European Commission

Destination CCAM: Insights, trends, and expectations for Connected, Cooperative and Automated Mobility in Europe

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Report

Research and Innovation

Destination CCAM: Insights, trends, and expectations for Connected, Cooperative and Automated Mobility in Europe

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Manuscript completed in December 2023
1st edition

PDF ISBN 978-92-68-11643-2 doi: 10.2777/99195 KI-05-24-057-EN-N

Luxembourg: Publications Office of the European Union, 2024

EUROPEAN COMMISSION

Destination CCAM: Insights, trends, and expectations for Connected, Cooperative and Automated Mobility in Europe

Directorate-General for Research and Innovation
2024 Horizon Europe

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SUMMARY

In July 2023, the EC published a stakeholder survey aimed at gathering insights from experts in the road transport community regarding the status of CCAM in Europe. The survey was structured according to four main themes related to CCAM: 1) potential and impact, 2) expectations, 3) governance and 4) readiness. In total, the answers from 276 respondents, very or somewhat familiar with the CCAM concept, were analysed.

Most respondents believed that CCAM could improve road safety by minimising human error and accidents. Reducing the number of people killed and seriously injured on roads was the priority chosen most often for improving the transport system. Despite high expectations, most respondents were still concerned with CCAM solutions in high-risk driving scenarios and potential dilemmas. Thus, research and development of automated driving is needed to ensure their safe operation regardless of the situation.

Little more than half of the respondents believed that CCAM could enhance traffic efficiency and reduce congestion on roadways. Yet, only a third saw that it could be helpful when driving in congestion in urban areas. Less than half of the respondents believed that CCAM could reduce environmental impact and improve energy efficiency through optimised driving behaviour. Thus, research and development should focus on solutions that ensure traffic and energy efficiency in urban areas and minimise environmental impact.

Two thirds of respondents believed that CCAM could expand mobility options for individuals who are unable to drive. Respondents saw CCAM to be very helpful in providing access to mobility services in rural areas and for commuting to and from peri-urban areas. Only few believed that poorer people would benefit more than richer people. Thus, the affordability of CCAM based mobility services is of concern and the deployment and operation costs should be a focus in the service development and design.

CCAM was seen to lead to jobs growth and creation. The impact of this was assessed to be the highest on information technology and data analytics sector and on the automotive sector. Only driving professions were seen to suffer from job losses and displacement. All sectors were assessed to have medium to high impact on reskilling/upskilling. In the transition to CCAM, education and training programs should respond to this shift in skill demand. Drivers should be accompanied in this transition to ensure that their skills match the demand for innovative mobility services.

Public transport and freight were considered the most promising CCAM use-cases. Respondents indicated higher willingness to use shared automated mobility solutions than private ones. Yet, the willingness to pay extra for using automated vehicles was highest for passenger cars. Thus, different forms of shared mobility options were seen promising but only if the cost of their use does not increase with automation.

A great majority of the respondents were at least somewhat concerned with issues related to data sharing and privacy, AI-based systems, accountability and liability, and with a possible unfair governance of mobility transition meaning that both public and private actors should guide the vision for CCAM. Almost all respondents saw legal and regulatory issues as a barrier to the widespread deployment of CCAM solutions in Europe. The most urgent regulatory needs were about liability issues and testing regulations.

1. Introduction

Since 2016, the European Commission (EC) has launched a series of policy initiatives, together with regulatory and public support actions, to propose a coherent approach around Connected, Cooperative and Automated Mobility (CCAM). The ambition of the EC is to optimise the entire transport system by implementing large-scale demonstrations of inclusive and user-oriented CCAM solutions for people and goods across Europe by 2030.

In July 2023, the EC published a stakeholder survey aimed at gathering insights regarding the status of CCAM in Europe[1] from the road transport community. The primary objective of this survey was to ensure alignment between EU policy objectives on CCAM, as outlined in the **Sustainable and Smart Mobility Strategy**[2], with latest and forthcoming advancements in the field. Additionally, the survey sought to better understand public expectations concerning the development, deployment, and future implementation of CCAM. The 2023 public consultation followed up the 2020 Special Eurobarometer 496 "Expectations and concerns of connected and automated driving"[3], which highlighted the need to raise awareness and build trust in CCAM among experts and citizens, to foster a shared vision towards this mobility transition.

2. Survey

The survey regarding the current state and future prospects of CCAM in Europe was designed by the Directorate-General for Research and Innovation (RTD)[4]. It consisted of 25 questions and was structured according to four main themes related to CCAM: 1) potential and impact, 2) expectations, 3) governance and 4) readiness. The survey was open from July to September of 2023. Different stakeholders were invited to provide their views using the mailing lists of the CCAM Partnership, the FAME project[5] and the European Climate, Infrastructure and Environment Executive Agency (CINEA)[6].

In total, 279 respondents answered the survey. Three of them stated to be unfamiliar with the concept of CCAM. Given the statistical irrelevance of such a sample, their replies were excluded from the analysis. Thus, the remaining dataset included the answers from 276 respondents. Out of these respondents, 79% claimed to be very familiar with the CCAM concept, with only 21% being somewhat familiar. Of the respondents 88% were directly involved in work related to CCAM. This impacted the outcomes of the survey by their better knowledge on CCAM, its development status and potential than of those who do not work in this field. This expert knowledge was specifically sought out to receive state-of-the-art insights, even though this particularity of the sample means that the results cannot be extrapolated to the general population.

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[1] www.research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/open-consultation-ccam-solutions-europe-2023-08-02_en
[2] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12438-Sustainable-and-Smart-Mobility-Strategy_en
[3] www.europa.eu/eurobarometer/surveys/detail/2231
[4] commission.europa.eu/about-european-commission/departments-and-executive-agencies/research-and-innovation_en
[5] www.connectedautomateddriving.eu/about/fame/
[6] CINEA is the agency responsible for evaluating and granting research proposals under the Horizon Europe Framework Programme, see cinea.ec.europa.eu/index_en

71% of the respondents were male and 26% female. The remaining respondents preferred not to say their gender. 12% of the respondents were of age 18–30 years, 53% were between 30–40 years and the rest older than 50 years.

The respondents were affiliated with various kind of organisations and entities (Figure 1). 42% were affiliated with a research organisation or academia, 24% with public sector, 21% with a small or medium sized enterprise, and 21% with industry (automotive or telecom, information technology (IT)).

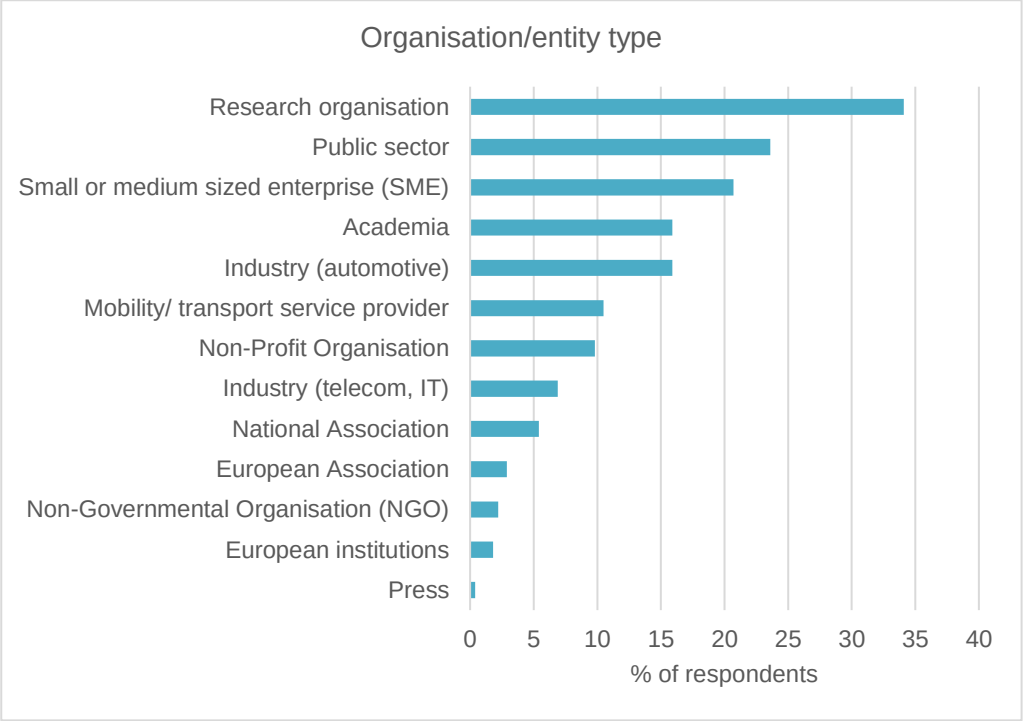


Figure 1. Type of organisation/entity the respondents were affiliated to. Multiple choice was possible.

