Automated Decision-Making for Future Transport Mobilities

Stakeholder Perspectives

ADM +S ARC Centre of Excellence for Automated Decision-Making and Society

MONASH University

Acknowledgement of Country

We acknowledge that this research was conducted on the unceded lands of the Wurundjeri people and pay our deepest respects to their Elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.

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Preface

The *Automated Decision-Making for Future Transport Mobilities: Stakeholder Perspectives* report identifies how stakeholders in the mobilities industry define emerging trends in transport automation, their views on future technology, and how they envision people using it in the future.

In presenting this report we have sought to represent the views and understandings presented to us by diverse automobilities sector stakeholders. We emphasise that the views on ADM in transport mobilities discussed in this report are those of the participants in our research, rather than our own views as mobilities scholars. We present the findings of 24 interviews with stakeholders from government, consultancies, peak bodies, technology providers and not-for-profits. Participants were primarily located in Australia (with three located in France, Sweden and America). Our focus is on futures likely to affect Australians.

Our participants were experts across different areas of focus in the automobilities sector, and each brought a different emphasis to our discussions. We stress, this report is not intended to deliver a vision of, or argument about, the future of automated mobility. But rather an account of the patterns and priorities that emerged when stakeholders explored it with us. Where possible we have shown where their views converge across sectors, and account for how different participants focused on different elements of the future of automated mobilities.

This research represents a snapshot in time, just after the Covid-19 pandemic lockdowns in Australia. In this fast-moving technology space specific developments in ADM and AI are continually surpassing themselves, therefore, creating an up-to-date report on stakeholder approaches to the most recent technologies is impossible. Rather we are concerned with how stakeholders learnt about and define the place of automation in the industry and sector, how they envisaged futures, if these visions align with dominant narratives, and which examples they picked to tell us the stories they found important to demonstrate their views on the future of automated mobilities.

We have not critiqued the assumptions of participants in our research from a scholarly perspective. Participants in anthropological research frequently hold views unaligned to those of anthropological scholarship about technology futures. That is precisely why we must ask the questions about what people know, how they know and how they use that knowledge to imagine futures. We are likely to engage our findings further in scholarship concerning the sector and the assumptions underpinning the work of its stakeholders involved in it. We encourage other scholars to engage with our report in the same spirit; as a demonstration of how a group of expert stakeholders understand their sector.

Sarah Pink and Emma Quilty
December 2023

Background

Automation is predicted to be one of the most significant and disruptive developments to impact the transport industry. Automated decision-making is already present in vehicles used for private use in the form of technologies such as automatic emergency braking, forward collision warning, and adaptive cruise control.

Commercially autonomous vehicles are becoming increasingly common in high-risk sites, such as open-cut mines where Australia is heralded as the world leader in autonomous haul trucks. A number of shuttle buses are being trialled around Australia testing the feasibility of autonomous buses to close the first and last mile of trips, as well as to evaluate the public's levels of trust and confidence in autonomous vehicles.

Transport technology has undergone a series of what historian Peter Norton (2021, p.34) calls 'techno-futuristic eras', that he maps onto a corresponding setup of transformative technologies anticipated to change how people and things move. The current era we are in now is driven by a vision of 'data-driven autonomy'. This sociotechnical vision encompasses new and emerging technologies including machine learning, wireless networks, and connectivity.

This *Automated Decision-Making in Transport and Mobilities: Stakeholder Perspectives* report details the **findings from 24 interviews** conducted with a range of stakeholders from government, consultancies, peak bodies, to technology providers and not-for-profits. It represents the second part of a two-stage scoping study that aims to identify emerging trends in transport automation, the future trajectories of this technology and how the people using this technology are being envisioned in the future. The first stage of this study involved a desk-based qualitative content analysis of over 60 industry and government reports. It identified the key trends, predictions and visions for the future of automation in transport, and is published in the Automated decision making in transport mobilities: review of industry trends and visions for the future report.

Executive summary

- Most participants expressed a sense of inevitability when it came to the integration of automation in transport and mobilities in the future.
- All except two of the 24 participants we interviewed were optimistic about the integration of automated decision-making (ADM) into the transport sector.
- To keep up with technology and transport mobility trends participants used sources, including social media platforms,consultancy reports, in-person events. They were aware of and cautious about hype in these sources.
- Future automated mobilities stakeholders source expertise in automation from organisations including peak bodies and consultancies, and research and development programs.
- Participants were hesitant to define or explain AI, tended not to be precise and differed in their emphasis. Only one of the 24 participants offered a definition of ADM.
- Most participants were confident that benefits would be delivered through automated mobility technologies but more than 50% were concerned about hype. The key benefits anticipated were increased efficiency, convenience, reducing labour costs, sustainability (via electrification), and increased productivity and safety.
- The key challenges and difficulties participants envisaged in a shift to automated mobility were: privacy, safety and gender; social norms and government regulations; engagement with digital services, media representation; government reluctance; the shift to working from home; reskilling employees in the mobility sector; and consumer trust in autonomous vehicles.
- In future visions participants identified: private use self-driving cars or automated vehicles; heavy industry automation in trucking, mining and agriculture and logistics; automation in the 'micro-logistics' sector of e-bike deliveries
- Participants saw ADM as being integrated into existing informational (e.g. connectivity) and material (e.g. smart roads) infrastructures.

- Participants envisioned digital platforms playing a role in the future of automation of transport through Mobility as a Service (MaaS), digital twins and ridesharing.

- Participant concerns about future automated transport: regulation and responsibility: lack of planning; impact on employment; infrastructure and urban design; control.

- Consumer needs were a key concern for our participants. They used surveys, forums and focus groups and expert consultation to understand consumer needs.

- Stakeholders we interviewed believed both consumers who are public transport users and people with impaired or limited mobility would be impacted by automated mobility.

- Stakeholders suggested considering the following in plans for Australia's future automated mobilities: the techno-political landscape; car culture; the spatial distribution of the population; possible rural population growth; shared micro-mobility impact on footpath space; anti-cyclist attitudes regarding active mobility; social trust

How to read this report

If you want to know the key findings from this report and you don't have much time - start with the **summary** (page 3).

If you are after details about the project's aims and objectives then head to **section one** (page 12).

If you want to know more about the background of this project, our previous report and how it 'fits' in the broader automation context, head to **section two** (page 16).

If you want to get straight into the practicalities of how we did the research, how we found our participants and the methodologies we based our techniques on, head over to **section three** (page 21).

If you want to jump straight to the findings from the interviews with stakeholders about how they understand automation in their field: how they keep up with the latest tech news, define key concepts and their hopes and concerns for the future, head to **section four** (page 32).

If you want to know more about how stakeholders anticipated the future of automation and transport in Australia, check out **section 5** (page 37).

Glossary of terms

ADM	**Automated Decision-Making**: When decision-making is delegated to a machine and carried out in relation to input data
AI	**Artificial Intelligence**: technologies that can perform tasks or solve problems using algorithms and machine learning, ideally without the direct intervention of humans
AV	**Autonomous Vehicle**: a driverless car or vehicle that is capable of detecting its surroundings sufficiently to navigate without a human driver
CAV	**Connected and automated vehicle**: this technology allows vehicles to exchange data through wireless communication
EV	**Electric Vehicle**: any vehicle, usually an automobile, that uses an electric motor for propulsion
ITS	**Intelligent transport systems**: use advanced information and communication technologies applied to vehicles and transport infrastructure
MaaS	**Mobility as a Service**: new service that, through a connected digital platform, enables users to plan, book, and pay for multiple types of mobility services
Micromobility	**Micromobility** refers to small, lightweight devices such as bicycles (including e-bicycles and shared bicycles), scooters and skateboards that typically operate at speeds below 25 km/h

Platooning	**Platooning** is a method for driving a group of vehicles together designed to increase the capacity of roads
SAE	The **SAE Levels of Driving Automation** are a taxonomy of six levels of driving automation, from Level 0 (no driving automation) to Level 5 (full driving automation), in the context of motor vehicles and their operation on roadways
Smart highways	**Smart highways** or freeways have information, communications, and control systems incorporated in and alongside the road
Techno-solutionism	**Techno-solutionism** is an endemic ideology that recasts complex social phenomena like politics, public health, education, and law enforcement as “neatly defined problems with definite, computable solutions (Schull 2013)
UAV	**UAV:** Unmanned aerial vehicles; also referred to as drones
V2V	**Vehicle to vehicle technology:** refers to communication that enables vehicles to wirelessly exchange information
V2X	**Vehicle to Everything:** refers to communication between vehicle to other parts of the traffic system

Report overview

The first section of the findings details the key sources of information that stakeholders use to inform their understandings of automation and transport mobilities. Social media sites Linkedin and Twitter were the most popular platforms stakeholders used to access information, tending to prefer shorter articles over longer, more technical reports. This section also details their definitions of key terms, including automation, AI and automated decision-making [hereafter ADM].

