10.3.2 Organisation B – Passenger transport

Table 170: Organisation B - information sheet

Organisation characteristics
• Large organisation providing mainly bus transport services but also services for other modes (rail, underground, tram, water transport, micromobility) • Provides bus services at all levels: urban, interurban, regional, national, and international • More than 15,000 employees • Operates in four countries • Links with other transport companies in several other countries, with same owners • Business model (in provision of bus services): bus ticket revenue
Current situation with regards to transport
• Owns more than 600 buses • More than 500 million passengers a year • A current challenge is how to reduce the environmental impacts of bus services • Already owns two self-driving buses, one of them operating in a public road. Both will connect specific locations (business/university campus) with more central locations.
Use case discussed in interview
Self-driving bus
Perceptions
• Automation can contribute to safer, more efficient, and more comfortable transport • Self-driving vehicles are costly • Technology needs to be further developed, especially when it comes to vehicle performance in long-distance trips • Lack of regulatory standards are a challenge • Human assistant (safety driver) will always be needed
Intentions
• The organisation has been incorporating vehicle automation into vehicles for a long time, such as driving assistance systems • Technology can become obsolete quickly, which is a barrier to acquiring more vehicles • Self-driving vehicles will complement self-driving ones, not completely replace them • Self-driving vehicles can be used for on-demand services
Needs
• Vehicles need to be cheaper • Regulation barriers need to overcome • Need to have on-board human assistants, especially for long-distance routes, to provide assistant to passengers but also to comply with regulations • Requires data centres to collect and analyse data in real time on the movement of vehicle and infrastructure conditions • Requires measures to ensure that the software and the data centres are protected from hacking
Impacts
• Vehicles will not be faster than existing ones, but will be more reliable, as the vehicle can use data to handle unforeseen events • Vehicles will be safer • Will not change the basics of the current business model • Will not provide new services but rather improve existing ones • Routes that are unprofitable will remain unprofitable, regardless of the type of vehicles • However, new on-demand services could be implemented in some of those routes • The organisation would not consider expanding to related markets (i.e., transport data management) • Ticket revenue will not necessarily increase. However, additional revenues could be made by

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expanding advertising surfaces outside or inside the buses, as automation will release some space • Costs will rise, as vehicle costs will not be compensated by the cost reduction allowed by increased efficiency. Costs will only decrease if supply of self-driving vehicle technology increases • Adaptation requires new jobs related to the operation and maintenance of the vehicles and associated software. This can contribute to attract individuals who currently do not consider working for this organisation • However, no impact is expected on workforce gender equality, beyond the efforts the company is already putting on that issue • Requires training of existing workforce • Problems of lack of physical accessibility to buses, and social exclusion because of lack of access or knowledge about digital tools, will still remain, or even be aggravated when vehicles are self-driving. • The organisation would consider changing some of the garage locations, if the self-driving technology could assist the process of parking, refuelling, and cleaning of buses

Table 171: Organisation B - SWOT analysis

Strengths	Weaknesses
• Large company present in several countries and operating a variety of transport modes • Owns two self-driving buses, one of them already operating • Has been incorporating automation in vehicles for long time	• It is more difficult to automate long-distance bus services, one of the key services of the company
Opportunities	**Threats**
• Self-driving vehicles can be used for on-demand transport services • Self-driving vehicles will improve safety and reliability of services provided • Can recruit staff from groups that currently are not attracted to working in the organisation • Additional revenue could be raised from expanding advertising surfaces • Could optimize facilities, by changing location of some of the garages	• Technology can become obsolete soon, requiring more investment in new vehicles • Vehicles are costly • Regulatory challenges • Problems in the service provided for some market segments, e.g., people with disabilities, those at risk of digital exclusion

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10.3.3 Organisation C – Passenger transport

Table 172: Organisation C - information sheet

Organisation characteristics
• Main operator of bus services in a mid-sided city • Provides regular city services and routes serving schools • Only 17% of the routes served are profitable • 70% of the revenue comes from public funding, 25% from ticket revenue, and 5% from advertising • 85% of the workforce are drivers and 86% of drivers are men
Current situation with regards to transport
• The organisation owns 50 large buses, 35 small buses, 67 mini-buses, and 22 tourist buses. It has the largest fleet of electric buses in the country • Traffic congestion is the main challenge • Another challenge is lack of suitable infrastructure and traffic management (bus lanes, bus stops, bus priority at junctions) • Difficult to recruit drivers • Need to meet increased demand for passenger travel
Use case discussed in interview
Self-driving bus
Perceptions
• The organisation is aware of self-driving vehicles and following developments • Self-driving vehicles are costly to acquire, but cheaper to operate than conventional vehicles (lower energy and maintenance costs). • Concern that users will not respond well to self-driving vehicles in the beginning but will eventually accept them • Self-driving vehicles still cannot handle unexpected situations well • Concern about whether the technology will meet the needs of passengers with disabilities
Intentions
• No intention to acquire self-driving buses in next five years • Receptive to idea of introducing these buses within a pilot scheme framework • Would consider acquiring self-driving buses in 10 years' time
Needs
• Requires improvement in physical infrastructure to ensure that bus circulation is safe • Requires solving restrictions about vehicle charging – a problem the organisation currently faces in relation to electric buses • Requires investment in data control and monitoring facilities • Requires vehicles that provide a suitable interface between passengers and the vehicle – for example, ensuring passenger can get off the bus when needed or that the bus stops when a passenger is waiting at a bus stop
Impacts
• Self-driving buses could help the organisation to meet increased demand for passenger travel without the need to recruit more drivers (which currently is a challenge) • They could service circular routes in city centre and those used by tourists • They could be used in night services, for which it is more difficult to recruit drivers • The organisation would not provide new services but rather improve existing ones, assuming that self-driving vehicles would come in tandem with an improvement in infrastructure and traffic management systems in the roads used • It could improve operational aspects, as currently they are restricted by regulations on number of hours the drivers can work and the timing of their breaks • Self-driving buses will reduce collisions but will not eliminate them as they cannot handle unexpected situations

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• They will also be faster, and more reliable in terms of observance of schedules, as they can communicate with the infrastructure (for example, allowing for smart signalling) • Routes that currently are unprofitable will remain so • Could increase revenue, as services will be more reliable, and so attract more demand • Could reduce costs, as energy and maintenance costs will decrease • Driver costs will decrease, but this will be compensated by increase in costs of other staff • Need for new staff responsible for supervising and monitoring the system. Also, some scope to offer entry-level positions in these areas • Drivers will still be employed as not all routes will be able to use self-driving vehicles • It will be more difficult for the older staff to adapt to the changes • As depot facilities may require less space, they could be relocated to further away from congested areas

Table 173: Organisation C - SWOT analysis

Strengths	Weaknesses
• Little competition from other public transport providers in the areas served	• Most bus routes are unprofitable • Dependence on public funding • Difficult to recruit drivers • No gender balance: workforce is overwhelmingly male
Opportunities	**Threats**
• Self-driving vehicles are more reliable and can help meeting existing demand and increase revenue • They could mitigate problems recruiting drivers • They could reduce energy and maintenance costs • They could improve operational aspects • Possible relocation of some facilities to less congested areas	• Congested roads • Lack of suitable infrastructure and traffic management • Problems in the service provided for some market segments, e.g., people with disabilities • Unprofitable routes will remain so • Problems in engaging older staff

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10.3.4 Organisation D – Passenger transport

Organisation D is a public transport authority, responsible for the concession of bus services in its region. The organisation has participated in the interview mostly by giving the points of view of the bus service operators and, where applicable, also the point of view of the authority

Table 174: Organisation D - information sheet

Organisation characteristics
• The public transport authority has three bus concessions in the region • Half of bus operators' revenue is from ticket sales, the other half is from subsidies • Several hundreds of employees, across all bus operators, with a range of different roles
Current situation with regards to transport
• The bus services include conventional buses and 8-seat vans driven by volunteers • More than 700 buses, across all bus operators • Planning to offer a "hub taxi" service to transport people from living in places with no bus services to main line bus stops • For new bus concessions, only electric buses should be bought • The main challenge is to recruit bus drivers. Most current drivers are approaching retirement • Fewer customers after Covid, as work patterns changed • Routes to villages are difficult to maintain, especially in evening and weekends • Vehicle maintenance and repair is expensive and complicated, it can cause service reduction
Use case discussed in interview
Self-driving bus
Perceptions
• Self-driving buses still require more technology developments • Expensive to buy but can reduce costs, especially labour costs • More reliable in sticking to schedules • Safer, as most collisions are due to human error, and buses will not go over the speed limit. But the system can fail or be hacked • More difficult to repair vehicles, or to solve problems during travel • More flexibility to create or modify bus routes • Can have more services in evenings, night-time, and weekends • Challenging to use self-driving buses in crowded areas with many pedestrians and cyclists • Due to investments needed, bus fares may have to increase • Customers may reject the idea of self-driving vehicles
Intentions
• Bus operators will be interested if they perceive self-driving buses as efficient • Self-driving buses may be necessary from 2030 as it will be difficult to recruit drivers • Operators may use self-driving community taxis or vans to link rural areas with main public transport services
Needs
• Requires large investment • Requires consideration of people's attitudes regarding self-driving buses • Requires measures to ensure accessibility to people with disabilities, and that these people are not afraid of using the buses. For example, measures to ensure they see, hear, or feel that the bus is approaching, and that the bus also "sees" them • The buses need suitable internal designs, e.g., with emergency buttons • Speed will have to be very low in crowded areas used by pedestrians and cyclists • Requires stewards at bus stations and on board • Requires changes in infrastructure (such as dedicated lanes for self-driving buses) and traffic management (to allow the bus to communicate with traffic signal systems)

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• Requires close monitoring of the whole transport system, because if one vehicle fails, it will affect the whole system
Impacts
• No changes foreseen in business models • Can solve problem of recruiting drivers • In the long term, it can reduce costs for operators • Because of investment, in the beginning, bus fares will increase • Bus travel will be faster outside crowded areas but only if buses can use dedicated lanes and have priority at traffic signals • Travel will also be more reliable as buses are driven by machines, but this also depends on the existence of dedicated lanes and signal priority • Travel will probably be safer, but self-driving buses are vulnerable to system failure or hacking • New routes and routes at different times of day or days of week increase accessibility to workplaces and leisure areas • Community and on-demand transport also improve accessibility, especially in rural areas • It can improve gender equality as it can allow for more flexible travel, e.g. escort children to school before going to work, a task currently performed by women • Customers can communicate with the system (e.g., booking taxis, vans, or buses via an app) • Bus-km offered by the operators will increase • With time, it will improve people's perceptions of bus travel, as self-driving services will be more reliable, so demand can increase • If self-driving cars are affordable, people may prefer them, rather than self-driving buses, as cars will also provide the opportunity to use travel time for productive or leisure uses (currently, human-driven buses provide this opportunity, but human-driven cars do not). • Some drivers could be retrained as stewards at bus stations, helping passengers getting on the right bus and assisting those with disabilities. However, most existing drivers will be retired by then • More technical staff will be needed to operate the system (maintaining the vehicles, monitoring and controlling the technology) and offering customer service for on-demand transport users • Gender equality in the workforce will be easier to achieve, as a range of new roles will be available • More entry-level positions could be offered, e.g., for stewards at bus stations • Older staff will face more challenges to adapt to the new job circumstances. Some may need to retire early if they cannot be re-assigned to new roles. • No changes anticipated in location of depots, as a new depot has recently been built. But new depots could be located in areas with cheaper land prices, away from the centre, if the self-driving buses can travel easily from them to the bus stations • It can reduce parking supply and demand in the city centre, as self-driving bus services could connect people from parking areas outside the centre. • Released parking space could be reallocated as green spaces, parklets, or outdoor cafés • Car ownership and use could decrease in urban areas but not necessarily in rural areas

Table 175: Organisation D - SWOT analysis

Strengths	Weaknesses
• Already has community transport in place and plans to extend it • Already has plans for decarbonisation of the bus fleet	• Half of revenue is from subsidies • Difficult to recruit bus drivers • Reduced demand after Covid • Difficult to maintain rural routes
Opportunities	**Threats**
• Can reduce labour costs and land costs of ne depots • Increased reliability can improve people's image of bus travel • Create new routes, offer more night and weekend services • Create more on-demand and community	• Users may not be willing to use self-driving services • Users may prefer to use self-driving cars • Possible problems in service provided for people with disabilities • Challenges in crowded areas, bus speed may need to be low

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transport services • Contribute to better accessibility and reduction of parking space in the region	• Ticket prices may need to increase

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10.3.5 Organisation E – Freight transport