Of the current CCAM initiatives and projects taking place in Europe, the respondents were most familiar with EU-funded projects on CCAM (average rating 4.8 on the scale from 1 = very unfamiliar, to 7 = very familiar, 42% of respondents rating it 6–7). The respondents were almost equally familiar with national initiatives and activities taking place under the umbrella of the CCAM Partnership (for both the average rating 4.6, 40% and 37% of respondents rating them with 6–7).

In total 84% of the respondents were personally involved in projects that focus on the development and deployment of CCAM related technologies and solutions, funded by the following instruments:

- EU-funded research programmes (e.g. Horizon 2020, Horizon Europe)
- National initiatives
- Connecting Europe Facility Programme
- Digital Europe Programme
- EU Regional Funds
- Key Digital Technologies JU

The most common funding instruments were EU-funded research programmes Horizon 2020 and Horizon Europe (59% of respondents, Figure 2) and national initiatives (47% of respondents). In total 64% respondents were familiar with at least one of the EU-funded research programmes Horizon 2020, Horizon Europe, Connecting Europe Facility, Digital Europe, EU Regional Funds and Key Digital Technologies JU.

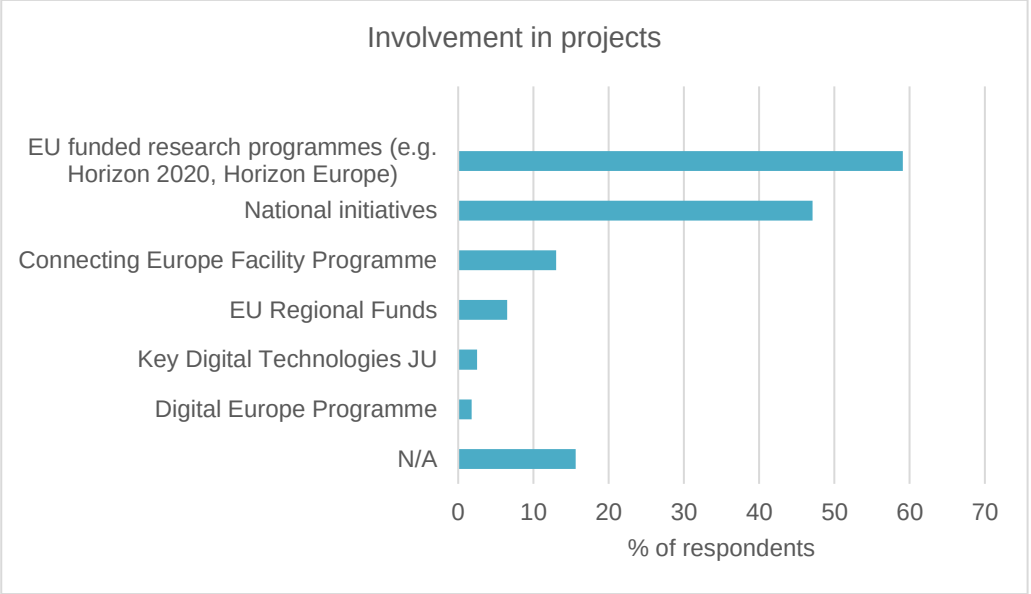


Figure 2. Personal involvement in projects that focus on the development and deployment of CCAM related technologies and solutions by funding instrument. Multiple choice was possible.

Survey results were analysed first for all respondents and then for specific relevant stakeholder groups to acquire interesting takeaways. In this report, the survey results are presented in the **Results** chapter question by question. They are later summarised according to selected cross-cutting themes together with related conclusions in the **Discussion** chapter. The formulation of survey questions and detailed results can be found in the **Annex**.

3. Results

3.1. Contribution to objectives

The respondents were asked how the wide deployment of CCAM could contribute to the specific objectives described by the following statements, on a scale from 1 = totally disagree, to 7 = totally agree (Question Q8):

- CCAM can improve road safety by minimising human error and accidents.
- CCAM can increase convenience and reduce stress for drivers during commute and errand journeys.
- CCAM can enhance traffic efficiency and reduce congestion on roadways.
- CCAM can expand mobility options for individuals who are unable to drive.
- CCAM can reduce environmental impact through optimised driving behaviour and energy efficiency.

The expectation was highest for CCAM improving road safety (average rating 6.0, and 74% of respondents rating it 6–7, Figure 3) and second highest for CCAM increasing convenience and reducing stress for drivers, equally for CCAM expanding mobility options for those who are unable to drive (for both: average rating 5.7 and 67% of respondents rating it 6–7).

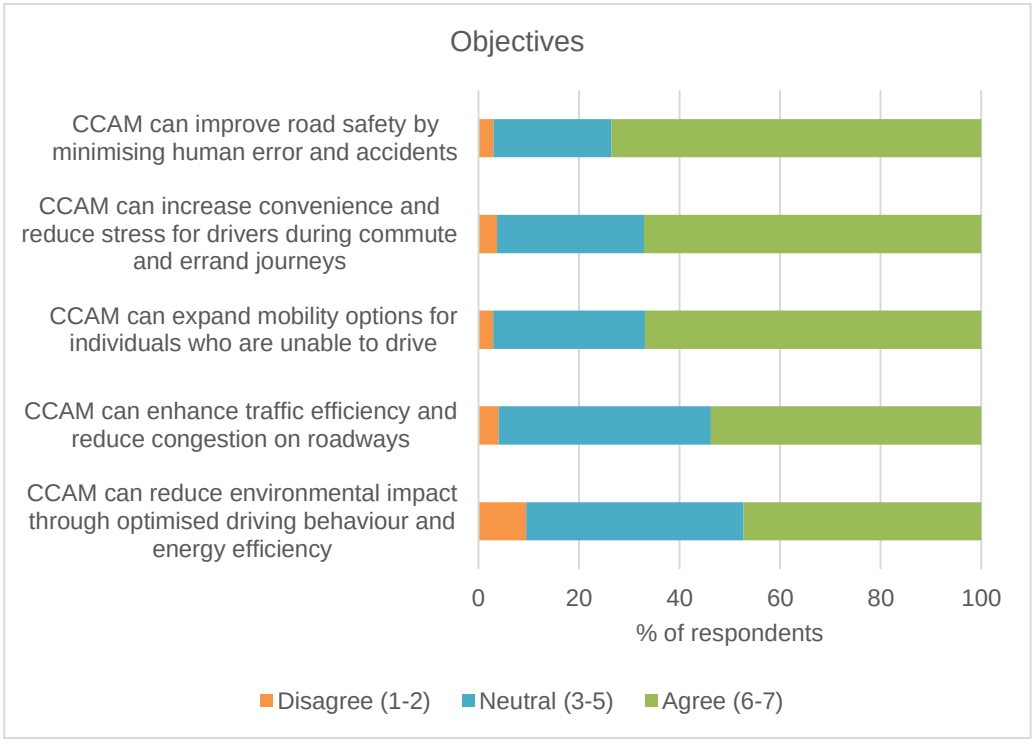


Figure 3. Agreement with contribution of wide deployment of CCAM for different objectives.

