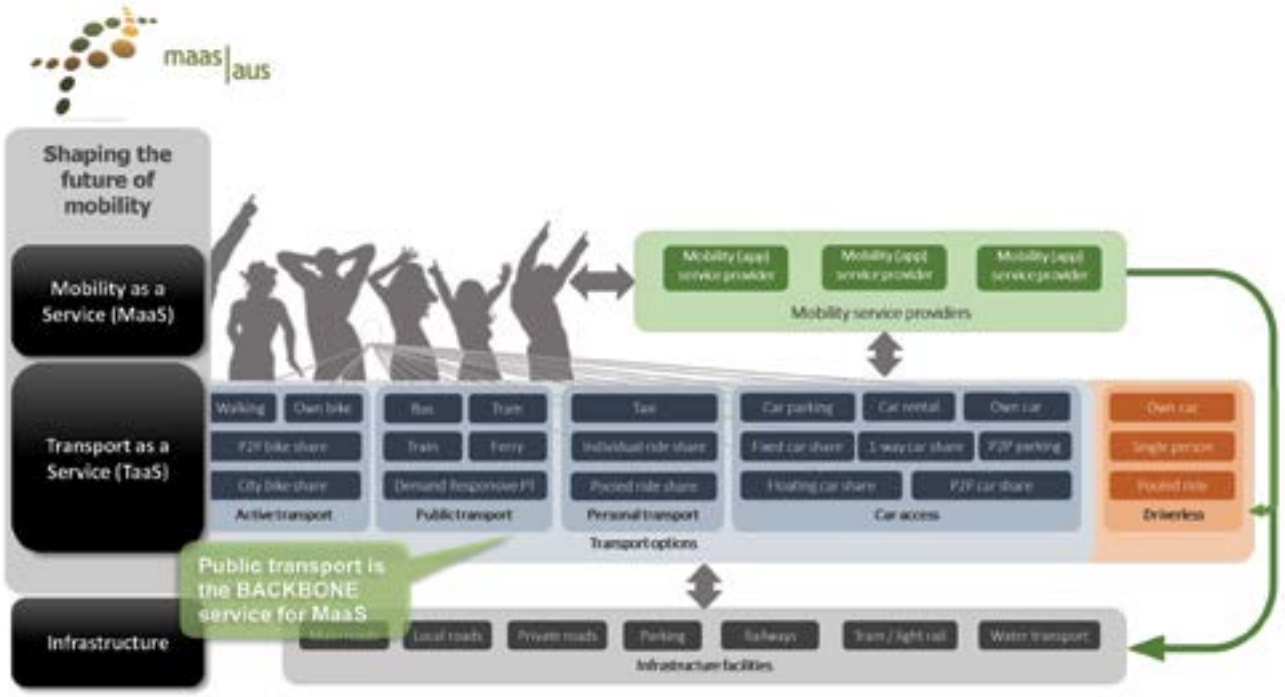


Figure 3: MaaS ecosystem developed by Mobility as a Service | Australia.

Integrated ticketing systems for multiple transport services do not, by themselves, constitute MaaS systems. Most major metropolitan regions worldwide already have one or more transport smart card services that provide customers access to multiple local, regional and national public and private mobility services (see, for example, the NS-Business Card or Radiuz Total Mobility in the Netherlands, Switchh in Hamburg, Germany, and a suite of mobility packages offered by SNCF, France's national state-owned railway company). These services typically do not have a digital platform for planning, booking or payment and ICT integration is limited at best. They function more like public transport smart cards, with access to additional privately owned and operated services.

Relatedly, there are mobility service providers that offer access to bundled services. A notable example is the SBB Green Pass mobility package, currently being trialled in Switzerland. The service offers unlimited access to national rail services; memberships and vouchers to car-share and bike-share programs; annual possession of either a BMW i3 electric car or a Stromer ST2 electric bike, with supporting maintenance services; and additional benefits. However, the SBB Green Pass mobility package does not have a single ticketing or payment platform and no ICT integration and as such are not recorded as MaaS services in this report.

Standalone journey planners, real-time travel information services and navigation systems do not constitute a MaaS system either. Previous reviews have included services such as Qixxit, TransitApp and Optymod in their discussion (see, for example, Jittrapirom et al., 2017).

There are other services internationally that describe themselves as offering MaaS, but within a strict definition to include at least multi-modal access and payment integration. These services would more likely be considered integration of one or two additional modal options, generally ride-sharing or bike-sharing.

While important to have a generally shared understanding of a full MaaS ecosystem, it is also useful to review the full range of offerings in the marketplace to capture the potential applicability of MaaS, perhaps better described as, Transport as a Service.

These other platforms include Beamrz and Tuup in the Netherlands, currently ride sharing service providers with goals to offer access to a broader suite of mobility services. The same applies to Las Vegas start-up SHIFT, known most commonly for ordering 100 Teslas, the single largest order of Teslas to date. The company proposed to merge different mobility services into one on-demand mobile application, but largely operated as a car sharing company during its two-year run from 2013 to 2015, with limited access to additional bike sharing, shuttle bus and valet services. Also, all modes of transport provided by the service were privately owned and operated by the company.

These examples are valuable to consider as many of these systems and services can serve as useful stepping stones towards the development of full service MaaS systems in Australia. Figure 3 is a useful schematic of a MaaS ecosystem developed by MaaS Australia and illustrates some of these potential pathways.

4.1 Mobility – mode-share

Central to the concept of MaaS is the creation of a single provider that offers access to the many different transport services operating within a given geographic area. As Hietanen (2014) writes in his seminal paper that first introduced the concept, "The vision is to see the whole transport sector as a cooperative, interconnected ecosystem, providing services reflecting the needs of customers. The boundaries between different transport modes are blurred or disappear completely."

The transport modes included in the service and the size of the geographic area may differ across MaaS providers, often significantly. For example UbiGo, a MaaS provider that has been trialing services in Gothenburg, Sweden since 2014, offers access to urban public transport, car sharing, car rental, taxi, and bike sharing services operating within the city. At the other end of the spectrum, myCicero, a MaaS provider in Italy, offers access to local, regional and national public transport and car parking services. In this regard, MaaS has been credited with introducing the concept of 'roaming' to the provision of mobility services, where MaaS providers offer services to customers not just in their city of residence, but anywhere in the world (Kamargianni and Matyas, 2017). Most existing public transport services themselves may be viewed as primitive versions of MaaS, where a single apex governing body typically contracts multiple bus and/or rail operators to provide services in predefined geographic areas.

Some studies have emphasised the role of customisation in the design of MaaS offerings. Hietanen (2014) placed customer needs at the heart of his conceptualisation of MaaS. Their vision has been echoed by subsequent studies through the importance placed on "need-based and customised mobility solutions for the users" (Jittrapirom et al., 2017; see also König et al., 2016). As a consequence, most current MaaS providers allow potential customers to selectively purchase access to a subset of transport modes and services on offer, as best meets their mobility needs.

4.2 Ticket and payment integration

Most metropolitan regions in Australia already have some level of public transport ticketing integration. For example, the Opal smartcard can be used to pay for travel on all public transport services operating in Sydney, the Blue Mountains, Central Coast, and the Hunter and Illawarra regions in New South Wales. Similarly, there are many multimodal journey planners available in Australia as well.

TripView is a popular third-party developed public transport journey planner for Melbourne and Sydney, and Google Maps offers journey planning services nationwide that include additional information from private transport service providers, such as Uber. However, at this point in time most ticketing and planning tools are not fully integrated or multimodal, with the ticketing and planning functionalities not yet integrated into a single tool.

An integrated ticketing and payment system is the second central component to MaaS. Most metropolitan regions in Australia and worldwide have multiple public transport service providers with different ticketing and payment systems. Private mobility service providers, offering services such as car-share, ride-share, car rental, taxi and bike-share, usually have their own independent systems. MaaS aims to make intermodal travel across these different transport modes and service providers as seamless as possible.

MaaS plans may be offered as monthly subscriptions or pay-as-you-go services. The monthly subscription model requires customers to pay monthly fees for access to a predetermined amount of mobility services, such as unlimited access to urban public transport services, a fixed number of kilometres with a ride-share or taxi service, and a fixed number of hours with a car-share or car rental service. The pay-as-you-go model bills customers periodically based on actual usage of different mobility services.

An integrated ticketing and payment system across different mobility services can lead to improvements in both the cost and convenience of transfers between services (for a recent review of the benefits of integration, the reader is referred to Chowdhury and Ceder, 2016). However, its impacts on patronage are unclear. Some studies have found that integrated ticketing and payment systems for public transport services can increase public transport patronage by 2 to 5 per cent in the short term (see, for example, Abrate et al., 2008 and Matas, 2004), and as much as 25 per cent in some cases (Sharaby and Shiftan, 2012). Others are not as enthusiastic. For example, the Scottish Transport Research Planning Group reports, "no conclusive evidence was found that integrated ticketing leads directly to patronage or revenue increases, partly because integrated schemes have apparently not been studied or introduced in isolation" (SESR, 2004).

There has been an increase in public transport usage in some jurisdictions, with Helsinki showing an uptake in public transport patronage following the introduction of WHIM.

Ticket and payment integration is typically enforced through smart card technology. Public transport smart cards, such as the Opal card in Sydney, the go card in South East Queensland and the myki in Melbourne, that offer access to public transport services operating in their respective metropolitan regions, serve as prototypes for smart cards that might be used by future MaaS providers. Existing smart cards could be integrated with other transport modes and service providers. For example, the ADEPT (Automatic Debiting And Electronic Payment For Transport) II project in Thessaloniki, Greece, offered road users electronic cards for the payment of road tolls, parking and public transport (Blythe 2004). Integration with dynamic travel demand management schemes, such as road congestion charge or incentives for off-peak travel, provide a useful tool to manage congestion if customer expectations can be moderated appropriately.

4.3 Information and communication technology (ICT) and data platforms

The integration of service-related information across different transport modes and mobility service providers through a single digital platform is the third essential component to MaaS. In particular, there is unmet demand for an integrated platform that offers journey planning, booking and real-time information services that are personalised to the needs and behaviours of each customer (Chorus et al., 2007 and Grotenhuis et al., 2007). Some studies have argued for the inclusion of additional information services as well, such as weather forecasts, synchronisation with personal activity calendar, travel history report, etc. (Jittrapirom et al., 2017). For a recent review of journey planners and related services, the reader is referred to Esztergá r-Kiss and Csiszá r (2015).

Journey planners allow customers to visualise, compare and select different modes of travel for a given journey. Journey planners may be multimodal, i.e. recommended routes for selected trips may involve transfers between different modes of transport. Evaluations of existing multimodal journey planners find their benefits lie in their ability to reduce the time and effort required to collect the relevant information, and to decrease the uncertainty associated with the information thus collected. For example, Zografos et al. (2012) surveyed 425 users of WISETRIP, an international multimodal journey planner, and found that 40 per cent of the sample was willing to pay at least €0.80 ($1.23) every time they used the service. However, their findings are based on a subset of study participants that already use the service, and not yet tested with a broader sample group.

Journey planners may be dynamic, i.e. they offer real-time updates based on traffic incidents, network delays, current location, etc. The impacts of real-time information on public transport use have been well studied. Benefits include reduced perceptions of waiting times, increased ease-of-use, better travel time utilisation and greater customer satisfaction. Some studies have even reported modest but statistically significant increases in public transport patronage of 1 to 2 per cent (see, for example, Brakewood et al., 2015 and Tang and Thakuriah, 2012). However, studies differ on customers' willingness to pay for access to real-time information.

In their review of previous research that has examined the question, Dziekan and Kottenhoff (2007) conclude, "the value of real-time information systems at stops and stations seems to lie in an interval between 5-20% of the ticket price for the trip." Others have argued that customers are unwilling to pay for information that they expect should be provided by the public transport service provider at no cost (Neuherz, 2000). The same sentiment may apply to the provision of similar information by MaaS providers.

Most journey planners offer tools for personalisation based on past histories and indicated preferences, such as favourite destinations, maximal walking distances, familiarity with the local transport system, preferences for time and cost, etc. (see, for example, Jakob et al., 2014 and Spitadakis and Fostieri, 2012).

Based on a review of past studies and focus group interviews, Stopka (2014) finds that most customers expect recommendations from journey planners to be automatically personalised to both the individual and the trip context. For example, customer preferences may vary, depending on whether they are seeking recommendations for their morning commute or a recreational trip during the weekend. Personalisation and contextualisation can increase the value of these services to customers.

5 Perspectives – Customer responses

To better understand the context in which respondents to the survey were considering the discrete choice models offered for both on-demand transport and MaaS models we asked a range of attitudinal questions to establish data points for reference. These included current travel behaviours, car ownership and attitudes to driving and public transport.

Through existing surveys and data available current customer understanding of household transport costs is known to be routinely miscalculated, with customers consistently underestimating the aggregate operational and day-to-day costs of maintaining private vehicles.

Multiple customer surveys indicate customers underestimate their household transport costs by a large factor; the RAC WA 2013 'Vehicle Operating Costs Survey' assess that on average there are 2 cars per household and the average running cost of a car is around $12,000 each year whereas the RAC Foundation 2012 'Keeping the Nation Moving' reports that 8 out of 10 Australians believe it costs them $5,000 or less per year.

Contrarily, this is both an asset that is often one of the most expensive Australians own and pay ongoing costs for, while also most likely to be the most underutilised, with the 'Survey of Motor Vehicle Use' by Data Cubes finding the average car is parked for around 96% of the time.

Historically, Australians' usage of private vehicles and personal attachment to their cars is considered to be a cultural trait, but the data show this is changing. There is an opportunity to leverage that shift from ubiquitous private car ownership (with many households having more than one vehicle) and offer a new version of both private and public transport.

Consideration of the drivers of this change and others are key in this report as they offer insight as to where opportunities for changing behaviours and attitudes could be leveraged into positive growth and development that will benefit the whole as well as the individual.

In terms of current travel behaviour, 90 per cent of our sample is licensed to drive with a mean ownership level of 1.6 cars per household, and 13 per cent of the sample owns a motorcycle. 9 per cent of the sample uses some form of mobility device, with walking stick being the most popular (5 per cent).

In terms of transport mode use, Figure 4 plots average use of different modes across the sample. Driving, walking and public transport are the most popular; car rental, car-share and bike-share are the least popular. Figure 5 plots average attitudes across the sample towards driving, public transport and car sharing. Many of these statements have been adapted from Kamargianni et al. (2018).

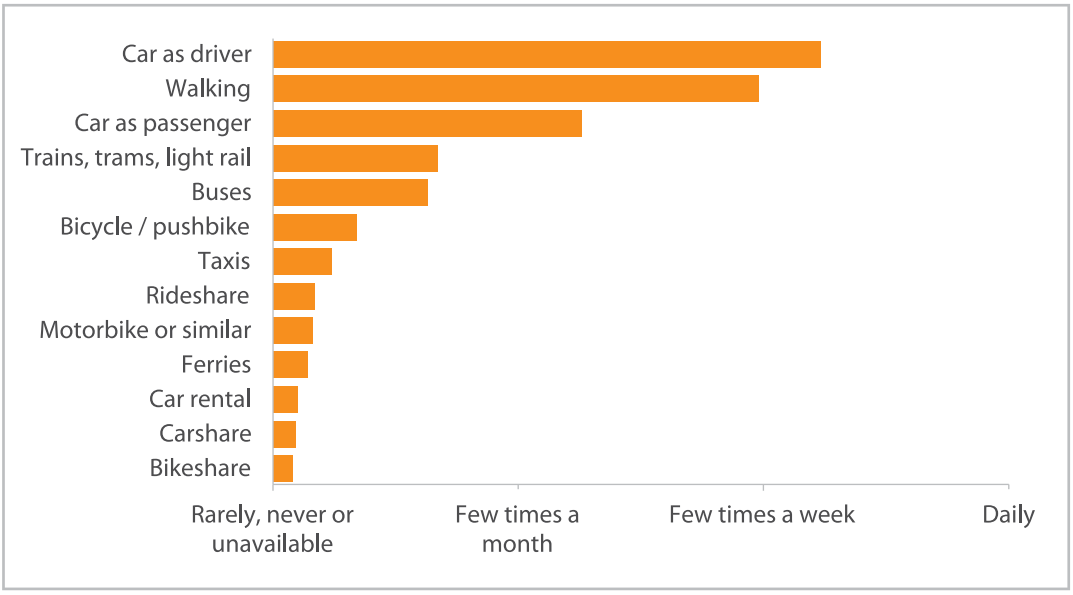
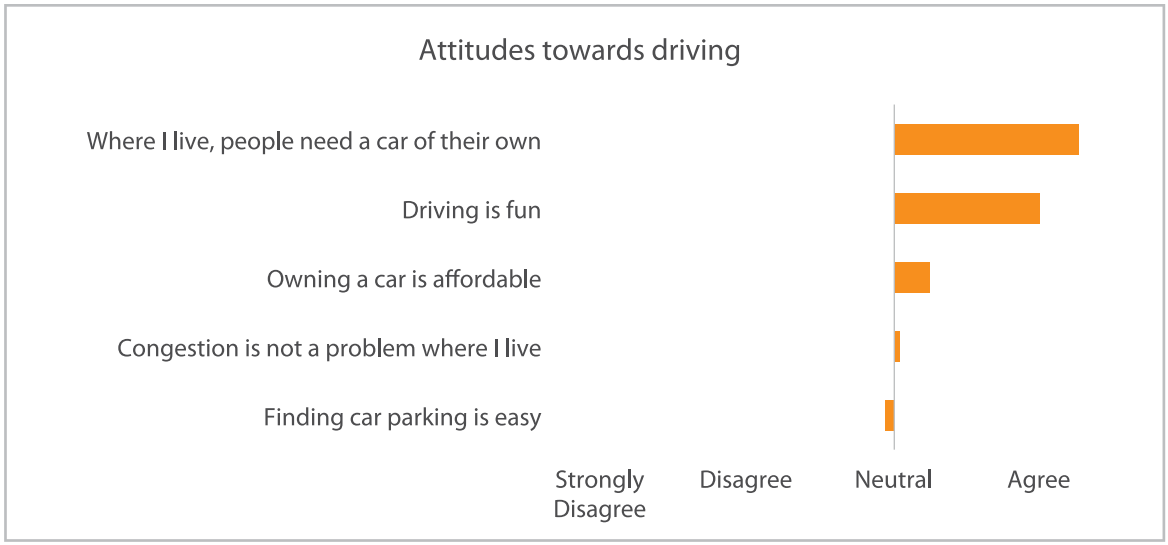


Figure 4: Average transport mode use across sample.