Table 176: Organisation E - information sheet

Organisation characteristics
• Freight company operating in a country, part of a larger multinational company • Handles international and long distance deliveries but also regional and local delivers • Uses a hub-and-spoke system, collecting deliveries during the day, which are then sorted in the hub, loaded onto trucks to be transported to their destinations • In the country analysed, the company has over 10 hubs and 74 distribution centres
Current situation with regards to transport
• Long experience in the sector • Difficult to recruit drivers. Most of workforce is approaching retirement age and it is difficult to recruit younger drivers • Most drivers are male
Use case discussed in interview
Long distance self-driving truck
Perceptions
• Self-driving trucks can be a good solution to increase the reliability of the delivery process • But they lack a human element, which is important in the delivery business
Intentions
• Plans for adopting self-driving trucks on an incremental basis. First, incorporating a small truck to transport packages inside the distribution centres • Then, trial a journey from hub to hub or hub to spoke, with a safety driver • Finally, try complete automation
Needs
• The public needs to accept having self-driving trucks using the roads • Self-driving trucks need to be combined with last-mile solutions using smaller vehicles • Even with these solutions, the customer still needs to collect the package from where the vehicle is parked, which could be a problem for individuals with disabilities, and for all customers when it is raining • Requires large data flows between vehicles and control room, with coverage for the whole journey • Requires investment in digital infrastructure – uncertain who will provide it (transport operators, communications companies, or governments)
Impacts
• No anticipated change in the business model • No anticipated expansion in markets served, or change in number of deliveries • Can reduce costs by cutting the human element • Can increase reliability of deliveries as it reduces dependence on drivers (who can, for example arrive late or stop on the way) • The whole delivery process will be more reliable, as the integration between trucks and air transport will be improved. This can also reduce costs • Removing the human element can weaken the bond between the customers and the company (for example, the company's uniforms are a distinctive part of the company's image and are instantly recognised by the public). This can even reduce demand. • Safety will increase but collisions will never be eliminated • Workforce will be reduced, although some staff may be retrained for new positions, such as teleoperations coordinating all the self-driving vehicles on the road • Uncertain if workforce gender quality will improve

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Table 177: Organisation E - SWOT analysis

Strengths	Weaknesses
• Large company, part of a multinational group • Long experience in the business	• Difficult to recruit drivers
Opportunities	**Threats**
• Self-driving trucks could mitigate problems recruiting drivers • They can reduce costs by reducing labour costs • They will increase the reliability of the delivery process, reducing costs	• Self-driving trucks can not deliver packages, they require last-mile solutions • Lack of human interaction can deteriorate the company's image and reduce demand • The public may not accept self-driving trucks using the roads • Digital infrastructure may not support reliable data transmission over the whole journey, over long distances

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10.3.6 Organisation F – Medical product deliveries

Table 178: Organisation F - information sheet

Organisation characteristics
• Organisation developing and deploying drones • Uses drones to transport medical products • Core funding is private but has received funding from national and European funds • Two business models: selling drones directly to customers (sometimes also involving maintenance series), and providing delivery services, charged either per km or per mission • More than 60 employees, with a good gender balance • Range of jobs: factory workers, drone operation, research and development, business development
Current situation with regards to transport
• Uses drones to transport medical products between labs and hospitals over distances of up to 80km several times a day, above various land uses, including dense cities • The main challenge has not been technological but regulatory
Use case discussed in interview
Delivery drones
Perceptions
• Drone allows for fast and direct delivery of medical products • Faster than road-based deliveries • High degree of reliability; tends to always have same travel time, regardless of weather conditions • Drones reduce delivery time but at a higher cost • Battery life can still be improved. Battery needs to be charged or replaced at destination before drone returns to sender • Wind conditions can limit the distance that can be covered • Landing in rooftops will be possible soon but it will take some time until technology allows for drones to land in balconies in residences • Many safety procedures in place • Regulations are lagging, considering the advance in technology • Complying with regulations is time-consuming and expensive • Cannot fly over some land uses, e.g. schools • Requires extensive testing, which is also expensive • Dealing with liability insurance issues is a complicated process
Intentions
• Wants to scale up operations • Wants to reach new customers within the health sector and beyond
Needs
• Development of drone technology requires large amounts of funding • Needs training of the staff in the healthcare institutions to send and receive the product • Needs systems so that senders and receivers monitor the location and speed of the drone and the state of the medical products transported (e.g. temperature) • Needs systems to ensure that the products transported are not damaged • Needs changes in regulations • Needs suitable locations for taking off and landing (at least a 5x5m space) • Carrying larger loads requires improvements in battery life and relaxing regulations • Requires cooperation with other companies to secure data and prevent hacking, and with research organisations
Impacts
• Reduces delivery time compared with delivery by road, because it flies directly (road-based deliveries usually involve collecting several items along the way) and avoids congestion

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• More reliable deliveries, not subject to road conditions, and resilient to whether conditions • Deliveries are more expensive • Reduces road congestion • Electric vehicle, so it can reduce emissions compared with road-based deliveries • It can be used for emergency deliveries that can save lives • Commercially, it works in built up areas, because it has advantages over road-based delivery, but not in rural areas • Can save labour costs, compared with road-based deliveries, staff can supervise several drones at same time • Difficult to expand market, as it is a bespoke service • In the future, if many drones are used, there can be congestion in the air, and priorities need to be established (e.g. for emergency deliveries) • Organisation can attract highly-skilled workers, but it is difficult to retain them in the long-term

Table 179: Organisation F - SWOT analysis

Strengths	Weaknesses
• Company specialising in a new technology, bases on self-driving vehicles that can be useful for a specific sector (health) • Few competitors, given the regulatory barriers	• Sells expensive product and services • Product has short battery life • Cannot transport heavy loads • Compliance with regulations is time-consuming and expensive • Based in Europe, where regulations are tight • Difficult to retain highly-skilled employees
Opportunities	**Threats**
• Potential for expanding market within the health sector (e.g. not only hospitals but also pharmaceutical companies and drug manufacturers).	• Difficult to attract institutional investors • Regulations not adapting to the use of drones

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10.3.7 Organisation G – Waste collection

Table 180: Organisation G - information sheet

Organisation characteristics
• Provides waste collection and management, street cleaning, and green area maintenance services in almost 100 municipalities in a European country. • It is also present in other European countries • Part of a larger multinational economic group • Two business models: public contracts through tenders and contracts with large private institutions • Operates mainly in large cities but also in towns and villages • More than 15,000 employees overall in the country, with about 10% working in waste collection
Current situation with regards to transport
• Owns hundreds of vehicles, travelling 24,000km a day • Collects waste from customers and transports to waste treatment sites • More than one trip can be made to collect waste from a customer, in case of large quantities • Trips made from before dawn (4-5am) until early afternoon • Some trips are made by the driver alone, others with more staff • Difficult to recruit drivers. In addition, when there are new positions, women do not usually apply
Use case discussed in interview
Self-driving waste collection vehicle
Perceptions
• Self-driving vehicles will not be deployed in the next 10 years • The industry needs to continue working on ensuring self-driving vehicles are safe • Self-driving vehicles will be expensive • Self-driving vehicles could be rejected by society because of concerns with safety or job losses
Intentions
• Does not envisage a replacement of the whole vehicle fleet of the organisation with self-driving vehicles in the next 25 years • The investment in this type of vehicles is too high to recover in short-term contracts with customers. It is only worth if the vehicle produces large savings and can be used in more than one contract
Needs
• The vehicle design would need to fit the purpose of waste collection (e.g., including a hook that loads a container) • It would also require multiple autonomous functionalities, not only moving but also loading and unloading • It would require testing in controlled environments before deploying • Would require standardization in terms of the location of the containers to collect and the timing of the collection • The organisation would only use self-driving vehicles if reassured that tests have been done and legislation has been applied regarding the safety of the vehicle. The company does not transport passengers, but safety issues are still important with regards to workers using the vehicle and citizens in the surroundings • The use of self-driving vehicles needs to be a priority of the organisation's customers, not the organisation itself. Public sector customers could add this as a selection criterion for awarding tenders. • At the beginning, the public sector would have to pay for these vehicles
Impacts
• Can improve operations, but that will not happen in the next 10 years • Vehicle repair would be more demanding than now • Self-driving vehicles could improve the organisations' competitive position in gaining public

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tenders but only if the use of these vehicles is a selection criterion (Not because of reduced costs) • Organisation would not expand to new markets • Self-driving vehicles will probably not change revenue • They could reduce costs as vehicles “can work 14 hours a day, do not take sick leave, and do not have mood swings” • Most drivers could be re-assigned to other tasks such as vehicle maintenance. Re-training is needed • Not all staff would adapt to the change in the same way. That is not related to age but to attitude. • Change to self-driving vehicles could improve the gender balance of the workforce • If self-driving vehicles could reduce waste collection costs, public authorities could reduce taxes that fund this service, benefiting citizens

Table 181: Organisation G - SWOT analysis

Strengths	Weaknesses
• Large company in a specialised sector • Works both for public and private customers	• Difficult to recruit drivers • The waste collection sector has a predominantly male workforce (not only among drivers)
Opportunities	**Threats**
• Possible reduction in costs	• It may not be possible to adapt self-driving vehicles for the purpose of waste collection • Cost reduction may not justify the investment

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10.3.8 Organisation H – Local government

Organisation D is a local government. It has participated in the interview mostly by giving the points of view of a large institution using passenger and freight transport. Where applicable, it also gave the point of view of a transport authority

Table 182: Organisation H - information sheet

Organisation characteristics
• Government of a mid-sized city • 450 employees
Current situation with regards to transport
• Does not own vehicles for employee transport • Owns vehicles used for services such as cleaning • No employees whose main occupation is driver, but an employee drives the Mayor for business trips • Most employees commute by car • Employees face problems related to lack of parking space, which sometimes causes them to be late. They also complain about high fuel prices • The organisation currently gives a €200 travel allowance to almost all its employees • The organisation is studying a possibility of a small bus where employees can park outside the city centre and the bus will pick them up • The organisation sends a large amount of internal and external mail, including packages, using the post office. These sometimes arrive late or not at all
Use case discussed in interview
Passenger use case: self-driving bus **Freight use case**: delivery drones
Perceptions
Self-driving bus • Self-driving buses provide an opportunity to transport several people together and may not require parking space • Users may not want to use self-driving buses as they may perceive it as unsafe • Self-driving buses will not be flexible as a driver is. If a passenger is late, the vehicle will not wait **Delivery drone** • Delivery drones address security issues, as it would prevent theft of important documents • However, they cannot carry large quantities or heavy objects • Perceived to be more expensive than existing delivery methods • Perceived to be generally safe
Intentions
• The organisation is receptive to the idea of acquiring a self-driving bus or mini-bus • It would use the self-driving bus to transport employees, a cheaper solution than the travel allowance it currently gives them • The organisation would not buy its own drone but would outsource an external company when it needs to use a one
Needs
• A human driver should be in the self-driving bus, at least in the beginning, so that users gain trust in the system • The road safety code will need to be changed for the safe movement of the self-driving bus • The delivery drone will need to be faster than existing methods, to compensate for the likely higher price

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Impacts
Self-driving bus • It will reduce the institution's travel costs, because using the self-driving mini-bus is cheaper than the travel allowance currently given to employees. • It is likely that younger staff will use the bus more than older staff • It would reduce stress reduced effort and time needed to find parking spaces • It would also increase productivity as it would reduce instances of staff arriving late because of time lost finding parking • It would not cut any job, as there are no employees whose sole function is to drive • It would also not create any new jobs, as even the maintenance of the self-driving bus could be done by current staff – but is likely that this would be younger staff only • There would not be any reduction in parking space: the plan is that spaces released by staff no longer needing to park staff would be used by citizens instead • Some facilities could be relocated away from the city centre **Delivery drone** • Drones may reduce road congestion • They may reduce parking problems • They can collide with birds • They will be safe • They will have no impact on the organisation's workforce

Table 183: Organisation H - SWOT analysis

Strengths	Weaknesses
• Public institution • No drivers, i.e., no staff whose role would be threatened by self-driving vehicles	• Staff relying on private car use
Opportunities	**Threats**
• Self-driving bus could save costs by replacing travel allowance currently given to employees • It would reduce car parking problems, reducing stress and late arrival of staff	• Staff not accepting the self-driving vehicle

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10.3.9 Organisation I – Educational institution

Table 184: Organisation I - information sheet

Organisation characteristics
• Mid-sized educational institution
Current situation with regards to transport
• Owns a bus but it is not used because of insurance and technical issues • One driver, but their licence has not been renewed because the vehicle is not being used • Outsources deliveries via courier services which go to the organisation and pick up the package • Deliveries are unreliable as they may take long time and be vulnerable to weather conditions. Packages may take long time to arrive even within the region
Use cases discussed in interview
Passenger use case: self-driving bus **Freight use case**: self-driving van
Perceptions
• Self-driving buses can be more reliable than self-driving ones • Self-driving vans can use existing infrastructure, unlike delivery robots and drones
Intentions
• The organisation does not intend to buy a self-driving van but outsource it from a bus company • It would also prefer using a delivery service based on self-driving vans than human-driven ones. It would not buy one, but lease it
Needs
• Prefers outsourcing rather than buying the vehicles to reduce maintenance or extra training needs • The institutional personnel would need to accept the new technology
Impacts
Self-driving bus • The self-driving bus can be used to transport students from/to the campus to the city centre, especially at hours when public buses are not operating • It can also be used for occasional uses, such as site visits or conferences • Up to 20 new job positions may be created, dealing with the information system • The former driver can retain their job, maintaining the vehicle, but this requires retraining • The service can reduce stress of staff and students, due to greater flexibility in their schedules • Staff and students will attend classes on time, improving productivity • Transport plans may be offered for staff and students (e.g. free tickets) • Can improve the image of the institution (better quality of life), which may attract new students • Supply and demand for parking spaces will likely remain the same • Some relocation of buildings inside the campus is possible • It may improve accessibility of people with disabilities, if free bus passes are offered, funded by the public sector **Self-driving van** • No impacts mentioned