The second section of the report explores how the organisations the stakeholders work for are engaging with automation, specifically whether they are sourcing or delivering expertise in automation. This section will also detail the key anticipated benefits and challenges automation will bring to transport and mobilities.

The third section of the report presents findings regarding the visions for the future of ADM in transport and mobilities. Participants discussed a variety of ADM applications including: everyday transport, heavy industry, logistics, infrastructure and digital platforms.

The fourth section explores how stakeholders understand consumers' needs and who they believe will be impacted by the anticipated changes.

The fifth and final section is about stakeholders and what they believe the future of ADM in transport and mobilities will look like in an Australian context. Specifically what is special or different about implementing automation in the Australian social and geophysical context.

Research process

Recruitment

Participants we interviewed were recruited by the research team in alignment with the report categories defined in our stage 1 project to represent consultancies, peak transport bodies, government transport departments, technology providers and not-for-profit organisations.

We further organised these stakeholders into 7 categories:

1. Government
2. Peak body
3. Technology provider
4. Consultancy
5. Research Centre
6. Not-for-profit organisation
7. Automotive manufacturer
8. Mining corporation

We interviewed a total of (24) participants, (6) from government departments, (5) from transport related peak bodies, (5) from technology providers, (3) from consultancies, (2) from research centres, (1) automotive manufacturer, (1) mining corporation and (1) from transport-related not-for-profit organisations.

Semi-Structured Interviews

Due to the social distancing requirements and travel restrictions related to the COVID-19 pandemic, the interviews were conducted remotely, primarily through online video conferencing and recorded videos,

Participants were primarily located in Australia (with the exception of three participants who were located in France, Sweden and America, respectively). Participants were recruited using snowball sampling. Interviews were audio and video recorded using Zoom, with the average interview length being approximately 60 minutes long.

Use of participant data

Depending on the preference of the research participant, either a pseudonym or their first name is used.

Quotes from participants are essentially verbatim, but [square brackets] indicate language not spoken by the participant that is needed to provide greater clarity or context to the direct quote. Ellipsis points (...) signal a break in the quote where the participant said other words that were deleted for brevity. This editing is never used to alter the meaning of the quote, only to provide greater clarity for the reader.

All names, quotes and images are used with participants' consent, in accordance with our human ethics procedures.

Analysis

The interview transcripts were imported into NVivo and coded using thematic analysis techniques (Clarke and Braun 2021). The categories for the coding structure were developed using the interview question guide used during the interviews with participants (see appendix A).

1. Understandings of Automation in the Transport and Mobilities field

In our interviews we asked participants about the main ways they keep in touch with trends relating to technology and transport mobilities. We also asked them to define key concepts including artificial intelligence and automated decision-making.

Keeping Up with Technology and Transport Mobilities Trends

The majority of participants used a combination of sources to keep up with the trends and the changes in the transport industry. Most participants sourced elements of their knowledge about future automated mobility from digital platforms, such as Linkedin and Twitter. For example, they may follow transport associations and peak bodies on Linkedin, read the reports released by the major Australian consultancies and watch webinars. Some participants attended in person events - such as conferences and car shows - although this has slowed down since the pandemic. These opportunities are limited due to the time and cost.

Most people indicated that they read shorter pieces online (accessed via Linkedin or digital newsletters), preferring these over longer and more technical reports.

Some participants who work for consultancies, technology providers, research centres and government departments mentioned engaging with academic research conducted by others, where relevant.

Several participants expressed criticism towards the major consultancies when it came to the future of automated mobilities. One participant felt that the consultancies did not offer anything new or valuable:

> *To be honest sometimes they don't really think they have also started the journey when we have started the journey, so it's like we are on the same level, so it's more like I don't really get anything new from them.* (Mary, Board Member at a Swedish Automotive Manufacturer)

Others, who work for technology providers and peak bodies, expressed concerns about the hype that is created through documents such as consultancy reports and predictions. On the one hand, these documents create a sense of pressure or urgency to make the necessary technological and infrastructural changes to support the widespread automation of transport. On the other hand, as one participant who works for a technology provider expressed, the predictions are not always accurate and can contribute to creating hype:

> *If you look at 2015 there's a graph [predicting] that by 2021 we'd have more than 40% of autonomous vehicles on our roads. So you can see that we've really stuffed up the prediction and I think it was that phenomenon of over-hype by the industry.* (Henry, Project Manager at an Australian Technology Provider)

Australia was framed by the participant below as a relatively small player in the global automotive market:

> *I think there was a lot of hype that we were getting these vehicles and everytime we picked up a report or someone read a report, you know, and it's super exciting. People were thinking this is coming tomorrow and then, Australia doesn't want to miss out.* (Sasha, CEO of an Australian Peak Body)

Defining Key Concepts

Generally speaking participants were hesitant to define or explain AI, and when they did, they tended not to be precise and differed in their emphasis. For example, one participant described it as follows:

> *It's a glorious open-ended (...) term. It does have some technical meanings, but we don't spend a lot of time focusing on the technical aspects. [It's] a generic term for (...) machine cleverness and (...) ability to evolve [its] responsiveness to a particular situation.* (Isaac, Director of an Australian Research Centre)

Others defined AI as the next step or evolutionary stage of automation. For instance:

> *AI is maybe that next step in automation in that it can then react or change its program function to suit some external inputs or influences that come in.* (James, Technical Director at an Australia-based Engineering Consultancy)

Some focused on the intelligence aspect of the term, defining AI as emulating human-like intelligence:

> *Artificial intelligence is artificial as in software on a machine, on a computer processes that emulates some aspects of intelligence that you'd see in an animal or a human.* (Martin, Joint Centre Director of an Australian Research Centre)

Participants also highlighted the decision-making capabilities of AI, distinguishing AI from automation via its ability to learn and evolve:

> *I think AI is part of automation. It's certainly the, I think it's something like machine learning as a sort of AI concept whereby automation can be improved based on, and can evolve based on the data that's been received and analysed because when this happens, this happens.* (Dean, Director working for the Australian Federal Government)

Only one of the participants offered a definition ofADM:

> *I guess automated decision making is any process where there's an artificial agent which is typically a computer software program whether it's on a computer cloud or robotic, doesn't really matter, making decisions that have*

ramifications in some way without direct supervision by a human. (Martin, Joint Centre Director of an Australian Research Centre)

When asked about whether or not they used ADM to describe automated or AI-based technologies, participant Mary, who works for an automotive manufacturer, had to be reminded of the meaning of the acronym. Another explained that in the case of discussions in their organisation:

[T]here's an implicit automated decision-making paradigm embedded in the whole concept of automated vehicle[s]. But no, we don't use automated decision-making as a term in its own right. (Isaac, Director of an Australian Research Centre)

Hopes and Concerns

All except for two of the participants we interviewed were optimistic about the integration of ADM into the transport sector. Throughout the interviews, participants at various points cited the "promised benefits" we identified in our first report:

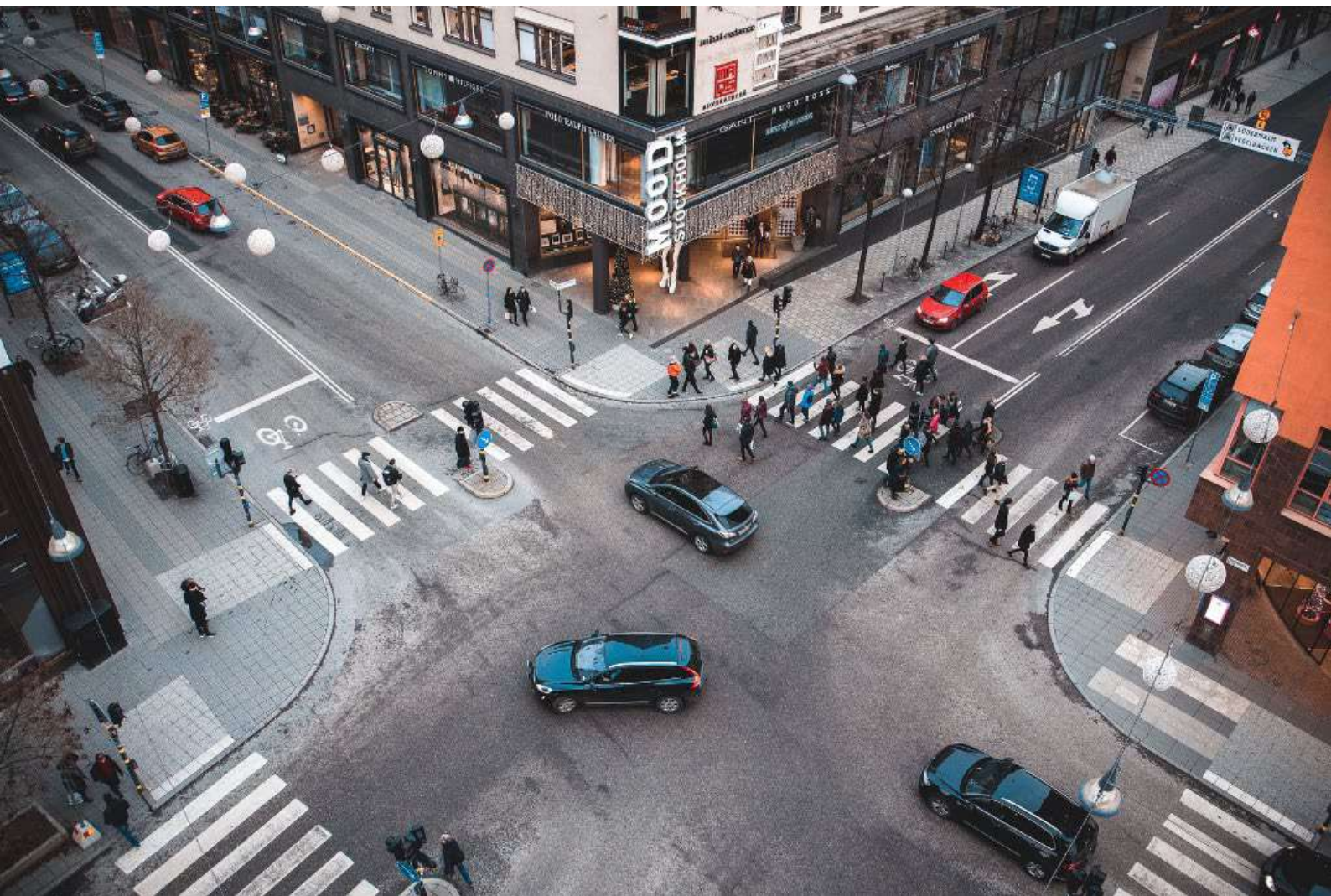
1. Increased road safety
2. Reduced congestion and increased productivity
3. Improved accessibility and health
4. Creating sustainable and resilient communities
5. Provide entertainment and convenience

Most of the participants were confident that these benefits would be delivered in some shape or form. However, more than half of participants were critical about these benefits, and questioned whether or not these promises had been 'over-hyped':

I mean, the value position why this is important and why we need to do this; firstly there's the safety consideration, as much as it's been over-hype we cannot under-hype the long-term benefits that will come with broad adoption of autonomous vehicles (Gavin, Director of an International Technology Provider)

2. How are organisations engaging with automated transport and mobilities technologies

In our interviews we listened to individuals from a range of organisations from government departments, peak bodies, automotive manufacturers, technology providers, not-for-profits and consultancies. These organisations engaged with automated transport and mobility technologies in a variety of ways.



Sourcing and delivering expertise in automation

Automation is present in the work of stakeholders in transport and mobilities from a range of different perspectives, some of which overlap.

For instance, our interviews with employees from federal and state government transport departments revealed that they often engage with automation through second or third parties, including peak bodies and consultancies, who provide them with advice and regulatory recommendations. The same participants also engage with automation via research and development programs, often through research centres.

We interviewed participants who work for peak transport bodies, which are trade or advocacy organisations that are usually established to create standards and processes. For the peak bodies in the transport industry, this involved providing advice and developing regulatory frameworks for emerging technologies. In Australia there are a wide variety of peak bodies that work directly in the transport industry. As one participant expressed it, the transport peak bodies we interviewed operated in an advisory capacity:

> *We're a statutory body that's set up to try to create harmonised transport reforms across all of the states and territories. We develop the regulatory framework for automated vehicles.* (Rani, Executive Director of an Australian Peak Body)

We also interviewed three participants who work for consultancies in the field of transport. We asked about how and where automation appears in their work. They described their areas of focus as follows:

> *[T]he intelligent transport systems that have been put into highways and whatnot at the moment, but it's still very much a manual operator. The old school signals are getting to that smart transport with the ramp metering to smooth those traffic flows.* (James, Technical Director at an Australia-based Engineering Consultancy)

> *I do a lot of work in digital twins building digital twins of transport systems so mobility operators and command centres can operate the network in more intelligent ways.* (Kiara, Lead Researcher of AI at an Australian Consultancy)

The two directors of transport-specific research centres we interviewed lead organisations dedicated to creating new knowledge around specific topics and issues in transport and mobility. The projects led in these centres had an explicit focus on the role and potential impact of emerging technologies. For example:

> *Our role is to take industry problems and then find researchers who can help solve the problem or secure the opportunity that industry partners are seeking.* (Isaac, Director of an Australian Research Centre)

> *We have over a hundred researchers doing everything around autonomous systems, automations, robotics, artificial intelligence and everything in between.* (Martin, Joint Centre Director of an Australian Research Centre)

One participant we interviewed works in the research and development department of one of the worlds largest automotive manufacturers:

> *I'm working mostly today like with new neighbourhoods being built, how the real estate people look at the mobility around there, working with the communities, the politicians, trying to get us closer and see if we can talk to each other.* (Mary, Board Member at a Swedish Automotive Manufacturer)

We also interviewed five technology providers who self-described as relatively new players in the broader transport landscape. For instance, Gavin, director of an international technology provider, explained that his company was primarily focused on providing the software for autonomous vehicles. His company operates as intermediary between automotive manufacturers and clients:

> *We really focus on the autonomous driving [software] components but for peripheral services that involve passengers, remote supervision software, on demand applications, warehouse management systems, we can integrate with third party technology to complement our own system.* (Gavin, Director of an International Technology Provider)

Finally, it is important to acknowledge the role of not-for-profits in automated transport mobilities. We interviewed one participant from a not-for-profit organisation that focused on data advocacy:

> *[Organisation] is a feminist tech start-up and we used crowd source data to make a city safer for women and gender diverse people, and to really try to close the gender data gap.* (Zia, CEO of not-for-profit)

Anticipated benefits of automation

Key anticipated benefits: increased efficiency, convenience, reducing labour costs, sustainability (via electrification), increased productivity and safety

The participants we interviewed identified a number of key benefits that they believed automation will deliver to the transport and mobility sector. We classified these benefits using categories established in our first report (Quilty et al 2022): increased efficiency; convenience; reducing labour costs; sustainability (via electrification); increased productivity; and increased safety.