In general, the expectations toward the listed objectives were positive as more than half of the respondents (54–74%, Figure 3) believed CCAM could contribute to them (rating 6–7). The only small deviation from this was the objective on environmental benefits and improving energy efficiency, where the proportion of those who agreed with the statement (rating 6–7) was slightly lower. Still 47% of respondents believed in CCAM contributing to this. Overall, only a few respondents did not believe in the wide deployment of CCAM to contribute to the listed objectives (rating 1–2). The share of these sceptical respondents varied between different objectives from 3% to 10%.

Some stakeholder groups were also analysed separately. One group that somewhat deviated from the overall result was those who worked for the automotive industry. They had very positive expectations on CCAM's contribution to different objectives. For example, 86% believed (rating 6–7) that CCAM could improve road safety and minimise accidents. 70% of them believed that CCAM could reduce environmental impact and improve energy efficiency. All of the objectives had at least 68% of respondents believe that CCAM could contribute.

3.2. Help for mobility challenges

The respondents were asked how automated driving systems could help improve the following mobility challenges, on a scale from 1 = unhelpful / no impact, to 7 = very helpful / high impact (Question Q15):

- Driving in dense urban centres among pedestrians and cyclists
- Traffic congestion in urban areas (i.e. overtaking slower vehicles, driving in intersections and roundabouts)
- Driving on motorways (i.e. entering and exiting on off/on ramps, driving on single-carriageway roads, long tunnels)
- Lack of parking space in urban areas (i.e. entering and parking in indoor parking lots)
- Commuting to and from peri-urban areas
- Driving in adverse weather conditions (rain, snow, fog)
- Accessibility of mobility services in rural areas (i.e. people without driver licences, low population density, precarious status of infrastructure, transport poverty)

CCAM systems were assessed to be most helpful in driving on motorways with an average rating of 5.7, and 65% of respondents rating helpfulness/impact a 6–7 (Figure 4). In terms of providing accessible mobility services in rural areas, the survey showed an average rating of 5.4, with 55% of respondents giving it 6–7, and for commuting to and from peri-urban areas, an average rating of 5.2, with 50% of respondents rating it 6–7. The highest proportion of those expecting no impact or CCAM to be unhelpful was for driving in dense urban centres among pedestrians and cyclists with 33% of respondents rating it 1–2.

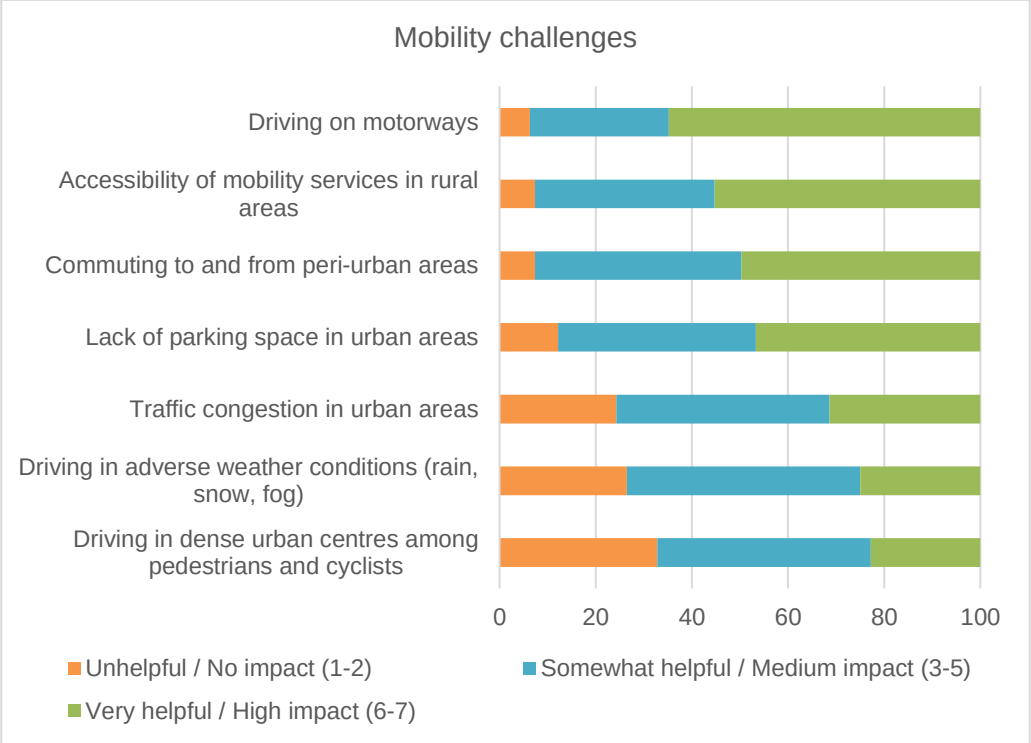


Figure 4. Impact of automated driving systems to help to improve mobility challenges.

3.3. Who benefits most

The respondents were asked who they thought would lose out or benefit most from the introduction of CCAM with the following statements, on a scale from 1 = totally disagree, to 7 = totally agree (Question Q17):

- CCAM will facilitate access to transport (i.e. young/elderly/disabled people, people with limited access to mobility services).
- Compared to now, poorer people will benefit more than richer people.
- Compared to now, people living outside cities and towns will lose out more than people living in cities and towns.
- Companies that make and operate CCAM solutions will benefit the most.
- Companies that move goods and materials around will benefit the most.
- Automated driving technology is too complex for government agencies to understand and to regulate.

In their opinion, young/elderly/disabled people and people with limited access to mobility services could benefit most from CCAM to improve their access to transport options (average rating 5.4, 55% of respondents rating it 6–7, Figure 5) as well as the companies that make and operate CCAM solutions (average rating 5.5, 53% of respondents rating it 6–7). The statements most commonly disagreed with were that poorer people would benefit more than richer people (45% of respondent rating it 1–2), automated driving technology being too complex for government agencies to understand and to regulate (44% of respondent rating it 1–2), and that people living outside cities and towns would lose out more than people living in cities and towns (39% of respondent rating it 1–2).

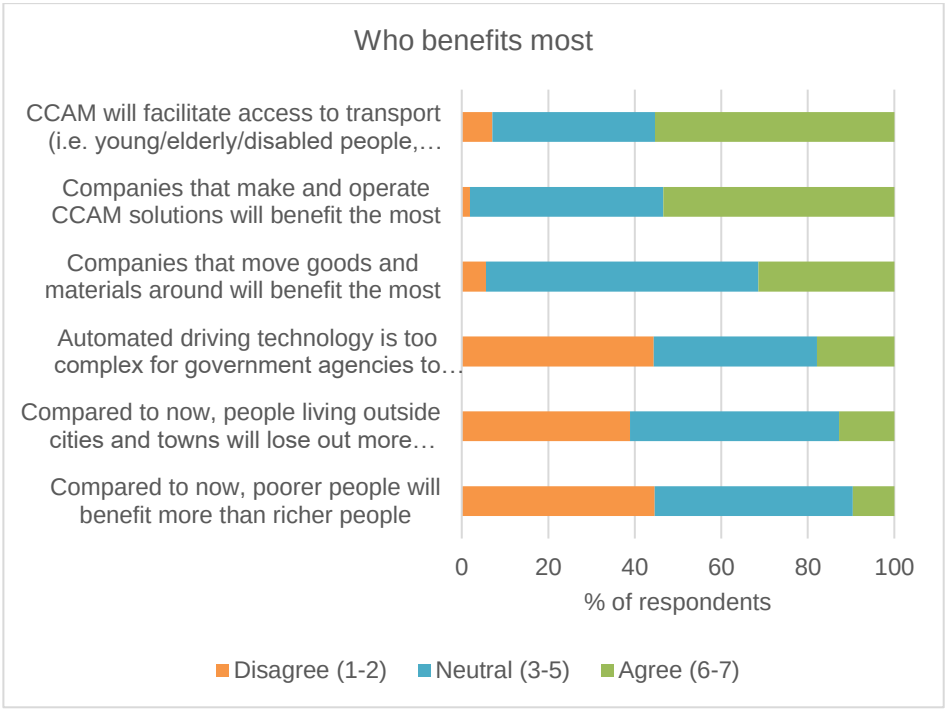


Figure 5. Level of agreement with who will lose out or benefit most from the introduction of CCAM.