Table 185: Organisation I - SWOT analysis

Strengths	**Weaknesses**
• A diverse community of staff and students	• Belief that in general staff is resistant to change
Opportunities	**Threats**
• Self-driving bus can improve mobility of staff and students • This has potential added benefits in terms of	• None identified

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reduced stress, productivity, and the image of the university	

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10.3.10 Organisation J – Vehicle developer

Table 186: Organisation J - information sheet

Organisation characteristics
• Organisation developing a self-driving mini-bus • Secured letters of intent from prospective customers (city governments, transport operators) • Innovation activities have been funded by private and public funding • Other revenue sources are the development of app-based on-demand transport services • 40 employees, and another 20 in an associated company specifically developing the automated system. Variety of roles (technical, business, legal) • Men are 75% of the workforce. The average age is around 30 • Difficult to recruit staff as the market is small for some of the highly-skilled positions required by the company • Partnerships with research institutions
Current situation with regards to transport
• Developed a self-driving mini-bus and has trialled it on public roads • The main challenge has not been technological but regulatory
Use case discussed in interview
Self-driving bus
Perceptions
• Self-driving buses can be used to provide regular bus passenger services over short distances but also longer ones (up to 200km) • Mini-buses can also be used within sites, both public and private (e.g. linking different parts of a company site, business estate, university campus, port, airport, parks, and even cemeteries, or linking them with car parking areas). • They are safe. But collisions will still happen if conventional vehicles or pedestrians do not see the self-driving bus and hit it. • Development of the vehicles is expensive • Trialling them is also expensive and requires navigating complicated regulations and insurance procedures • Vehicle is expensive to produce now and would be expensive to buy, but when it starts to be produced and sold (2028) it is expected it will not be more expensive than a conventional electric mini-bus. • Concern that the potential market for self-driving vehicles has been affected by recent setbacks in the industry, including companies that developed products but failed to commercialise them • Self-driving mini-buses may require having a human operator on board, at least initially, while regulations are still adapting
Intentions
• Wants to keep developing the vehicle so that it is homologated by 2027 • Hopes to start producing the vehicle in 2028 • Hoping to sell to national and international buyers • The organisation could also open up additional revenue sources by offering services to public transport operators such as management or supervision of self-driving bus fleets
Needs
• Requires strategic funding from various sources (private and public, national and European) • Requires more relaxed regulations regarding tests and deployment of the bus on public roads • Requires demonstrating the vehicle to citizens so that they are aware of this solution and how it can change their lives • Requires city authorities to promote these vehicles, so that they are regarded as a better solution than self-driving private cars • Requires producing data to show to potential customers, especially regarding the cost savings that

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self-driving buses will provide • Infrastructure needs to be changed so that vehicles can communicate with traffic signals
Impacts
• Rising market potential for the organisation, as public transport operators are facing increased labour costs and difficulty to recruit drivers • Believes market will be mostly the public sector (governments on bus services run by municipal companies or contracted by them) • The developed mini-bus can improve people's accessibility, as it can be used for on-demand services or to transport people from areas not currently served by public transport to central locations or public transport hubs • The first localities that deploy self-driving buses can improve their image, due to media coverage • Public transport operators may be able to reduce labour costs • Believes that in the long term city transport systems will be based on shared self-driving vehicles, not private ones • It will be complicated to establish legal liability in case of collisions

Table 187: Organisation J - SWOT analysis

Strengths	Weaknesses
• Early mover in this market • Have developed, tested, and trialled an innovative product • Believes that the country is operating in is pro-technology	• Workforce is predominantly male and younger • Difficult to receive approvals for tests and deployments on public roads • Reliance on public funds: revenues only cover a small percentage of investment and operating costs
Opportunities	**Threats**
• Public transport operators are struggling to find drivers and self-driving buses could be a solution	• Market growing slowly • Not being able to find further funding from public sources • Vehicle not homologated within the expected timeframe (2027) • Regulations not yet in place when company intends to commercialise the vehicles (2028)

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10.3.11 Organisation K – Software developer

Table 188: Organisation K - information sheet

Organisation characteristics
• Start-up company working in a European country but with headquarters outside Europe • It is developing systems based on artificial intelligence for self-driving vehicles to react to rare events • The systems are used in trials of self-driving vehicles, not in road traffic • This is based on large datasets including video recordings of real-world traffic, from surveillance cameras and vehicle dashboards, as well as reports from insurance companies, and interviews with taxi and bus drivers • 10 staff in the European office (engineers), only two of them women. Average age around 25. Plan to reach more women and individuals from ethnic minorities in the next recruitment round but without positive discrimination in recruitment procedures • High salary costs, as it requires high-skilled staff and is based in an expensive city • Offers paid internships to university students. Some are recruited by the company afterwards • Main customers are governments • Is trying to diversify revenue sources by offering artificial intelligence solutions in domains other than self-driving vehicles
Current situation with regards to transport
• It is a software developer, not a transport vehicle manufacturer or transport service provider.
Use case discussed in interview
None in particular. General discussion on self-driving vehicles
Perceptions
• Concern that societal, business, and political enthusiasm for self-driving vehicles is decreasing • View that there is still work to do to improve advanced driver-assistance systems, before full automation • View that full automation still requires solutions for the vehicles to detect objects of the road (e.g. wires, litter) and to react to events such as fast-moving emergency vehicles • View that some users are frustrated with current advanced driver-assistance systems and overwhelmed with so many automated functions
Intentions
• The organisation is currently offering solutions for fully automated vehicles • However, it wants to expand business on solutions for advanced driver-assistance systems, as a stepping stone for better solutions for fully automated vehicles
Needs
• Requires strategic funding from a variety of investors, as innovative businesses as this are risky • Requires partnerships with governments, vehicle developers, and research institutions • Requires measures to protect intellectual property, which are costly • Few problems regarding legal liability, as the solution developed is used in trials, not in road traffic • Governments should be involved in trialling the vehicles, rather than relying on transport operators doing it • Requires regulations before solutions are developed, rather than governments reacting to the solutions • Difficult to comply with some regulations without disclosing confidential business information and compromising intellectual property • Requires standardisation (which is also related with regulation) • Users need to accept the technology – starting with advanced driver-assistance systems, before fully automated vehicles. • Requires changes in transport infrastructure • Vehicles should be able to communicate with other vehicles and with the infrastructure (such as

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traffic signals and electronic signs).
Impacts
• Unsure of the market potential for fully automated vehicles • Market for the software developed by the company is narrow • View that users will not want to spend much time inside the self-driving cars, regardless of the possibilities to use their time. They will rather have shorter travel times

Table 189: Organisation K - SWOT analysis

Strengths	Weaknesses
• Company working in a specialised aspect of self-driving vehicle technology (rare events), with few competitors • Highly-skilled workforce • Access to large amounts of data • Partnerships with vehicle manufacturers	• Dependence on public sector customers (governments) • Workforce is predominantly male, younger, and from the ethnic majority
Opportunities	**Threats**
• Funding from research and innovation programmes • Use work on advanced driver-assistance systems as a stepping stone to fully automated vehicles	• Decreasing enthusiasm for self-driving vehicles • Users may not trust the technology • Not enough investors to ensure financial sustainability of the company

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10.4 Perceptions, intentions, needs and impacts on organisation

10.4.1 Overview

This section triangulates the information generated by the case studies, to derive insights on perceptions, intentions, needs, and impacts on organisations. The analysis is split by use case.

In the case of self-driving buses and drones, the information is derived from several organisations, including some who are potential users of these vehicles and others who are producing them. We treated self-driving mini-buses as a special case of buses, and so integrated information about them with that about larger buses.

In the case of trucks and waste collection vehicles, the analysis that follows has the caveat that it is derived from a single organisation (which is a potential user).

Self-driving vans were discussed with only one organisation, but the discussion did not generate enough information to allow any analysis. For this reason, results for this use case are not presented.

10.4.2 Perceptions

Table 190 shows the perceptions about the four use cases. The self-driving mini-bus was perceived to have large potential to meet user needs that are not currently met with human-driven buses. However, organisations identified a mix of advantages and disadvantages in using these buses. Self-driving buses are safer and more reliable and may reduce costs, but this requires large investment. There are also problems that need to be fixed, especially those that may cause barriers for users with disabilities. A general view across most organisations was that a human assistant, or even a safety driver, may still be needed, at least in the initial stages of implementation of these buses.

The self-driving truck was perceived as enhancing the reliability of deliveries but it has to be complemented with last-mile solutions and may alienate customers who are used to human interaction when receiving deliveries.

Drones also have wide potential, and share the same advantage identified for buses and drones: reliability. However, it is also perceived as expensive. There are also issues that have not been fully resolved regarding battery range and compliance with regulations.

As the other vehicles, the self-driving waste collection vehicle is also perceived as expensive to buy but it can also lead to a reduction of costs when in use.

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Table 190: Perceptions of organisations on self-driving vehicle use cases

Use case	Perceptions
Bus	**Potential** • Large potential to provide new public transport services (i.e. on-demand services, community transport) • Potential to create more bus routes, be flexible with existing ones, and offer night and weekend services • Potential for non-transport companies to use own vehicles to transport staff (e.g. for commuting or business trips) • Mini-buses can be used within sites such as universities or airports • Can cover small or long distances (up to 200km) • The public may not be willing to use a self-driving vehicle. Passengers may be concerned with being recorded **Advantages and disadvantages** • They are safer than human-driven buses, but technology still needs to be developed to avoid failures • More reliable in sticking to schedules • Costly to produce and purchase but can reduce costs, especially labour costs • They may be cheaper to operate (reduced energy and maintenance costs) • Not as flexible as a human driver (e.g., human would wait if a passenger were late) • More difficult to repair or solve problems during travel • Human assistant (safety driver) may be needed • Possible problems for passengers with disabilities
Truck	• Can increase reliability of deliveries and improve integration between different delivery modes (e.g. truck with airplane) • Needs to be complemented with last-mile solutions • They lack a human element that customers value
Drone	**Potential** • Can carry medical products in case of emergencies • Can securely carry confidential documents • Cannot carry numerous or heavy objects **Advantages and disadvantages** • Fast and reliable (in terms of delivery time and resilience to weather conditions) • Generally safe • Issues with battery range, and flying over or landing on certain land uses • Expensive • Costly and time-consuming to comply with regulations and liability insurance • Still requires further testing
Waste collection vehicle	• Will be expensive to buy • It may reduce costs

10.4.3 Intentions

Table 191 shows the conclusions regarding intentions to use self-driving vehicles. The self-driving bus is already a reality in the life of some of the organisations interviewed, who are already using or testing them. There was a generally positive view regarding using these vehicles, both among transport providers and among institutions that use transport services. While most organisation showed interest in self-driving buses, their preference was for smaller ones. Regardless of intentions, self-driving buses they may prove to be necessary as organisations consistently stated

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that it is increasingly difficult to recruit drivers. At some point in the future, when current drivers (who tend to be older) retire, self-driving buses may be the only viable solution to keep bus services running. The generally positive intentions about these vehicles is somehow balanced with some apprehension among the companies developing the buses and automation software, as they think societal, business, and political enthusiasm over them has waned in the last few years.

Drones are already being used by one of the organisations. Others said they would use but not buy one.

Intentions about the self-driving truck were positive and the ones about the waste collection vehicle were less so, but these conclusions are based on the views of a single organisation each and should not be generalised.

Table 191: Intentions of organisations about self-driving vehicle use cases

Use case	Intentions
Bus	• Some transport providers already using or testing self-driving buses (mainly mini-buses) • Others would want to test these vehicles before acquiring them • Self-driving buses may be necessary at some point in the future due to the growing difficulty in recruiting drivers • Willingness to try self-driving mini-buses for on-demand services • It will take long time to replace the larger buses or to apply self-driving technology on longer routes • Self-driving buses may only complement, rather than completely replace human-driven ones • Non-transport companies may either buy or outsource one to use when needed • Organisations developing self-driving vehicles and software are hopeful they can commercialise their products but concerned that societal, business, and political enthusiasm for them has waned in last few years
Truck	• The organisation interviewed to discuss this use case has an incremental plan to deploy self-driving trucks, first in their own facilities, then on public roads
Drone	• One of the organisations interviewed is already using drones for deliveries • Non-transport organisations would probably not buy their own drone but outsource one when needed
Waste collection vehicle	• The organisation interviewed will not replace their entire vehicle fleet with self-driving vehicles in the next 25 years

10.4.4 Needs

Organisations mentioned several needs and requirements to start using these vehicles (Table 192). Using self-driving buses requires a series of pre-conditions related to the development of the vehicles and adaptation of the infrastructure, regulations, and workforce. The price of the vehicle is also a barrier. Using self-driving buses also requires meeting several operational criteria. Lastly, users need to be convinced that the vehicles are indeed a good solution.