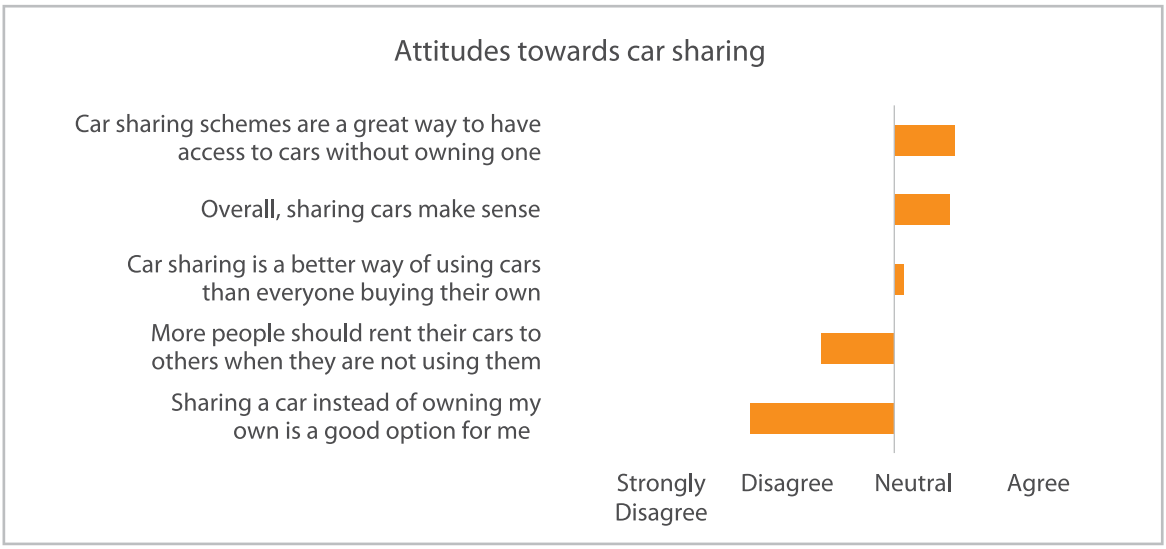


Figure 5: Attitudes towards driving, public transport and car sharing across sample.

With respect to driving, on average, the sample both enjoys driving and reports a need for car ownership but is neutral on issues relating to ease of parking, congestion and affordability of car ownership. Interestingly, while public transport use is on average lower than driving, attitudes toward public transport appear to be more positive than those towards driving, indicating that high levels of public transport satisfaction do not always translate into high levels of public transport use.

And finally, on average, the sample is not very receptive to the concept of car sharing, as indicated both by their negative attitudes towards car sharing services and their low propensity of use.

Figure 6 plots the distribution of self-reported weekly household travel expenditure across the sample, including car fuel, insurance and registration fees, public transport tickets, taxis and ride or car-share, parking and road tolls, etc. Roughly 80 per cent of the sample reports weekly costs of less than $150. In comparison, RAA's 2017 cost of vehicle ownership survey finds that average costs of car ownership can vary from as little as $100 per week for a micro car such as the Suzuki Celerio, up to around $200 per week for a large sized car such as the Holden Commodore.

Given that 93 per cent of our sample owns at least one car, these figures indicate that most individuals underestimate how much money they spend on car ownership, maintenance and operation. Differences between actual and perceived costs of private car ownership could be a potential barrier to the widespread adoption of new public transport systems and services, such as MaaS.

5.1 Population preferences for **MaaS**

Here we provide a population-level summary of Australians' familiarity with MaaS, their preferences for different MaaS schemes, their willingness to purchase these schemes if they were available today and how they would use them.

Only 4 per cent of our sample indicated having heard of the concept of MaaS. Of these, half indicated being only slightly familiar with the concept and the remainder indicated being moderately or very familiar. As there are no commercial MaaS services currently available in Australia and the concept is still relatively new globally, low levels of awareness and familiarity are to be expected.

In terms of preferences, on average, customers preferred pay-as-you-go schemes twice as much as prepaid schemes that offered unlimited access. Figure 7 illustrates customer preferences for access to different transport modes, as a function of the subscription model, in terms of average demand elasticities. For example, on average and all else being equal, pay-as-you-go schemes that offer access to local public transport services are 12 per cent more likely to be purchased than pay-as-you-go schemes that do not offer access to the same.

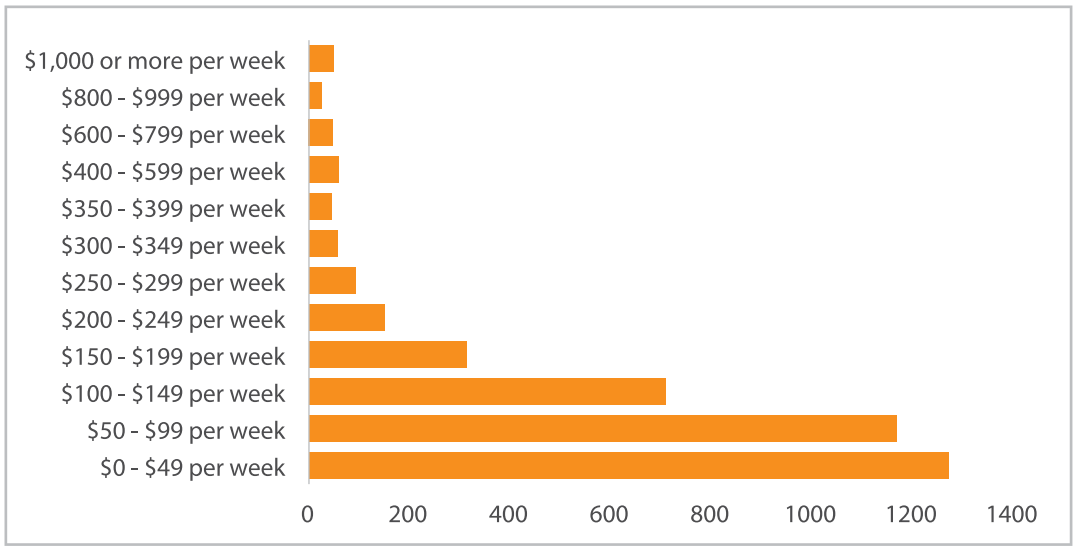


Figure 6: Distribution of self-reported weekly household travel expenditure.

For pay-as-you-go schemes, local public transport is by far the most popular mode, followed by long-distance public transport, taxis, car rentals and ride-share services. Car-share and bike-share services have limited appeal. For prepaid schemes that offer unlimited access, local public transport and taxis are the only two modes that are strongly preferred. These findings indicate the inclusion of which transport modes are most critical to the adoption of MaaS schemes among Australian customers.

We asked survey respondents to indicate the importance of different potential MaaS service features. Figure 8 ranks these features in order of their average importance. Access to real-time information and dynamic updates, incentives to change travel behaviour and special services for increased safety and security were ranked as the three most important attributes, serving to emphasise what aspects of service provision are most valued by potential customers.

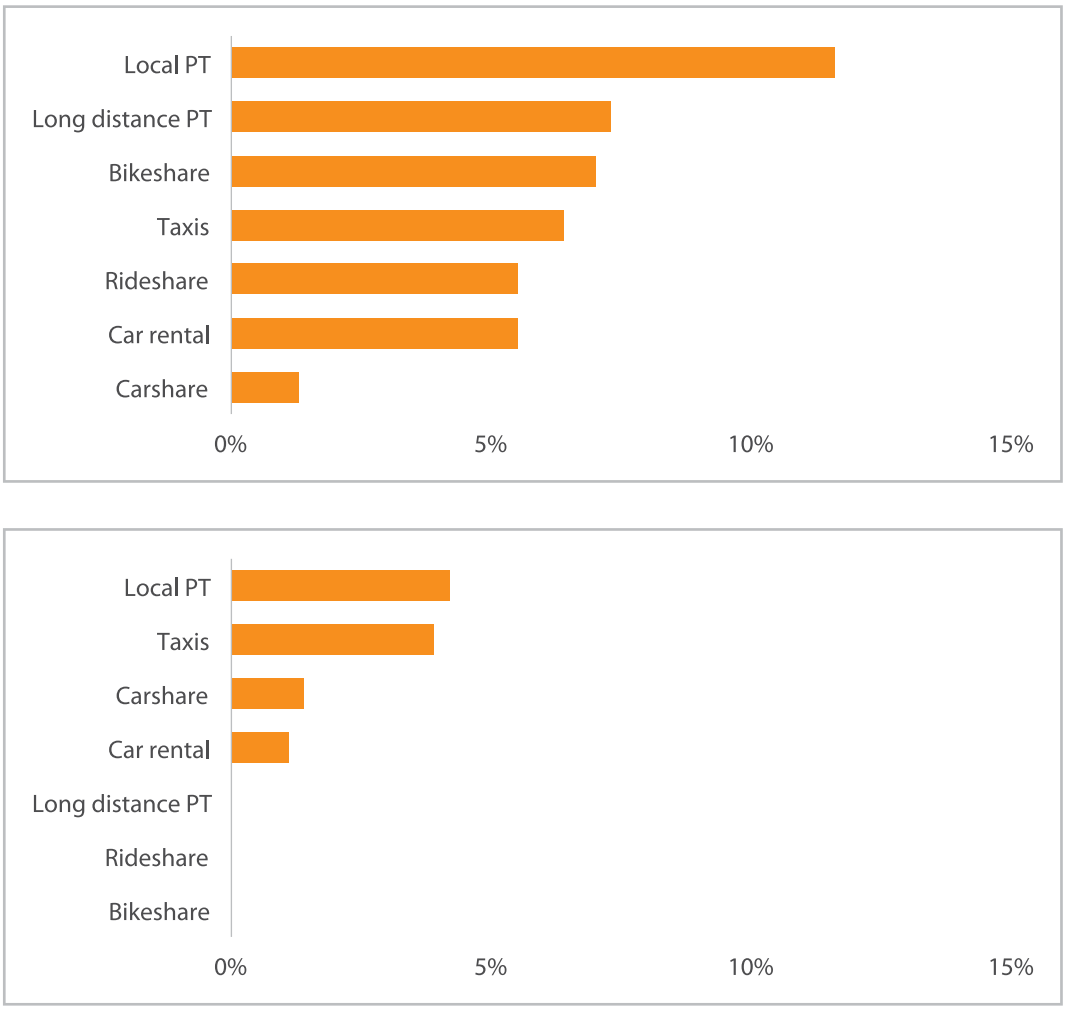


Figure 7: Average demand elasticities for pay-as-you-go and unlimited bundled MaaS schemes, as a function of access to different transport modes.

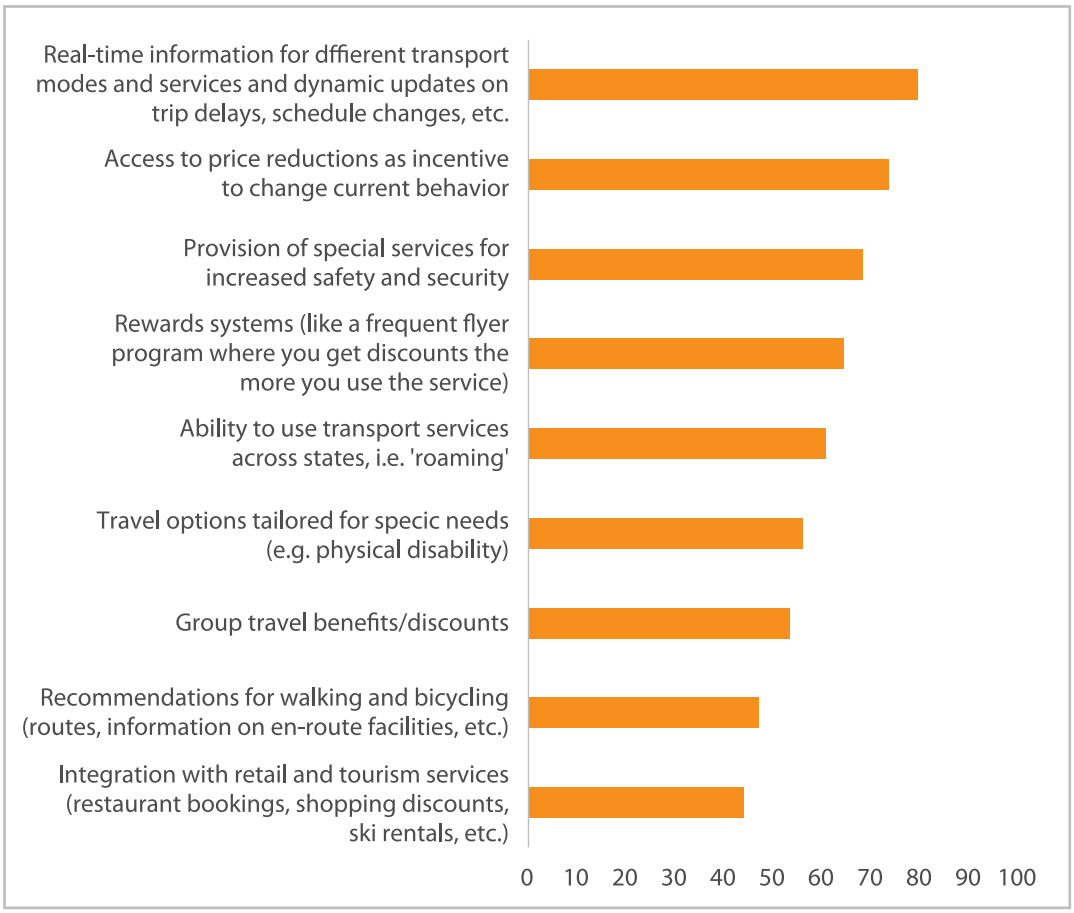


Figure 8: Ranked importance of different MaaS service features.

A number of experts that we interviewed for the study mentioned how MaaS could potentially be used to implement travel demand management strategies, such as real-time route optimisation and dynamic road pricing. From a customer standpoint, "Access to price reductions as incentive to change behaviour" was rated the second most important feature, indicating that customers would be very receptive to these travel demand management strategies being woven into MaaS systems.

For each of the MaaS scenarios, respondents were asked to indicate what kinds of trips, if any, would they make using their preferred MaaS alternative. Figure 9 plots the proportion of scenarios where respondents indicated that they would use their preferred MaaS alternative for different trip types. As is clear from the figure, MaaS use is greatest for one-off social trips, like eating out, going to the movies, etc., indicating that MaaS could help plug service gaps that make these trips relatively inconvenient to make using existing public transport services.

That being said, for one in five scenarios, respondents indicated they would use their preferred MaaS alternative for other trips as well, such as to commute to a place of employment or education, to visit their friends and family members and to run errands. Overall, these findings indicate considerable customer appetite for MaaS in Australia.

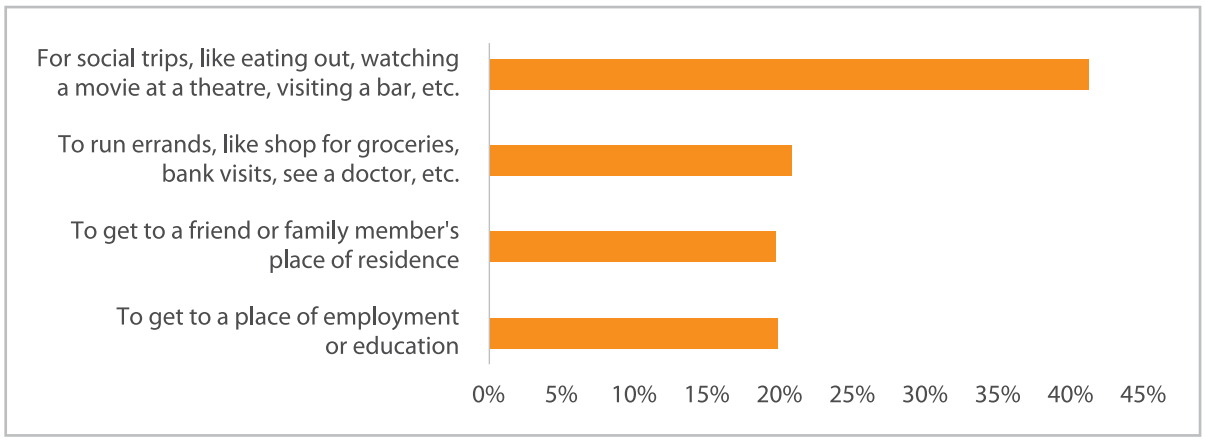


Figure 9: MaaS use for different trip purposes.

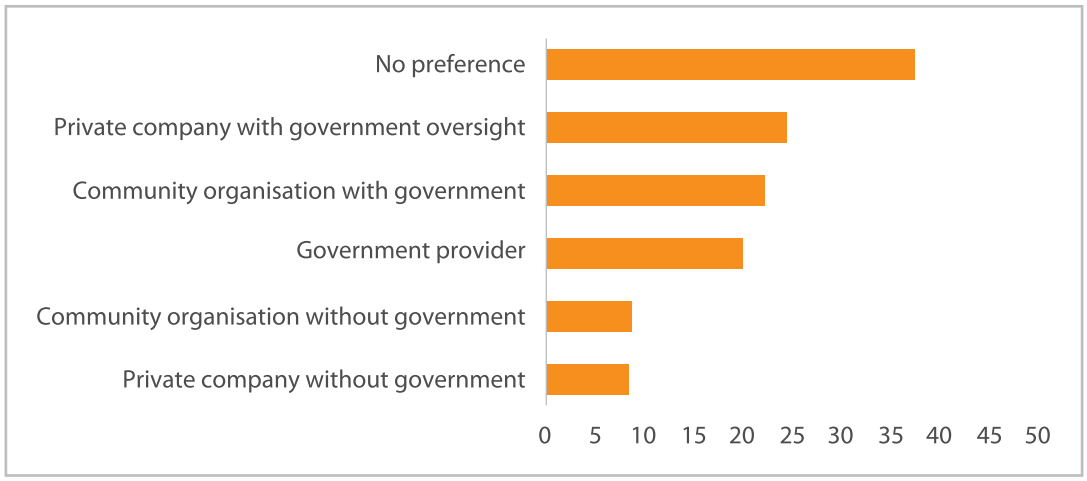


Figure 10: Customer preferences for different models of service provision.

We asked respondents if they had any preferences for how MaaS is delivered in Australia. Figure 10 plots the results. 37 per cent of the sample indicated that they had no preference. Of those that did indicate a particular preference, there was a strong inclination towards the government playing a role in any potential service provision model, especially as an overseer, but also possibly as a service provider. Roughly 24 and 22 per cent of the sample indicated they would prefer to see MaaS provided by either a private company or a community organisation, respectively, with government oversight. 20 per cent of the sample indicated they would prefer to see MaaS provided by the government directly.

Finally, Table 3 indicates adoption rates of different MaaS schemes among Australian customers, as predicted by our model. For the sake of simplicity, all our scenarios assume that the MaaS service offers full planning, ticketing and booking integration; and access to both real time information and personalisation features. By and large, our model indicates that there is definitely a market for MaaS in Australia. MaaS schemes that offer pay-as-you-go access to transport modes have a predicted adoption rate of between 30 and 46 per cent, depending on the transport modes that they offer access to and their monthly subscription costs.

Even prepaid schemes that offer unlimited access to local public transport and taxi services for a high monthly cost of $500 have a high predicted adoption rate of 18 per cent. Overall, these findings provide a counterpoint to industry and government experts who had cautioned for various reasons that there may be minimal commercial markets for MaaS in Australia and should serve to encourage industry and government actors interested in the provision of MaaS.

MaaS scheme (all schemes assumed to have full planning, ticketing and booking integration; real time information; and personalisation features)		Predicted share of Australian population that would purchase scheme
Pay-as-you-go access to all modes	No monthly subscription costs	45.9%
	$5 monthly subscription	39.5%
	$10 monthly subscription	37.0%
Pay-as-you-go access to local public transport, long distance public transport and taxis	No monthly subscription costs	35.8%
	$5 monthly subscription	31.8%
	$10 monthly subscription	29.4%
Unlimited access to local public transport and taxis	$500 monthly subscription	18.1%
Unlimited access to local public transport	$150 monthly subscription	17.4%

Table 3: Predicted adoption of different MaaS schemes.

5.2 MaaS preferences by geography

We examined how customer preferences for MaaS vary by state and region. In particular, we compared predicted adoption rates across states and regions for two MaaS schemes. The first scheme offers pay-as-you-go access to all modes; has no monthly subscription costs; has full planning, ticketing and booking integration; and offers real time information and personalisation features. The second scheme offers unlimited access to local public transport and taxi services; has a $500 monthly subscription cost; has full planning, ticketing and booking integration; and offers real time information and personalisation features.