3.4. Jobs and skills

As the deployment of CCAM solutions progresses, there may be potential for job displacement and losses, but also job opportunities and jobs growth. Respondents were asked about the kind of impact CCAM (for people and goods mobility) would have on the following employment sectors, in terms of jobs growth and creation, job losses and displacements, and finally the potential for reskilling and upskilling, on a scale from 1 = no impact, to 7 = high impact (Question Q13):

- Driving professions (bus, taxi, truck, delivery, chauffeur)
- IT and data analytics (IT specialist, remote control operator, cybersecurity analyst)
- Automotive and manufacturing (engineering, robotics, software developers, sensor providers)
- Operations and planning (fleet/ traffic manager, logistics coordinator, route planner, driver trainer, safety manager)
- Maintenance and repair (maintenance technician, mechanic, roadside assistance technician, parts specialist)
- Service provision (including logistics and first-last mile delivery)
- Administrative and customer service

The respondents assessed the highest jobs growth and creation in IT and data analytics (average rating 6.0, 75% of respondents rating a high impact (6–7), Figure 6), automotive sector and manufacturing (average rating 5.7, 66% of respondents rating it 6–7), and in operations and planning (average rating 5.2, 49% of respondents rating it 6–7). Those working for the automotive industry shared the same view on jobs growth and creation in automotive and manufacturing sector with others.

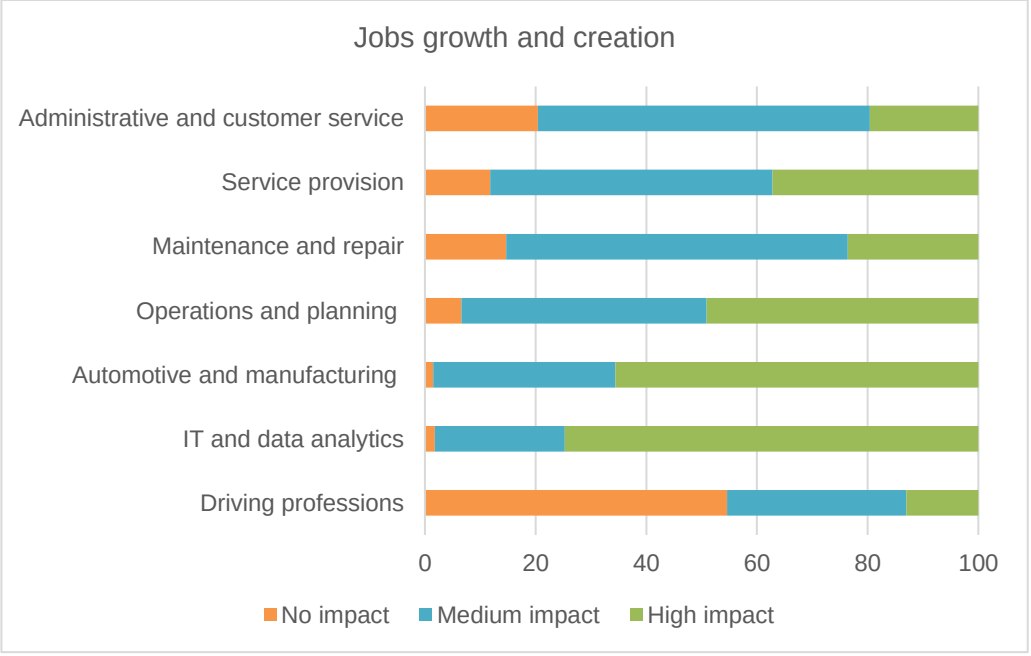


Figure 6. Impact on jobs growth and creation.

The respondents expected job losses and displacement in driving professions with an average rating 5.4 and 57% of respondents rating a high impact (6–7, Figure 7). For other professions, a majority of respondents (52–82%) expected no job losses or displacement. For reskilling and upskilling, the rating was similar to all professions with average 4.1–5.2. Almost all respondents (81–96% of them) assessed medium to high impact across sectors (Figure 8).

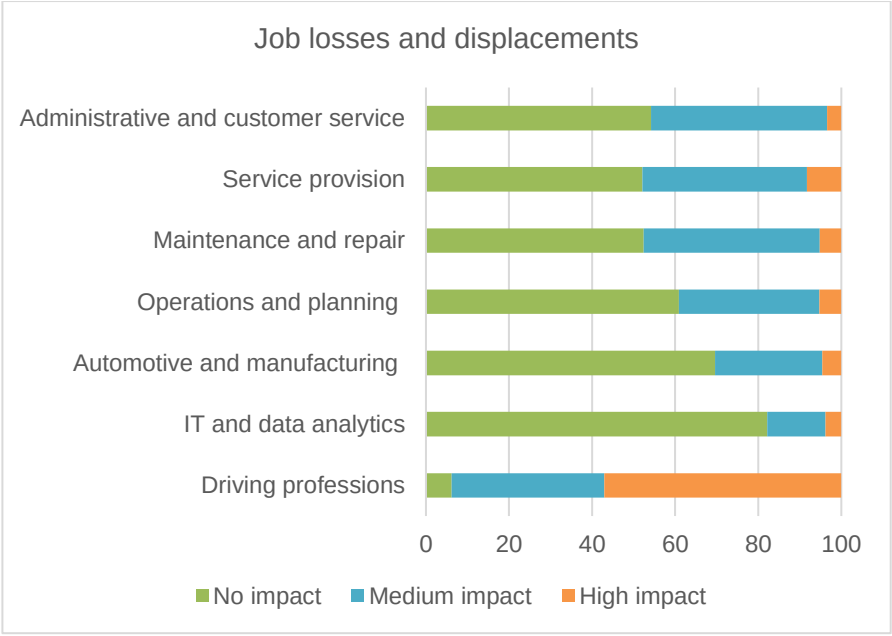


Figure 7. Impact on job losses and displacement.