Two of the technology providers we interviewed indicated that for the benefits of automation to be realised, the vehicles have to be powered by electricity, and not by fossil fuels. It is relevant to note that their focus was on shared transport rather than

passenger vehicles where the application of automation is site-specific, for example they have vehicles designed for medical and agricultural environments:

> *At EasyMile we really focused on the autonomous public transport sites, we believe that, you know, to realise all the positivity, the positive externalities of mobility it has to be electric, it has to be shared and autonomous. So we don't focus on passenger cars because we don't believe that it will do much in terms of sorting out the very big challenges that we have in urban centres nowadays, in terms of congestion and traffic, it's highly inefficient.* (Gavin, Director of an International Technology Provider)

They also identified efficiency as a key outcome:

> *And it's all about streamlining flows and making it more efficient, making it faster.* (Grace, Head of communication, Technology Provider)

Both of the directors from transport-specific research centres identified a number of benefits. For instance, logistics efficiency:

> *The second element of it is that everything, every parcel, every pallet, every container that is moved, the people who are going to receive that thing can see it coming and they know when it's going to arrive.* (Isaac, Director of an Australian Research Centre)

Another benefit noted was resource optimisation:

> *Assuming you can overcome these sorts of privacy issues, data sharing issues of having free transport information across these boundaries, yeah, sure having a city wide optimised mobility system is obviously a good thing.* (Martin, Joint Centre Director of an Australian Research Centre)

We interviewed one participant who worked for one of Australian mining corporations who identified reduced labour costs and increased productivity as the key benefits of introducing automation. For instance:

> *You've got four people for every piece of equipment. That's a significant cost so that creates an incentive to reduce the labour cost*. (William, Practice Leader at Australian Mining Corporation)

> *If you can make it cheaper to run and more productive, then you get a double hit.* (William, Practice Leader at Australian Mining Corporation)

Similar to the findings of our first report, safety is another benefit cited by participants. This participant expected Autonomous vehicles made for personal and everyday use to be much safer than cars driven by humans:

> *[T]here's talk that in years to come, the manually driven cars will be the drunk drivers of today.* (Sasha, CEO of Transport Peak Body)

> *The cars are aware of what's happening around them and they drive safely according to what's going on around them, whereas human drivers make mistakes. They get distracted. The phone rings. They get tired. Machines don't get tired; they don't get distracted. They keep on task.* (Sasha, CEO of Transport Peak Body)

Key challenges and difficulties

We interviewed stakeholders about the key challenges and limitations of automation and transport, specifically trying to understand what they perceive is holding them back from enjoying the benefits of automation.

Ten participants out of the total twenty-four we interviewed raised privacy as one of the key issues. As one participant summed it up:

> *Another issue with that is these cars are effectively giving the company that controls them real time surveillance of the entirety of the city. So once again, there are sort of privacy issues to solve in that regard.* (Martin, Joint Centre Director of an Australian Research Centre)

One participant expressed that for them, the core issue for the future of transport concerned safety and gender:

> *Cities have always been designed by men not women and with technologies we're just repeating that.* (Zia, CEO of Not-for-profit)

Another participant highlighted social norms and government regulations as the key challenges to achieving widespread integration of automation:

> *You'd have to have a lot of authoritarian control to knock down a whole strip of buildings and rebuild it to pull cars completely out of an area and then bound it by highways, so it's private practice. Social norms and then probably, government regulation would be pretty big blockers and just the cost of it all to the user would be massive.* (Dylan, Graduate Transport Planner, Consultancy)

One participant indicated that automotive companies like the one they were employed by, needed to 'move with the times' so to speak, or risk being left behind. They explained that automotive companies needed to do more than just 'make the car', they need to develop services - like 'ride-hailing and car sharing':

> *If we want to be a part of the future we need to be on the other side and actually develop services around the product that we have sold so far.* (Mary, Mobility Strategy, Automotive Manufacturer)

Another participant expressed that media coverage of automated mobility was a key issue, one that had led to a strong association of particular personalities and brands with autonomous vehicles:

> *People hear "autonomous driving" and they're immediately thinking Elon Musk, Tesla, Waymo, sexy cars, speeding down highways.* (Grace, Head of communication, Technology Provider)

Three participants identified government reluctancy as one of the key challenges:

> *They would have their concerns about interrupting the status quo, and I certainly found some councils or governments are more receptive than others to you know, different to changing and doing different things and improving systems with automation.* (James, Technical Director at an Australia-based Engineering Consultancy)

3. Visions for the future of ADM in Transport and Mobilities

In our interviews we asked participants about the future of automated mobilities, specifically, what are the key benefits and key concerns.

The future of automated mobility

Participants discussed a variety of ADM applications which we have organised into 5 key categories:

1. Everyday transport
2. Heavy industry
3. Logistics
4. Infrastructure
5. Digital Platforms

1. Everyday transport

Almost all of the participants we interviewed included self-driving cars or automated vehicles for private use in their visions of the future.

Several participants anticipated that the automotive sector will shift in the future to focus more on service delivery than on manufacturing.

> *[I] f we want to be a part of the future we need to be on the other side and actually developing services around the product* (Mary, Mobility Strategy, Automotive Manufacturer)

For example, one of the technology providers we interviewed explained how they partner with third-parties to create the hardware for their products:

> *We ultimately sell the complete solution, so that's the vehicles themselves, but the vehicles are manufactured by, well, we say, blue-chip third-party manufacturers.* (Grace, Head of communication, Technology Provider)

Instead of focusing on private vehicles, some technology provider participants saw the future of everyday automated mobilities within their agenda to create 'niche, specialised vehicles' for public use:

> *…here are some things that are a bit of an AV no-brainer, like an airport shuttle could be good.* (Rani, Executive Director of an Australian Peak Body)

> *[F]rom the train station to the bus station or from the last bus stop to the downtown or will it go on a private site, like a medical campus.* (Grace, Head of communication, Technology Provider)

They anticipated that the applied uses of automation for everyday transport will likely be leveraged for first and last mile solutions, for both people and goods:

> *So, our hero vehicle, the first one we're known for, is an autonomous shuttle, so it's like a little toaster thing. It's quite slow and it will connect gaps in public*

transports called 'First Mile, Last Mile'. (Grace, Head of communication, Technology Provider)

2. Heavy Industry

Participants discussed the application of automation in heavy industry, focusing on three primary industries: trucking, mining and agriculture.

Participants described the mining sector as the most automated of the heavy industries and cited Australia as a leader in the space. One participant expressed:

> *The work on autonomous vehicles or high levels of automation in mining and agriculture, has also been going on for quite a long time. Australia is a leader in that, but a lot of that happened, five, 10, 15 and 20 years ago. So, in mining, this is not quite true, but there's not much left for us to do.* (Isaac, Director of an Australian Research Centre)

One of the technology providers we interviewed described one of their "niche vehicles" used in the mining industry to transport coal:

> *[We] automate[d] the little train that goes along the tracks to pull coal.* (Grace, Head of communication, Technology Provider)

The same provider has also developed other related vehicles for the transportation of goods in the mining sector:

> *[O]n the goods transportation side we're developing a forklift, swap body truck and a prime mover to move full containers as well.* (Henry, Project Manager at an Australian Technology Provider)

Automation has been one of the most significant factors affecting labour in the mining industry. As one participant described, automating haul trucks has had considerable impacts on drivers:

> *They're pulling their drivers out of the haul trucks and now moving them to air conditioned DONGA's where they can control the trucks and reskilling them up.* (Dylan, Graduate Transport Planner, Consultancy)

Image of haul trucks in an open cut mine
***Image source**: Pexels*

The trucking industry was predicted to be the second heavy industry impacted by automation. Platooning (a method for driving a group of vehicles together, designed to increase the capacity of roads) was often listed by participants as one of the technologies that they expect will be tested and integrated:

> *If you can get the driver out of the car then that's obviously a really significant saving and then, it's just managing the other cars around those freight trucks. So, is it a multi-lane highway where you've got this platooning activity, so there's space for people to get around*? (Sasha, CEO of Transport Peak Body)

> *… platooning was one of these ones that was touted as being a huge thing, but it's probably not progressed as far as everybody said it would.* (Declan, Director Transport and Customer Strategy with an Australian State Government)

Agriculture was the final heavy industry that participants foresaw being impacted by the application of automation. This participant saw it as a logical follow-on from successful applications in the mining sector:

> *I think certainly there's some opportunities to look at that automation and setting it on, like they do in the mining industry where they have, they've got the driverless trains and driverless dump trucks that go down into the mines and pick it up and move back and forth. So certainly the combine harvesters, I would imagine, could look at that next step and having it automated.* (James, Technical Director at an Australia-based Engineering Consultancy)