Public acceptance has also been identified as important in the case of the truck. Using a drone has also a series of requirements regarding technical, financial, and regulatory aspects. The case of waste collection vehicles is also complicated, as this is a very specific type of vehicle for which automation needs to meet additional functional criteria.

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Table 192: Needs of organisations regarding self-driving vehicle use cases

Use case	Needs
Bus	**Pre-conditions** • Requires funding, research, and collaboration to trial solutions • Need to reduce regulatory barriers to the development of these buses • Need to integrate self-driving buses with other modes • Vehicles need to be cheaper • Need to redesign or improve infrastructure (e.g. bus lanes) and traffic management (e.g. traffic signals communicating with the bus and giving them priority) • Need to expand and improve network of charging facilities • Need to secure technology and data from hackers • Need to adapt road traffic regulations • Need to motivate and reskill employees **Operation** • Requires close monitoring of the whole transport system • Need for suitable interfaces for passengers to communicate with the vehicle (e.g., to get off the bus or be picked up at a stop) • Vehicles need to be adapted for the use of passengers with disabilities • Human assistant (safety driver) will always be needed • Human assistants will also be needed at stations • Speed may have to be low in crowded areas with many pedestrians and cyclists **Users** • Users need to gain awareness and trust • Requires demonstrating the vehicles to citizens to increase acceptance
Truck	• Needs to be combined with last-mile solutions • Requires large amounts of data circulation, and the digital infrastructure to support it, especially in long journeys • The public needs to accept self-driving trucks circulating on the road
Drone	• Requires funding, research, and collaboration to trial solutions • Requires suitable locations for taking off and landing • Requires training both for senders and receivers • Requires extensive safety procedures • Requires changes in regulations • Batteries need to be further improved • Would need to be faster or more secure than existing methods, to compensate for the likely higher price
Waste collection vehicle	• Vehicles need to be fit for the purpose of waste collection • Needs to be autonomous both in movement and in handling waste • Needs comprehensive testing before using • Public authorities need to have a role in promoting these vehicles, both in contract awarding and in funding vehicle purchase

10.4.5 Impacts

This section analyses the impacts that self-driving vehicles may have on different aspects of the organisations. Some new business models may be possible for transport providers offering services using self-driving buses (Table 193). However, viable business models are still uncertain for the organisations developing these buses. In contrast, the organisation who is developing

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drones is already applying two types of business models. There is no anticipated change in business models for the other two use cases.

Table 193: Impacts of self-driving vehicle use cases on organisations – business models

Use case	Impacts on business models
Bus	• Possibility of running on-demand services based on mini-buses • Possibility of raising revenue through expanding advertising surfaces • Companies developing the vehicles and software need suitable business models, with a diversity of revenue sources.
Truck	• No anticipated change in business models
Drone	• An organisation is already applying two types of business models: selling drones to customers and providing delivery services
Waste collection vehicle	• No anticipated change in business models

Table 194 shows the impacts on financial aspects. The general view for transport providers and institutional users is that self-driving buses are expensive but may increase revenue and decrease costs. However, this may happen only in the long term. Again, for the organisations developing the vehicles, financial aspects are more crucial, as they threaten the viability of the organisation itself. Securing funding and sustainable revenue streams is a challenge for these organisations at the moment.

Trucks and waste collection services are not expected to raise revenue but may reduce costs. The problem with drones is mainly the high cost of the service, which needs to be passed on to the customer.

Table 194: Impacts of self-driving vehicle use cases on organisations – financial aspects

Use case	Impacts on financial aspects
Bus	• Self-driving buses are expensive • Revenue can increase if the efficiency and reliability gains increase demand • Labour and probably energy and maintenance costs will decrease • Large cost reduction and revenue increase only possible when technology is further developed • For non-transport companies, it could reduce costs, if running the bus is cheaper than giving staff a travel allowance • Companies developing the vehicles and software struggle finding enough funding for their activities
Truck	• Not expecting to increase revenue through increased demand • Can reduce labour costs and costs related to delivery problems, as the delivery process will be more reliable
Drone	• The costs of operating a drone delivery service are high, so the prices charged to customers also need to be high, otherwise the service cannot make a profit
Waste collection vehicle	• It will probably not change revenue. No anticipated expansion to new markets or major gains in competitive position • It may reduce costs, as the automated processes may be cheaper than labour

There is a general view among all organisations that all use cases will improve reliability, both for passenger and freight transport (Table 195). This was referred mainly in terms of travel time reliability. Operations may also be more efficient in terms of resource use, for all use cases,

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although this may happen only in the long term, especially in the case of the waste collection vehicle.

Table 195: Impacts of self-driving vehicle use cases on organisations – operational aspects

Use case	Impacts on operational aspects
Bus	• Vehicles will be more reliable as data can be used to mitigate problems • More efficient use of resources, as bus operation is currently restricted by regulations on number of hours the drivers can work and timing of their breaks
Truck	• More reliable distribution process: problems caused by delays will be reduced, as integration between modes will be easier
Drone	• Reduces delivery time and delays, compared with road-based deliveries
Waste collection vehicle	• Can improve operations although organisation interviewed believes that will not happen in next 10 years • Vehicle repair will be more demanding than now

Employment aspects were discussed at length by all organisations (Table 196). Three themes cut across all use cases: 1) There is a belief that self-driving vehicles will solve existing problems of recruiting drivers. 2) The use of these vehicles will create new positions, and 3) There is also hope that drivers could be retrained to work in these new positions or in existing ones. Organisations discussing the self-driving bus use case gave additional detail, mentioning that is may be possible to diversify their workforce.

Table 196: Impacts of self-driving vehicle use cases on organisations – employment

Use case	Impacts on employment aspects
Bus	• Some organisations think it will reduce problems in recruiting staff, but others think it may still be difficult to recruit staff • New positions needed to manage and monitor the system • Some belief that drivers can still be employed as not all routes would be using self-driving buses • Need to motivate and reskill employees • Can attract staff from groups currently not interested in working for the organisation • Can open entry-level positions
Truck	• Workforce will be reduced • Some staff may be retrained
Drone	• A start-up company has been engaged in drone deliveries. They reported no problems in recruiting staff, but problems in retaining high-qualified staff
Waste collection vehicle	• Organisation interviewed believes that most drivers could be reassigned to other tasks

Regulatory issues came across as a major issue for most organisations, especially for those developing self-driving vehicles and software, but also for transport providers (Table 197). This is especially important in the case of drones.

Table 197: Impacts of self-driving vehicle use cases on organisations – regulatory aspects

Use case	Impacts on regulatory aspects
Bus	• Traffic regulations need to be made compatible with the need to provide services for passengers with disabilities • Regulations applying for long-distance travel need to be re-assessed
Truck	No information provided

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Drone	• Requires an extensive set of new regulations regarding where drones can take off, land, and fly over, as well as safety and security aspects
Waste collection vehicle	• Public authorities could require that waste collection is done with self-driving vehicles, when awarding contracts

10.5 Views on wider impacts

This section triangulates the information generated by the case studies to derive insights on the organisations' views on the wider impacts of self-driving vehicles in their regions. The analysis is split between positive and negative impacts.

Mobility is likely to increase, as the new vehicles can be used to extend the supply of public or company-based transport services, while also increasing travel time reliability (Table 198). However, this comes at the expense of higher travel costs. There are also the risks the increases in mobility will be felt in all areas, and that individuals will prefer self-driving cars rather than public transport. The view is that congestion will decrease (Table 199). However, organisations expressed this view thinking that vehicles will be more reliable and can deal better with bottlenecks or unexpected events, reducing delays. They did not relate possible increases in private car ownership and use with increased traffic levels and congestion.

Table 198: Organisations views on wider impacts – mobility

Positive	• New on-demand services may be implemented • More scope for night-time public transport services (which are currently limited by difficulties in recruiting drivers) • Public transport services will be more reliable • Organisations can use self-driving vehicles to transport staff when public transport services are not running
Negative	• New travel options may be expensive • Areas currently not reached by public transport may still be inaccessible if routes remain unprofitable • The public may choose self-driving private cars rather than public transport alternatives

Table 199: Organisations views on wider impacts – transport network

Positive	• Self-driving buses can reduce traffic congestion as vehicles will be more reliable • Drones could reduce road congestion • Disruption may be reduced as data allows vehicles to better handle unexpected situations
Negative	• More complex traffic regulations and control needed

Some organisations expressed an intention to change location of their facilities to less central areas, although this was never expressed very strongly (Table 200). On the negative side, there was consensus among the non-transport institutions that self-driving vehicles will not have an impact either on the supply or demand for parking spaces, so parking problems will remain. The environment was mentioned rarely, with some organisations mentioning that emissions will decrease, with another raising specific concerns about drones colliding with birds (Table 201)

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Table 200: Organisations views on wider impacts – land use

Positive	• Some large transport depots could be relocated if automation facilitates parking, refuelling, and cleaning of vehicles • Non-transport organisations may also relocate some facilities to outside the city centre
Negative	• Non-transport institutions mentioned that the use of self-driving buses would not change either the supply or demand for parking spaces

Table 201: Organisations views on wider impacts – environment

Positive	Self-driving vehicles will reduce negative environmental impacts of the transport sector
Negative	Drones could collide with birds

The views on economic impacts (Table 202) revolved mostly about whether jobs will be created or destroyed, with organisations thinking both will happen and that the net effect is uncertain. Other positive impacts are increased productivity and institutional image.

Views were also mixed with regards to equity impacts (Table 203). On the plus side, self-driving vehicles will increase the accessibility of some groups. However, there was strong concern amount almost all organisation about whether self-driving vehicles raise new barriers for the mobility of people with disabilities. There was also no evidence from the interviews that the current gender imbalance in the transport sector will improve. In addition, the emergent industry developing self-driving vehicles and software is creating even more imbalances, as it is dominated by young men from ethnic majorities.

Table 202: Organisations views on wider impacts – economy

Positive	• New types of job will be created • Bus drivers may still be employed (as drivers), as not all routes may be suitable for self-driving vehicles. • It can improve productivity if it allows workers to arrive on time to their workplaces • It can improve the image of non-transport institutions using the vehicle, increasing demand for their services • A new industry developing self-driving vehicles and their software
Negative	• Some jobs will be destroyed • Large investments needed to protect vehicles and data from hackers

Table 203: Organisations views on wider impacts – equity

Positive	• Can improve accessibility of people in rural areas and night-shift workers • Allows for flexible travel, e.g. escort children to school before going to work, a task currently performed by women
Negative	• May be difficult to adapt buses to be accessible for passengers with disabilities (e.g. difficult to install ramps) • Digital exclusion will increase • No evidence from interviews that current gender imbalance in the work force will improve • Older staff may feel excluded • The new industry that is emerging for developing self-driving vehicles and their software is dominated by younger men from ethnic majorities

The reported impacts on public health (Table 204) and safety (Table 205) are all positive. Self-driving buses can improve accessibility to health facilities and drones can make emergency medical deliveries. Having more (and more reliable) public transport can also reduce stress. All

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organisations believe that vehicles will be safer, but that collisions will not be eliminated. With regards to security (Table 206), there was a strong concern about vehicle and data system hacking.