Reflecting on Table 3 that the first scheme has a national predicted adoption rate of 45.9 per cent, and the second scheme has a national predicted adoption rate of 18.1 per cent. Table 4 and Table 5 show how these numbers break down across the states and territories. On aggregate, New South Wales, Victoria, Queensland and the Australian Capital Territory have bigger potential markets than Western Australia and South Australia. Across metropolitan regions, good markets for MaaS pilots would be Melbourne, Canberra and Sydney. However, by and large, the potential market for MaaS in metropolitan regions appears to be sizable across all states, especially for pay-as-you-go schemes.

State/Territory	Total	Metro	Regional and Remote
New South Wales	48.0%	47.5%	49.3%
Victoria	44.7%	49.2%	36.3%
Queensland	44.0%	45.8%	41.7%
South Australia	39.3%	45.4%	28.4%
Western Australia	41.5%	42.2%	39.5%
Northern Territory	NA	NA	NA
Tasmania	NA	NA	NA
Australian Capital Territory	49.0%	49.0%	NA

Table 4: Predicted proportion of residents living in metro, regional and remote areas across different states and territories that would purchase a MaaS scheme that offers pay-as-you-go access to all transport modes, has no monthly subscription costs, offers full planning, ticketing and booking integration, real time information, and personalisation features.

State/Territory	Total	Metro	Regional and Remote
New South Wales	18.7%	18.1%	20.2%
Victoria	16.6%	19.7%	10.8%
Queensland	16.9%	16.9%	16.9%
South Australia	13.7%	16.0%	9.4%
Western Australia	15.4%	15.6%	14.7%
Northern Territory	NA	NA	NA
Tasmania	NA	NA	NA
Australian Capital Territory	18.7%	18.7%	NA

Table 5: Predicted proportion of residents living in metro, regional and remote areas across different states and territories that would purchase a MaaS scheme that offers unlimited access to local public transport and taxi services, at a monthly cost of $500, offers full planning, ticketing and booking integration, real time information, and personalisation features.

Respondents in regional New South Wales indicated a higher percentage of acceptance of the potential of MaaS products than their metro counterparts. We examine this finding in more detail through a plot of the predicted proportion of New South Wales residents across different regions that would purchase different MaaS schemes, shown in Figure 11.

In drawing up these and other maps that follow, we described all possible MaaS schemes that were shown to survey respondents, including the two MaaS schemes corresponding to Table 4 and Table 5 and used the discrete choice models to predict the probability that a particular respondent would purchase the scheme if it were available today. These probabilities were averaged over all MaaS schemes, reweighted to adjust for differences between our sample and the Australian population, and averaged over particular geographic areas, to provide predicted probability that an Australian living in that geographic area would purchase MaaS if it were available today.

The following communities in particular suggest high potential interest for MaaS: regional communities along the New South Wales coastline, both north and south of Sydney; regional communities in the far west suburban and exurban regions surrounding Sydney; agricultural communities in the Murray basin; and mining communities in New England and North West New South Wales. While the populations in these regions might not be large enough to commercially support the launch of MaaS pilots, analysis indicates that residents in these regions are more willing than the average Australian to embrace this new paradigm of transport service provision.

Similarly, Figure 12 plots the predicted proportion of South East Queensland residents that would purchase MaaS. Compared to Sydney, demand is more evenly spread, with no single area standing out as a particularly attractive or unattractive market for MaaS in the region.

More generally, the reader should note that predicted adoption rates specific to a neighbourhood or region are subject to greater sampling variance than predicted adoption rates for the entire state, due simply to smaller sample sizes. As such, findings are indicative of potential demand for MaaS across much of the Greater Sydney metropolitan area (Figure 13), the Melbourne metropolitan area (Figure 14), parts of South East Queensland and parts of regional New South Wales. However, more data is needed to conclude definitively which neighbourhoods and regions in particular could be more productive settings for early trials.

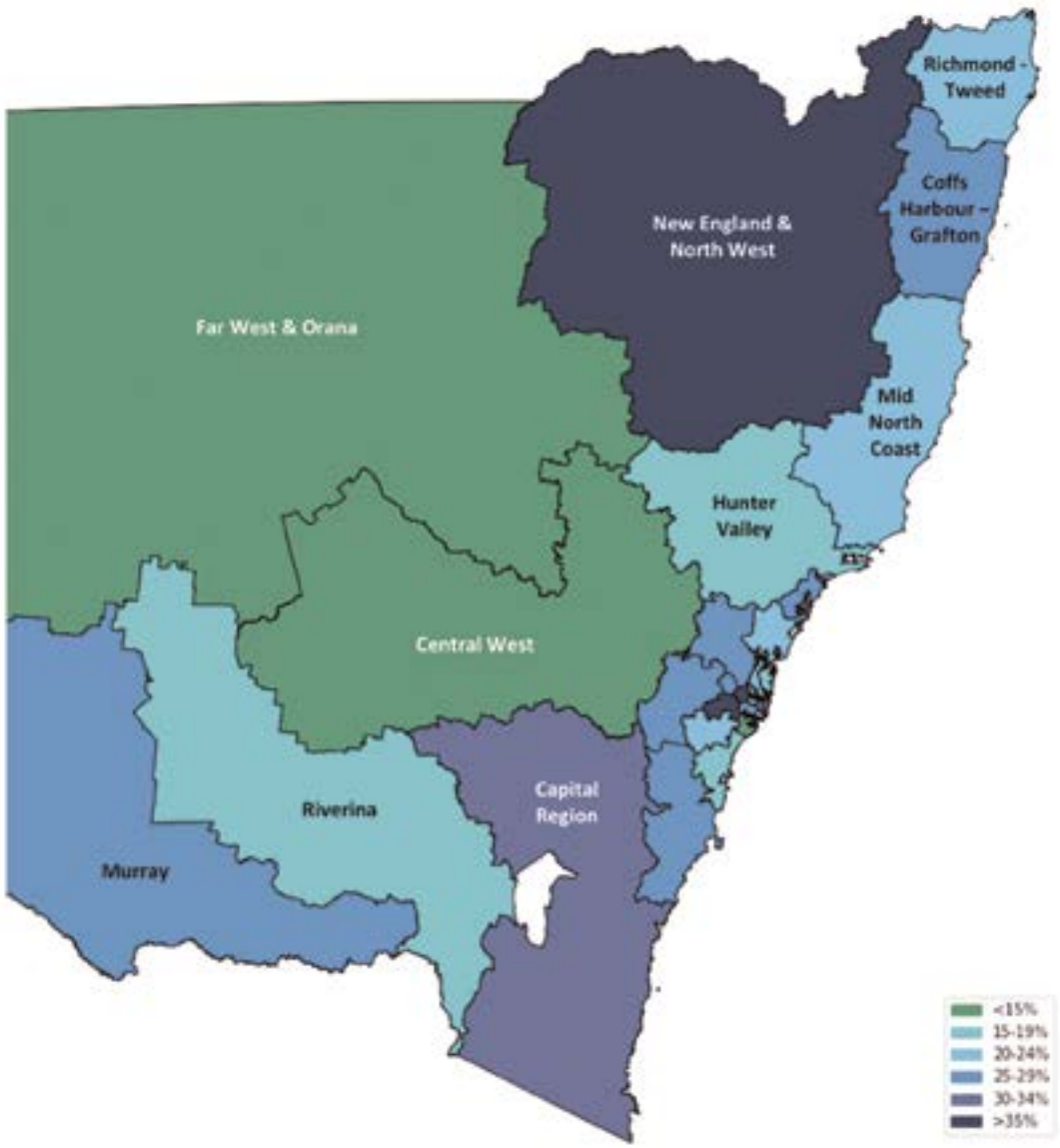


Figure 11: Predicted proportion of New South Wales residents across different regions that would purchase MaaS if it were available today.

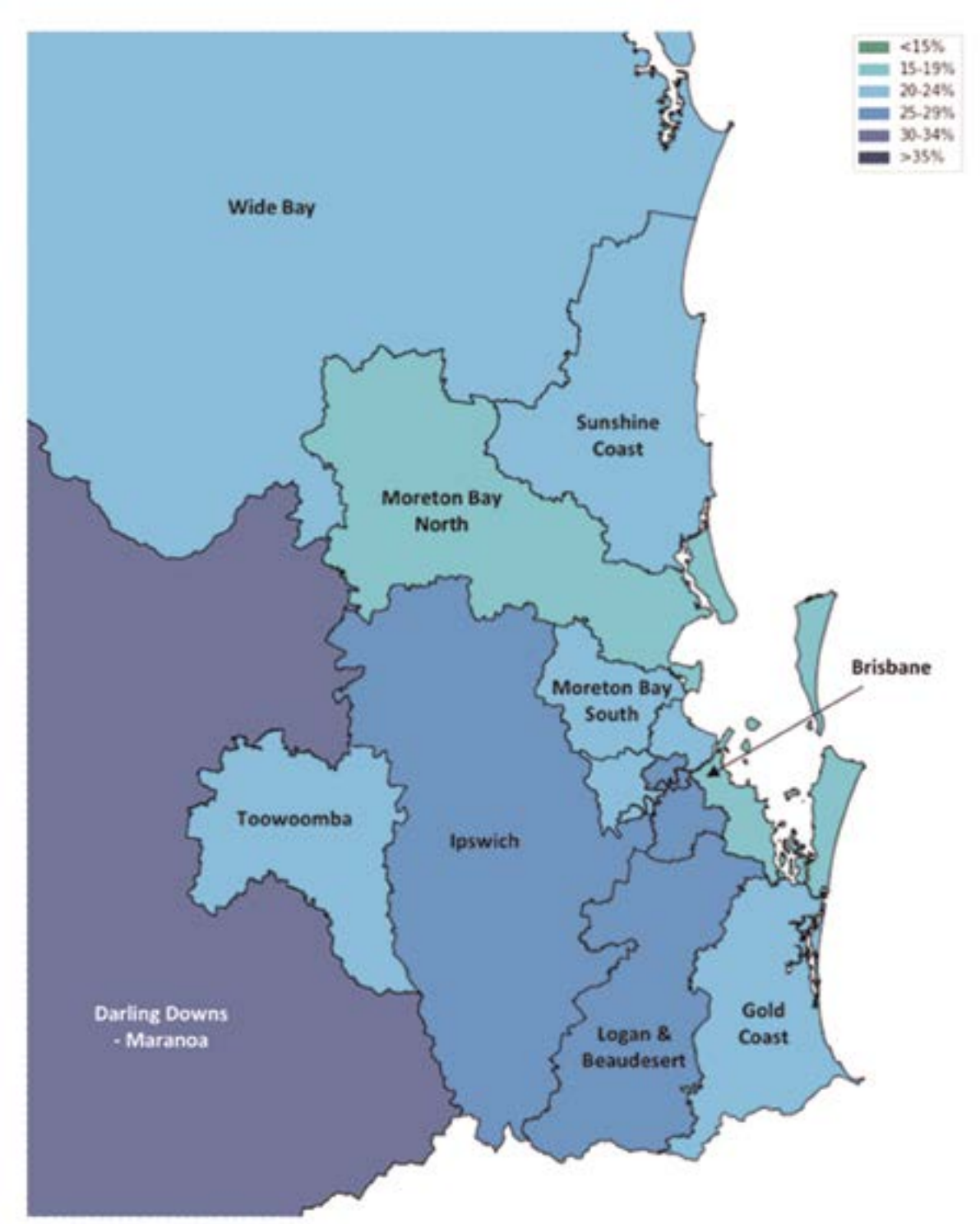


Figure 12: Predicted proportion of South East Queensland residents across different regions that would purchase MaaS if it were available today.

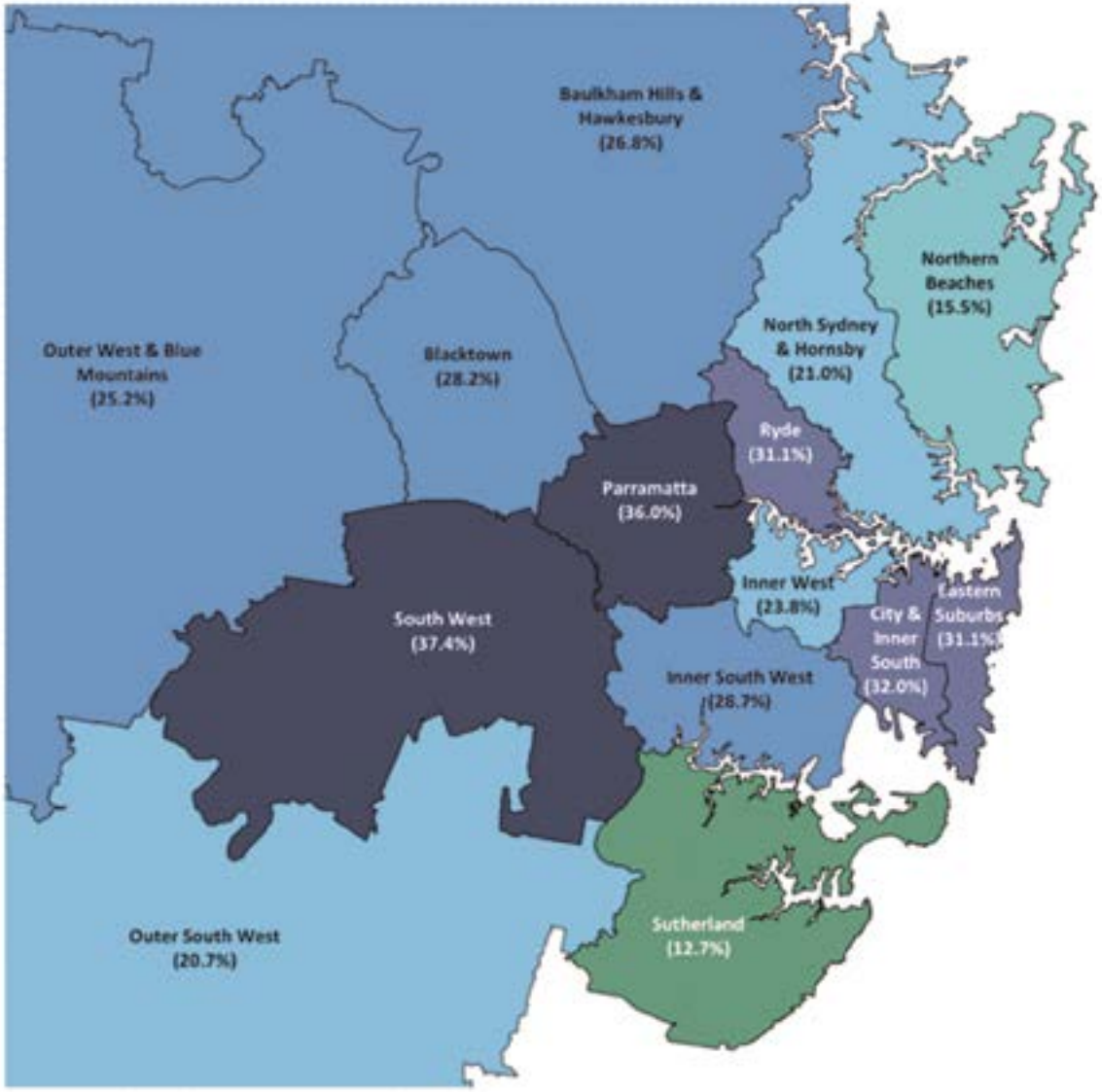


Figure 13: Predicted proportion of Sydney residents across different neighbourhoods that would purchase MaaS if it were available today.

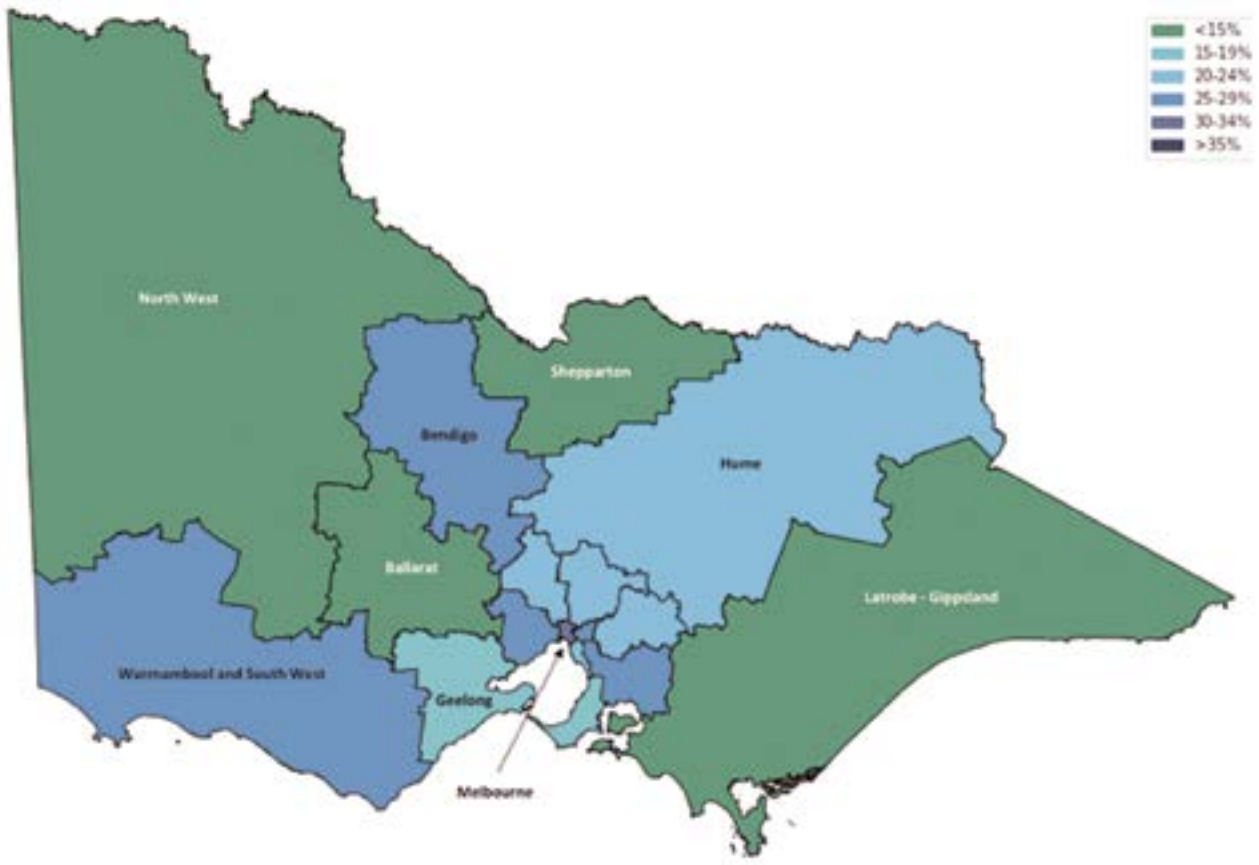


Figure 14: Predicted proportion of Victorian residents across different regions that would purchase MaaS if it were available today.

5.3 MaaS customer personas

We summarize the five different personas identified by our discrete choice model in Table 6, based on differences in terms of their preferences and attitudes towards MaaS, their sociodemographic profiles and their current patterns of travel behaviour. The personas have been ordered in terms of their decreasing willingness to use MaaS and their increasing dependence on the private car as a mode of transport.