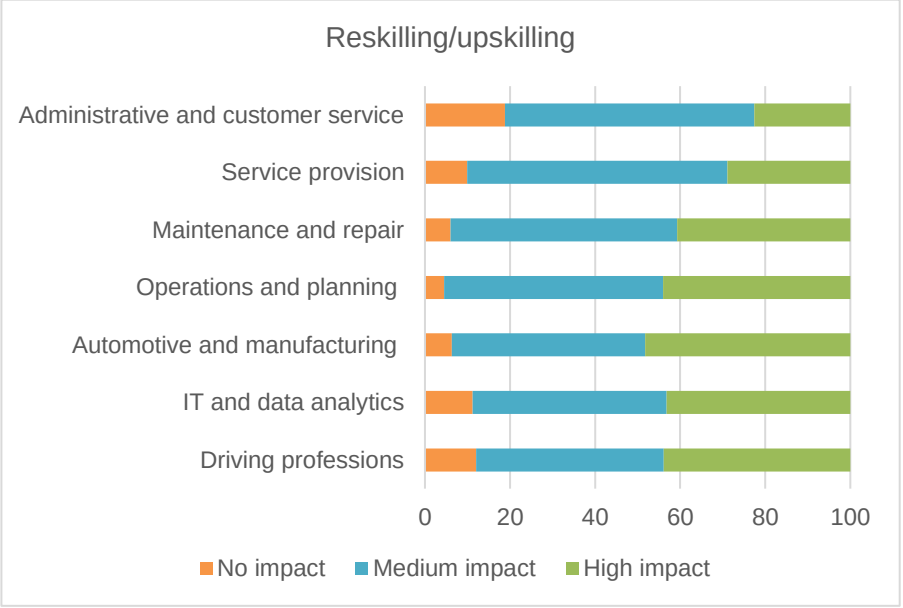


Figure 8. Impact on reskilling and upskilling.

3.5. CCAM use-cases

The respondents were asked to rate the most promising (Question Q9) and most developed (Question Q10) CCAM use-cases among public transportation, passenger cars, freight transport and delivery services, on a scale from 1 = least promising/developed, to 7 = most promising/developed.

All these use-cases were considered somewhat or most promising by almost all respondents (rating 3–7 by 97–98% of respondent for all use cases, except passenger cars for which this proportion was 85% of respondents, the left-hand graphic in Figure 9). Public transport (average rating 6.0) and freight transport (average rating 5.8) were considered the most promising use-cases, and more than two thirds of respondents gave them top rating (respectively 72% and 68% of respondents rated them 6–7), while passenger cars got the lowest rating (average rating 4.5, 34% of respondents rating it 6–7).

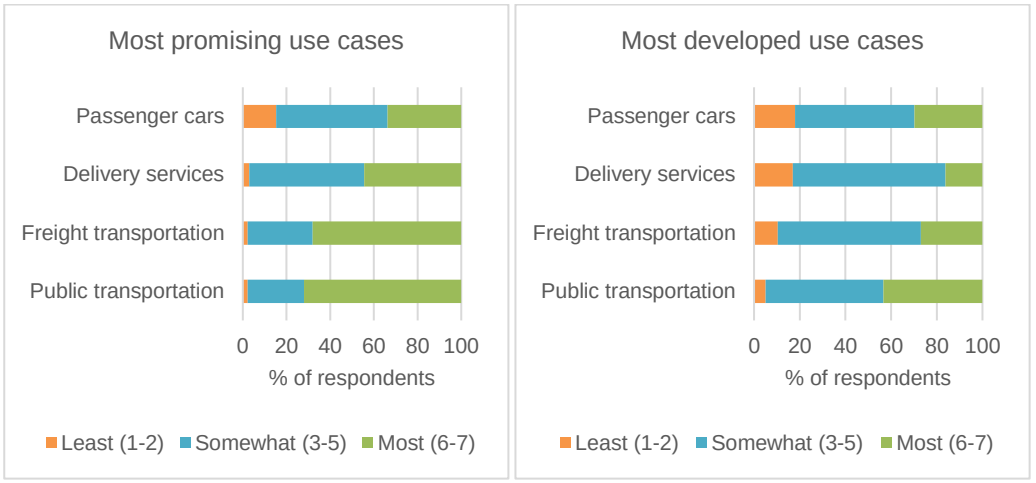


Figure 9. The ratings for the most promising (left) and developed (right) CCAM use cases.

Of those who worked within the automotive industry, no one rated the public transport or freight transport use-cases to be least promising (rating 1–2), while 82% and 80% rated them most promising (rating 6–7). For the other two use-cases, the proportion of those who assessed the use-case to be most promising (rating 6–7) was smaller among those who worked for the automotive industry than across all respondent groups: 48% of this respondent group for the delivery services and 51% for the passenger cars.

The majority of all respondents rated CCAM use-cases to be somewhat developed (from 52% to 67% of respondent rating them 3–5, the right-hand graphic in Figure 9). Public transport was considered the most developed use-case (average rating 5.1, 43% of respondent rating it 6–7). Delivery services received the lowest rating (average rating 4.0, only 16% of respondents rating it 6–7).

Of those who worked for the automotive industry, the use-case with the highest proportion of top ratings (6–7) for most developed use-case, was passenger cars with 45% of respondents. The passenger cars use-case got the top rating from only 30% of those who worked for the public sector and from 28% of the mobility and transport service providers. For these two stakeholder groups, the highest proportion of top ratings were for public transport with 52% of the respondents working for the public sector and 38% of respondents working for the service providers.

3.6. Introduction of CCAM

The respondents were asked about the potential introduction of CCAM and related expectations by rating the following statements, on a scale from 1 = totally disagree, to 7= totally agree (Question Q12):

- Human-driven vehicles and CCAM vehicles should not share the same stretch of road.
- CCAM will never really work on public roads.
- CCAM solutions are coming whether we want them or not.
- I don't trust the companies developing CCAM to make sure they are safe.
- EU's industrial competitiveness will suffer unless we are at the forefront of CCAM development.
- CCAM should only be introduced if it is supported by a clear majority of the public.

Most respondents agreed with the statement that CCAM solutions were coming whether we want them or not, and that the EU's industrial competitiveness would suffer unless the EU is at the front of CCAM development (average rating for both 5.0, and 48% and 46% of respondents rating them 6–7, Figure 10). The statements that CCAM would never work on public roads and that human-driven vehicles and CCAM vehicles would not be able to share the same stretch of road, were disagreed with by a majority of the respondents (for the statement about public roads: average rating 2.2 and 69% of respondents disagreeing (rating 1–2), and for the statement about sharing the road: average rating 2.8 and 59% of respondents disagreeing). There was also disagreement with the statement that there would be a lack of trust in companies developing CCAM to make sure they are safe (average rating 2.8, 55% of respondents rating it 1–2). Most respondents were neutral towards the statement of CCAM introduction requiring a majority of public support (rating 3–5 by 55% of respondents).

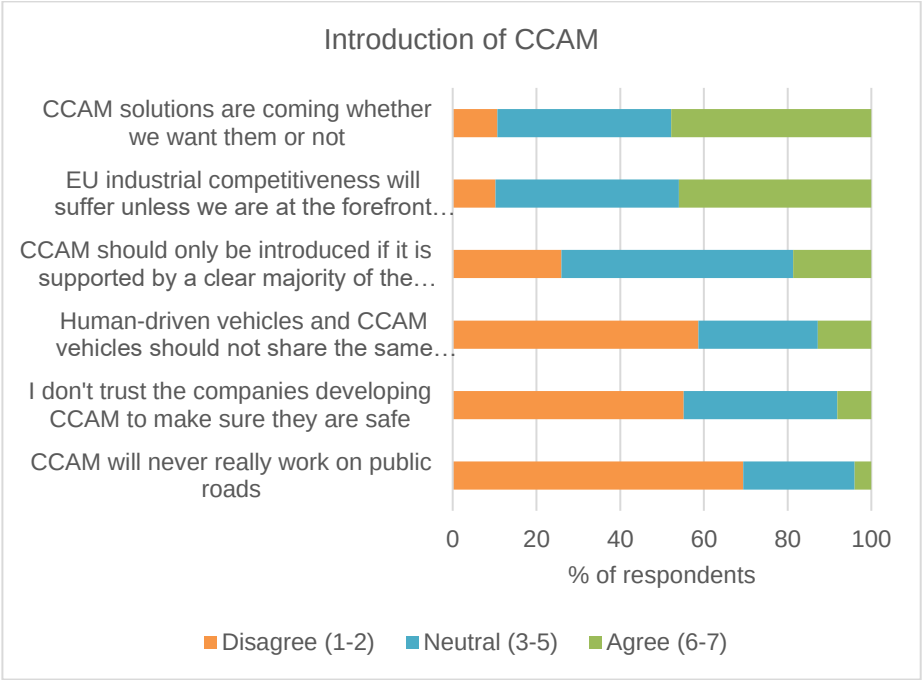


Figure 10. Agreement with statements regarding the potential introduction of CCAM.