Table 204: Organisations views on wider impacts – public health

Positive	• On-demand transport services can be used for trips to health facilities • Drone can make emergency deliveries of medical products, saving lives • Public transport services will be more reliable, decreasing stress (e.g. waiting at bus stops, or trip delays) • It can reduce stress of not having flexible or reliable transport or having to find parking space
Negative	No negative impacts mentioned

Table 205: Organisations views on wider impacts – safety

Positive	Vehicles will be safer but will not eliminate collisions. More comprehensive tests are needed
Negative	No negative impacts mentioned

Table 206: Organisations views on wider impacts – security

Positive	• Drones can be used to transport confidential documents
Negative	• Vehicles and data systems can be hacked • Passengers do not want to be recorded while travelling

Organisations usually related some of the impacts addressed above. For example:

- Some economic, equity and public health benefits were related to the increase in mobility
- Some negative equity impacts were related to negative economic ones

10.6 Conclusions

Detailed case studies were conducted with eleven organisations across Europe to understand their views on self-driving vehicles. The objectives were to understand the organisations' perceptions, intentions, needs, and impacts regarding self-driving vehicles, as well as their views on the impacts on their region. The case studies were mostly based on semi-structured interviews. Some parts of the interviews focused on specific use cases of self-driving vehicles, from those co-created in the project and analysed in previous chapters of this report. The following overall conclusions can be derived from the analysis of the information from the case studies:

- **Perceptions**: self-driving buses have a large potential for providing additional bus services, covering unmet demand. Drones can also provide useful services. Both are safe and reliable and can reduce costs but require large investments
- **Intentions**: organisations intend to use self-driving vehicles. In the case of buses, they may even be forced to use them if current problems in recruiting drivers are aggravated. There are also positive intentions regarding the other use cases
- **Needs**: a large number of technical, financial, regulatory, infrastructural, safety, and labour issues need to be addressed before the organisations start using self-driving vehicles in their daily operations

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- **Impacts on organisation**: Self-driving vehicles are expensive but may increase revenue and decrease costs, albeit only in the long term. They will also improve operational aspects but will force changes in the workforce.
- **Wider**: Mobility will increase but this will cost. Travel will be more reliable but may fail to meet the needs of people with disabilities. Some large facilities may be moved away from the centre, but parking spaces will not. Jobs will be created and destroyed. Travel will be safer but less secure.

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11. Conclusions of Part 2 – Impact on Organisations

Part 2 of this deliverable analysed the impact of self-driving passenger and freight vehicles on organisations. A variety of data types was collected, in activities involving organisations in eight countries in Europe. This included qualitative assessments using group discussions (Chapter 8), a demonstration of self-driving vehicles (Chapter 9), and case studies of 11 organisations (Chapter 10). This final chapter of Part 2 compares the main conclusions from these activities, using the same eight-impact structure assessed in each of the chapters.

Table 207 shows the results. A common conclusion is that self-driving vehicles can enhance **mobility**, especially of groups currently underserved because they live far from city centres or need to travel at night-time when there is little public transport. Trips will be more reliable but also more expensive.

The increase in mobility is likely to increase road traffic levels, especially of private vehicles, although this will not necessarily increase congestion in the **transport network** if vehicles are more reliable in dealing with unexpected events and bottlenecks. Extensive changes to the infrastructure are needed to cope with the new types of vehicles.

Regarding **land use**, parking needs will probably not decrease, especially in city centres. Some free space may be released in city centres, due to relocation of large facilities (e.g. public transport depots).

It is likely that the **environment** will improve, as emissions will decrease. However, organisations expressed concern about issues such as battery disposal and visual pollution (due to increased number of vehicles). Noise may not decrease.

Regarding impacts on the **economy**, organisations were consistent across activities that there will be both job creation and job destruction. There is a high degree of uncertainty on whether the net effect will be positive or negative. Some activities also concluded that productivity could increase both because travel time will be more reliable (so employees can arrive on time to work or business appointments), while also allowing for working while travelling. There was also a concern about customer resistance to new solutions, especially when they fail due to weather or other circumstances. Costs will also probably increase and be passed on to customers. There will also be a new industry developing self-driving vehicles and software. To adjust the economy to the new realities, large investments are needed.

The perceived effects on **equity** are mixed. Self-driving vehicles can improve accessibility of some groups such as rural and suburban residents and night-shift workers. But there are also concerns about whether the new solutions can meet the needs of people with disabilities, and with digital and price exclusion. The self-driving vehicle industry is also dominated by younger males. Across all industries, older workers may feel excluded.

The perceived impacts on **public health** were also mixed. Self-driving vehicles can solve emergency situations. However, the impact on stress is uncertain: it can increase or decrease.

The impacts on **safety** were consistent across activities: travel will be safer, with fewer collisions, but there was a strong concern about emergency situations that self-driving vehicles may not be able to handle.

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The strongest concern was **public security**. This was a conclusion about all the activities: travelling in public transport without a human driver or assistant may create fear of crime and harassment. Freight deliveries by self-driving vehicle are also vulnerable to theft. On top of these concerns, vehicles can be hacked, and citizen data can be abused by transport companies or governments, or stolen with malicious intent.

Table 207. Comparison of impacts on self-driving vehicles on organisations

	Qualitative assessment	Demonstration	Case studies
Mobility	• Can enhance citizens mobility	• Can enhance citizens mobility • May be slower and more expensive	• Can increase mobility, especially at night-time or in areas currently underserved by public transport • More reliable trips • Will be more expensive
Transport network	• Reduces congestion only if traffic decreases • Requires extensive changes to transport infrastructure		• Traffic levels can increase, especially of private vehicles • But congestion may decrease because of increased reliability
Land use	• Increases free space in urban areas only if traffic decreases		• Parking needs will not decrease • Some large facilities can be relocated outside the city centre
Environment	• Better air quality only if traffic decreases • Problem of battery disposal • Noise and visual pollution	• Quiet and environmentally-friendly	• Can reduce environmental problems
Economy	• Increased freight delivery reliability • But malfunctions may cause customer resistance • Transport and delivery costs will increase and may be passed onto customers • Fear of job losses • More jobs and industries can be created		• Fear of job losses • More jobs and industries can be created • Use of travel time to work can increase productivity • Creation of a new industry to develop vehicles and software • Large investments needed

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Equity	• Concerns about people with disabilities • May create more digital exclusion • Price-related exclusion		• Can improve accessibility of shift-workers and people in rural or outer suburban areas • May improve gender equality • Concerns about people with disabilities • Digital exclusion • Older staff may feel excluded in organisations • Self-driving vehicle industries are dominated by younger males
Public health		• Will increase stress	• Can be used for emergency trips of patients or medical products • Will reduce stress
Safety	• Fewer collisions • Concerns about emergencies • Concerns about weather conditions	• Safe in all situations and for all road users • Concern about emergencies	• Safer but will not eliminate collisions
Security	• Concern about freight security (crime) • Concern about hacking	• Concern with passenger and freight security (crime)	• Concern with hacking and data privacy

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PART 3

FURTHER ANALYSIS, SYNTHESIS, AND CONCLUSIONS

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Part 3 - FURTHER ANALYSIS, SYNTHESIS, AND CONCLUSIONS

Part 3 reports the results of further analysis on impact, synthesizes all analyses, and concludes the deliverable.

Chapter 12: Further qualitative assessment of impact, through discussions and other activities in groups mixing citizens and organisations

Chapter 13: Syntheses of all analyses in this deliverable, comparing impacts of self-driving vehicles on citizens and organisations in Europe

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12. Joint qualitative assessment of impacts - citizens and organisations

12.1 Overview

Following the initial co-creation of use cases, and the qualitative impact assessment activities with citizens and organisations in all regions, a set of co-creation activities was organised in the project's prototypical regions (Helmond, North Aegean Region, Metropolis GZM).

Prior activities with these audiences included:

- Use case co-creation with citizens (reported in D1.2)
- Use case co-creation with organisations (reported in D1.2)
- Impact assessment to create causal loop diagrams with citizens (Chapter 2 of this report)
- Impact assessment to create causal loop diagrams with organisations (Chapter 8 of this report)
- Joint qualitative impact assessment and exploration of areas of uncertainty (this chapter)

Chapters 2 and 8 described the impact assessment in detail, exploring each use case by a range of domains. The activities described in this chapter were designed to validate and expand upon those detailed findings. Bringing together citizens and organisations at the same in-person workshop for the first time, the aim was to further assess the impact of self-driving vehicles in each region, and specifically revisit some previously identified areas of uncertainty: trip frequency and take-up of self-driving vehicles; safety; and jobs. In each of these cases citizens and organisations struggled to reach a consensus on whether introducing new self-driving vehicle services would have positive or negative impacts, and at what scale.

The specific objectives of these activities were:

- **Dialogue between citizens and organisations**: At the very beginning of the engagement, citizens and organisations had different levels of knowledge of self-driving vehicles. However, as citizens had now taken part in several activities, it allowed us to bring citizens and organisations together for a more equitable discussion. While we still expect different perspectives and motivations from these different groups, it is useful to bring them together and explore how this plays out in a dialogue. For example, does exposure to views of organisations influence citizen attitudes, or vice versa? Do they reach new or different conclusions when working together?
- **Consolidated scenario exploration**: Up until this point, self-driving vehicles and services had only been considered on a case-by-case basis. Considering them together and at scale could therefore lead to different perspectives on self-driving vehicles and their impact on the transport system. Moving from a technology-focussed lens to a systems-based one, we conducted the workshops in situ – thus grounding discussions in the physical and social geographies of place, rather than in the abstract technological world.
- **Unpicking uncertainty about future impacts**: The workshops sought to bring different groups together to build a consensus on key areas of uncertainty regarding the impact of self-driving vehicles. These areas (trip frequency, safety, employment) had been identified both in the literature as well as in earlier co-creation activities.

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- **Taking a societal perspective on self-driving vehicles**: Understanding the impacts of the introduction of self-driving vehicles relies on understanding how people will behave, which is in turn influenced by how transport systems are implemented. By asking citizens to step outside of their individual perspectives, we invited them to consider some of the policy challenges which transport planners face. At the same time, we also asked them to reflect on how their own behaviour might be influenced, and how others in society might be impacted.

The chapter is organised as follows:

- Section 12.2 describes the methods used to explore use cases and areas of uncertainty
- Section 12.3 shows the sample characteristics
- Section 12.4 reports the results of the workshops
- Section 12.5 draws conclusions

12.2 Methods

12.2.1 Workshop design

Following the analysis of data from previous co-creation activities, key areas of uncertainty were identified as common across regions and use cases., covering:

- **Dialogue between citizens and organisations**: We invited both citizens and organisations to take part. In each workshop, citizens outnumbered organisations to ensure they felt confident to express their opinions without deferring to “expertise”.
- **Consolidated scenario exploration**: We introduced the consolidated use case scenario (i.e. a scenario in which previously discussed use cases are available) as the “baseline conditions” early on in the workshop. These conditions were presented as a hypothetical scenario set in 2050, where manually driven vehicles have been phased out, low emission zones are common, most transport is electrified and using renewable energy, public transport is available and costs are comparable to current prices. The use cases commonly available in this hypothetical future are: self-driving bus service; self-driving e-hailing (shared); mobility bus on demand; and consolidated delivery bot.
- **Unpicking uncertainty about future impacts**: Related to the above use cases, three key areas of uncertainty were explored: trip frequency; safety; and jobs. Within each area of uncertainty, we introduced a potential positive feedback loop and a potential negative feedback loop. Workshop participants discussed ways in which the positive outcome could be encouraged, and the negative outcome prevented, as well as which outcome they felt was more likely.
- **Taking a societal perspective on self-driving vehicles**: Citizens and organisations were asked to imagine that they were in charge of transport planning for their local area/region and had to assess applications for licenses for new self-driving vehicles. They were asked to share their key questions for providers, the wider factors they would take into consideration before approving an application, and how they would decide whether or not to grant a license to a service. Workshops concluded with a map-based activity, where participants marked up where, when, and how they would like services to operate in their city or region.

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Figure 244: Stimulus outlining the services available in a hypothetical 2050

Figure 245: Stimulus showing the potential positive and negative feedback loops in relation to trip frequency for self-driving e-hailing services

12.2.2 Workshop facilitation

In each region, citizens and organisations took part in a 2-hour, face-to-face workshop. All workshops were facilitated by local partners in the local language. Discussions were semi-structured, using translated stimuli and worksheets.

12.3 Sample characteristics

A total of 44 citizens joined the workshops, representing a good mix of demographics and life stages (Table 208). Overall, the sample skewed older, with 17 participants aged 65+. The sample in Greece was the most rural, with more than half of participants living in a village.

A total of 10 organisations joined the workshops. In each workshop, representatives from 3-6 organisations were present, five from research and higher education institutions, three from self-driving vehicle developers/manufacturers, two from non-governmental organisations, and two from authorities and regulatory bodies.

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Table 208. Sample characteristics

		All	Nether-lands	Poland	Greece
All		44	13	16	15
Age	18-34	7	0	3	4
	35-64	20	7	6	7
	65+	17	6	7	4
Gender	Man	26	10	8	8
	Woman	18	3	8	7
Employment status*	Works full-time	19	2	10	7
	Works part-time	4	4	0	0
	Student	3	0	2	1
	Seeking work	2	1	0	1
	Homemaker	1	0	0	1
	Retired	13	6	3	3
Household composition*	Single	7	3	3	1
	Shared home	1	1	0	0
	Lives with parents/family	4	0	3	1
	Lives with partner	13	4	6	3
	Lives with partner and children	17	5	4	8
Location*	City centre	12	1	5	6
	City, not in the centre	13	9	4	0
	Small city	2	2	0	0
	Small town	4	0	4	0
	Village	11	1	3	7
Driving attitude*	Enjoys driving	23	9	8	6
	Would prefer to do something else	5	2	1	2
Disability	Has a disability impacting mobility	7	2	5	0

Note: *Some data is missing.