In going from left to right, there are several general trends to be observed. In particular, willingness to use MaaS is correlated with age and life cycle stage. Young and middle-aged individuals who are either single or married, with or without children at home, are far more likely to use MaaS. In contrast, older individuals whose children have left home are most unwilling to use MaaS. Education and employment are strongly correlated with willingness to use MaaS as well, with more educated and employed individuals being more likely to use MaaS.

Current patterns of travel behaviour and attitudes towards existing transport modes and services serve as excellent indicators of willingness to use MaaS. Individuals unwilling to use MaaS have lower assessments of public transport services in their local neighbourhoods, are generally not open to the idea of car sharing, and are more likely to report that private car ownership is a necessity where they live. And the converse is true for individuals most willing to use MaaS.

The higher an individual's perceived travel costs, the more likely they are to use MaaS. This is an important consideration as was previously detailed in Figure 6, that most individuals in our sample underestimate their weekly travel expenditures. The two findings together suggest that making customers more aware of the marginal costs of private car ownership and use is an important mechanism for increasing interest in and acceptance of MaaS.

Our model is able to identify multiple niche markets for MaaS, based on current travel behaviour patterns. In particular as shown in figure 16, individuals with high travel needs, those with high rates of motorcycle ownership and people with high dependence on mobility devices are very receptive to the concept of MaaS and have shown a strong willingness to use the service if it were available in the market today.

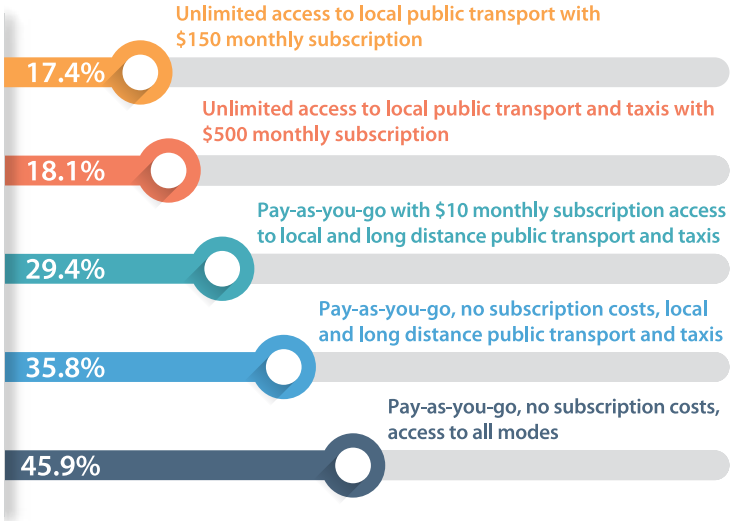


Figure 15: Predicted adoption of different MaaS models.

PERSONA	LIKELIHOOD TO PURCHASE MAAS	DEMOGRAPHIC
 Personalisers	87%	• Evenly spread across metro, regional and remote areas • More likely to be younger, male, college educated, employed, have children at home • High overall travel needs, high motorcycle ownership, high use of mobility devices • $185 per capita per week
 Socialisers	51%	• More likely to live in metro areas • More likely to be middle aged, female, college educated, high household income • Negative opinion of private car ownership and use; open to carsharing • $121 per capita per week
 Roamers	33%	• More likely to live in metro areas • More likely to be college educated, single and living with parents, high household income • Negative opinion of private car ownership and use; open to carsharing • $136 per capita per week
 Planners	2%	• More likely to live in regional and remote areas • More likely to be older, female, not college educated, retired, empty nesters • Low opinion and infrequent use of public transport and carsharing • $98 per capita per week
 Car lovers	1%	• More likely to live in regional and remote areas • More likely to be older, not college educated, retired, empty nesters • Low opinion and infrequent use of public transport and carsharing • $107 per capita per week

Figure 16: Personas of customers by demographic and liklihood to purchase MaaS.

	Persona I: Personalisers	Persona II: Socialisers	Persona III: Roamers	Persona IV: Planners	Persona V: Car lovers
Share of the Australian population	14 per cent	7 per cent	17 per cent	22 per cent	41 per cent
Average MaaS purchase probability	87 per cent	51 per cent	33 per cent	2 per cent	1 per cent
MaaS use	Likely to use for all travel	Most likely to use for one-off social trips		-	-
Attitudes towards MaaS	MaaS could help reduce car dependence and car ownership			MaaS unlikely to have effect on car dependence or car ownership	
Geography	Evenly spread across metro, regional and remote areas	More likely to live in metro areas	More likely to live in metro areas	More likely to live in regional and remote areas	More likely to live in regional and remote areas
Demography	More likely to be younger, male, college educated, employed, have children at home	More likely to be middle aged, female, college educated, high household income	More likely to be college educated, single and living with parents, high household income	More likely to be older, female, not college educated, retired, empty nesters	More likely to be older, not college educated, retired, empty nesters
Current travel behaviour and attitudes	High overall travel needs, high motorcycle ownership, high use of mobility devices	Negative opinion of private car ownership and use; open to car sharing	Negative opinion of private car ownership and use; open to car sharing	Low opinion and infrequent use of public transport and car sharing	Low opinion and infrequent use of public transport and car sharing
Average self-reported travel costs	$185 per capita per week	$121 per capita per week	$136 per capita per week	$98 per capita per week	$107 per capita per week

Table 6: High-level summary of different MaaS customer personas.

5.4 Population preferences for On-Demand Transport

In this section, we report findings from our analysis of the customer data on on-demand transport. Of our sample, 9 per cent indicated having heard of on-demand transport, and 3 per cent said that they had used such as service before.

Table 7 lists average customer willingness to pay for different on-demand services attributes, as measured by a discrete choice model, estimated using the customer data. Customers are willing to pay most to avoid sharing a vehicle with other passengers: $0.28 per km. Recall that the on-demand transport scenarios varied the potential number of other passengers between 0 and 10. However, our model did not find customers to be sensitive to the number of passengers, only whether or not they have to share the vehicle with other passengers.

This finding differs from studies conducted by Queensland Transport and Main Roads, following on-demand trials in the state, which found customers to be most sensitive to the potential number of other passengers that they might have to share the service with (as that number serves as a proxy for level of service, in terms of door-to-door travel times). Note however that most individuals in our sample have no prior experience with on-demand transport and their sensitivity to particular service attributes might likely change once they have actually used such a service.

Customers are willing to pay $0.17 per km for door-to-door service. However, we did not find any willingness to pay for flexible routes and/or flexible schedules. Again, we speculate this may be due to customer inexperience with these types of services and that the value of flexible routes and schedule might only become apparent to customers once they have actually used the service. Finally, customers are willing to pay a nominal $0.10 per km to be able to book the service in real time, as opposed to having to book the service several hours in advance.

Willingness to pay to be able to…	Amount	Comments
Book ODT service in real time	$0.10 per km	-
Have door-to-door service	$0.17 per km	No preference between fixed route fixed schedule services and flexible route flexible schedule services
Avoid sharing a vehicle	$0.28 per km	Number of passengers that the vehicle is shared with did not have a statistically significant effect

Table 7: Customer willingness to pay for on-demand transport service attributes.

ODT service	Predicted usage			
	Daily	Few times a week	Few times a month	Rarely or never
$1.15 per km (comparable to UberX prices in Melbourne); no sharing; real time booking; and door-to-door service	5%	12%	23%	61%
$0.70 per km (comparable to bus fares in Sydney); sharing; no real time booking; fixed route fixed schedule	4%	11%	21%	65%
$0.30 per km; no sharing; real time booking; and door-to-door service	11%	20%	18%	51%

Table 8: Predicted usage rates of different on-demand transport services.

Table 8 highlights usage rates across the national population, as predicted by our model for different potential on-demand services. For a service that costs roughly the same as UberX, and offers comparable level-of-service, roughly 17 per cent of the national population can be expected to use the service a few times a week or more.

For an on-demand service that costs roughly the same as public bus services, and offers comparable level-of-service, roughly 15 per cent of the national population can be expected to use the service a few times a week or more. Note that our model predicts relatively similar levels of usage for UberX-like on-demand services and public bus-like on-demand services.

Finally, for an on-demand service that provides the same level-of-service as UberX, but at a fractional cost of $0.30 per km, a significantly larger 31 per cent of the national population can be expected to use the service a few times a week or more.

While we don't intend to explore potential business models or any commercial viability, the figure serves to underscore that while customers are willing to pay extra for improved level-of-service, cost is ultimately the most important determinant of on-demand use.

We asked respondents how, if at all, they would use different on-demand services shown to them across scenarios. Figure 12 plots the proportion of scenarios where respondents indicated that they would use the proposed service for different trip purposes. As with MaaS, on-demand use is greatest for one-off social trips.

5.5 On-demand customer personas

The on-demand customer data was used to estimate discrete choice models of on-demand transport use that allowed us to segment the population into different personas, based on differences in terms of their preferences for on-demand transport, their sociodemographic profiles and their current patterns of travel behaviour. Table 8 summarizes the five different personas identified by our model. The personas have been ordered in terms of their decreasing average frequency of use of on-demand services.

These customer personas are strongly correlated with the MaaS personas. Many of the demographic trends are similar: in going from left to right, there is a clear progression in age and life cycle stage, and a decline in education and employment.

The two personas predicted to use on-demand transport most frequently are also most likely to belong to the first MaaS persona, i.e. Personalisers, which have a high average predicted probability of purchasing MaaS. Similarly, the persona predicted to use on-demand services least frequently is also most likely to belong to the fifth MaaS persona, i.e. Car-lovers, which have a near zero average predicted probability of purchasing MaaS.

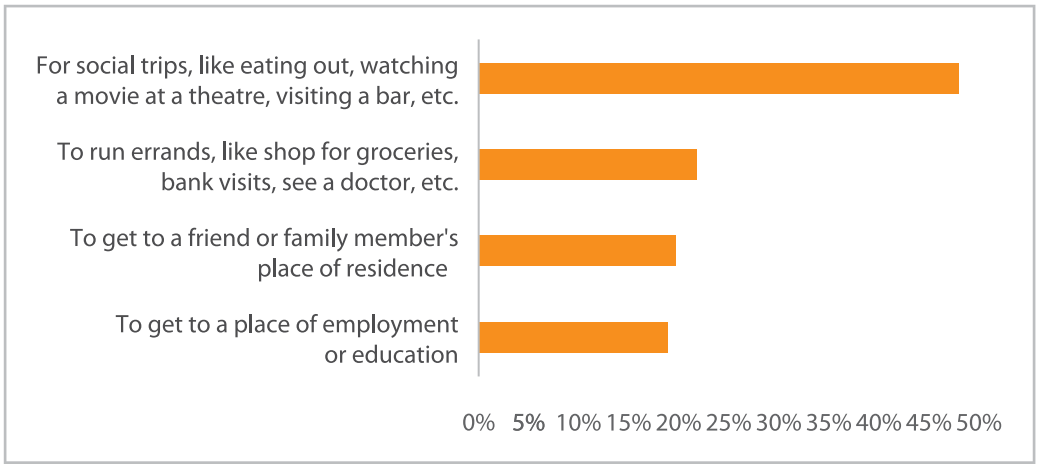


Figure 17: Proportion of scenarios where respondents would use on-demand transport to make certain trips.

On-demand transport use is relatively similar to MaaS use for other trip purposes, with respondents indicating for roughly one in five scenarios that they would use the service to commute to a place of employment or education, to visit their friends and family members and to run errands.

	Persona I: Innovators	Persona II: Early adopters	Persona III: Potential early majority	Persona IV: Potential late majority	Persona V: Potential laggards
Share of the Australian population	3 per cent	10 per cent	9 per cent	20 per cent	58 per cent
On-demand transport use	Daily	Few times a week	Few times a month	Few times a year	Rarely or never
Sensitivity to service attributes	High willingness to pay for door-to-door service ($0.58 per km)	High willingness to pay for avoiding sharing a vehicle ($0.36 per km)	Not very sensitive to any service attributes	High sensitivity to costs	High willingness to pay for door-to-door service ($0.69 per km)
Attitudes towards ODT	ODT could help reduce car dependence and car ownership		ODT could help reduce car dependence		ODT unlikely to affect car dependence or ownership
Geography	Proportionally spread across metro, regional and remote areas				Regional and remote residents more likely to belong to this persona
Demography	Young; highly educated; employed; male; have children at home; low income; disabled; residents of outer regional and remote areas	Young; highly educated; male; have children at home; low income; disabled	Middle aged; residents of inner city areas; high incomes	Don't have children at home; young; median incomes; residents of outer regional and remote areas	Old; retired; empty nesters; not college educated; high incomes
Correlation with MaaS personas	Highly likely to be in MaaS persona I, i.e. MaaS enthusiasts		No strong correlation with MaaS personas		Highly likely to be in MaaS persona V, i.e. car dependents

Table 9: High-level summary of different on-demand transport customer personas.

Technology Adoption Curve

Everett Rogers - Diffusion of Innivations 1962

People tend to adopt new technologies at varying rates. Their relative speed of adoption can be plotted as a normal distribution, with the primary differentiator being individuals' psychological disposition to new ideas.

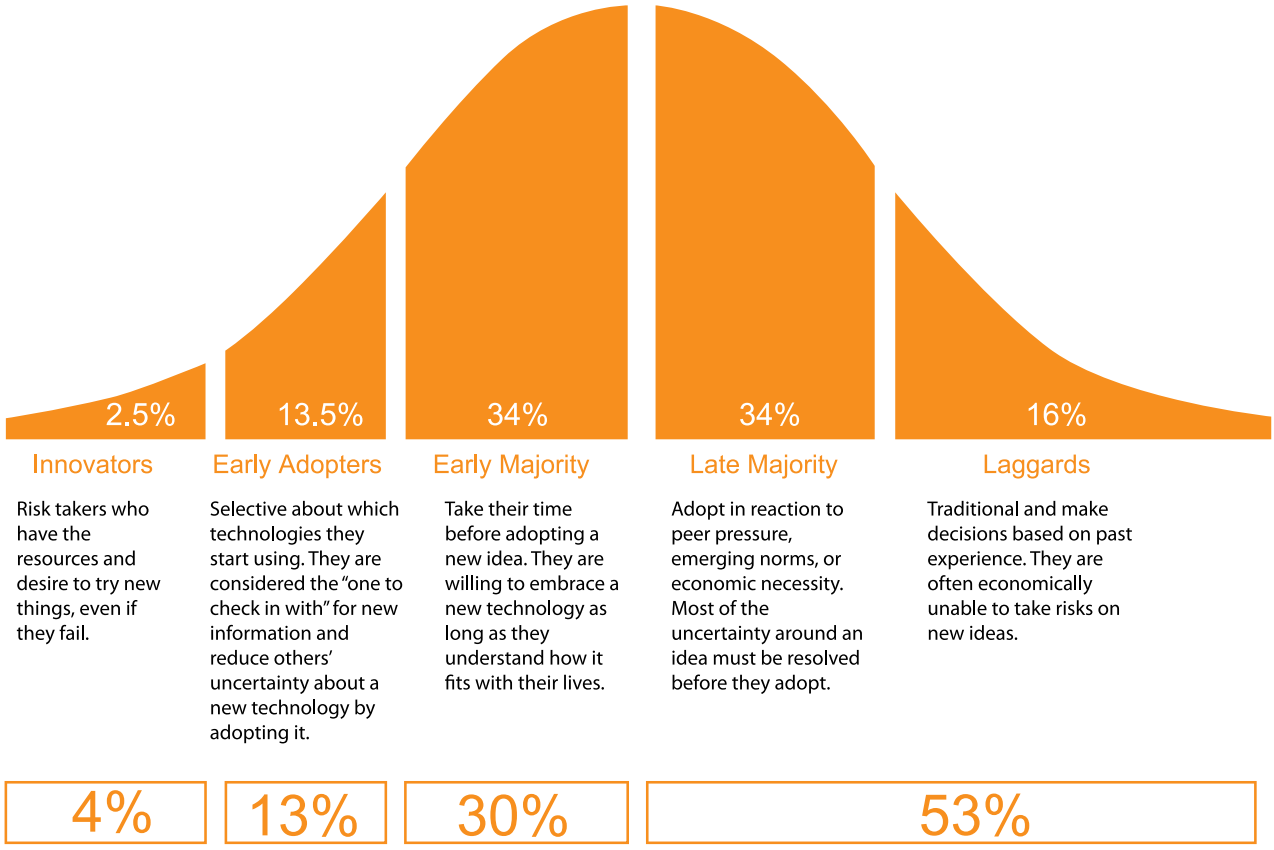


Figure 18: The technology adoption curve, as described by the innovation diffusion process (Rogers, 2010). Figures in orange indicate the relative technology adoption curve of the customers surveyed.

Finally, the size of the five customer personas is remarkably consistent with the size of different adoption cohorts as described by the innovation diffusion process (Rogers, 2010). For reference, Figure 18 shows the different cohorts. In particular, the size of the first two on-demand personas is almost identical to the Innovators and Early Adopters cohorts. As the on-demand market evolves and as more of these services become available to customers, it is likely that the other cohorts too will emerge from the remaining personas identified by the analysis.

These findings should serve as a positive reminder that while a large share of the national population may not yet be willing to use such services, as the technology adoption cycle for other innovations has demonstrated in the past, they too could be persuaded to use on-demand transport, similarly the early adopters could lead the charge for MaaS highlighting its benefits to the wider community.

6 Perspectives – Expert stakeholder responses

"I expect that privacy commissioners everywhere would be very interested in how this [MaaS] is used, how the data is used, and whose data it is."

Barbara Wise
NSW Point to Point Commissioner

6.1 Challenges to MaaS implementation in Australia

Most experts agreed that the greatest challenge facing MaaS in Australia is the integration of different transport services. Many referenced the current status of 'siloed' systems that don't talk to each other. For example, in many regions, public transport itself is not fully integrated to the extent necessary to support a local MaaS service; integration with additional services run by independent private operators would only be more challenging.

Data access and sharing were repeatedly cited as key challenges. While many public-sector operators have an open data policy, there is a perception it might be more difficult for the private sector to share its own data. In many jurisdictions public sector data is required to be openly available where feasible. For example, in the ACT, bike sharing companies are contractually required to share their data. Similar models could be considered nationally. There was an acknowledgement that many private sector business models, such as Uber, access our roads infrastructure for profit with no financial impost beyond that of a regular customer. While there has been some data sharing this is not as yet a formal requirement.

Relatedly, data interoperability was cited as a potential challenge. Some experts noted a positive development would be to work towards a national set of data protocols and standards for all transport service providers. For example, the General Transit Feed Specification (GTFS), developed by Google, has been adopted by the public transport industry as the default format for releasing public transportation schedules and associated geographic information. Similar protocols are needed for the publication of data from other transport services. In the case of road toll collection systems, it took nearly a decade to achieve national interoperability.

Concern for data privacy and cyber-security could impede customer adoption. Some experts talked about building community consensus for data sharing through public information and education campaigns. Others mentioned the need for stricter data sharing protocols. Customers already share so much of their personal information willingly with banks, online search engines, social media platforms, etc. Customers could be made aware of the benefits of sharing their data, such as personalized recommendations to fulfil their mobility needs. Potential MaaS schemes could even allow customers to opt into different levels of data sharing.

Opening up the public transport ticketing system to private service providers could prove challenging, with particular reference made to the procurement and contract arrangements undertaken for ticketing software and infrastructure, with public transport agencies limited in their ability to open access to these platforms. There are some international examples of changes improving these opportunities, as well as pilot programs in Australia that are testing the potential to do the same locally. If MaaS is to succeed in delivering customers a seamless payment and travel experience through digital platforms, ticketing integration will need to be a key focus.