Those working for the public sector were a little less worried than other stakeholder groups about the EU's industrial competitiveness if it was not at the forefront of CCAM development, with 32% of them agreeing with this statement (rating 6–7), versus 50% of other respondents. The public sector was also more prone to disagree with the statement that human-driven vehicles and CCAM vehicles should not share the same stretch of road (69% of them disagreeing with it (rating 1–2), versus 56% of other respondents). They were more neutral towards the statement that CCAM should only be introduced if it is supported by a clear majority of the public with 67% of them rating 3–5, versus 52% of other respondents. Otherwise, the public sector responses were similar to those of the other stakeholders.

The biggest stakeholder groups that stood out were examined for the statements most disagreed with. Academia and mobility and service providers were more sceptical than others that human-driven vehicles and CCAM vehicles should share the same stretch of road, with 20% and 17% of them agreeing with the statement that they should not share it (rating 6–7), versus 10% of other respondents. Additionally, academia was more sceptical than others that the companies developing CCAM would make sure they are safe. 14% of these agreeing (rating 6–7) with the statement that they would not trust companies developing CCAM to make sure they are safe, versus 7% of other respondents. Academia was more in the category of neutral (rating 3–5) than others with the statement that CCAM would never really work on public roads with 43% of respondents rating 3–5, versus 23% of others, and 57% of academia members rating it 1–2 (disagreement), versus 72% of others.

3.7. Deployment timeliness

In terms of deployment timeliness (Question Q14), only a few respondents (5%) expected automated vehicles to be a common feature on European roads in less than 5 years (Figure 11). The expectation divided the rest of the respondents somewhat equally among the 5–10 years range (34%), 10–15 years (31%) and more than 15 years (30%). Of those who worked for the automotive industry, mobility or transport service providers or the public sector, 39–48% believed automated vehicles would be deployed at large-scale within 5–10 years.

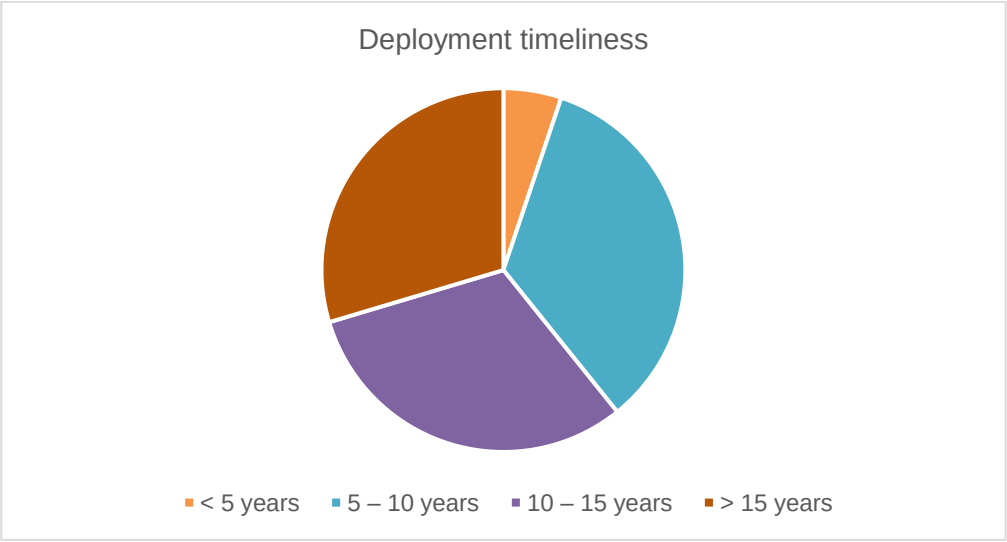


Figure 11. Distribution of deployment timeliness for automated vehicles to be a common feature on European roads.

3.8. Use of automated mobility solutions

The respondents were asked whether they would be likely to use shared or private automated mobility solutions if these were readily available and well established in their region, on a scale from 1 = very unlikely, to 7 = very likely (Question Q22).

The use of shared automated mobility solutions was seen more likely than the use of private automated mobility solutions, with an average rating of 5.8, compared to the average rating of 4.6 for private mobility solutions. The use of shared automated mobility solutions was rated likely (6–7) by 67% of respondents while private automated mobility solutions by 44% (Figure 12). Only few (5%) considered the use of shared solutions unlikely (rating 1–2), while this was the case for 20% of the respondents for the use of private solutions.

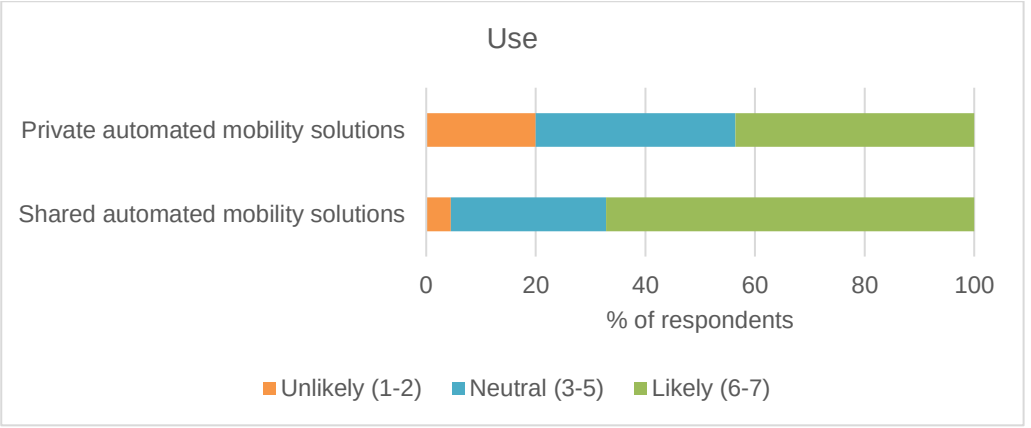


Figure 12. Likeliness of use of private and shared automated mobility solutions.

3.9. Willingness to pay

The respondents were asked about their willingness to pay extra for using the following vehicles equipped with automated driving systems (Question Q23):

- Automated taxis or ride-hailing services
- Automated shuttle buses
- Automated delivery systems
- Privately owned automated passenger cars

The willingness to pay was highest for the privately owned automated passenger cars with 45% of respondents willing to pay extra (Figure 13). For the other mobility concepts, the willingness to pay was lower (26% of respondents for automated shuttle buses, 25% of respondents for automated taxis or ride-hailing services, and 22% of respondents for automated delivery systems).