3. Logistics

The role of automation in the future of logistics was the third area of application that participants described in their future visions of ADM. In the context of this report, logistics refers to the overall process of managing how resources are acquired, stored, and transported to their final destination. Participants saw this a occurring across a range of sectors and machines, including the 'micro-logistics' sector of e-bike deliveries:

> *Then we'll have some agricultural machinery which is used in farms, heavy vehicles, some of the micro logistics delivery vehicles, electric bikes.* (Rachel, Executive Director of Transport Peak Body)

E-Bikes are a common mode of transport for micro-logistics, such as restaurant or supermarket delivery. Image source: Pexels

The environment plays an important role in the future applications of automation, as one technology provider pointed out, transporting goods in private sites is easier than on public roads because they can exercise much higher levels of control over the space. For example, in the past airports are one of the sites they have designed autonomous vehicles:

> *[I]t will go air side and will tow the luggage from the aircraft to the terminal autonomously.* (Grace, Head of communication, Technology Provider)

The tow tractor design has also been scaled up to transport heavier items in the car manufacturing sector:

> *[A] big car manufacturing plant in the north of France. They're towing big, heavy car parts to certain points along the production line autonomously.* (Grace, Head of communication, Technology Provider)

Several participants anticipate that automation will become a more fully integrated part of Australian ports to improve the efficiency of moving large containers on and off cargo ships:

> *Ports are quite highly automated with some of their smarts they do with getting containers and freight on and off the wharfs.* (James, Technical Director at an Australia-based Engineering Consultancy)

> *[L]ooking at the technology and the efficiency of moving containers and freight from containers to its destination is certainly something that we're interested in.* (Declan, Director Transport and Customer Strategy with an Australian State Government)

As mentioned above, platooning is one of the primary applications of automation in the area of logistics:

> *I think the other thing that will be really interesting is how it all plays out for freight. So, just thinking about what that might mean for our regional road network. We've got some big freight routes through South Australia, in the middle between New South Wales and Victoria and WA. So, I think, that's the other space it'll be interesting and what that means for our regional road network.* (Mia, Director of Road Safety for Australian State Government)

4. Infrastructure

The integration of ADM and existing infrastructure was discussed by participants in two ways. The first was informational infrastructure, which would allow vehicles, networks and roads and highways to share information. The second was material infrastructure such as roads and highways that will require updating or upgrading to "smart" status with sensors and other technologies to gather the information that will (theoretically) allow the automation to occur.

For example, in terms of informational infrastructure, participants anticipated the connectivity that will likely be needed for the benefits of automation in transport to be realised:

> *So every automated vehicle knows where the other automated vehicles are.* (Mark, CEO of Transport Peak Body)

Some framed their work as focused entirely on informational infrastructure rather than automation:

> *So, in our endeavour, we're not focused on automation per se, we're focused on making better use of data in personal mobility, in supply chain management, in managing traffic networks.* (Isaac, Director of an Australian Research Centre)

Automation - via increased data collection and integration with regulatory bodies - was anticipated to have improve productivity and safety by decreasing risks (such as fatigue):

> *[I]mproving the real time information that's available which obviously helps industry and improves productivity outcomes. Looking at opportunities to use technology to better regulate things like fatigue. Some of those possibilities could help to improve industry outcomes and productivity outcomes and safety outcomes as well.* (Mia, Director of Road Safety for Australian State Government)

In terms of material infrastructure, participants also discussed the possibilities of increasing the number of smart roads and highways:

> *You've got the standard, the old school which, the signals, but they're getting to that smart transport with the ramp metering to smooth those traffic flows, and some pedestrian features which are helping countdown time, and a little bit more smarts in how the system operates.* (James, Technical Director at an Australia-based Engineering Consultancy)

5. Digital Platforms

The last category of applied automation is digital platforms. The primary ways participants envisioned digital platforms playing a role in the future of automation of transport was through Mobility as a Service, digital twins, and ridesharing. One participant described a future scenario where customers can order self-driving cars via ride-share style platforms:

> *So, if it's pouring with rain, you're going to go on your App and you're going to call the little [name removed] shuttle that will literally stop at the door to your building and you can duck on and it will just trundle 500 metres down the road, and you'll get off and be able to jump on the train.* (Grace, Head of communication, Technology Provider)

The expectation was that integrating autonomous vehicles into existing ride-share systems will increase efficiency, increase the customer base, and remove labour costs:

> *[S]oon we're not going to have to worry about the driver anyway because Ubers will all be fully automated and these cars will be used 24/7, so they'll be super-efficient.* (Sasha, CEO of Transport Peak Body)

While ride sharing and Mobility as a Service are not synonymous, at the time of the interviews, they were often seen as the starting point for future applications of automation in the transport and mobility industry:

> *Autonomous cars and MaaS, they can work together but they are not mutually exclusive.* (Kiara, Lead Researcher of AI at an Australian Consultancy)

An emerging concern, particularly amongst government departments and regulatory bodies, was about the control over the platformisation of mobility and automation sitting with software developers and automotive companies:

> *[I]f Tesla wanted to they could flip a switch and we'd have 2,000, the potential for 2,000 automated vehicles here, or at least semi-automated at the moment, overnight.* (Sam, Principal Analyst of an Australian Peak Body)

Future benefits

Participants identified a variety of benefits emerging from the integration of automation into the future of transport and mobility. We have organised these benefits into 4 categories:

1. **Making life easier** - by increasing convenience and creating seamless mobility experiences for both consumers and companies
2. **Increased safety** - by reducing risks associated with human drivers in both passenger and heavy vehicles such as fatigue
3. **Sustainability** - by introducing electric vehicles and their related infrastructure
4. **Increased productivity** - by automating existing processes and reducing labour costs

1. Making life easier

Participants reported feeling optimistic about the integration of automation into transport and mobility, describing a future where life is made easier. For example, one participant described this process as inevitable, and helped along in part because trading personal data to companies for convenience has become normalised:

> *Personally, it's just something that is inevitable and if it provides benefits, then I'm happy [and] as long as it makes life easier…we give our information and our personal data away and everybody seems comfortable with that because they get the benefit from it.* (Declan, Director Transport and Customer Strategy for Australian State Government)

Another way that it was suggested life will be "made easier" was through the introduction of MaaS:

> *Let's ensure that we're incorporating MaaS capabilities into those things, so that when we get to the point where customers are back on the network and travelling and connecting more, they're going to see that option as being really seamless for them.* (Lakshmi, Executive Director of Transport for Australian State Government)

2. Increased safety

The benefit of safety was suggested as one of the primary reasons why automation should be integrated into existing transport and mobility systems. Generally participants proposed that machines would be safer than humans when it comes to driving. For example, as expressed by two participants:

> *The technology can do what we can't do, which is, you know, not be distracted at all, so, you know, have that 360 degree attention span, and I think that those benefits are huge.* (Sam, Principal Analyst of an Australian Peak Body)

> *They [autonomous vehicles] don't drink, don't get tired, they don't get distracted, so there's a real business case for safety with all the externalities that they bring to society, you know, in term of loss of life, in term of injuries, in term of burden on the society from a health system perspective, so that's really critical.* (Gavin, Director of an International Technology Provider)

3. Sustainability

One participant, an employee of an automotive manufacturer, advocated for car reductions, while five other participants argued in favour of exchanging ICE cars with EVs. These participants worked in a variety of organisations from government departments of transport (3), an engineering consultancy (1) and a technology provider (1).