12.4 Results

12.4.1 Encouraging dialogue between citizens and organisations

At the start of each workshop, we conducted a “traffic director for the day” exercise where participants were asked to imagine the kinds of questions they would ask of service providers before approving a service in their city/region. The aim was to prompt participants to consider different viewpoints and needs from the start of the discussion.

Citizens and organisations were relatively aligned in their priorities and concerns regarding the introduction of self-driving vehicles in the local area. Cost, functionality and integration with the wider transport system came out as key themes, as well as concerns about inclusion and accessibility – demonstrating that participants were ready to adopt a systems lens.

Table 209 summarises responses to the “traffic director for the day” exercise:

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Table 209: Summary of questions arising during traffic director exercise

Safety	• Safety had been a major concern throughout engagement activities and was still a priority. • However, there was also an assumption that services would not be introduced unless they were safe – through extensive trialling and phased rollouts – which almost made the question of safety a "hygiene factor". ○ This may reflect the influence of organisations in the workshops – representatives from organisations were more likely to argue for the safety of self-driving vehicles compared to manually driven vehicles. • The main remaining concern was about cyber security and the risk of a malicious actor hacking the vehicles.
Functionality, effectiveness and efficiency	• A key question was whether self-driving vehicles would really function more effectively and efficiently than current services, e.g. would the service be more accessible, more timesaving, and – crucially – how would they interact with the services and infrastructure that already exists? • More practically, citizens wanted to know how many people would be able to use a service at a time, how many stops there would be, and how frequently the service would run. • Citizens questioned whether vehicles would be able to navigate more challenging weather conditions, including snow (in Poland), as well as more unusual traffic conditions or random events. • There were questions about the amount of maintenance and servicing required. • In addition, participants wanted self-driving vehicles to be pleasing to the eye, comfortable, and clean.
Cost and funding	• A main concern for all was the potential cost of using self-driving vehicles, including as part of public transport. Citizens suggested free trial periods and subsidised bus passes to increase acceptance and take-up of services initially. At the very least, they would want the service to be of a comparable cost to current public transport. • There were also concerns about the cost to municipalities – of purchasing or hiring vehicles and adapting the local area and infrastructure to their use.
Inclusion and accessibility	• While self-driving vehicles were seen as potential solutions to current exclusion issues for those who cannot or will not drive, participants wanted reassurance that the service would be user-friendly and accessible to elderly and disabled passengers. • However, organisations in Poland raised a concern about services specifically designed to support those with restricted mobility may lead to their further marginalisation by singling them out.
Service provider/ manufacturer	• Participants wanted to know whether manufacturers would be liable for their products and responsible for their upkeep and maintenance. • They would want to know how long a supplier has been in business for and whether they have previously supplied products/services to other cities or regions. • Citizens questioned whether manufacturers would provide custom-made products and services adapted to local contexts, including, for example, the branding of vehicles.

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12.4.2 Area of uncertainty: Trip frequency and take-up of self-driving vehicles

Trip frequency and the adoption of shared self-driving transport emerged as a key area of uncertainty in previous engagement activities. This speaks to the wider complexities and uncertainties within transport systems regarding how automation will impact shared mobility, as well as wider modal shifts, and interact with other factors, such as the need for decarbonisation.

In previous workshops, citizens and organisations alike had expressed doubts over whether the public were ready to abandon their private cars to replace them with e-hailing and public transport options. Many felt there was a risk that the introduction of self-driving vehicles would lead to an increase in the overall number of vehicles on the road, rather than the desired reduction.

At these final workshops, we introduced two possible scenarios for the introduction of **self-driving e-hailing services**. Self-driving e-hailing was selected as the most appropriate use case to explore this uncertainty, as it goes beyond simply replacing existing vehicles with self-driving ones, and instead represents a change in the *system*, thus potentially leading to wider and more transformative impacts.

Scenario 1: Fewer people use public transport

Fewer people use public transport, using the self-driving e-hailing service instead. This means the same number of trips is achieved through more vehicle movement. Therefore, the total number of vehicles on the road increases, leading to increased congestion and parking needs, as well as increased energy consumption, which has negative impacts for the environment.

Overall, citizens felt it was unlikely that self-driving e-hailing services would lead to a significant reduction in the use of public transport, as most expected these services to be more expensive, similar to current taxi or e-hailing services (e.g. Uber, Bolt, Lyft). Those familiar with these types of service felt (or assumed) that they had not caused significant modal shifts, affecting mostly traditional taxi services, with no impact on car ownership or use of public transport. However, organisations in Poland cited Uber and Bolt as having led to increased traffic, without increasing the parking space available.

Scenario 2: Fewer people use personal vehicles

Fewer people use personal vehicles, so the same number of trips is achieved with fewer vehicles. Therefore, the number of vehicles on the road decreases, leading to reduced congestion and demand for parking, with positive impacts for the environment through reduced energy consumption.

Participants questioned whether the fact that the service would be *shared* would make it less convenient than even public transport, as it would be more difficult to predict how long a trip might take. Disabled participants also raised the issue of accessibility, which current public transport offers them and which they assumed would not be a given with e-hailing services.

In terms of the service's impact on privately owned cars, there was a strongly held sentiment that there will always be a group of people who prefer the convenience of their own car to any kind of shared transport – whether that is e-hailing or public transport. Some, mostly female, participants raised safety concerns about sharing an e-hailing service with strangers.

> *"Freedom for me means that I can go wherever and whenever I want. At any time of the day. Let's say there's an emergency and I need to rush to a hospital in the middle of the night. That's one of the reasons I want to own my own car.*

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Or another option is shared cars. That would work for me too. As long as this car is immediately available in case of an emergency." Citizen, Helmond

Most felt that, in order to avoid Scenario 1, they key would be to improve public transport, which was seen to have a more significant impact on behaviour and take-up than the presence of e-hailing services. Participants felt that affordable, accessible and reliable public transport (whether self-driving or not) would lead to more positive outcomes than introducing self-driving e-hailing on its own.

Organisations in GZM felt that the most likely outcome would be somewhere between the two scenarios, imagining that some people will change their main travel mode, e.g. because parking their own car is too expensive, but that it is unlikely to affect the overall amount of traffic.

As a result, all felt that self-driving e-hailing would have to have very clear benefits - without a significant added cost - to be adopted at a scale that would affect either public transport or car ownership and use. Indeed, citizens felt that impacts were largely dependent on cost – i.e. if the cost of using the e-hailing service was comparable to public transport, they felt that there was a chance that congestion could *increase*, while a more expensive service, e.g. comparable to current taxi or e-hailing services, was felt to have no impact. Congestion was thought to *potentially* reduce if the cost of the service was low enough to lure people away from their private car, without competing with public transport. In an ideal world, they could see self-driving e-hailing as a way to fill gaps in the current public transport system, and the reduction of friction (e.g. the number of changes) when travelling, thus making public transport the more attractive mode.

Outcomes are seen to be determined most significantly by:

- Cost
- Convenience
- Quality of available public transport

12.4.3 Area of uncertainty: Safety

Throughout the engagement, the personal safety of passengers, other travellers, and pedestrians had been a key concern.

While some felt, having taken part in previous workshops and demonstrations, that self-driving vehicles may be safer than manually operated ones in terms of road accidents, there remained concerns about the risks of unsupervised travel; the risks posed by other travellers, especially to vulnerable passengers; and the threat of cyber attacks.

At the workshops, we introduced two possible scenarios for the introduction of **self-driving bus services** in relation to safety. Self-driving bus services had been selected as particularly appropriate, as there are a number of risk factors – transport is shared with other passengers, buses operate in the same environment as other types of vehicles, and they are currently commonly used by all participants.

Scenario 1: More automated vehicles lead to an increased risk of cyber-attacks

Increasing incidents of cyber-attacks and vehicle hijacking, with vehicles being taken off course and operated with malicious intent leads to increased risks to public health and people do not feel safe using self-driving bus services. This can also lead to increased congestion, due to greater private vehicle use, and reduced mobility for those without access to private transport.

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Scenario 2: More automated journeys lead to fewer road accidents caused by human error

Self-driving vehicles are trained to follow rules and regulations, while avoiding collisions and obstacles, so more self-driving journeys results in fewer road accidents caused by human error. This leads to positive impacts for public health and more people feeling safe to travel around the city using self-driving bus services. This also has positive impacts for mobility (reduced congestion) and the environment (reduced energy consumption, pollutants and noise).

Interestingly, Scenario 2 was accepted as very likely, with faith in the vehicles themselves relatively high, reflecting a shift in perceptions over the course of the research. This may indicate that road safety, which had been frequently raised as a key concern, is not as deep-seated as we might have assumed. Citizens seemed fairly easily persuaded that it will be solved before self-driving vehicles are used widely, in part, perhaps, because it feels so essential. According to the baseline conditions which were introduced at the start of the workshop, by 2050, manually driven vehicles will have been slowly phased out and legal issues, such as the question over who is liable in the case of an accident, will have been resolved. This meant that participants' main concerns regarding road safety were about the transition phase, and the ability of self-driving services to integrate with existing ones.

In addition, many believed that self-driving vehicles would be safer than manually operated ones, with human error seen as a main factor in issues with road safety. There was an assumption that news of self-driving vehicles causing fatalities had been blown out of proportion and that, given time, they would be more widely accepted as safe. This may reflect the impact of organisations, who were more likely to be arguing for the safety of self-driving vehicles compared to manually driven ones. An example from an exchange at the workshop in Helmond below:

The combination of self-driving and regular transport clashes with each other. We've seen that in America." Citizen, Helmond

"The Emergency Services Organisation considers self-driving transport to be the safest form of transport at the moment." Organisation, Helmond

Some felt the greater challenge would be for passengers to overcome a "psychological barrier" and get used to being "left alone" on public transport. They imagined an intercom or alarm system through which contact could be made with a human operator.

"For safety, we said, there should be a button in the vehicle, so that if something happens, we can press that button to give a signal to the company that checks all these things, telling them that something has happened, that someone must come and help." Citizen, North Aegean Region

Participants felt that education of citizens on how to behave when using self-driving vehicles would be a key part of building confidence in their safety. Without a driver to intervene in potential social conflict between passengers, participants felt that the public would need to know what to do in certain situations, including what would happen if too many people tried to get onto a bus, if there was an incident between passengers, or with another vehicle.

Scenario 1, however, did raise worries. While the scale of the risk posed by cyber-attacks was unknown to participants, they perceived it as a real threat. However, they also had faith that digital security would increase and that, as self-driving services are introduced and rolled out, security measures would be put in place to reduce any cyber-attacks.

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Organisations in particular felt that these risks already existed but were successfully minimised, and that there was no reason to assume that self-driving buses were more at risk of hijacking than existing ones.

"Hacking systems is very topical at the moment. I hope that by 2050 everything will be under control. That there are solutions for this." Citizen, Helmond

"Some fears are artificially blown up - nowadays it is also possible to hijack a bus, but it happens very rarely." Organisation, GZM

In practical terms, citizens imagined that vehicles would have some type of override system, through which a manual (or another remote) controller could take over if needed.

As it stands, cyber security is a much less well understood threat than road safety. Both organisations and citizens find it difficult to predict how big an impact cyber threats will have, while at the same time trusting that security systems will be able to keep up with advancements in malicious types of hacking.

Outcomes are seen to be determined most significantly by:

- Public trust and acceptance
- Technological advancement

12.4.4 Area of uncertainty: Jobs

Discussions of self-driving vehicles triggered discussions of the wider impacts of automation on employment throughout the engagement.

Participants had been undecided on the likely impact of self-driving vehicles on the employment of those currently driving for a living. While there were some expectations that automation would create other jobs, possibly in the maintenance, monitoring or operation of self-driving vehicles, participants found it difficult to judge whether this would make up for the job losses elsewhere and thus still lead to a net reduction in employment.

At the workshops, we introduced two possible scenarios for the introduction of **self-driving consolidated delivery bots** in relation to jobs.

Scenario 1: There are no training opportunities for former delivery drivers

As self-driving consolidated delivery bots are now the norm for last-mile deliveries, delivery drivers are no longer required. Most of these drivers are not presented with any solutions or opportunities to continue working for their companies, which will result in negative impacts for the local economy as unemployment rises.

Scenario 2: There are opportunities for former delivery drivers to retrain

As self-driving consolidated delivery bots are now the norm for last-mile deliveries, delivery drivers are no longer required. Drivers are presented with options for retraining (e.g. remote operation or monitoring of delivery bots) and companies are supported and incentivised to retain and adapt staff to new requirements and demands. This will result in positive impacts for the local economy as people are not only able to keep their jobs but also upskill and meet current transport and delivery needs.

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Participants acknowledged and accepted that the transport sector would change, causing a shift in the labour market. Many trusted that workers would be absorbed elsewhere over time, but worried about the impact of sudden automation on low-skilled, manual labour.