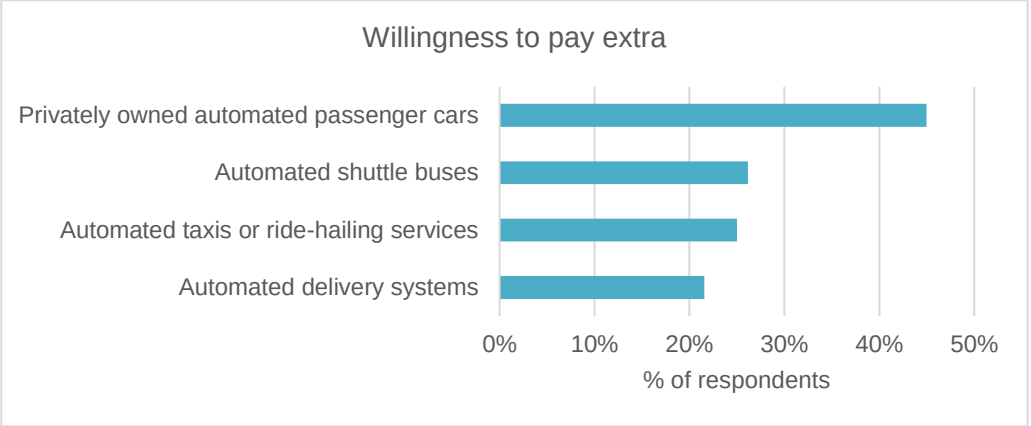


Figure 13. Proportion of respondents who would be willing to pay extra for using different vehicles equipped with automated driving systems.

3.10. Encouraging adoption

Respondents were asked to choose the three most important factors for encouraging the adoption of CCAM solutions among the following options (Question Q25):

- Evidence of safety benefits (for drivers, passengers, pedestrians, VRUs)
- Availability of financial incentives (for adopting in-vehicle purchases, for using mobility alternatives, e.g. lower insurance premium, low circulation tax)
- Improved comfort and possibility to engage in non-driving related activities while travelling
- Evidence of environmental benefits
- Better service offering (e.g. first and last mile services)
- Extensive public education and awareness campaigns
- Better use of travel time

Evidence of safety benefits was seen as most the important factor (chosen by 82% of respondents, Figure 14), followed by better service offering (48% of respondents) and evidence of environmental benefits (44% of respondents). Those respondents who worked for the automotive industry or for mobility/transport service providers were somewhat less likely to choose the evidence of environmental benefits than others. Results across all respondents, indicated that the availability of financial incentives or extensive public education and awareness campaigns were not considered important for encouraging the adoption of CCAM solutions, with respectively only 23% and 17% of respondents choosing them.

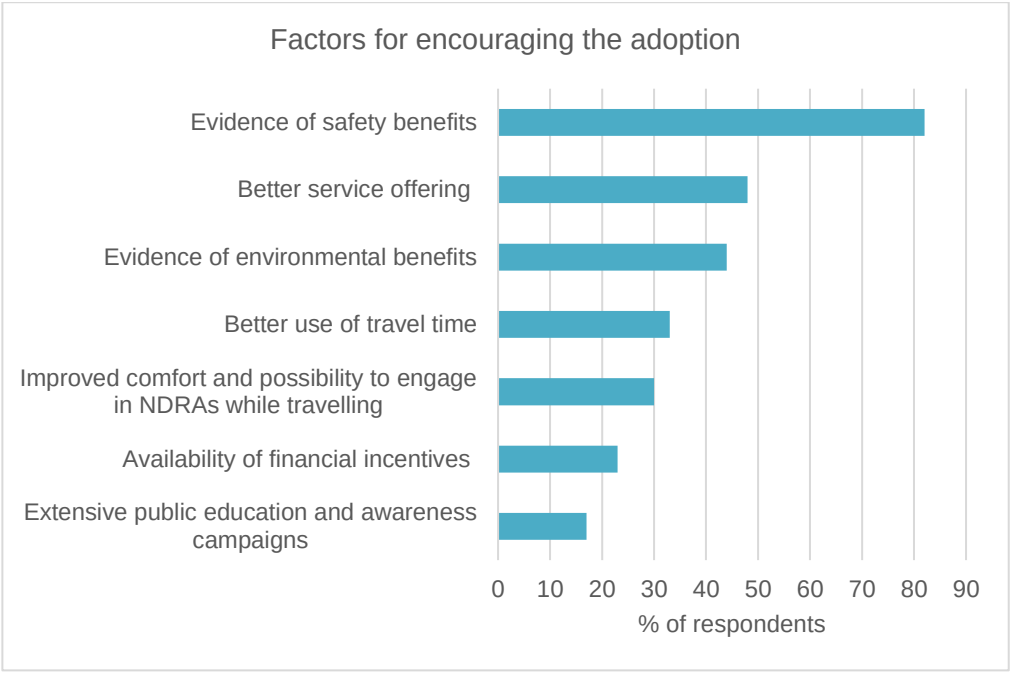


Figure 14. The most important factors for encouraging the adoption of CCAM solutions, max 3 alternatives could be chosen. NDRA = non-driving related activity.

3.11. Governance of rules

Respondents were asked about who should decide on the rules of the road for CCAM vehicles, and the rules governing how human drivers and CCAM vehicles should share the road, on a scale from 1 = totally disagree, to 7 = totally agree (Question Q18).

There was a rather strong agreement that there should be international standards regulating automated driving technology (average rating 6.2, 81% of respondents rating it 6–7, Figure 15) and the driving environment to make it easier for CCAM to work everywhere (average rating 5.6, 63% of respondents rating it 6–7). A majority of respondents also thought that CCAM should be regulated by national governments (average rating 5.3, 54% of respondents rating it 6–7) and half of them disagreed that automated driving technology would be too complex for government agencies to understand and to regulate (49% of respondents rating it 1–2). Almost two thirds of all respondents (63% of them) disagreed (rating 1–2) with the idea that CCAM should be regulated by technology companies. The proportion of those with rating 1–2 was smaller, slightly less than half (46%), for those working for the automotive industry. There was no common agreement that CCAM would be smart enough by itself to abide by different regulations in different countries, or if local authorities should make the decisions about which roads CCAM solutions should be allowed to use.

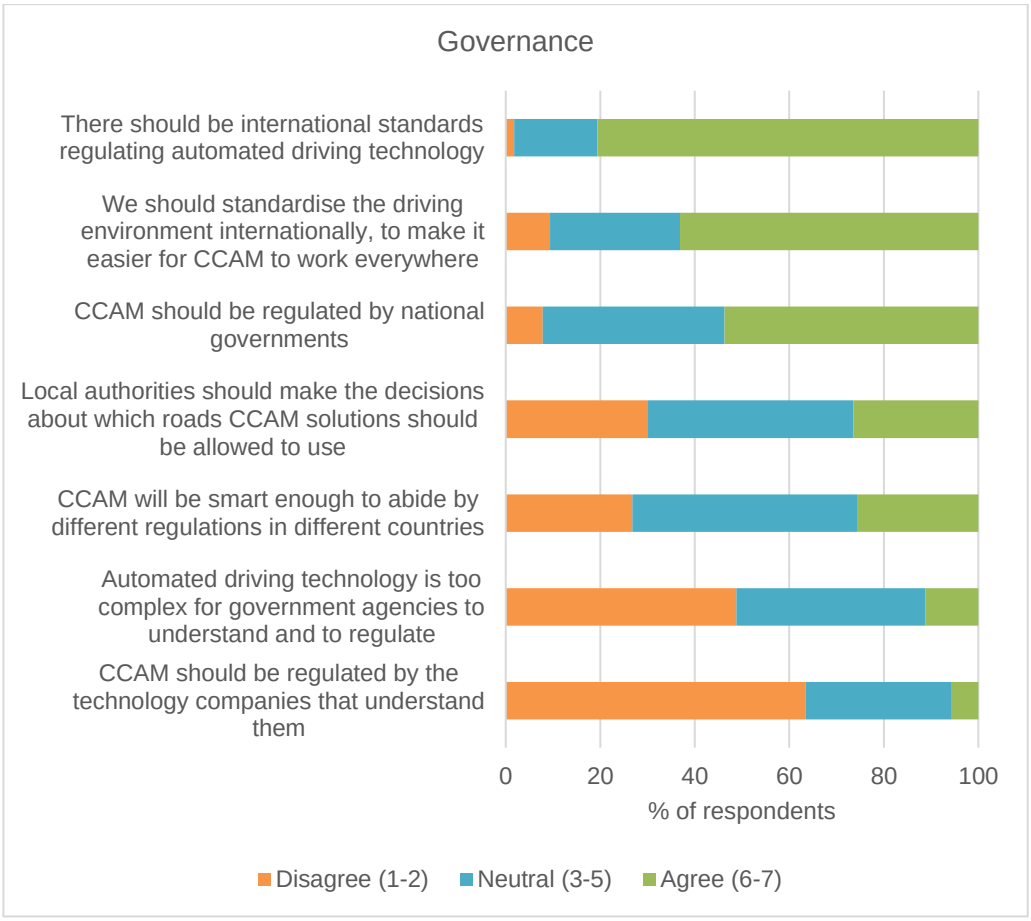


Figure 15. Agreement with who should decide on the rules of the road for CCAM vehicles, and on the rules governing how human drivers and CCAM vehicles should share the road.