> *Car ownership reduction, that's a good one if you've got a shared ownership or a timeshare of a car, those are some of the big ones. In a shift to electric, there's a potential for environmental benefits as well.* (Dylan, Graduate Transport Planner, Consultancy)

> *But it would have been better if everybody actually just had an electrical car instead of taking the trams so often. It's, okay, we cannot handle it due to congestion then, but it's energy wise it is better for actually everyone just driving a car. Because they are so heavy, and it's so much to actually produce, and when they are empty it's just not efficient at all.* (Lakshmi, Executive Director of Transport for Australian State Government)

4. Increased productivity and efficiency

Participants described automation as bringing about increased productivity via the reduction of mundane and time consuming tasks from driving to grocery shopping:

> *So whilst putting in the smart infrastructure is a cost as well, you've got to muck around with surface and stuff and put in your gantries and your electronics. Once it's in there, I think overall, it's probably a more cost effective long term solution [compared to adding more road lanes].* (James, Technical Director at an Australia-based Engineering Consultancy)

The street [would] look like an Amazon warehouse today where you steer all this automated guided vehicle, you know, moving around and it's extremely organised and extremely efficient transport. (Gavin, Director of an International Technology Provider)

Concerns

There were a number of key factors that were of concern when it came to the future of automation and transport. These concerns would need to be addressed for the aforementioned benefits or desired results to be achieved:

1. Regulation and responsibility
2. Lack of planning
3. Impact on employment
4. Infrastructure and urban design
5. Control

1. Regulation and responsibility

Some participants identified government regulation as one of the key challenges:

> *Social norms and then probably, government regulation would be pretty big blockers and just the cost of it all to the user would be massive.* (Dylan, Graduate Transport Planner, Consultancy)

Others expressed concerns about regulation harmony between states and territories:

> *you don't want to be in a situation where you've got somebody importing, you know, an automated vehicle and then having to deal with …eight different flavours of regulation.* (Sam, Principal Analyst of an Australian Peak Body)

Some participants speculated that the reluctance of automotive companies to jump on the AV bandwagon is because of the risk that accidents will shift from the driver to other parties:

> *So it's thinking of this in a completely different way because it does shift the accountability. What we used to conceive as the driver from the passenger, particularly for fully automated systems, to the manufacturer or the software developer.* (Declan, Director Transport and Customer Strategy for Australian State Government)

2. Lack of planning

The stakeholders we interviewed warned about the risks of not planning for disruption of automation, as well as the risk of being distracted by utopian visions of the future:

Many of them can be quite utopia based, as well or it's sort of like this grand vision. And there's not a lot of thinking back towards the steps of how that would occur. (Dylan, Graduate Transport Planner, Consultancy)

3. Impact on employment

Some participants expressed concerns about the (potentially negative) effects of automation on employment:

It's going to shift there in terms of job displacement, but I think a lot of jobs will be lost because you don't have that option or it's not as feasible. (Dylan, Graduate Transport Planner, Consultancy)

There's a role for industry here and there's a role for the government in working together to identify opportunities where a future workforce can go. Let's say truck drivers or taxi drivers are one of the most obvious ones who may lose employment or may have their jobs changed through the sort of advanced mobility. (Dean, Director working for the Australian Federal Government)

4. Infrastructure and urban design

Participants indicated that the infrastructure for autonomous vehicles would be expensive and complex to roll out. They gave the example of the transition to electricity based charging infrastructure:

Poorly designed infrastructure is probably poorly designed infrastructure whether you're a human driver or an automated driver. (Sam, Principal Analyst of an Australian Peak Body)

And it's a very good idea with self-charging cars in the infrastructure, but who wants to pay for infrastructure then? Because nobody really wants to pay for the infrastructure of electrical at the moment, so it's like ... and it's too expensive. (Mary, Mobility Strategy, Automotive Manufacturer)

4. Accounting for people in future automated transport mobilities

In our interviews we explored how stakeholders understood consumers' needs. Who will be impacted by the anticipated changes?

Understanding consumers' needs

The needs of the people who will use automated technologies were a key concern for the stakeholders we interviewed with. There are three primary mechanisms utilised to gauge an understanding of the consumer needs:

1. Surveys
2. Forums and focus groups
3. Expert consultation

Surveys were the most popular method organisations used to ascertain consumer needs. The participants explained that the organisations they worked for used surveys to gather information about transport consumers. For example one participant was involved with running a Mobility as a Service trial that collected consumer data through multiple avenues, from the application to the mobility providers to social media:

> *We [run] surveys before the trial, during the trial. We've got data coming in from the app, from our other mobility providers, from our accounting, data from the customer interactions through our support channels, through social media. We've got no shortage of data!* (James, Director, Technology Provider)

> *We do a longitudinal public opinion survey, to gauge where the community sentiment is at, where their concerns are. So we target things to address the concerns and where their appetite is to see the technology come to market.* (Rachel, Executive Director of Transport Peak Body)

Forums and **focus groups** were another common means of gleaning consumer needs:

> *Things like community forums can be really helpful, just let everyone know what might be happening on their streets out the front of the properties, speaking to people early, businesses and residents as early if there's going to be any change to their, parking is often a big issue.* (Gavin, Director of an International Technology Provider)

The third mechanism for understanding what the consumer needs is **expert consultations**:

> *Our usual approach is to do public consultations on our policy proposals. So that will usually involve putting out a policy paper which asks a range of questions to stakeholders and then we'll publicly consult on that which would involve obviously making the paper available to everyone, but also sending it out to particular stakeholders that are particularly relevant.* (Rani, Executive Director of an Australian Peak Body)

Collecting data through digital platforms is another form of understanding consumer needs. One participant described a future scenario where MaaS are connected to the government via public transport networks, which over time will collect more data and

optimise, increasing the system's ability to more accurately predict transport patterns and customise experiences for individuals:

> *We actually don't know enough about how our customer travels, [we don't have] the data that we need to help them make better choices and predict journeys for them. Google does, because we're logged into Gmail and we're logged into everything and our phone location services are on. But from a government perspective, we don't understand [people's] first and last mile. We need to gather that information before we can really feed back to the customer, it's a bit Big Brother, but that's what Mobility as a Service apps do, right?* (Lakshmi, Executive Director of Transport for Australian State Government)

Some participants described using a combination of methods for understanding consumer needs. See for example the participant below who was involved in overseeing the implementation and governance of a large Mobility as a Service trial in Australia. Their approach involved a combination of surveys, consultation and prototyping:

> *We start with that surveying to help understand the customer behaviours now and what the issues are, and then we go into the human-centred design process. So it's [getting] the right players in the room, using evidence to talk through what the issues are. Then prototyping and working with them to actually understand those issues and create what those solutions could be. Community-based [approaches] are really important.* (Lakshmi, Executive Director of Transport for Australian State Government)

Who will be impacted by automation

The stakeholders we interviewed identified a range of people who will be impacted by the integration of automation in transport and mobilities in the future. The first group of consumers who were predicted to be impacted by automation are **public transport users**. For the people using public transport, as one engineer explains, the future of automated transport will change and, hopefully, improve the way people travel in their first and last mile:

> *When people drive to the station, or if they're doing kiss and ride (picking up, dropping off). How [might] that change in the future with AVs?* (Dylan, Graduate Transport Planner, Consultancy)

This stakeholder, a government employee working in the department of transport, expressed concerns about **women's safety** and her hopes regarding the possibilities automation could deliver in the future:

> *I'll see young women get off the train, you know, they might work in hospitality or whatever, and they literally walk across the road and they disappear into the dark. And I just think to myself, [that's] dangerous. How far do they have to walk? They have no first and last mile option.* (Lakshmi, Executive Director of Transport for Australian State Government)

One participant suggested that families were a group of people likely to be positively impacted:

> *Yes, if the parents don't have to pick the kids up after school, it's a win. They can just do it themselves with a[n autonomous] car.* (Dylan, Graduate Transport Planner, Consultancy)

One stakeholder suggested the benefit of being able to program an autonomous vehicle to pick up and drop off children to school. In addition to this, family pricing models could be introduced as an incentive for families to buy autonomous cars that can 'pay for themselves' rather than sitting idle at work or home:

> *From a family pricing model, if you've got young kids and you're trying to save or you've got a mortgage, you can have one car, have it do all the jobs for [the] family and then pay itself off as an Uber service during the middle of the night or during the middle of the day.* (Dylan, Graduate Transport Planner, Consultancy)

The third group of people who participants imagined will benefit from automation are people with **impaired or limited mobility**:

> *[S]peaking to people who are physically and mentally, you know, quite able except they've got limited vision or fully vision impaired which means that they can't – really, their personal mobility is significantly impacted*. (Rachel, Executive Director of Transport Peak Body)

Challenges for the future of automation

The stakeholders we interviewed outlined a number of challenges for the future of automation and transport. For example, the shifting patterns of work, especially post-lockdown in Australia. One participant, who works for a government department of transport, observed that more people (post-lockdown) had the option to work from home:

> *I mean, one of the big changes is, like everywhere else, we've got more people working from home now, so I think that that's something that isn't going to go away.* (Mia, Director of Road Safety for Australian State Government)