Participants wanted reassurance that the transition would be gradual, and that some manual jobs would remain, whether that is in the servicing of the vehicles, or through a system that allowed for humans to be included if needed, e.g. if a passenger requires assistance or a package needs to be delivered to an elderly person.

Participants assumed that these shifts would begin now, with new jobs created in adapting the infrastructure to the new self-driving vehicles, thus smoothing the transition and not leading to a net decrease of jobs in the local economy overall.

"Since the Industrial Revolution, there hasn't been automation that has cost jobs. Knowledge passes on. There will be other jobs, including for the driver. Our children have to grow with this. They are already learning that the job you are studying for is probably not the job you will get later or retire with."
Organisation, Helmond

"First of all, jobs will increase before this is implemented. They will increase for the infrastructure." Citizen, NAR

In Helmond and GZM in particular, there was a sense that automation in transport could be the answer to shortages in bus drivers and other driving professions. Participants spoke of a decline in the popularity of these low-paid jobs, which had already led to issues for public transport.

This means that, while still an area of some uncertainty, there is faith that transport automation will not lead to an increase in net unemployment. Instead, participants expected to see shifts in the labour market, as well as job creation in supporting industries, which would "soften the blow" and – potentially – even lead to more growth and employment.

Outcomes are seen to be determined most significantly by:

- Speed of transition
- Job creation elsewhere

12.4.5 Moving towards a "societal view"

For the final exercise, each workshop used local maps to imagine what a future with self-driving vehicles might look like. The maps were not intended to be geographically accurate, but rather to serve as stimulus for thinking about the needs of different areas and different groups of people. See below an example of a marked up map from the Katowice area (Figure X).

Across locations, participants imagined hubs around the city, for both freight and passenger vehicles. These would be connected with smaller neighbourhood hubs for picking up and distributing parcels. Neighbourhood hubs should be within walking distance of residents' homes (no more than 250 metres). Passenger services would be integrated with inter-regional and national transport, local public transport and cycling hubs, similar to current park and ride arrangements.

In the city centre, there would be self-driving buses for transporting larger numbers of people at the same time, for example, connections to the university, football stadium, and business parks. In Helmond, participants imagined a grid of north-south and east-west connections, where

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frequent shuttles drive all day, and it is easy to change from one shuttle to another. They imagined a similar system for transporting goods.

For most, self-driving bus services were easiest to imagine, running along similar lines as today, except without a driver. However, this also means they were seen as adding the least value. Shared e-hailing and mobility-on-demand services were therefore seen as most different and therefore offering the most potential change to the overall system, however, there were questions over the pricing structure for these services. Participants imagined that prices would be subsidised for those who needed them (e.g. disabled people), while those who *wanted* them were expected to pay more.

> *"If self-driving e-hailing is as expensive as the regular taxi, then the self-driving e-hailing has no added value. Replacing the existing bus with a self-driving bus service on the same fixed routes as today makes no improvement. I really see the self-driving e-hailing service as an added value." Organisation, Helmond*

Participants in Lesbos (North Aegean Region), where public transport is seen to be sparse and unreliable, thought that self-driving vehicles could be a solution to many of their transport issues, but they had less faith in the feasibility of a roll-out of these types of services. They imagined it would require large-scale public investment which they felt was unlikely to happen. This was also a concern elsewhere, with participants finding it difficult to imagine the public money and investment required to implement even the charging infrastructure for electric vehicles. This prompted discussions over whether the responsibility for these services and their implementation would rely on the private sector and what this would mean for local governments in terms of financing, and users in terms of costs.

Figure 246: Marked-up map of Katowice from workshop

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12.5 Conclusions

The following conclusions aim to address the objectives of these co-creation activities stated in the introduction of the chapter.

12.5.1 Citizens and organisations working together

This was the first time in the project in which representatives from organisations and citizens participated in the same co-creation activity and were able to exchange their views. In each session, citizens outnumbered organisations, so as to ensure their voices are heard and they feel empowered not to defer to “expertise”.

The discussions held as part of the workshops were productive, with all participants openly sharing their views about different use cases and their potential impact on their region and society. The two groups shared many opinions and concerns, while also bringing different perspectives to the challenge. Depending on role and function, representatives from organisations were more likely to consider system-wide impacts, thinking, for example, about the overall value added by self-driving vehicles. Citizens, on the other hand, were more likely to consider their impact on “people like them”, but also other groups in society. Organisations were also more likely to argue for the safety of self-driving vehicles, which may have shaped conversations on this topic.

Positively, the two groups complemented each other well, rather than putting forward competing views, participants worked together to assess what the future might look like.

12.5.2 Areas of uncertainty

The areas of uncertainty previously identified were mostly expected to be resolved by 2050:

- **Trip frequency**: Participants found it difficult to judge whether people would be travelling more or less by 2050, however, there was a sense that the same number of trips could be completed with fewer vehicles on the road through a combination of public transport and active travel. In order to avoid adding to congestion, participants felt that public transport would need to be able to “compete” with both private self-driving cars and shared e-hailing services. At the same time, they wanted the convenience of private cars to be preserved, especially for regional and leisure travel, but there was openness to using shared vehicles for this (similar to current car sharing or car clubs).
- **Safety**: Participants believed that security issues would be mostly resolved by 2050, and that public acceptance of the vehicles would automatically increase. While hacking was seen as a potential risk, it felt no greater than the current risk of physical hijacking and was felt to be an issue in other parts of the economy as well. Counter-measures were expected to have to keep up with more sophisticated attacks.
- **Jobs**: As long as the transition was gradual, participants felt that job losses would be absorbed elsewhere, so as not to result in a net loss of jobs overall. They imagined that the transition would create new jobs, while a base level demand for human services would remain.

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12.5.3 Moving towards a "societal view"

For most participants, the penetration of self-driving vehicles into their local transport infrastructure was a question of when, not if. As a result, they were very open to the idea of a mostly automated network by the year 2050 and it was understood that the more widespread the roll-out, the safer and more efficient the system would be. Participants worked together to imagine a future that would work for everyone, demonstrating that they had moved from considering their personal circumstances into considering the "societal view".

For self-driving vehicle services to be successful and gain public trust, participants felt they would need to prove to be:

- Safer than manually driven services
- More punctual than traditional public transport
- Convenient in terms of frequency and routes
- Low cost
- Not causing additional traffic congestion
- Accessible to disabled people
- Comfortable

Importantly, the rollout that participants can realistically envisage depends heavily on interventions from government and transport system operators. It relies on investment and development of security provisions, the public transport system, and job transitions being managed well. Without this investment in a supportive policy environment, participants find it difficult to imagine how benefits might be realised or accrue. Crucially, there are substantial economic and geographic disparities between the prototypical regions, which means that, for example, residents in Greece and, to a slightly lesser degree, Poland, are much more sceptical about the feasibility of securing the necessary investment, compared to those in the Netherlands.

Recommendations for policy makers resulting from this project will therefore consider the wider policy context, as well as the differences between regions and administrations.

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13. Synthesis - comparison of impacts on citizens and organisations

This deliverable analysed the impact of self-driving passenger and freight vehicles in Europe, using data from a large variety of activities involving citizens and organisations. This final chapter compares the main conclusions derived from these two types of activities

Table 210 synthesises all results. Opinions of citizens are mostly consistent with those of organisations. Self-driving vehicles can enhance mobility, especially of underserved groups, and improve travel reliability, but this may come at the expense of increased costs. Traffic levels will increase but congestion may not. Parking needs may not decrease. Current environmental problems will be reduced, but new ones will be created, related to the disposal of batteries. There will be both job creation and job destruction and the net effect is uncertain. There is also a concern about the large investments needed to adapt the economy and about customer resistance to freight delivery solutions based on self-driving vehicles. The accessibility of some groups may increase but there is a strong concern about whether self-driving vehicles can meet the needs of people with disabilities, as well as price and digital exclusion. The impact on travel stress is uncertain. Safety will improve but collisions will not be eliminated. The strongest concern, both among citizens and organisations, is the security of both passengers and freight in self-driving vehicles.

Table 210. Comparison of impacts on self-driving vehicles on citizens and organisations

	Citizens	Organisations
Mobility	Can enhance citizens' mobility. Travel may be cheaper or more expensive but will be more comfortable and allow for productive or leisure uses of time. Number of trips may increase, especially by private modes.	Can enhance citizens' mobility, especially of groups currently underserved. Trips will be more reliable but also more expensive
Transport network	Road traffic levels will increase but congestion may not	Road traffic levels will increase but congestion may not
Land use	The effect on parking is uncertain	Parking needs will not decrease. Some large facilities may be relocated away from the centre
Environment	Emissions and noise will decrease, but new problems arise because of increased demand for electricity and need for battery disposal	Emissions will decrease, but new problems arise because of visual pollution and need for battery disposal. Noise may not decrease
Economy	The net effect on jobs is uncertain. Productivity may increase. It may be difficult for new freight solutions to capture market	The net effect on jobs is uncertain. Productivity may increase. It may be difficult for new freight solutions to capture market. Large investments are needed, and cost increases may be passed onto customers

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Equity	Can increase accessibility in areas less served by public transport. Concern about people with disabilities and price-related exclusion	Can increase accessibility in areas less served by public transport. Concern about people with disabilities and price and digital-related exclusion. May increase gender and age imbalance in transport industry
Public health	Better air quality. Impact on stress is uncertain	Can solve emergency situations. Impact on stress is uncertain
Safety	Safety will improve but collisions will not be eliminated. Concern about emergency situations	Safety will improve but collisions will not be eliminated. Concern about emergency situations
Security	Strong concern about security of passengers and freight, and with data hacking and privacy violations	Strong concern about security of passengers and freight, and with data hacking and privacy violations

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APPENDICES

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APPENDICES

The Appendices collect data collection materials (Appendix 1-11) and full results of statistical models (Appendix 12)

Appendix 1: Questionnaire to collect citizens' demographic data (used in Chapters 2, 3, and 4)

Appendix 2: Pre-events questionnaire - citizens (used in Chapters 2, 3, and 4)

Appendix 3: Qualitative assessment of impact – activity guide (used in Chapters 2 and 8)

Appendix 4: Self-driving vehicle demonstration – post-event questionnaire (used in Chapters 3 and 9)

Appendix 5: Virtual reality experiments - post-event questionnaire (used in Chapter 4)

Appendix 6: Virtual reality experiments - group discussion guide (used in Chapter 4)

Appendix 7: Pan-European survey on impact on impact on citizens – questionnaire (used in Chapter 5)

Appendix 8: Impact of self-driving freight vehicles – questionnaire (used in Chapter 6)

Appendix 9: Pre-events questionnaire – organisations (used in Chapter 8)

Appendix 10: Organisation case studies – topic guides (used in Chapter 10)

Appendix 11: Further qualitative assessment of impact – activity guide (used in Chapter 12)

Appendix 12: Models of impacts (reported in Chapter 5)

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Appendix 1 – Questionnaire to collect citizens' demographic data

Q0	Please fill your ID number. This is a number from 1 to 100 given to you by the event organisers	
Q1	How old are you?	1: 18-34; 2: 35-64; 3: 65+; 4: Prefer not to say
Q2	How would you describe your gender?	1: Woman; 2: Man; 3: Other; 4: Prefer not to say
Q3	[NOT IN NETHERLANDS] How would you describe your ethnic background?	1: White 2: Asian 3: Black / African 4: Mixed 5: Other (please specify) 6: Prefer not to say
	[NETHERLANDS ONLY] Do you have a migration background?	1: Yes, one or both of my parents were born abroad 2: No, both of my parents were born in the Netherlands 3: Prefer not to say
Q4	Q4: Which of the following best describes your situation in relation to driving?	1: I have a valid driving license and I am able to drive 2: I don't have a driving license 3: I have a driving license, but I do not have a car in my household that I can use 4: I have a driving license, but I am unable to drive because of health or other reasons 5: Prefer not to say
Q5	Which of the following best describes your current employment situation?	1: I work full time (30+ hours per week) 2: I work part time (8-29 hours per week) 3: I am not working, but seeking work or temporarily unemployed / sick 4: I am not working and not seeking work 5: Student 6: Retired 7: Homemaker/ houseperson/ housewife / househusband etc. 8: Prefer not to say
Q6	What is the highest educational level that you have achieved to date?	1: No formal education 2: Primary school 3: Secondary school 4: Vocational qualification 5: University degree or equivalent professional qualification 6: Higher university degree, doctorate, MBA 7: Still in full time education 8: Don't know 9: Prefer not to say

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Q7	[NETHERLANDS ONLY] What is your annual family income? By family income we mean the total income of everyone who contributes financially to your household. If you have a partner or children who also work and contribute to the household finances, this includes their income as well as yours.	1: Under €5000 2: Between €5000-€14,999 3: Between €15,000 and €24,999 4: Between €25,000 and €34,999 5: Between €35,000 and €49,999 6: Between €50,000 and €99,999 7: €100,000+ 8: I'd rather not say 9: I do not know
Q8	Who, if anyone, do you live with?	1: I live alone 2: I live with friends / in a house share 3: I live with my partner / spouse, with no children 4: I live with my partner and my child(ren) who are under 15 5: I live with my partner and my child(ren) who are over 15 6: I live with my parents or other family members 7: Prefer not to say
Q9	Which of the following best describes where you live?	1: City centre (in a city over 10,000 people) 2: City, not in centre (in a city over 10,000 people) 3: Small town (2000-10,000 people) 4: Village (with less than 2000 people) 5: Prefer not to say