Payment integration was also considered to be a potential challenge, mostly due to the number of complex systems and stakeholders involved and the issue of integrating back-end networks. One solution could be through credit cards and third-party payment apps, like PayPal, that have independent agreements with MaaS providers to allow customers to pay for access to transport services through the MaaS digital platform. The other alternative is to open-up the transport system itself to the banks, such that credit cards become public transport tickets, and MaaS systems provide pay-as-you-go access with no need for tickets.

"If you're accessing the physical infrastructure… you're using the city, the roads, your drivers are using this, you need to help plan a better city, you need to contribute… and part of that is you have to give us your data."

Chris Pettit
Professor of Urban Science, UNSW

"I really believe in a national public transport ticketing system. We insist on having an Opal in New South Wales, a Myki in Victoria… we need to get that PT [public transport] portion of it right first, and then have the taxis, ride-shares, point to points, all the rest of it, feed in."

Chris Lowe
Executive Director, Bus Association Victoria

While definitely feasible, as there are international examples of successful integration of banking and credit cards and transport payments, it was thought by some experts interviewed that perhaps Australian markets were not substantial enough to be viable for financial institutions to make the investment required. A positive step in this direction is also a pilot program operating in Sydney integrating MasterCard and Sydney Ferry services as a proof-of-concept.

While not considered insurmountable, there are some technological gaps that will need to be considered. For example, if smartphones, connected devices and apps become the primary platform for MaaS systems, then MaaS providers would have to plug gaps in the 3G network to ensure customers are always connected.

Some experts considered that there are relatively few barriers to the deployment of MaaS in Australia, and that the importance of these barriers has been overstated in many cases. They mostly agreed that while complex, technological barriers are negligible given enough drive to work towards and resolve issues collectively. The biggest hurdle, in their opinion, is the absence (as yet) of a compelling commercial business case, which leads us to the second theme that emerged from our interviews.

6.2 Commercial opportunities

Most experts agreed that urban inner-city neighbourhoods in the bigger metropolitan regions, such as Sydney, Melbourne or Brisbane, would be ideal markets in which to introduce MaaS. These cities have the densities needed to support public transport, which many experts view as the backbone of any MaaS system. Some experts argued that regional centres might be better choices for early MaaS trials, such as Newcastle in New South Wales or Warrnambool in Victoria, that are neither too large nor too small in terms of size or population, have access to multiple public transport modes and services, including taxis and community transport schemes, and have a broad demographic spread.

From a demographic standpoint, almost all experts agreed that younger segments would likely be most open. Numerous studies have found that Millennials, or those born roughly between 1980 and 2000, are much less dependent than previous generations on the private car as a means of transport.

For example, Delbosc (2015) report that the proportion of Victoria residents aged between 25 and 64 who have a driver's license has remained steady at 95 per cent, but the proportion of Victoria residents under 25 who have a driver's license has decreased significantly, from 77 per cent in 2001 to 66 per cent in 2012 (Delbosc, 2015).

Potential early adopters could include university students who are particularly sensitive to costs, young urban professionals who are more multimodal, and more generally, young adults that are especially tech-savvy and keen to try new technologies and services.

"The traditional binary view of car ownership and public transport is no longer meaningful as we transition to passenger-centric mobility underpinned by access rather than ownership. Automobile clubs must realign their mobility offerings to ensure that we continue to meet and service the needs of members both now and into the future."

Rebecca Michael
Head of Public Policy, RACQ

"You'll have different isolated pockets based on what the real need is for the customer, and therefore you've got a different business model."

Jill Fitzroy
Director Service Strategy, VicRoads

A recurrent issue raised by experts, both as a potential risk and opportunity was with regards to customers with specific accessibility and mobility needs. Existing regulatory frameworks require a certain level of service requirements for operators to ensure they meet for customers with disabilities and other mobility needs.

There was general consensus that these customers could both offer a market for a specialised MaaS product that might better suit the current and future transport needs while at the same time government was felt to be an important facilitator to ensure equity and accessibility was ensured for all customers.

Niche markets might emerge over time that provide specialized services for, say, children, pet owners, parents with young children, individuals with disabilities, women, etc. Relatedly, many experts mentioned the transport vulnerable and the transport disadvantaged as potential early adopters. These could include older adults, those with physical disabilities, low-income households, students, etc. Retirement villages, university campuses and hospital campuses may be good early test beds.

One expert suggested tourists might be a good potential market for MaaS systems, locals potentially being too familiar with local transport systems, and too fixed to routine travel patterns to consider potential benefit from MaaS.

Many of the experts who thought that there aren't many barriers to MaaS deployment in Australia, also thought that the commercial case for MaaS is not compelling enough just yet, or else these services would exist already. Some went as far as to call MaaS a solution in need of a problem, which may work well for younger, tech-savvy individuals living in urban environments, but may not be appropriate and/or cost-effective for a number of other demographic segments, such as residents in regional and remote areas, lower-income individuals who cannot afford costly monthly subscriptions, older adults, individuals who cannot read English, or individuals who do not have the manual dexterity to use smartphones, etc.

Some also viewed connected and autonomous vehicle (CAV) technology as being essential to the success of MaaS. Australians are traditionally attached to their cars and are reluctant to depend solely on public transport services to fulfil their mobility needs. While patterns of car dependence may be changing now, the pace of change is not necessarily fast enough to make the business case for MaaS compelling. However, CAVs could offer similar levels of mobility as private cars and make MaaS a viable alternative for a bigger proportion of the population.

"If we've looked at it and we believe it's a robust enough system to recommend to our members, then it comes with a level of credibility."

Mark Borlace
Senior Manager, Future Mobility, RAA

6.3 Governance models

Most experts would prefer to see the private sector take the lead with the public sector playing the role of regulator and facilitator, only stepping in when there are market failures. A small minority did express a preference for the public sector to play the role of provider. The private sector can produce perverse outcomes that may not be societally beneficial (e.g. more congestion, inequitable outcomes), and greater oversight from the public sector could ameliorate these possibilities.

Within the private sector, there was some appetite among existing transport service providers, car motoring clubs, and telecom operators to take the lead. Many experts suggested starting with a "public transport plus one" model and scaling incrementally over time through the inclusion of other private transport services.

For example, bus operators could potentially lead through initial provision of app-based on-demand transport services. Alternately, existing rail operators could partner with other transport services, such as ride-share or bike-share, to increase the catchment area and increase the commercial viability of existing rail services. Airlines such as Qantas are already trialing simpler versions of this multimodal integration, where customers can book an Uber pickup through their frequent flyer app.

Most motoring clubs interviewed are exploring potential commercial opportunities that might arise from MaaS. Motoring clubs might profit from the vertically integrated nature of their operations and easy access to financial institutions through the insurance arm of their business operations. Additionally, motoring clubs could play the role of educator and information provider for their members and the general public, relying on their reputational integrity to build trust and bring credibility to a new model of mobility service provision that is still unfamiliar to most Australians.

Telecom operators would benefit from their technological expertise, their control of the telecom infrastructure that would underlie any MaaS system, and their access to large segments of both the customer and business markets. For example, Telstra has as its customer base more than half of the national population, giving the company access to a large segment of the potential market for MaaS and the company has relations with most businesses that would need to be integrated in order to implement MaaS. In addition, the company is investing heavily in the development of future mobility solutions, including but not limited to MaaS.

> "I see this [MaaS] as a slow burn for those without mobility issues. Australians love their ability to have their vehicles and go where they want. I think within schemes like the NDIS and in Aged Care, however, where access without owning vehicle is vital, MaaS has real potential."
>
> Ben Whitehorn
> Manager, Randwick Waverly,
> Community Transport

A big role for government could be as data broker. The private sector saw positive opportunities for engagement with government in facilitating data sharing between different transport service providers. Potentially, government could even help create an integrated digital ecosystem that both small and large transport service providers can use to reach customers, as opposed to each transport service provider having to build the digital infrastructure up from scratch.

Such measures would reduce the barrier to market entry, increase market competition, and ultimately, improve the customer experience. However, government itself was much more reluctant to play that role, arguing that market forces will hopefully compel private transport service providers to share their data willingly. Potentially, government could play the role of enabler by setting up the appropriate incentives that promote such behaviour from the private sector.

For example, the ACT government has entered agreements with individual private organizations, such as Strava (a website and smartphone app used to track athletic activity), where the government has granted access to its infrastructure in return for open access to the private organization's data.

The public sector can also facilitate greater integration between public transport services. Many experts mentioned how mass public transport will be the spine of any MaaS system and an integrated public transport system could significantly ease the provision of MaaS. In most metropolitan regions in Australia, public transport services are typically contracted separately for each transport mode. Even for the same transport mode, multiple service providers might be contracted, depending on the size of the catchment area.

Newcastle recently became the first metropolitan region in Australia to hire a single contractor to operate the region's bus, ferry and future light rail system. An integrated public transport system was cited as an important factor by several local experts for selecting Newcastle as the site for the first on-demand transport trial in New South Wales. Similar efforts to integrate public transport across other regions could help lay the groundwork for future MaaS systems.

Market fragmentation was cited as a potential concern, where multiple MaaS providers might emerge in a single market, each of them offering access to only a subset of transport services, and there is no single fully integrated platform that is available to customers. Some experts made comparisons with digital streaming services, where the market now has multiple service providers, such as Netflix, Stan, SBS, etc., and there is no single catchall streaming service. While that may be an acceptable outcome for media streaming, it may not be acceptable for mobility and transport. In such cases, the government may be forced to step in to specify minimum standards of operation.

Some mentioned the need for government to actively support MaaS, at least at first, to get the ball rolling. For example, government could use various policy measures, such as investments in supporting infrastructure, tax concessions for MaaS providers, etc., to make MaaS more commercially viable and incentivise greater participation from the private sector. Others were very categorical in their rejection of any form of public support for such systems, arguing that the money would be better spent improving existing public transport services in other ways.

"I personally see government having an important role to collect and redistribute the data pertaining to various transport services and operations, so as to provide a level playing field to all the actors who want to play in the MaaS space, whether they are public or private."

Pascal Labouze
Executive Director, Operational Systems, TfNSW

"Expose the building blocks. If government wants to build a service as well, that's great. But allow innovators in the private sector to have direct access to the building blocks as well."

Dean Economou
CTO, Products, Telstra

MaaS could over time also serve as a tool for travel demand management, where the public or the private sector could incentivise changes in customer behaviour to relieve network congestion, improve system-wide performance and encourage more sustainable travel patterns. Integration of travel demand management strategies within MaaS systems would also strengthen the case for greater public-sector involvement and support, particularly if these strategies can create cost savings for government and increase public transport patronage over time.

Some experts expressed concern around social equity. If MaaS is provided by the private sector, it could further exacerbate transport disadvantage for those who cannot afford access to the new system. That may create a case for some sort of government intervention. For example, the government may use MaaS systems to subsidise travel for specific population segments at greatest risk of transport disadvantage, as it already does through transport subsidy schemes. Additionally, the government could set minimum standards of service provision and delivery, as they do currently with public transport services and as they have been called to do more recently in the case of ride-share services, such as Uber.

Relatedly, many experts also saw a bigger role for government in terms of regulation around safety, insurance, fair employment practices, etc. The growth in the 'gig' economy, while offering potential flexibility in the employment market, has also been shown to open workers to potentially unsafe and unregulated workplaces, leaving them vulnerable to potential exploitation. Many experts saw the rise in these service offerings and employment models as areas of concern to consider in any broad deployment of MaaS.

Figure 19: Transport for NSW – Operational Technology High Level Architecture.

7 Findings and opportunities

ITS Australia Vision Statement for MaaS

Transport and mobility as a service offers the potential to drastically improve customer choices, reduce travel costs, increase network capacity and transport sustainability while improving social and environmental outcomes. To support these goals ITS Australia undertakes to work with government and industry to shape opportunities for MaaS in Australia that:

1. Promote the efficient movement of people and goods to improve safety, and reduce congestion and environmental impacts.
2. Encourages a vibrant and competitive industry sector and supports effective MaaS deployment.
3. Builds on the existing public transport network and supports improved access to transport options for customers.
4. Enhances transport access and mobility options to customers across metropolitan and regional centres that Australians live and work in.
5. Is inclusive and responsive to the socio-demographic and mobility needs of all customers, balancing innovation and improvements against equitable access for all Australians.
6. Offers interoperable open access solutions that encourage competition and enables effective data sharing while protecting privacy and security concerns.
7. Aims to be more convenient than individual use of private vehicles.

This research and report does not aim to be definitive but rather provide a starting point and some initial insights to guide potential pilots or early deployments. As we are in the embryonic stage of this completely new transport delivery model we anticipate that both perceptions and realities will evolve as we start to experience MaaS and advance on demand transport in Australia.

Community & stakeholder engagement

Findings	Opportunity
MaaS is a new concept for Australian customers but there is a general interest in and excitement for what it could offer.	Communicate with customers what MaaS and on-demand transport can offer with improved convenience, cost, travel times and personalisation opportunities using relevant and evidence-based facts and figures.
People consistently underestimate how much it costs to own and run a car; this miscalculation potentially impacts on willingness-to-pay for MaaS as an alternative to car ownership.	Work with key stakeholders to develop and deliver effective messaging to educate customers as to their actual transport costs. Include 'real' transport costs as reference in price models for MaaS and on-demand transport options and target households with multiple cars.
Public transport is the most popular transport mode for inclusion in an Australian MaaS scheme and bike sharing is the least popular.	Public transport is an integral foundation to MaaS and so government will necessarily play a key role in any deployment of MaaS. This could be anything from oversight to full deployment.
MaaS is an unknown quantity so as yet it is not seen as a likely replacement for a private vehicle.	Behavioural change and 'nudge' programs could improve understanding of and acceptance of on-demand transport and MaaS through targeted campaigns and products to segmented markets.
There is a current customer inclination to prefer to use MaaS for socials trips although there is support for use in other contexts which could grow with trials.	Initiatives for driving behavioural change towards sharing in anticipation of MaaS (as this seems to be something users are currently 'against') – developed in anticipation of MaaS and not just when MaaS arrives.

MaaS Providers & Governance models:

Findings	Opportunity
There is a real opportunity today for a MaaS scheme to be utilised by Australians – 46% of the population are predicted to be ready to adopt a pay-as-you-go scheme.	The time for an Australian MaaS is now. This is evident in the interest from local and international organisations in the Australian market.
Customers have no strong preference for a Govt or private led MaaS provider, although there were stronger preferences for schemes with Government oversight compared to those without; many had no preference.	Safety, security and performance requirements must be foundational elements of any MaaS and on-demand product developed and made available to customers. As such there is a serious role for government to play in securing a framework underwhich MaaS providors would operate.
Expert stakeholders suggest a role for Government as a MaaS regulator and facilitator they also indicated Government could work with industry and play a role as a data broker.	Data access and data sharing challenges need to be overcome to deliver acceptable MaaS and On-Demand transport services. Government and industry must explore, identify and break down barriers to data sharing.
Stakeholders raised concerns around potential for fragmentation and existing challenges of silos and closed back-end systems.	Government and industry must explore, identify opportunities to enhance interoperability and open-source platforms to support competition. Integration and interoperability of ticketing systems and other key platforms are vital.
There is a current customer inclination to prefer to use social use MaaS for socials trips although there is support for use in other contexts which could grow with customer exposure.	The adoption of equitable transport pricing models is required to provide actual price signals to encourage MaaS.

Key considerations for MaaS deployment

- Interoperability across regional and state boundaries is a high-level objective for Government and industry to strive for, supporting customer requests.
- Robust protocols and standards for data sharing are likely to support a rich MaaS ecosystem. Industry and Government are encouraged to support and seek out standards and data-sharing protocols.
- Privacy and security issues need to be well-understood and managed. There is significant potential to undertake a collaborative approach to develop MaaS policy frameworks to protect all stakeholders from potential negative outcomes.

Ticketing and subscription models

Findings	Opportunity
Customers don't want to share – this contrasts with acceptance of public transport and needs to be considered in how MaaS is promoted and deployed.	Behavioural change programs and 'nudges' could be developed to better position customers to adapt to on-demand and MaaS schemes. Industry can consider how MaaS is packaged and promoted to address perceptions around vehicle sharing.
Pay-as-you-go and low-cost-subscription models were by far the most popular for customers. Market segmentation could improve understanding of benefits of cost bundled and subscription options.	Market segmentation could be used to design the appropriate price points to appeal to and incentivise customers. With some customers showing a strong attraction to price reductions offered to incentivise behaviour.
Strong preference for minimal sharing suggests potential appeal of low-cost automated vehicles for last-mile or even end-to-end trips.	It is recommended that governments and industry collaborate and play an active role to encourage the use of appropriate shared transport solutions as part of any MaaS schemes developed.
Potential for increased congestion could have damaging impacts on network efficiency and other as yet unknown negative externalities.	The highly positive associations with public transport should be leveraged as the primary product on which on-demand and MaaS models are built.

MaaS features that are considered most attractive include:

- Real-time dynamic information on schedules;
- Roaming was seen as valuable (ability to use transport services interstate from one account).

Stakeholders observed:

- Data access and sharing as significant challenges;
- Privacy implications for data sharing – both in light of cyber-security concerns and potential implications of GDPR and other potential changes to international and local data privacy regulations. This is an important issue to at least factor in to on-going discussions.

User groups and markets

Findings	Opportunity
The survey indicates that certain socio demographic groups are more likely to adopt MaaS now – this provides insights around which groups initial deployments could be prioritised and targeted.	User groups identified and segmented into personas would benefit from additional targeted research and usage modelling to develop potential business cases or deployment options across sectors and geographies.
Experts suggest young people will be likely 'early adopters' of MaaS schemes. Others highlight the massive potential of MaaS and on-demand transport to improve transport access for the elderly and mobility impaired.	Specific middle metro areas with existing but constrained public transport appears to provide another opportunity for MaaS and on-demand transport to supplement existing transport services.
Industry observers suggest that inner city suburbs of Sydney, Melbourne and Brisbane are locations where early MaaS deployments could be progressed.	Additional research and further interrogation of the survey data could ascertain some potential drivers or incentives that might nudge customers more effectively than others.
This research suggests some specific metropolitan and regional centres appear to provide good opportunities for MaaS and expanded on-demand trials and deployments.	More investigation recommended to better understand the communities and regions that are amendable to MaaS and the particular drivers behind that.

Key findings on early deployment potential

- Survey data highlights some regional areas are more amenable to MaaS. This presents opportunities for trials and early deployments.
- There is a preference for MaaS in middle suburbs with some access to public transport with a need for MaaS to supplement existing services.

Next steps

National Reference Committee

It is recommended that a National Reference Committee be established to continue the national collaboration that has been fostered during the establishment of this report and to strive for the best outcomes from MaaS and ODT across Australia's varous communities.

Scope:

- Use vision statement to establish baseline and framework of 'what success looks like'
- Roadmap to MaaS referencing regional variations
- Review progress against identified opportunity areas
- Consider alignment of current activity against the vision statement
- Develop tools and metrics to measure longitudinal developments
- Share learnings across organisations and outcomes of pilot programs and further research
- Share recent and planned activity to identify opportunities for collaboration

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Appendix A – MaaS models reviewed in detail

This section reviews past or current MaaS systems worldwide. We build on similar reviews conducted previously by, among others, Kamargianni et al. (2016), König et al. (2016) and Jittrapirom et al. (2017).