Stakeholders identified the process of **re-skilling** employees as another challenge. One engineer we interviewed gave the example of drivers and autonomous haul trucks in Western Australian coal mines:

> *They're pulling their drivers out of the haul trucks and now moving them to air conditioned DONGA's where they can control the trucks and reskilling them up. It's going to shift there in terms of job displacement, but I think a lot of jobs will be lost because you don't have that option or it's not as feasible.* (Dylan, Graduate Transport Planner, Consultancy)

Another stakeholder, an executive member of an Australian peak body for advanced transport technology, anticipated that re-skilling will not involve job loss, rather, it will more likely involve a **shift from operational roles to customer service** focused work:

> *If you were talking about automated buses, I think that retraining is definitely a piece of work that needs to take place, but I don't know that there's less people. They're just people doing different things and maybe it's more a customer service type role [rather] than a driver and they're actually adding more value helping people on and off the vehicle, providing a range of support in that way.* (Sasha, CEO of Transport Peak Body)

Another one of the key concerns stakeholders raised during our interviews was **trust**. For example, one engineer, who had been involved in a research project exploring the potential role of automated vehicles in a variety of different sites, commented:

> *We found with public transport that people were less likely to use the autonomous bus, if it didn't have a conductor on board, as that safety and trust element.* (Dylan, Graduate Transport Planner, Consultancy)

This research project also involved speaking to retired Australians about their transport preferences:

> *A lot of them liked the comfort of speaking to a driver too. So, some of them found the bonuses were, what taxi service do you use, out of curiosity? And it's like, "I use Bill or Greg" [they] have someone they knew saved in their phone who worked these taxi services.* (Dylan, Graduate Transport Planner, Consultancy)

To improve trust in autonomous vehicles, and other related automated transport infrastructure, one government employee we interviewed told us:

> *I'd like to see more consumer engagement in trials to let people experience it because they will then I guess that will help build the trust that you're talking about.* (Dean, Director working for the Australian Federal Government)

5. Possible futures of ADM in transport and mobilities in Australia

In our interviews we asked stakeholders about what the future of ADM in transport and mobilities will look like in an Australian context. What is special or different about implementing automation in the Australian social and geophysical context?

Australian Context

The stakeholders we interviewed identified a number of key factors that will need to be considered when planning for the future of automated mobilities in Australia. One of these considerations is the broader techno-political landscape.As this participant explains, Australia follows international lead on innovation not the other way around:

> *Australia does look to other countries for innovation and they have perceptions about what to expect even from other countries, but I think their adoption decision is very strongly locally driven.* (Isaac, Director of an Australian Research Centre)

This has led to what one participant described as a lack of Australian specific use-cases:

> *I think generally there were very few use cases that were Australian-centric at this time.* (Charlotte, Director of connected and automated vehicles for Australian State Government)

When we asked stakeholders about Australia's car culture, they explained that there were multiple reasons why Australia has such a strong and persistent car culture, beginning with urban planning and lifestyle choices that rely on driving:

> *[Car] culture is largely driven by the fact that we've planned for it.* (James, Technical Director at an Australia-based Engineering Consultancy)

> *The Great Ocean Road, or camping on the beach, driving your 4WD on the beach, camping and really experiencing the outdoors, they're in places that are not accessible by any other mode. So your car is quite important, in terms of your comfort and time and safety and flexibility.* (Lakshmi, Executive Director of Transport for Australian State Government)

Image of the Great Ocean Road
Image source: Unsplash

Social Context

One participant explained why they believe Australia and America both have car cultures for reasons that run deeper than convenience or efficiency:

> *The US and Australia have similar cultural values in terms of our obsession with cars, and owning cars, and the status symbolism that goes along with that.* (James, Director, Technology Provider)

There is another dimension to the status symbol of the car as it relates to the Australian context. As this participant pointed out, in migrant communities cars are a signifier of affluence and success:

> *A car was often seen as something quite prestigious, especially if you've got a really nice car, it's about how hard you worked and there's a different mindset from different communities about having a vehicle.* (Lakshmi, Executive Director of Transport for Australian State Government)

There are also state-specific aspects to the car culture in Australia. For example, as this participant explained:

> *People have always been really into their cars here (South Australia). We used to have the Grand Prix and we've got the Bay to Birdwood and the historical motor museum, and we used to be the home of Holden and all those sorts of things. So, people are really into their cars, almost as a cultural thing historically here and that identity as being a car place.* (Mia, Director of Road Safety for Australian State Government)

In addition to the historical and cultural aspects of Australia's car culture, the differences in car ownership shift depending on whether people live in major cities or rural areas:

> *[If] you have your own house with a backyard and your own car, whereas I think in bigger cities like Sydney and Melbourne, people are more used to sharing resources, if that makes sense, and needing to do that to get by. It's interesting.* (Mia, Director of Road Safety for Australian State Government)

They argued that this will likely be compounded in the future by the increase of population (in certain areas):

> *We're looking at population growth in south-east Queensland over the next couple of years. [In] the last couple of year alone or something, 33,000 people moved to Queensland.* (Lakshmi, Executive Director of Transport for Australian State Government)

One of the interesting concerns that emerged during the interviews concentrated on shared micro-mobility, particularly in regards to footpath space:

> *Getting…these devices to be parked conveniently but also not infringing on pedestrians or a person with disability access to areas.* (James, Director, Technology Provider)

The same participant argued that these concerns had created a sense of "nimbyism" (not in my backyard) for shared micro-mobility schemes such as e-bikes and e-scooters:

> *So it's not perfect, and a lot of people continue to want things to be improved, and there is probably a little bit of nimbyism going on as well in certain suburbs, I would say more affluent suburbs are less inclined to have these devices around. But certainly suburbs that have high student and under-30 population, they're a huge hit.* (James, Director, Technology Provider)

This is compounded further by anti-cyclist attitudes that some road users express towards those using active mobility:

> *The culture of driving in Australia does not allow for cyclist like people get annoyed and frustrated with cyclist.* (Kiara, Lead Researcher of AI at an Australian Consultancy)

Some of the participants we interviewed were critical of car-centric (as opposed to people-centric) transport planning:

> *I don't think the tail should wag the dog. Rather than say 'what do we need to change in our streets for automated vehicles to operate and to fit in?' We [should] design our streets and how we want to live to suit us and our lifestyle and the technology needs to be made to fit what we need, rather than us*

having to change. (James, Technical Director at an Australia-based Engineering Consultancy)

Additionally, participants emphasised the importance of transparency and communication of future technologies to maintain social trust:

> *There are going to be unexpected outcomes and so making the follow up point of these technologies as transparent and public as possible so that you can rectify these inevitable problems is very important.* (Martin, Joint Centre Director of an Australian Research Centre)

There were a number of anticipated changes that the stakeholders we interviewed anticipate will change future transport decisions and patterns. The first related to changes in the work commute:

> *I think that profile of how we move for work, the work trip, has had the biggest change and will continue to have the biggest change on the way we live and work.* (Rachel, Executive Director of Transport Peak Body)

The second related to a broader generational shift away from car ownership:

> *In saying that, younger people that we talk to now are like, we're not going to need a car in the future. They're like, it's changing, it's different, but you have to have the options there in order for people to want to not use their car, and we don't have those options everywhere.* (Lakshmi, Executive Director of Transport for Australian State Government)

Geophysical context

The geophysical context of Australia, specifically its spatial distribution, overlaps with the social context outlined above. For example, Australia's population is concentrated in its major cities, with most of Australia's population concentrated in two widely separated coastal regions (the south-east and east, and the south-west). Some participants were focused on the possibilities of using automation for heavy vehicles:

> *A big country with states and big open spaces. So I think it's probably an attractive environment for heavy vehicle deployments, just given the massive distances that trucks have to travel here.* (Charlotte, Director of connected and automated vehicles for Australian State Government)

> *So your first and last mile in a very regional area is often like 60-70 km. In some of our cities it's over 100km.* (Lakshmi, Executive Director of Transport for Australian State Government)

One participant pointed out that the benefits of automating heavy trucks related to the relative ease of putting automated vehicles on highways versus streets:

> *The urban environment is very different to highways. I never had any issues on a highway, in fact quite often it would be driving me for very long distances without my input, but in cities it's much more complex to navigate.* (James, Director, Technology Provider)

Participants suggested this could be aggravated by other facets of the transport system that are unique to Australia:

> *[O]perational elements like the hook turn in Melbourne, for example, which is different.* (Charlotte, Director of connected and automated vehicles for Australian State Government)

> *Another unique thing is the left hand drive. So you'll see a lot of automated vehicles, obviously they need to be modified because they're being developed in America and the EU. They have to come here and go on the other side of the road which is a challenge rather than a benefit*. (Rani, Executive Director of an Australian Peak Body)

One participant, who works for a major mining corporation in Australia, explained in his interview that the anticipated benefits of automating heavy trucks is connected to the current application of automation in mining. Mining is a dangerous industry and the participant quoted below foresees a future where automated machines can access places where it is too dangerous for people:

> *I do see automation as possibly a mechanism whereby we could perhaps put machines where we can't put people. There's an example of a mine in Sweden, it's 2,500 metres below the surface where the oil body is [located].* (William, Practice Leader at Australian Mining Corporation)

Most of the participants expressed a sense of inevitability when it came to future integration of automation in transport and mobilities:

> *Automation is coming at us and it has been doing so for decades and decades and it will continue.* (Isaac, Director of an Australian Research Centre)

> *So you'll get a lot of answers about this focusing on regulation and society itself on all these sort of things. I don't really agree with any of those because fundamentally if they get the technology to the point where it actually genuinely works really well and if there is an amazing economic case to be made for it, then it will be completely inevitable despite all these other things.* (Martin, Joint Centre Director of an Australian Research Centre)

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Appendices

Appendix A: Interview Question Guide

ROLE, UNDERSTANDING OF AUTOMATION IN MOBILITIES FIELD

1. How would you describe your role, career and the organisation you work for?
2. What specific work do you do in relation to development and implementation of automation in your area of work?
3. How do you keep in touch with trends relating to technology and transport mobilities - what reviews, reports, meetings organisations etc inform them about this?
    a. What events have you engaged in? Did you find them valuable?
    b. What have you read in the last 12 months? Did you find them valuable/insightful/helpful?
4. How do you define:
    a. Artificial Intelligence
    b. Automated Decision-Making
    c. Automated systems
    d. Automated technologies
5. How do you differentiate between AI and ADM?
6. How do you feel about ADM increasingly becoming part of our lives and worlds?
    a. Do you have concerns or hopes?

ORGANISATION

1. How and to what extent is your organisation engaging with automated systems and technologies (related to transport mobilities) ?
2. What are the existing uses of automated tech in your workplace?
3. How and when was this introduced?
4. Why was it introduced?
5. What changes came about - were they positive/negative etc
6. Did other systems and processes need to adapt?
7. Did it impact people external to the organisation? If yes: How? Why? What happened?
8. How useful is it in its current form?
9. What are its limitations?
10. What benefits do they bring (and to whom)?
11. What challenges and difficulties surround them?
12. What do they think is holding them back?

13. How do they think these existing uses by your organisation will evolve, over the next 5 years (or other timescale if they don't want to refer to 5 years)
14. How do you see this in 2030 and 2050?

FUTURES

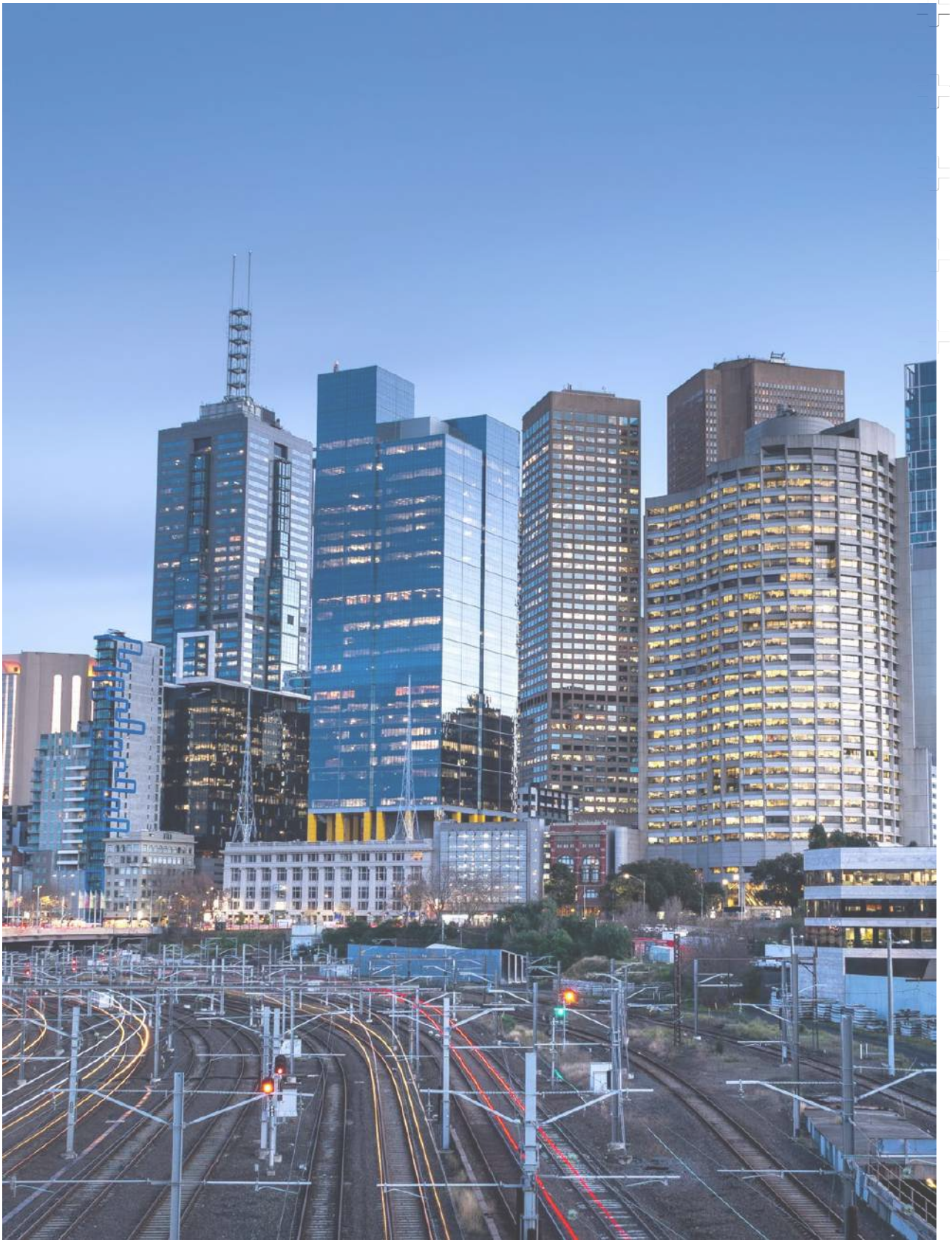
15. What first comes to mind when you think about the future of automated mobility?
16. What possibilities do you think automation offers for the future of transport mobilities? [focus on identifying these and ensure that the answers are descriptive]
17. What technologies will they involve? What will they look like? - this might include some of the things in the previous question, but also encourage them to include others
18. Who will they impact?
19. What would the benefits be (societal, economic, for governments, for industry, for people)?
20. Do they have any concerns that would need to be addressed or accounted for to ensure that the desired results were achieved?
21. What do you think is the most important application of ADM for the future of transport mobilities?

PEOPLE

1. How do you/ your organisation go about understanding the needs of the people who will use automated technologies are consumers involved in the design and implementation of work in your field?
    a. Is consumer engagement meaningful? Ongoing? How are the findings implemented?
2. How do you imagine the people who will use your technologies in the future?
3. What are the predicted/hoped for benefits?
4. What are some of the challenges/barriers? For acceptance? Trust?

AUSTRALIA

1. What do you think is specific/ special/ different about the Australian context?
    a. Social context (community/user acceptance or adoption)
    b. Geophysical
2. If they are positioned within an Australian organisation or government, how do they see future automated mobilities in Australia in particular, and why?



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