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Appendix 2 – Pre-events questionnaire - citizens

Q0	Please fill your ID number. This is a number from 1 to 100 given to you by the event organisers	
	Residential Area Characteristics	
Q1	*How far from your home are the following places?*	
	The place where you work or study	1: Less than 1 km 2: 1-2 km 3: 2-5 km 4: More than 5 kms 5: I don't know, or I don't go there
	Shopping areas	
	Health centre	
	Leisure places (e.g. park, sport facilities)	
	Mobility restrictions	
Q2	Do you have a long-term illness, health problem, disability or impairment affecting your daily life? Please remember that your answers are always treated confidentially	1: Yes 2: No [GO TO Q5] 3: Prefer not to say [GO TO Q5]
Q3	[IF Q2=1] Does your long-term illness, health problem, disability or impairment affects your ability to move around?	1: Yes, a lot 2: Yes, a little 3: No 4: Prefer not to say
Q4	[IF Q2=1] Do you use any mobility aids or equipment?	1: Yes, a wheelchair 2: Yes, a mobility scooter 3: Yes, walking stick or crutches 4: Yes, a guide dog 5: Other 6: No 7: Prefer not to say
	Travel behaviour	
Q5	*How often do you travel to the following places?*	
	The place where you work or study	1: Less than once a month (or never) 2: Once a month 3: 2-3 times a month 4: Once a week 5: 2-3 times a week 6: 4 or more times a week
	Shopping areas	
	Health centre	
	Leisure places (e.g., park, sport facilities)	
Q6	*Which transport mode do you use for going to these places? You can choose more than one option*	
	The place where you work or study	[MULTIPLE CHOICE] 1: Bus or tram 2: Train 3: Private car as driver 4: Private car as passenger 5: Taxi (or ride-sharing such as Uber)
	Shopping areas	
	Health centre	
	Leisure places (e.g., park, sport facilities)	

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		6: Walking 7: Cycling 8: E-scooter 9: Motorcycle 10: I don't go there
Q7	[ASK IF Q6.1=3 OR Q6.2=3 OR Q6.3=3 OR Q6.4=3] How do you feel about driving?	1: I enjoy driving and I do not mind spending time doing it 2: I would prefer to use the time for doing something else, instead of driving
Q8	[ASK IF Q6.1=3 OR Q6.2=3 OR Q6.3=3 OR Q6.4=3] What else do you do while you are travelling by bus, tram, or train? Choose all that apply	[MULTIPLE CHOICE] 1: Talk to other passengers 2: Talk on the phone 3: Work 4: Listen to music or audiobooks 5: Watch videos 6: Other activities on my phone or laptop (e.g. games, social media, browse internet) 7: Sleeping 8: Look outside window 9: Think 10: Nothing 11: Other (please add)
	Awareness of self-driving vehicles	
Q9	Were you aware that self-driving vehicles are being developed and will be used in the future?	1: I am aware I and have been following developments 2: I am aware, but I do not know much about it 3: I was not aware [END QUESTIONNAIRE]
	Concerns	
Q10	Which are your three main concerns about self-driving vehicles?	1: Traffic safety (collisions) 2: Legal issues (will the vehicle owner be liable if something goes wrong?) 3: Vehicle software can be hacked 4: Vehicle is too expensive to buy 5: Who will have access to data from my trips 6: Vehicle software fails during the trip 7: Jobs lost (e.g. drivers) 8: Others (please add) 9: I do not know
	Adoption of self-driving vehicles	
Q11	Would you use a self-driving vehicle?	1: Yes; 2: No; 3: I am not sure
Q12	Would you pay to use (without buying) a self-driving vehicle?	1: Yes; 2: No; 3: I am not sure
Q13	Would you be likely to buy a self-driving vehicle?	1: Yes; 2: No; 3: I am not sure
	Use of travel time in self-driving vehicles	
Q14	If you used a self-driving vehicle, what would you do during the trip?	[MULTIPLE CHOICE] 1: Talk to other passengers 2: Talk on the phone 3: Work

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		4: Listen to music or audiobooks 5: Watch videos 6: Other activities on my phone or laptop (e.g. games, social media, browse internet) 7: Sleeping 8: Look outside window 9: Think 10: Nothing 11: Other (please add)

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Appendix 3 – Qualitative assessment of impact - activity guide

Materials used both in workshops with citizens and organisations, both physical and online

Task name and aim	Script	Materials	Time (min.)
Welcome and introduction. Participants understand aim of session and research consent	*Thank you very much for joining us this evening. The aim of today's session is to build on ideas and thoughts from previous sessions, as well as what you have told us last week during the online community, to consider the potential impacts of different scenarios for self-driving vehicles for you and your local area. My name is xx, I'm also joined by my colleagues xx* Lead moderator to briefly outline T&Cs of the research: *As a research organisation, we abide by the Market Research Society Code of Conduct and GDPR legislation. We will never include your name within our research reports.* *Nothing you say here today will be directly attributed to you. The only exception to this is if you tell me something that gives me reason to think that you or someone else is at risk of harm. In the unlikely event that this happens, we do have a duty to report this to the relevant authorities.* Lead moderator to present running slides including information on session's purpose, (including what we are trying to find out and why) and go through agenda for the day. *In order for cities and regions to introduce self driving vehicles in ways that benefit citizens, they need to understand the potential impacts. As you know the Move2CCAM project aims to develop a computer model that will help cities and regions test the impacts of self driving vehicles. One important element of the model is predicting the impacts of different types of vehicles or transport service. That's what we're going to look at today. At the end of the session, we will have worked together to draw a map of the impacts that you think four different vehicles/services could have in your*	Introduction slides	10

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	city/region. It will look something like this Lead moderator to show simplified causal feedback diagram *This might seem complex, but we will build it up from simple questions and discussion. There are no right or wrong answers, we just want to hear your opinions.*		
Introducing the first use case. Participants are familiar with the use case and warm up to participating	Participants join a breakout group (max 5 people in online workshop, or 8 in physical workshop). See table for allocation of use cases. Moderator to introduce themselves and go around the table asking participants to share their name and something that stood out to them taking part in previous activities of the project Moderator to refresh participants on the baseline conditions then introduce the first use case.	• Baseline conditions and use case slides • [Physical workshop]: post-it notes and pens	5
Exploring impacts in each domain Participants share their views on the impacts specific to each use case/ domain, online community data is validated by wider group	Moderator to screen share draft impact diagram, printed [in physical workshop] or on Miro [in online workshop]. *Now, imagine that we are 12 years in the future and this service has been operating in your area for a while now. This diagram shows the main impacts you told us you would expect. Let's review them together.* Moderator to spend around 15 minutes reviewing central part of diagram and discussing. Each moderator to start with a different domain and work clockwise around the diagram to ensure all domains are covered. *Which impacts are most important to you?* NB: this will help moderators to focus on the areas about which they are most concerned, given that it is not possible to discuss all possible impacts. *Are there any which you disagree with? Or are uncertain about? What's missing from this diagram so far?* Moderator to prompt participants to think about each domain. For each impact moderator to prompt on whether it would be positive or negative, and why and record.	• [Physical]: printed or hand-drawn impact diagram (use case specific), post-it notes, pens • [Online] Impact diagram on Miro board (use case specific)	15

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Exploring causal loops Participants contribute their views on the causal feedback loops of impacts	*Now let's take a step back. Let's look in more detail at each domain. Starting with the impacts you think are most important, I want you to think about what the consequences of these impacts are (for example, if there is less air pollution, does this lead to better health outcomes for local people, does it make the city a more appealing place to live and therefore increase house prices).* • *What are the additional impacts in each domain?* • *Are they positive or negative?* • *Do you think any of these impacts will then affect the number of self-driving vehicles in use? (for example, if people see that air quality is improved by using self driving vehicles are they more likely to use them?)* Moderator to capture these feedback loops in the diagram.	As above	20
Timeline and penetration analysis	*Now we'd like to get your views on a different question. When do you think this use case will be deployed in your city/region?* [Physical workshop]: Show questions on screen/read out, and have printed slips on tables for ease, table moderators to distribute and collect. [Online workshop]: Moderator to invite participants into the Miro board to individually complete the timeline chart (moderator will share Miro board link in the zoom chat where they can each place-coloured dots where appropriate on the timeline. OR moderators can do this for them if they/participants prefer. *Thinking about this use case, what proportion of the population in your city/region will choose this service instead of a human-driven service in the following years? 2026, 2035, 2050* Moderators can move on to next use case before the allotted time if everything has been covered.	[Physical]: Timeline worksheet (printed). Enough for 3 for each participant. [Online]: Timeline chart on Miro board	10
[Physical workshop only] Repeat exploring impacts. Causal loops and timeline	See table for allocation of use cases	Impact diagram (use case specific)	30

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for second use case			
Identify differences in impacts and causal loops for third use case (Verifying data by sharing between groups)	Moderator to explain that they will now be leaving to go to another group to show them their ideas. They will have a new moderator that will present other groups ideas for the group to review. New moderator to briefly introduce themselves and then spend a few minutes introducing the third use case. *Now we're going to look at a different passenger/freight use case. What do you think would be different in this use case?* Moderator to encourage participants to identify differences based on the application, vehicle type, journey type, operating model etc. *Let's go back to the impact diagram, are there new impacts that you think are important in this use case? Or impacts that wouldn't happen?* Moderator to share copy of impact diagram and adapt in response to participant discussion. *Let's have a look at the timeline for this use case. Would it differ from the others?* Moderator to share copy of timeline for participants to complete. If there is time left moderator to repeat for the fourth use case.	Impact diagram and timeline completed for earlier use case	25
Close	Moderator to thank participants and remind about next steps.		5

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Appendix 4 – Self-driving vehicle demonstration – post-event questionnaire

Thank you for participating in the self-driving vehicle demonstration! Now we will ask you some questions about your experience

Please fill your ID number below. This is a number from 1 to 100 given to you by the event organisers.

SECTION 1: Previous experience

Q1. Had you had any experience involving fully self-driving vehicles before today?

Click all that apply

Yes, I used a self-driving bus before			
Yes, I used a self-driving mini-bus or shuttle before			
Yes, I used a fully self-driving car before			
Yes, I used another type of self-vehicle before		Which one?	
Yes, I saw a self-driving distribution vehicle before			
No, I had never had any of these experiences before			

SECTION 2: Bus

Today you've experienced using two self-driving vehicles (a bus and a mini-shuttle) and you observed a self-driving distribution vehicle. Think about the bus first

Q2. How did you feel while you were riding on the self-driving? Circle all that apply

Sad	Scared	Happy
Alert	Active	Irritated
Confident	Worried	In control
Motivated	Safe	Bored
Content	Annoyed	Pleased

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Melancholic Amused Surprised

Q3. What were the top three things you liked about the experience?

Q4. And what were the top three things you disliked?

Q5. How safe did you feel during these parts of the trip?

	Very unsafe	Unsafe	Not safe nor unsafe	Safe	Very safe
Boarding					
Bus starting					
Bus moving forward					
Bus turning					
Pedestrian crossing in front of the bus					
Bus stopping					
Getting off the bus					

Q6. Based on your experience riding in the self-driving bus, think about how self-driving buses will compare with buses with a human driver. Which trips you think will be…

	Human driven bus	Self-driving bus	Both will be similar	I don't know
More interesting				
Faster				
Cheaper				
More stressful				
More comfortable				
More dangerous (in terms of accidents)				
More insecure (in terms of crime				

Q7. If self-driving buses become widely available in your area, would you use one?

Yes	
Maybe	
No	

Q8. Which would be your three main concerns about using a self-driving bus?

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Q9. How safe would you feel using other modes in streets used by self-driving buses?

	Very unsafe	Unsafe	Not safe nor unsafe	Safe	Very safe	Don't know/ I normally don't use this mode
Walking						
Cycling						

Answer the next two questions if you have already tried the virtual reality experiment today. If you have not tried it yet, go to Q12

Q10. Was there anything you liked in the real bus that you had previously disliked in the virtual bus?

Q11. Was there anything you disliked in the real bus that you had previously liked in the virtual bus?

SECTION 3: Shuttle mini bus

Now think about the shuttle mini bus

Q12. How did you feel while you were riding on the shuttle mini bus? Circle all that apply

Sad	Scared	Happy
Alert	Active	Irritated
Confident	Worried	In control
Motivated	Safe	Bored
Content	Annoyed	Pleased
Melancholic	Amused	Surprised

Q13. What were the top three things you liked about the experience?

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