Based on these criteria, we've identified ten MaaS systems, either currently in operation, or that have operated in the past but are no longer in service. That being said, our review found that almost all major metropolitan regions in the world are in some stage of planning or implementing a MaaS trial.

The coming years are expected to witness a flurry of activity, as more players enter the market. We summarize the key attributes of each of these systems in Table 2.

UbiGo

The first MaaS system was piloted in 2013-14 in Gothenburg, Sweden under the name UbiGo (Sochor et al., 2014, 2015). The service offered participating households access to local public transport, car rental, car-share, taxi and bike-share services. In total, 195 individuals from 70 households trialled the service over a six-month period.

Sochor et al. (2015) describe the pilot as follows: "For its users, the UbiGo service offered one-stop access to the range of travel services [through a smartphone app]. Customers paid a monthly subscription adapted to their transport needs, which included a personalized combination of, and amounts of credit for, the different travel services. During the FOT [field operational trial], the minimum limit for prepaid credit was 1,200 Swedish krona (SEK) per month ($219 AUD) as of November 2014. (As a reference value, the 2013 gross median income for Gothenburg County was 244,463 SEK, ($44,690 AUD). Credit could be topped up or rolled over depending on how much credit the household utilized, and the subscription could be modified on a monthly basis. To encourage participation in the FOT, any unused credit was refunded to the participants at the end of the test. Also, the project could compensate participants for not using a private car during the FOT; i.e., to offset insurance, parking, etc., up to a fixed limit.

"To access their travel services, the UbiGo traveler logged into the app via a Google or Facebook login, where they could activate tickets and trips, make or check bookings and access already activated tickets (e.g., for validation purposes). The app also allowed them to check their balance, bonus, and trip history, and get support (in terms of FAQ–customer service). Each participant received a smartcard, which was used, for instance, to check out a bicycle from the bike sharing service or to unlock a booked car, but also charged with extra credit for the public transport system in case there was any problem using the UbiGo service. UbiGo also included a centralized customer service phone line that was open 24 hours per day."

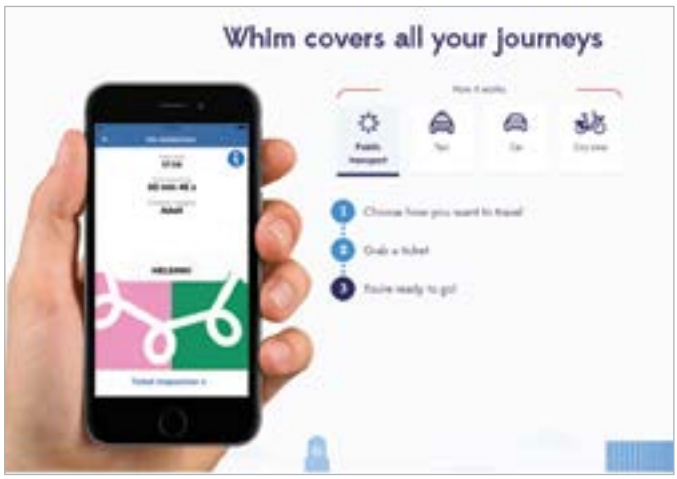
The development of UbiGo was led by the public sector, with the intention of offering a sustainable and viable alternative to private car ownership for local residents. The initial pilot was funded by Vinnova, the Swedish government agency that administers state funding for research and development. Currently, UbiGo are preparing for the relaunch in Stockholm in the beginning of next year in cooperation with platform provider Fluidtime.

Whim

Whim is a full service commercially available MaaS system that was launched in Helsinki, Finland in 2016. Whim uses a smartphone app that allows customers in the Helsinki metropolitan region access to local public transport, taxi and daily car rental services, with access to car-share and bike-share services expected to be added soon. Since its launch, Whim has commenced operations in the West Midlands, UK. The service is currently being trialled in Greater Amsterdam in the Netherlands and the Antwerp region in Belgium. The intent is to be a global MaaS provider. The company website states that "negotiations are ongoing in Austria, Canada, Singapore, and several other markets".

Whim has an integrated ticketing and payment system and a personalized journey planner. Whim currently offers three payment plans. The first is a pay-as-you-go plan that charges customers market prices for access to each of the available transport modes, with no commitment or surcharges. The plan is targeted at new customers who wish to trial the service, and customers who don't travel much. The second plan offers a monthly subscription at €49 per month ($75.00), and provides unlimited access to local public transport and discounted rates for taxi and daily car rental services. The plan is targeted at travellers who frequently use alternative modes of transport, and depend on private car access only occasionally. The third plan offers a monthly subscription at €499 per month ($767.00) and provides unlimited access to all available transport modes. The plan is marketed as a "modern alternative for owning a car" and is targeted at travellers who depend on private car access to fulfil most of their mobility needs, but do not wish to own a car.

The development of Whim has been led by the private sector. The service is operated by MaaS Global, a private company based in Helsinki. However, MaaS has enjoyed great support from the public sector in Finland. For example, Sonja Heikkilä's 2014 thesis, the first formal introduction of the concept of MaaS and its ability to reorganize the passenger transport sector, was commissioned by the Helsinki City Planning Department. The Finnish Transport Agency has continued to support the delivery of local MaaS solutions through the creation of appropriate national policies and strategies, investments in the necessary infrastructure, and the adoption of an open data policy.



Moovel

Moovel is a full service commercially available MaaS system in Germany. Moovel uses a smartphone app that allows customers in Germany access to car2go, a national car-share service; mytaxi, a national taxi service; Deutsche Bahn, the German national rail service provider; and selected bike-share services. In the cities of Stuttgart and Hamburg, customers also have access to local public transport services through Moovel. The service has an integrated ticketing and payment system and a personalized journey planner. The service currently offers a single pay-as-you-go payment plan with no registration fees that provides access to all available services.

The personalized journey planner is available as a standalone app by the same name in selected cities in Europe, North America, Asia and Australia. Moovel aims to be a global MaaS provider. As per their webpage, Moovel is trialing their MaaS systems currently in three American cities: Austin, Boston and Portland. Moovel also provides their digital platform to host MaaS systems in other places. For example, the Karlsruhe Transport Association, which oversees the management of public transport systems and services in Karlsruhe, Germany, uses the Moovel platform to host a MaaS system that is tailored to Karlsruhe, offered as a smartphone app by the name KVV.mobil. The system provides customers access to all local public transport services, local car-share services provided by the company stadtmobil, and local bike-share services provided by the company Fächerrad.

The development of Moovel has been led by the private sector. The company is owned by the auto manufacturer Daimler. It was created in 2016, as part of an industry wide trend that's seen other auto manufacturers like General Motors, Ford and BMW enter the mobility market as service providers as well. Moovel has experienced resistance from public transport agencies in many cities, out of fear that their business may be cannibalized by these new service providers (Muoio, 2017). In the cities where the service has been able to persuade public transport agencies to come on board, Moovel has employed a symbiotic approach, where the service earns a cut from ticket sales made using the app, and the public transport agencies get access to Moovel's data on how customers are using the local transport system.

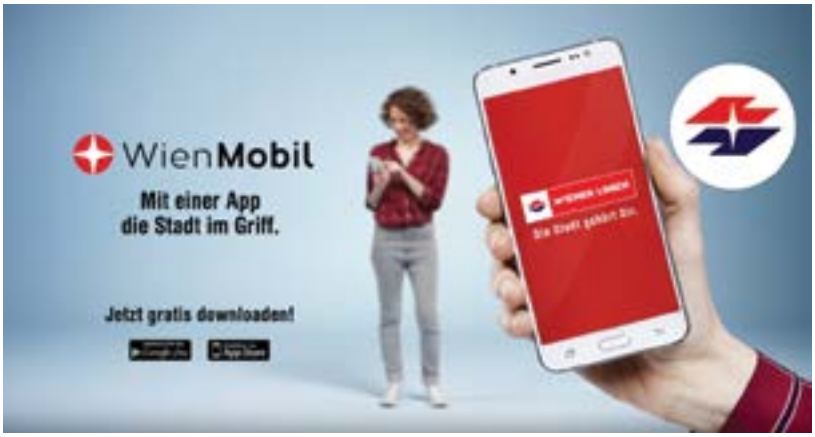
WienMobil

WienMobil is a full service commercially available MaaS system available in Vienna, Austria. WienMobil uses a smartphone app that offers customers access to local public transport, car-share, taxi, car park and bike-share services. It combines functionality from two previous public transport apps for customers in Vienna: qando, a public transport journey planner, and the Wiener Linien ticket app, for buying tickets to Vienna's local public transport system. The service emerged from an earlier prototype, called SMILE, that has been referenced by previous reviews.

With has an integrated ticketing and payment system, the service currently offers a single pay-as-you-go payment plan with no registration fees. However, the platform does require the user to register with the car-share and bike-share service providers separately, either through the WienMobil app or through their independent platforms. Registration information may be stored in the app and used to book these mobility services.

It has a built-in multimodal journey planner that offers a greater degree of personalisation than other MaaS systems. For example, the app can store information about student passes, season tickets, discounts and memberships, and integrate them in its calculation of fares and fees for different routes. The journey planner allows customers to compare different modes for a given trip in terms of not just the time and cost that they incur, but also their environmental impact.

WienMobil has been developed by Wiener Linien, a public-sector company under control of the Vienna city government that runs the majority of the public transport network in Vienna. However, as noted previously, the service has been able to integrate transport services provided by multiple private companies.



EMMA

EMMA is a full service commercially available MaaS system in Montpellier, France. It provides customers a single subscription card that can be used to access local tramway lines and bus routes; and car-share, car park, on street parking, bike-share and bike park services.

The project was led by the Public Transport Authority. Helped by Europeans funding and local funding Montpellier Agglomeration delegate the development to Transdev Company.

EMMA offers mobility contracts on a monthly or yearly basis. However, we are unable to find detailed information regarding the fee structure. König et al. (2016) report that the service charges separate prices for students, older customers, and companies, but they do not report the actual fee structure.

Both Kamargianni et al. (2016) and König et al. (2016) seem to indicate that the contracts offer unlimited access to public transport services, and pay-as-you-go access to car-share, car park and bike-share services, at possibly discounted rates. However, the monthly or yearly subscription includes all costs of services used passed through to customers subscription and registration fees.

EMMA has a smartphone application that allows customers to plan, book and pay for all available services, including any fines. The journey planner is dynamic and personalized, offering real-time updates on public transport services and parking availability in Montpellier. The app is available as a standalone journey planner for customers who haven't subscribed to the MaaS system.

Mobility Shop

Mobility Shop is a full service commercially available MaaS system that was launched in Hannover, Germany in February 2016. The service was developed by a collaborative project between ÜSTRA, one of the local public transport providers, and GVH, the Greater Hanover Transport Association that oversees the region's integrated public transport services. Primitive versions of the service were trialled in 2004, and again in 2014 and 2015, under the name Hannovermobil. The Hannovermobil service is still offered as a mobility bundle, under the broader umbrella of services provided by the Mobility Shop.

Mobility Shop offers customers access to the GVH, the local public transport service in Hannover; Deutsche Bahn, the German national rail service provider; stadtmobil, a car-share service; and Hallo Taxi, a local taxi operator. These services can be booked through a smartphone app or a web interface. The smartphone app has a built-in journey planner that allows customers to compare for a given trip the different transport services available through Mobility Shop. The service currently offers two payment plans. The first is a pay-as-you-go plan that charges customers market prices for access to local public transport services and car-share services, and 10 per cent discounted rates for the taxi services, with no commitment or surcharges. The plan does not include access to the Deutsche Bahn. The second plan, called Hannovermobil, is also a pay-as-you-go plan, but with a fixed overhead cost of €9.95 ($15.30) per month. Hannovermobil charges customers market prices for local public transport services, 25 per cent discounted rates for national rail services, lower tariff rates for the car-share services, and 20 per cent discounted rates for the taxi services.

There is no single smart card for access to the different mobility services. GVH tickets and stadtmobil car-share services can both be bought directly through the smartphone app or web interface. Deutsche Bahn tickets must be purchased directly from the rail operator, and discounts are enforced by providing customers an individual BahnCard 25, a discount card that entitles the holder to 25 per cent discounted rates on all services operated by the Deutsche Bahn. Hallo Taxi services may be booked by phone or hailed off the road. The customer must provide either the booking agent or the taxi driver their name and Mobility Shop customer ID. The appropriate discount is applied to the taxi fare and recorded against their monthly bill.

helloGo

helloGo is a full service MaaS system currently being trialled in the Netherlands. The system has been developed by the Keolis Group, a private sector company whose Dutch subsidiary Keolis Nederland operates a large fraction of bus and passenger train services in metropolitan and regional areas across the country. In addition to the local, regional and national public transport services operated by the company, HelloGo offers customers access to services operated by Nederlandse Spoorwegen, the main national passenger rail network; Leisure King for national bike rental; Gogido and Taxiboeken, taxi service providers; and MyWheels, a car sharing platform.

While helloGo offers access to transport services nationwide, Keolis Nederland focused early attention in terms of marketing on potential customers in the Utrecht metropolitan region. The helloGo trial was officially started in October 2017 with focus groups the helloGo app is now being tested live and will then be publicly launched.

HelloGo will be available as a smartphone app that offers an integrated digital platform for booking and payment across all transport services. The service will offer a single pay-as-you-go payment plan with no registration fees. HelloGo has a built-in multimodal journey planner that offers dynamic real-time updates and high degree of personalisation. For example, the app allows customers to save preferred transport modes, and search for routes based on speed, cost, environmental impacts, etc.

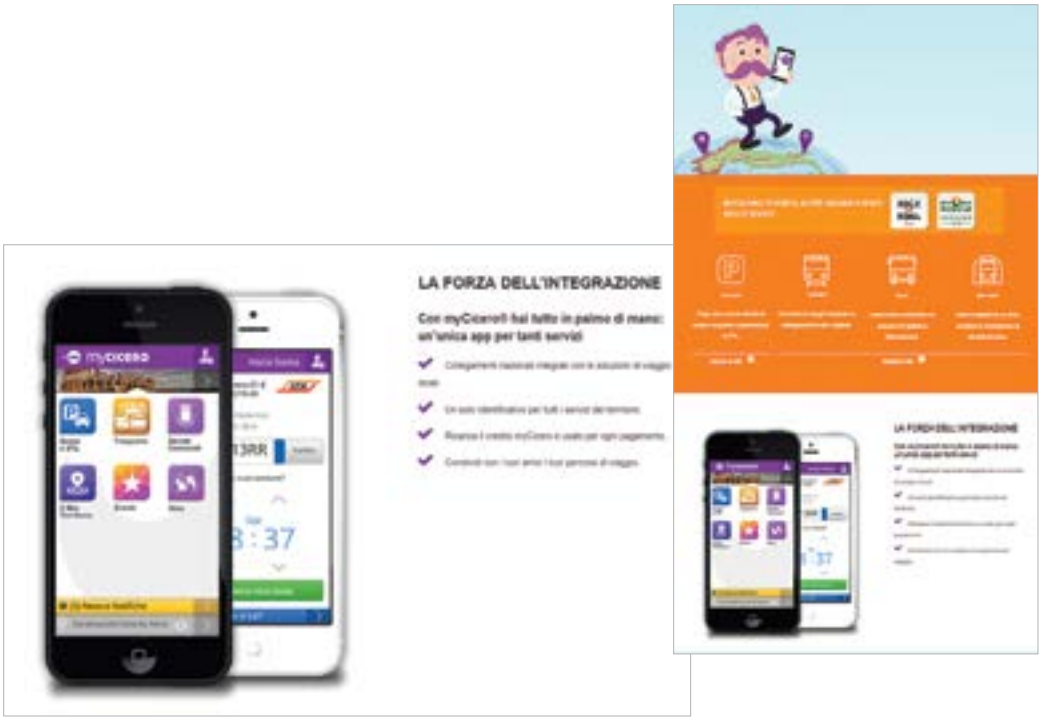
Didi

Didi is a partial service MaaS system commercially available in China. The system has been developed by Didi Chuxing, a privately-owned transport service provider in China. Didi began as a ride sharing app that quickly grew the company into one of the largest ride sharing companies in the world and the biggest ride-share service provider in China. In early 2018, the company integrated bike rental services operated by Ofo and Bluegogo within Didi. This is the first instance of the company cooperating with other third-party mobility service providers, and is part of Didi Chuxing's long-term plan to offer an integrated shared mobility platform.

Didi offers an integrated digital platform for booking and payment across ride sharing and bike rental services provided by the app. The service offers a single pay-as-you-go payment plan with no registration fees. Journey planning capabilities are limited by the fact that Didi currently does not provide access to public transport or other scheduled services. However, the app does allow customers to plan trips that require both ride sharing and bike rental services in an integrated manner.

myCicero

myCicero is a full service commercially available MaaS system across Italy that provides customers access to local, regional and national public transport and car parking services. The service is available through a smartphone app that offers an integrated ticketing and payment system. There are no registration fee and the service offers a single pay-as-you-go payment plan. The app has a built-in journey planner with some integrated functionality.



PostBus

PostBus is a commercially available MaaS system in Switzerland that offers customers access to all public transport services operating in Switzerland. However, PostBus does not currently offer access to privately owned and operated mobility services, such as car-share, ride-share or bike-share services. PostBus has an integrated ticketing and payment system, and currently offers a single pay-as-you-go payment plan with no registration fees that provides access to all available services. The service uses a smartphone app with a built-in personalized journey planner with real-time information and dynamic updates. For example, the app has a countdown function that displays departure times from the user's current location to their personally defined favourite destinations on the start screen, so they know exactly when to leave.

Choice / Ride Mate

Choice is a Queenstown pilot developed by NZ government targeted to visitors in accessing information and booking transport between Queenstown airport, the city and ski areas

Includes public transport, private transport (e.g. helicopter bookings), taxi and ride-share (e.g. Uber).

Ride Mate is an Auckland pilot, also developed by NZ government which includes public transport, private transport (e.g. shuttles), taxi and ride-share (e.g. Uber) it includes the ability to offer in-app rewards and discounts allows mobility suppliers to reach new customers and enables data to be collected and used for transport planning.

Appendix B – Customer Survey Questions

Do you currently have a valid drivers license?

- ○ Yes
- ○ No

How many cars does your household own?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5 or more

In addition to the cars that your household owns, you may have regular access to other cars, for example, through a friend, relative or employer. How many additional cars do you regularly have access to (i.e., the car is available when you need it, even though you do not own it)?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5 or more

How many motorbikes or scooters does your household own?

- ○ 0
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5 or more

Do you use any of the following devices regularly (please select all that apply):

- ☐ Manual wheelchair
- ☐ Power wheelchair or mobility scooter
- ☐ Walking stick
- ☐ Crutches
- ☐ Walker
- ☐ Pusher
- ☐ Other mobility device (Please specify): _____
- ○ No

How frequently do you use the following modes of transportation? Please select the option that best corresponds to your usage.

	Daily	Few times a week	Few times a month	Rarely or never	Unavailable
Private transport modes (owned by yourself, relative, friend, employer, etc)					
Car as driver	○	○	○	○	○
Car as passenger	○	○	○	○	○
Motorobike or similar	○	○	○	○	○
Bicycle / pushbike	○	○	○	○	○
Walking	○	○	○	○	○
Public transport services (owned and operated by a third party)					
Buses	○	○	○	○	○
Trains, trams, light rail	○	○	○	○	○
Ferries	○	○	○	○	○
Taxis	○	○	○	○	○
Car rental (e.g. Hertz, Thrifty)	○	○	○	○	○
Carshare (e.g. GoGet)	○	○	○	○	○
Rideshare (e.g. UberX)	○	○	○	○	○
Bikeshare (e.g. Reddygo, Melbourne Bike Share, City Cycles)	○	○	○	○	○

In an average week, how much money does your household roughly spend on transport (including car fuel, insurance and registration fees; public transport tickets; taxis and ride or car share, parking and road tolls, etc.)?

- ○ $0 - $49 per week
- ○ $50 - $99 per week
- ○ $100 - $149 per week
- ○ $150 - $199 per week
- ○ $200 - $249 per week
- ○ $250 - $299 per week
- ○ $300 - $349 per week
- ○ $350 - $399 per week
- ○ $400 - $599 per week
- ○ $600 - $799 per week
- ○ $800 - $999 per week
- ○ $1,000 or more per week

Think about the last time you used a taxi or ridesharing (e.g. Uber) service.

Do you remember how far you travelled for that trip? Your best guess is good enough.

[ ] kms

Do you remember the approximate fare? You best guess is good enough.

$ [ ]

Think about the last time you used a public transport service (e.g. bus, train, tram, ferry, etc.).

Do you remember how far you travelled for that trip? Your best guess is good enough.

[ ] kms

Do you remember the approximate fare? You best guess is good enough.

$ [ ]

Have you heard of Demand Responsive or On-Demand Transport (ODT)?

- ○ Yes
- ○ No

Have you used an ODT service before?

- ○ Yes
- ○ No

How familiar would you say you are with the concept of ODT?

- ○ Not familiar
- ○ Slightly familiar
- ○ Moderately familiar
- ○ Very familiar

On-demand transport

On-demand services offer flexible transport options that can be tailored to your needs. They are a cross between buses, taxis, and dial-a-ride services.

Think about a trip you take regularly, could be to work, to school, the shops, to a friend's house, etc. With on-demand transport you could either call or use your smartphone or other device to book a vehicle to pick you up and drop you off at your location, like a taxi, but sharing the service with others.

Alternatively it could be a fast, frequent service that stops near you and travels to a major transport hub or popular local centre that arrives every 5-10 minutes and you can track in real-time on your smartphone or other device.

In some cases, you may need to book a few hours ahead of time. In others, you may be able book a few minutes before you need to make the trip, exactly like a taxi service. Often you will be able to track the vehicle in real-time, like a package being delivered to you.

The pickup vehicle may be a bus or a smaller van. It may or may not need to pick up and drop off other passengers between picking you up and dropping you off, like a bus service.

The next few questions will ask you to consider options where you have access to different services of this type.

Scenario 1 of 4

Imagine that the following on-demand transport (ODT) service is available in your region:

Hover your cursor over the blue text for more information.

	On-demand transport (ODT) service
Price	$1.50 per kilometre
Vehicle sharing	You have the vehicle all to yourself
Booking	No, you can request a vehicle to pick you up in real-time (when you need it)
Route information	Pick-up and drop-off at designated bus stops, but the route may change in real-time based on passenger demand

How frequently would you use this service?

- ○ Daily
- ○ Few times a week
- ○ Few time a month
- ○ Rarely or never

What kind of trips would you use this service for? Please select all that apply. If you wouldn't use this service, you can skip this question.

- ☐ To get to a place of employment or education
- ☐ To get to a friend or family member's place of residence
- ☐ To run errands, like shop for groceries, bank visits, see a doctor, etc.
- ☐ For social trips, like eating out, watching a movie at a theatre, visiting a bar, etc.

Have you heard of the concept of Mobility as a Service (MaaS)?

- ○ Yes
- ○ No

How familiar would you say you are with the concept of MaaS?

- ○ Not familiar
- ○ Slightly familiar
- ○ Moderately familiar
- ○ Very familiar

Mobility-as-a-Service

Mobility-as-a-Service, or MaaS, is the idea that people can plan, book and pay for all their transport needs through a single interface, e.g smartphone app.

This can include; buses, trains, trams, ferries, taxis and car rentals, as well as carshare (e.g. GoGet), rideshare (e.g. UberX) and bikeshare (e.g. Reddygo, Ofo). You don't need to register independently with these different services. You just need to register with the MaaS provider, and you can access them all through a single smartcard or the smartphone app.

Describe where and when you want to go, and you will be given options to choose from, book, and pay for.

Some MaaS schemes could provide access to all transport services offered that you pay for as monthly subscription. Others might offer more flexible pay-as-you-go payment plans, at potentially discounted rates, but with reduced service options.

The next few questions will ask you to consider options where you have access to different services of this type.

Example scenario

Compare the schemes, and let us know which you prefer, whether you'd purchase your preferred scheme if it were available in the market today, and how you'd use it.

		Scheme A	Scheme B
Transport Services	Local public transport (buses, trams, local trains, ferries, etc.)	✗	✗
	Long distance buses and trains	✗	✗
	Taxis	✗	✗
	Car rental (e.g. Hertz, Thrifty)	✗	✗
	Carshare (e.g. GoGet)	✗	✗
	Rideshare (e.g. UberX)	✗	✓
	Bikeshare (e.g. Reddygo, Melbourne Bike Share, City Cycles)	✓	✓
Real-time information (e.g. service interruptions, schedule delays)		Unavailable	Unavailable
Personalization (e.g. save preferred services, show wheelchair friendly routes)		Available	Unavailable
Ticketing integration (i.e. can the same card or device be used for all transport services in the Scheme?)		Single card and/or device to access all services	Separate tickets/cards are needed to access different services
Booking integration (i.e. can the same platform be used to book all transport services in the Scheme?)		Bookings when needed can be made through a single digital platform	Bookings when needed must be made with the service provider
Costs		$10 per month for unlimited access to all services	$5 per month for pay-as-you-go access to all services

Scenario 1 of 4

Imagine that the following Mobility-as-a-Service (MaaS) schemes are available in your state. For each transport service type, imagine that the schemes offer equal access to all operators in your state that provide that service type. For example, a scheme that offers access to car rental services offers access to ALL car rental companies operating in your state.

		Scheme A	Scheme B
Transport Services	Local public transport (buses, trams, local trains, ferries, etc.)	✗	✗
	Long distance buses and trains	✗	✓
	Taxis	✓	✓
	Car rental (e.g. Hertz, Thrifty)	✓	✗
	Carshare (e.g. GoGet)	✗	✗
	Rideshare (e.g. UberX)	✗	✗
	Bikeshare (e.g. Reddygo, Melbourne Bike Share, City Cycles)	✗	✗
Real-time information (e.g. service interruptions, schedule delays)		Unavailable	Unavailable
Personalization (e.g. save preferred services, show wheelchair friendly routes)		Available	Unavailable
Ticketing integration (i.e. can the same card or device be used for all transport services in the Scheme?)		Separate tickets/cards are needed to access different services	Separate tickets/cards are needed to access different services
Booking integration (i.e. can the same platform be used to book all transport services in the Scheme?)		Bookings when needed can be made through a single digital platform	Bookings when needed can be made through a single digital platform
Costs		No monthly cost for pay-as-you-go access to all services	$5 per month for pay-as-you-go access to all services

Which of these service schemes do you prefer more?

- ○ Scheme A
- ○ Scheme B

Would you purchase this scheme, if it was available in the market today?

- ○ Yes
- ○ No

What kind of trips would you use this scheme for? Please select all that apply. If you wouldn't use this scheme, you can skip this question.

- ☐ To get to place of employment or education
- ☐ To get to a friend or family member's place of residence
- ☐ To run errands, like show for groceries, bank visits, see the doctor, etc.
- ☐ For social trips, like eating out, watching a movie at a theatre, visiting a bar, etc.

Imagine now that the Mobility as a Service (MaaS) scheme also offered the following services, in addition to integrated planning, booking and payment access to multiple transport modes and services. Which of these additional services would be important to you, and which would not be important?

	Important	Not important
Real-time information for different transport modes and services, and dynamic updates on trip delays, schedule changes, etc.	○	○
Access to price reductions as incentive to change current behavior	○	○
Recommendations for walking and bicycling (routes, information on en-route facilities, etc.)	○	○
Integration with retail and tourism services (restaurant bookings, shopping discounts, ski rentals, etc.)	○	○
Rewards systems (like a frequent flyer program where you get discounts the more you use the service)	○	○
Group travel benefits/discounts	○	○
Travel options tailored for specific needs (e.g. physical disability)	○	○
Ability to use transport services across states, i.e. 'roaming'	○	○
Provision of special services for increased safety and security	○	○

If a Mobility as a Service (MaaS) scheme were introduced tomorrow in your region, would you have a preference for who should operate the service:

- ☐ Private company without government oversight
- ☐ Private company with government oversight
- ☐ Community organisation without government oversight
- ☐ Community organisation with government oversight
- ☐ Government provider
- ○ No preference

How strongly do you agree or disagree with the following statements about driving, car ownership and related subjects:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Congestion is not a problem where I live	○	○	○	○	○
Finding car parking is easy	○	○	○	○	○
Where I live, people need a car of their own	○	○	○	○	○
Driving is fun	○	○	○	○	○
Owning a car is affordable	○	○	○	○	○

How strongly do you agree or disagree with the following statements about public transport services in your region:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Public transport in my region is reliable	○	○	○	○	○
Public transport in my region is convenient	○	○	○	○	○
Public transport in my region is comfortable	○	○	○	○	○
Public transport in my region is safe	○	○	○	○	○
Public transport in my region is affordable	○	○	○	○	○

How strongly do you agree or disagree with the following statements about carsharing and similar services:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Car sharing is a better way of using cars than everyone buying their own	○	○	○	○	○
Overall, sharing cars make sense	○	○	○	○	○
Sharing a car instead of owning my own is a good option for me	○	○	○	○	○
Car sharing schemes are a great way to have access to cars without owning one	○	○	○	○	○
More people should rent their cars to others when they are not using them	○	○	○	○	○

How strongly do you agree or disagree with the following statements about on-demand transport (ODT) schemes, such as those described previously in this survey:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I'd be concerned about ODT services having access to my real-time location information	○	○	○	○	○
ODT would help me depend less on a car	○	○	○	○	○
If ODT were available my household would need to buy fewer cars	○	○	○	○	○
If ODT were available I would not need to buy a car at all	○	○	○	○	○
If ODT were available I would delay buying my own car	○	○	○	○	○

How strongly do you agree or disagree with the following statements about Mobility-as-a-Service (MaaS) schemes, such as those described previously in this survey:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I'd be concerned about MaaS services having access to my real-time location information	○	○	○	○	○
MaaS would help me depend less on a car	○	○	○	○	○
If MaaS were available my household would need to buy fewer cars	○	○	○	○	○
If MaaS were available I would not need to buy a car at all	○	○	○	○	○
If MaaS were available I would delay buying my own car	○	○	○	○	○

How strongly do you agree or disagree with the following statements about your attitudes towards new technologies:

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
I enjoy taking chances in buying unfamiliar technologies just to get some variety in my purchases	○	○	○	○	○
When I see a new technology, I often try it just to see what it is like	○	○	○	○	○
I shop around a lot for new technology just to find out more about the lastest advancements	○	○	○	○	○
I like introducing new technologies to my friends	○	○	○	○	○
I get bored with buying the same technology brands even if they are good	○	○	○	○	○
I often read information about new technologies just out of curiosity	○	○	○	○	○

What is your year of birth?

What is your gender?

- Male
- Female
- Other

What is the highest level of education you have completed?

- Doctoral Degree
- Masters Degree
- Graduate Certificate or Graduate Diploma
- Bachelors Degree or Honours
- Diploma, Advanced Diploma or Associate Degree
- Certificates I-IV
- Year 12 or equivalent
- Year 11 or equivalent
- Year 10 or equivalent
- Year 9 or below
- Other (Please specify):

Which of the following best describes your current employment status?

- Employed full time
- Employed part time
- Unemployed
- Not in the labour force - Stay-at-home parent or caregiver
- Not in the labour force - Retired
- Not in the labour force - Other (Please specify):

What is the suburb of your current place of residence?

A suburb list will populate as you type, please select the relevant suburb from the list.

What is the suburb of the place outside your home that you most frequently visit (e.g. place of employment or education, friend's house, etc). If you don't know the suburb, please leave blank.

A suburb list will populate as you type, please select the relevant suburb from the list.

How many people (including yourself) are part of your household?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5 or more

Which of the following best describes your household composition and your role in it?

- ○ Couple with no children
- ○ Couple with children living at home
- ○ Couple where all children have left home
- ○ Single parent with children living at home
- ○ Single parent where all children have left home
- ○ Single parent household
- ○ Group household (shared with non-relatives)
- ○ Single living with parents
- ○ Living with your son/daughter
- ○ Other (Please specify):

What is your total household income? Do not deduct taxes, superannuation contributions, health insurance, amounts salary sacrificed, or any other automatic deductions. Include income from all sources, including wages or earnings, assistance for children, unemployment benefits, pensions, student allowances, workers' compensation, etc.

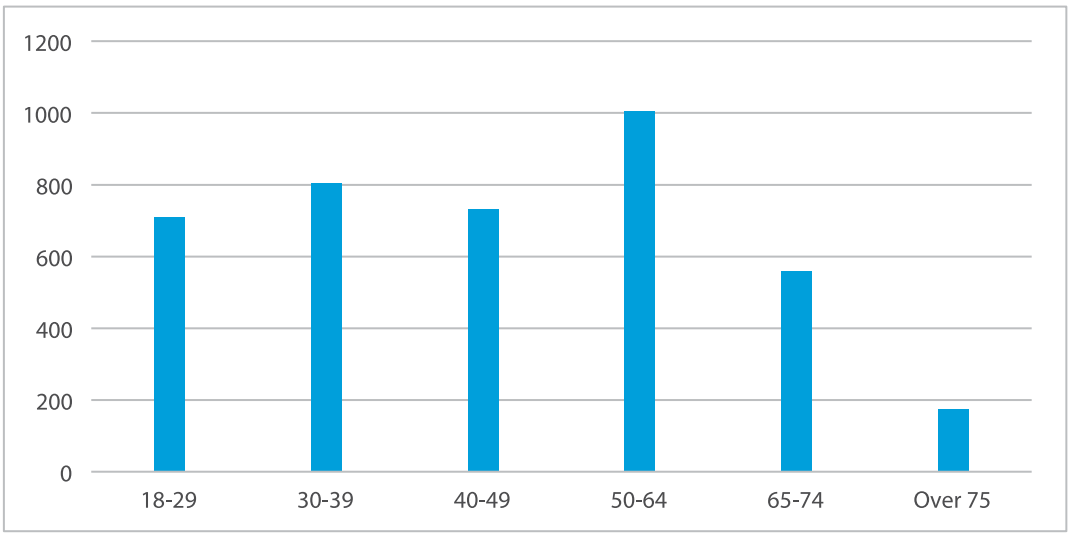
- ○ $1 - $149 per week (i.e. $1 - $7,799 per year)
- ○ $150 - $299 per week (i.e. $7,800 - $15,599 per year)
- ○ $300 - $399 per week (i.e. $15,600 - $20,799 per year)
- ○ $400 - $499 per week (i.e. $20,800 - $25,999 per year)
- ○ $500 - $649 per week (i.e. $26,000 - $33,799 per year)
- ○ $650 - $799 per week (i.e. $33,800 - $41,599 per year)
- ○ $800 - $999 per week (i.e. $41,600 - $51,999 per year)
- ○ $1,000 - $1,249 per week (i.e. $52,000 - $64,999 per year)
- ○ $1,250 - $1,499 per week(i.e. $65,000 - $77,999 per year)
- ○ $1,500 - $1,749 per week(i.e. $78,000 - $90,999 per year)
- ○ $1,750 - $1,999 per week (i.e. $91,000 - $103,999 per year)
- ○ $2,000 - $2,499 per week (i.e. $104,000 - $129,999 per year)
- ○ $2,500 - $2,999 per week (i.e. $130,000 - $155,999 per year)
- ○ $3,000 - $3,999 per week (i.e. $156,000 - $207,999 per year)
- ○ $4,000 or more per week (i.e. $208,000 or more per year)
- ○ Prefer not to say

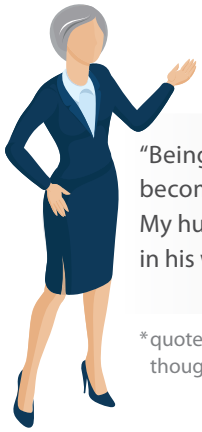

Thank you
Before you submit the survey, if you have any opinions regarding this survey, please type in the box below. This will help us to improve our future surveys.
Please click the button on the bottom right to submit your responses. Once submitted, you will be redirected to the panel incentive page.

Appendix C – Customer Survey Demographics

Who did we talk to?

AGE



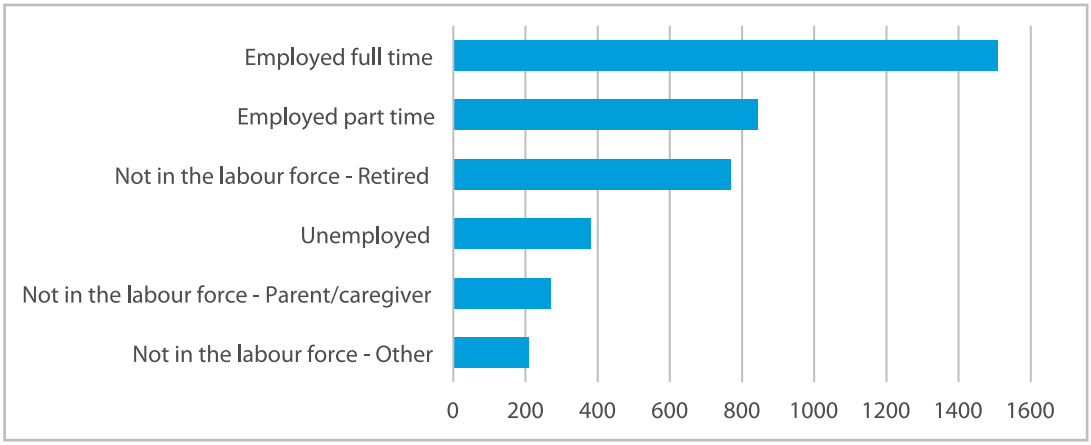


"Being an older person I think this could become a very useful thing to happen. My husband would not agree, he is more set in his ways (and too) old school."*

*quotes taken from respondents asked their thoughts on the survey.

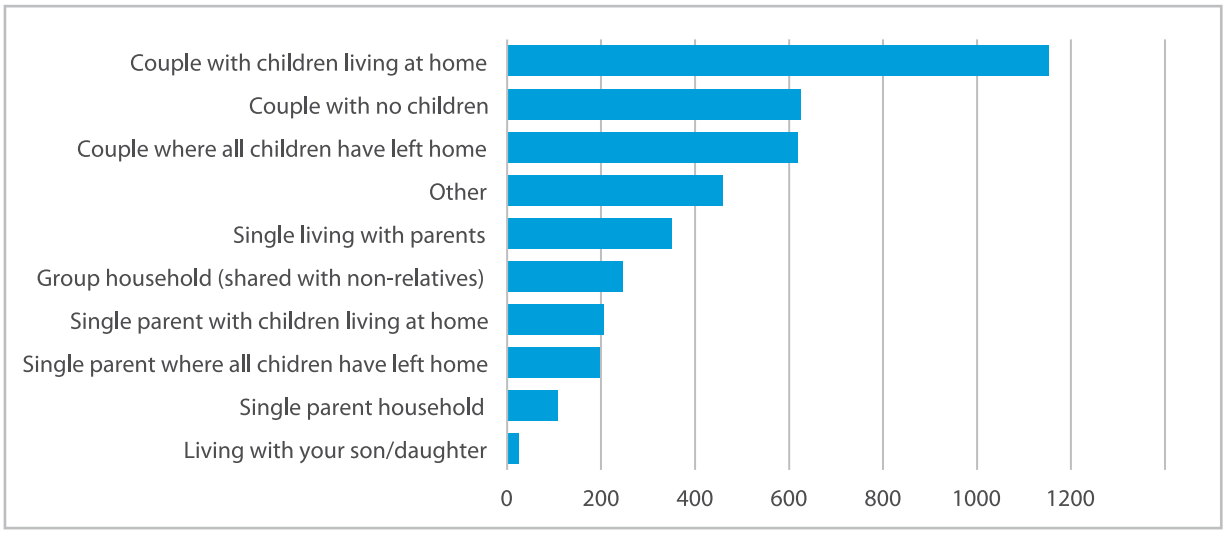
51%

EMPLOYMENT & EDUCATION



Education Level	% of sample
Year 9–11 of high school	14%
Year 12 Certificate	16%
Certificate I–IV or Diploma	30%
University Degree	40%

AGE

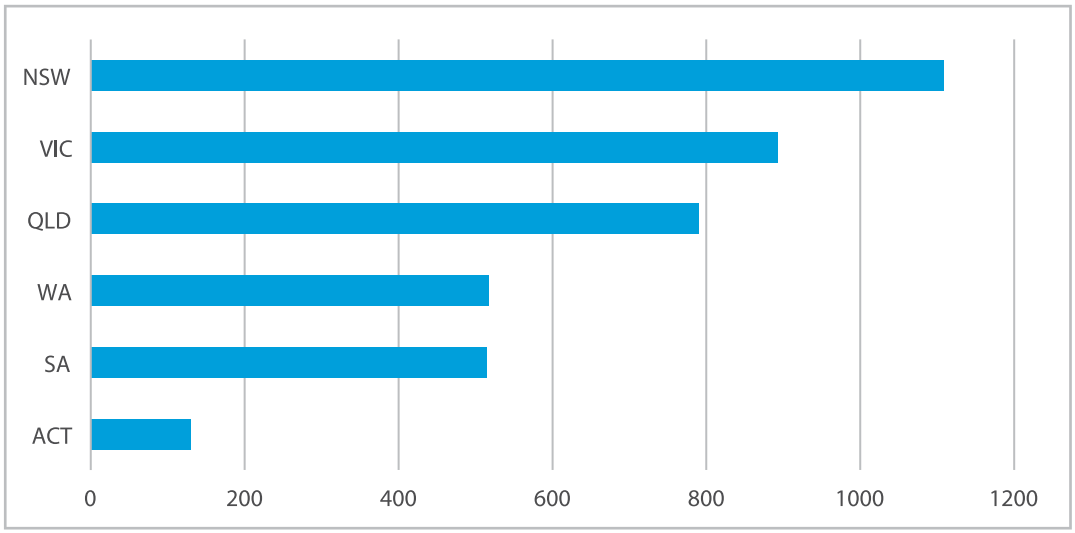


"Thank you. I really look forward to this kind of public/sharing/technology based transportation which is affordable, safe and convenient for all ages, young and old."

*quotes taken from respondents asked their thoughts on the survey.

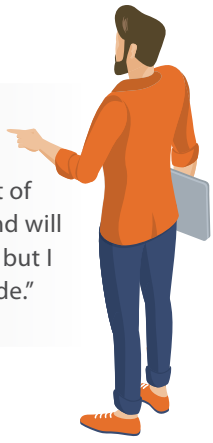
Where do they live?

STATE

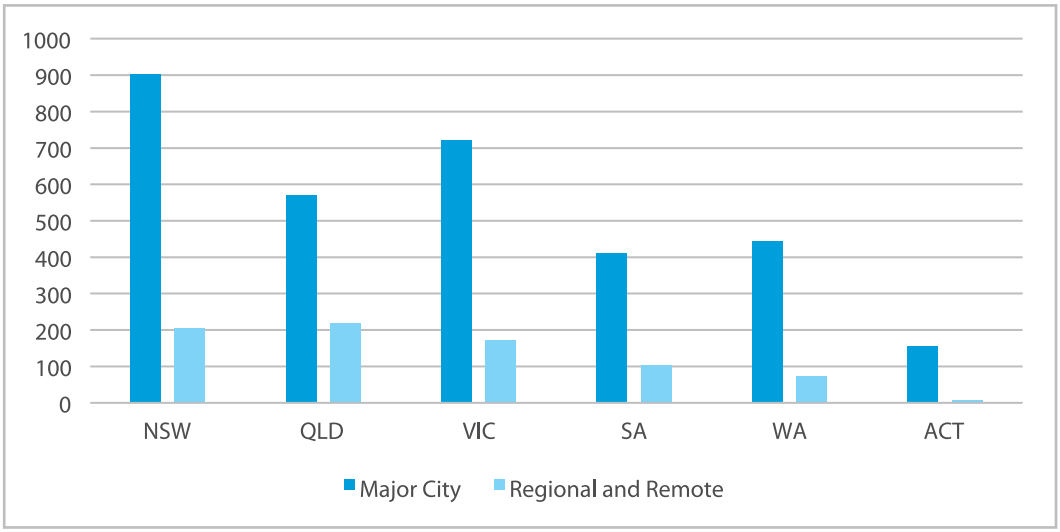


"As much as I dislike traffic I don't think options match owning your own car's flexibility. Perhaps en-mass deployment of self driving vehicles available on demand will replace this need if priced low enough, but I don't see this happening within a decade."

*quotes taken from respondents asked their thoughts on the survey.



METRO & REGIONAL

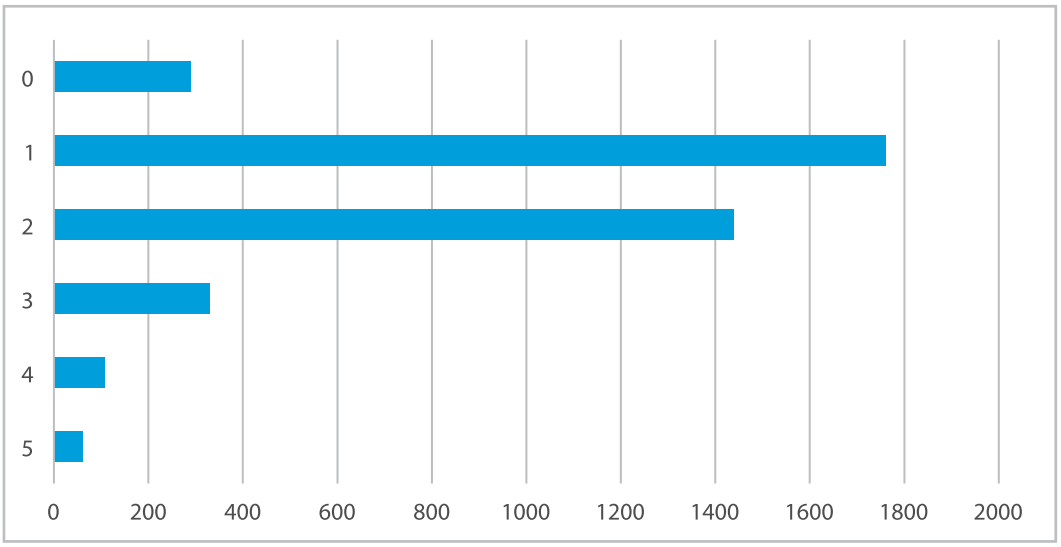


"If I ever found myself unable to drive, these schemes would be attractive as it is a fair way for me to walk to a bus stop."

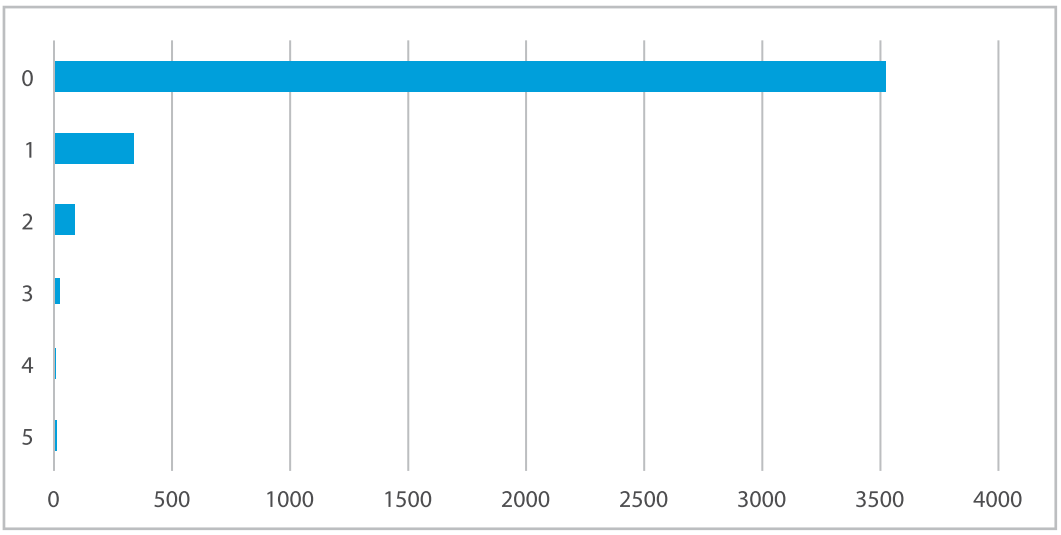
*quotes taken from respondents asked their thoughts on the survey.

What transport do they own?

CAR & MOTORBIKE

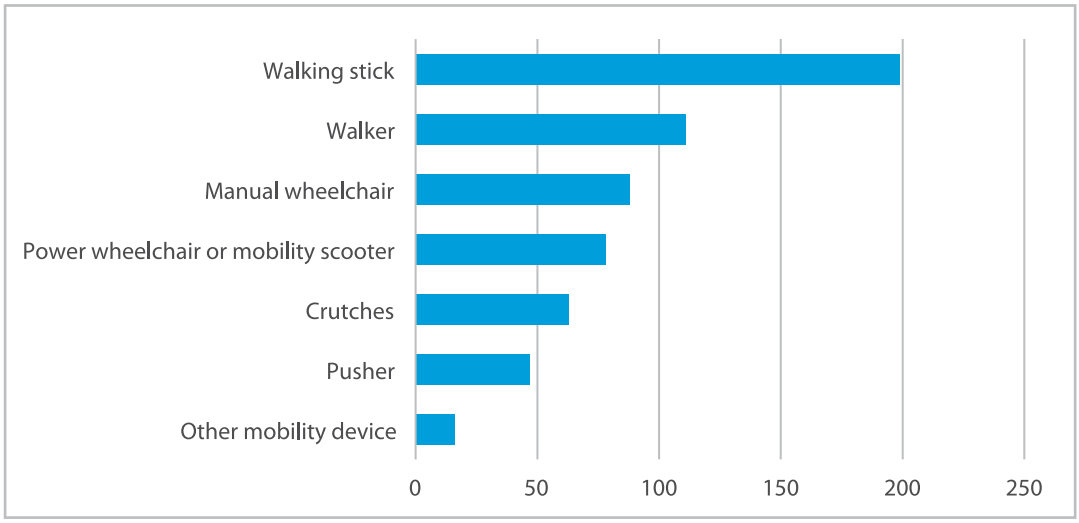


Car ownership



Motorbike ownership

MOBILITY AIDS



"I enjoyed this survey and seeing the possibilities of a future transportation system. I personally do not like to drive, but these days public transport cost[s] too much and when you bring kids in [to] the equation it works out cheaper to drive for short distances. [The] transport system is very convenient for me in my area, if the cost can be brought down i.e. $50 per month option I would certainly consider using that and I think it will reduce much of the traffic congestion and improve overall environment around the suburbs."

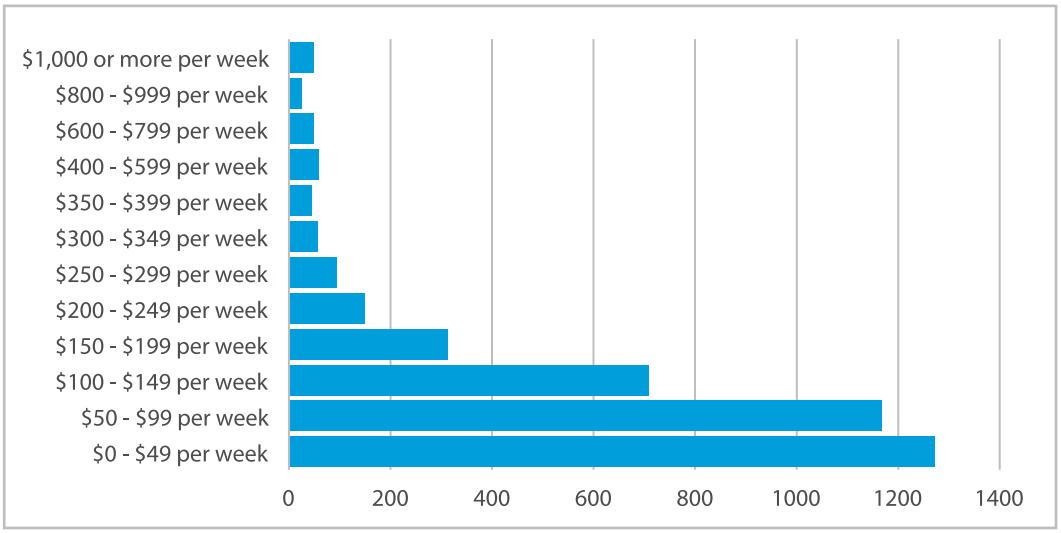
*quotes taken from respondents asked their thoughts on the survey.

What transport do they use?

TRANSPORT TYPES

Mode	Daily	Few times a week	Few times a month	Rarely or never	Unavailable
Car as driver	56%	26%	5%	7%	7%
Walking	41%	30%	14%	11%	4%
Car as passenger	8%	37%	29%	23%	3%
Trains, trams, light rail	7%	12%	22%	46%	13%
Buses	6%	13%	19%	52%	10%
Taxis	1%	3%	15%	67%	14%
Ride-share (e.g. UberX)	1%	3%	9%	53%	35%
Ferries	1%	2%	6%	56%	35%
Car rental	1%	2%	4%	68%	25%
Car-share (e.g. GoGet)	1%	2%	3%	52%	43%
Bicycle / pushbike	3%	7%	11%	39%	40%
Bike-share (e.g. Reddygo, City Cycles)	1%	2%	2%	48%	47%
Motorbike or similar	2%	4%	4%	34%	57%

TRANSPORT SPEND



Survey demographics as compared with the ABS population distribution

In surveying 4000 demographically representative Australians across urban, regional and rural areas, our survey sample closely matched the Australian Bureau of Statistics Census data.

Table 1: Sample distribution across states, and how it compares with the ABS population distribution.

State/Territory	Sample		ABS proportion
	Size	Proportion	
New South Wales	1108	28.0%	31.9%
Victoria	893	22.6%	25.7%
Queensland	790	20.0%	20.0%
South Australia	514	13.0%	7.0%
Western Australia	517	13.1%	10.5%
Northern Territory	0	0.0%	1.0%
Tasmania	0	0.0%	2.1%
Australian Capital Territory	130	3.3%	1.7%

Table 2: Sample distribution across different remoteness areas, and how it compares with the ABS population distribution.

Australian Statistical Geography Standard (ASGS) Remoteness Designation	Sample		ABS proportion
	Size	Proportion	
Major cities of Australia	3207	80.5%	71.2%
Inner regional Australia	541	13.6%	18.2%
Outer regional Australia	204	5.1%	8.5%
Remote Australia	21	0.5%	1.2%
Very remote Australia	12	0.3%	0.8%

Table 3: Sample distribution across different age groups, and how it compares with the ABS population distribution.

Age group	Sample		ABS proportion
	Size	Proportion	
Under 18 years old	0	0.0%	22.4%
18-29 years old	710	17.0%	16.9%
30-39 years old	805	20.0%	14.1%
40-49 years old	733	18.0%	13.4%
50-64 years old	1005	25.0%	18.0%
65-74 years old	558	14.0%	8.6%
75 years and older	174	4.0%	6.6%

Table 4: Sample distribution across genders, and how it compares with the ABS population distribution.

Gender	Sample		ABS proportion
	Size	Proportion	
Male	1936	48.6%	50.1%
Female	2041	51.2%	49.9%
Other	8	0.2%	0.0%

Table 5: Sample distribution across different employment categories and how it compares with the ABS population distribution.

Employment status	Sample		ABS proportion
	Size	Proportion	
Employed	2352	59.0%	56.1%
Unemployed	382	9.6%	4.1%
Not in the labour force	1251	31.4%	33.1%
Labour force status not stated	0	0.0%	6.7%

Table 6: Sample distribution across different education levels and how it compares with the ABS population distribution.

Highest educational attainment level	Sample		ABS proportion
	Size	Proportion	
Postgraduate Degree	425	10.7%	6.3%
Graduate Diploma	188	4.7%	2.2%
Bachelor Degree	973	24.4%	16.2%
Advanced Diploma	550	13.8%	8.6%
Certificate III/IV	637	16.0%	24.2%
Year 12 or equivalent	655	16.4%	17.9%
Year 11	133	3.3%	5.6%
Year 10	304	7.6%	11.0%
Below Year 10	81	2.0%	8.0%
Other	39	1.0%	0.0%

Table 7: Sample distribution across different household size categories and how it compares with the ABS population distribution.

Household size	Sample		ABS proportion
	Size	Proportion	
1	705	17.7%	24.4%
2	1478	37.1%	33.4%
3	732	18.4%	16.2%
4	669	16.8%	15.9%
5 or more	401	10.1%	10.1%

Table 8: Sample distribution across different household structure categories and how it compares with the ABS population distribution.

Household structure	Sample		ABS proportion
	Size	Proportion	
Couples with children	1153	28.9%	30.3%
Couples without children	1244	31.2%	24.8%
One parent families	314	7.9%	10.4%
Group household	245	6.1%	4.0%
Lone person	705	17.7%	22.8%
Visitor only households	0	0.0%	1.7%
Other	324	8.1%	6.0%

Table 9: Sample distribution across different household income categories and how it compares with the ABS population distribution.

Household income	Sample		ABS proportion
	Size	Proportion	
Neg/Nil Income	0	0.0%	1.6%
$1 - $149 per week	79	2.0%	0.8%
$150 - $299 per week	95	2.4%	2.0%
$300 - $399 per week	115	2.9%	2.8%
$400 - $499 per week	207	5.2%	6.4%
$500 - $649 per week	241	6.0%	4.3%
$650 - $799 per week	266	6.7%	7.0%
$800 - $999 per week	307	7.7%	6.6%
$1,000 - $1,249 per week	331	8.3%	8.0%
$1,250 - $1,499 per week	268	6.7%	7.2%
$1,500 - $1,749 per week	303	7.6%	5.8%
$1,750 - $1,999 per week	300	7.5%	5.6%
$2,000 - $2,499 per week	300	7.5%	10.4%
$2,500 - $2,999 per week	255	6.4%	6.4%
$3,000 - $3,999 per week	201	5.0%	7.8%
$4,000 or more per week	147	3.7%	6.8%
Prefer not to say	570	14.3%	10.4%

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ITS Australia Head Office

Suite 22, 574 Plummer Street,
Port Melbourne VIC 3207
Australia

T +61 3 9646 6466
E admin@its-australia.com.au
www.its-australia.com.au