3.12. Priorities for improving transport system

Respondents were asked to give their two highest priorities regarding how they would like governments, highway authorities and cities to improve the transport system (Question Q19):

- Making it affordable for everybody regardless of their financial means, to move around
- Reducing the number of people killed and seriously injured on the roads
- Giving individuals the ability to travel when and how they want
- Reducing traffic congestion
- Making travel easier for those currently unable to drive as a result of age or physical disability
- Reducing the pollution and environmental cost of transportation

The clear top two priorities were to reduce the number of people killed and seriously injured on the roads (chosen by 55% of respondents, Figure 16) and to reduce the pollution and environmental cost of transportation (49% of respondents). All the other alternatives were chosen by a similar share of respondents (18–28% of respondents).

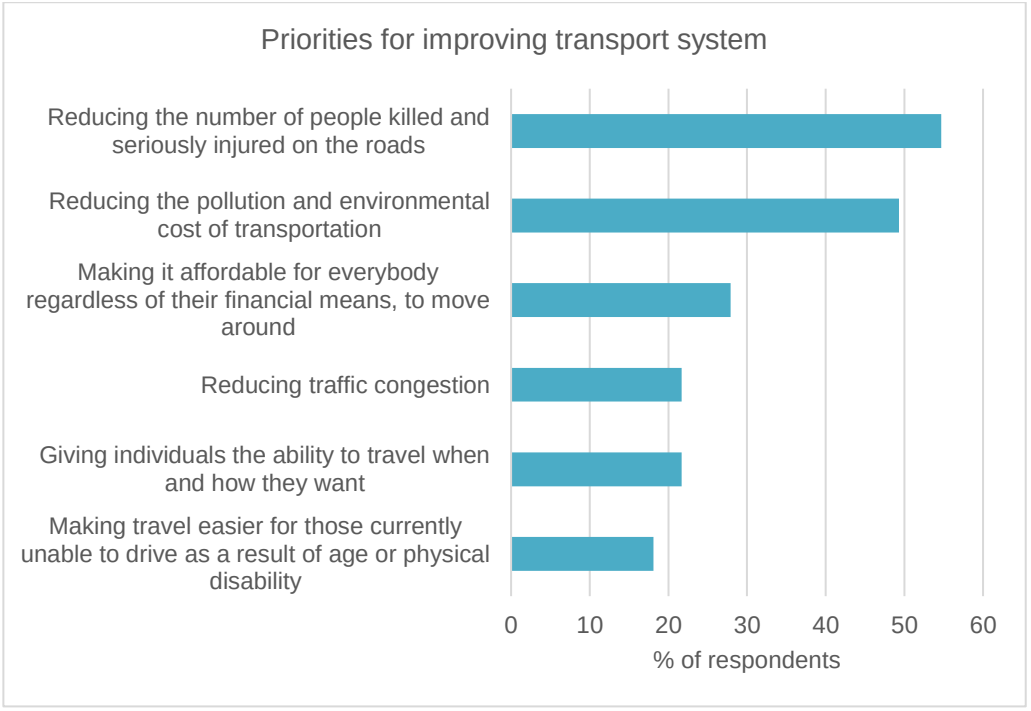


Figure 16. The highest priorities for governments, highway authorities and cities for improving transport system, max 2 could be selected.

3.13. Concerns

The respondents were asked to rate their level of concern for the following implications generated by the development of CCAM systems, on a scale from 1 = totally unconcerned, to 7 = very concerned (Question Q16):

- High risk driving scenarios and potential dilemmas
- Lack of transparency/explainability of artificial intelligence (AI) based systems
- Data-sharing and privacy issues
- Accountability and liability issues
- Unfair governance of mobility transition

The respondents seemed rather concerned overall. There were no major differences between the implications (Figure 17). The average rating for all listed concerns were similar, ranging from 4.4 to 4.8. The largest respondent group (45–51% of them) was somewhat concerned (rating 3–5) and the second largest (33–38% of respondents) was very concerned (rating 6–7). Only a minority of respondents did not feel concerned (12–22% respondents rating them 1–2). The concern on accountability and liability issues was rated highest.

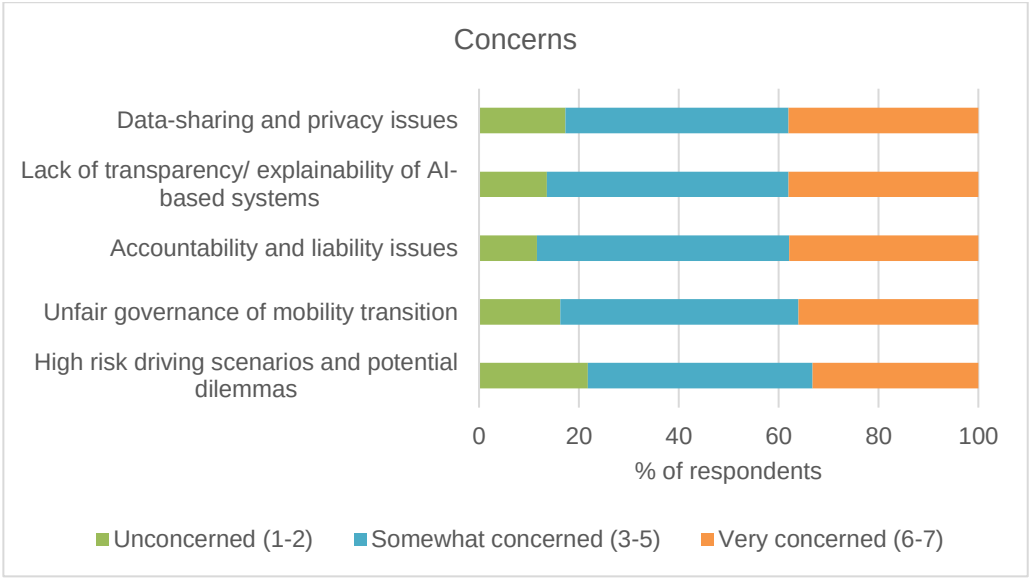


Figure 17. Level of concern for implications generated by the development of CCAM systems.

3.14. Urgent regulatory needs

The respondents were asked of the most urgent regulatory needs among the following options when it came to the deployment of automated driving systems (Question Q20, two highest priorities):

- Liability regulation
- Traffic rules
- Testing regulation (i.e. pre-deployment testing by manufactures, researchers…)
- Data-sharing regulation
- Type-approval regulation
- Access to in-vehicle data regulation

Liability and testing regulation were the two most popular options, chosen by 49% and 41% of respondents (Figure 18). For those who work for the automotive industry, type approval regulation was also rated high (chosen by 39% of them). For those who work for the public sector the data sharing and type-approval regulations were rated second highest (chosen by 35% of them) after the liability regulation (46% of them). Access to in-vehicle data regulation was chosen least often, by 11% of all respondents.

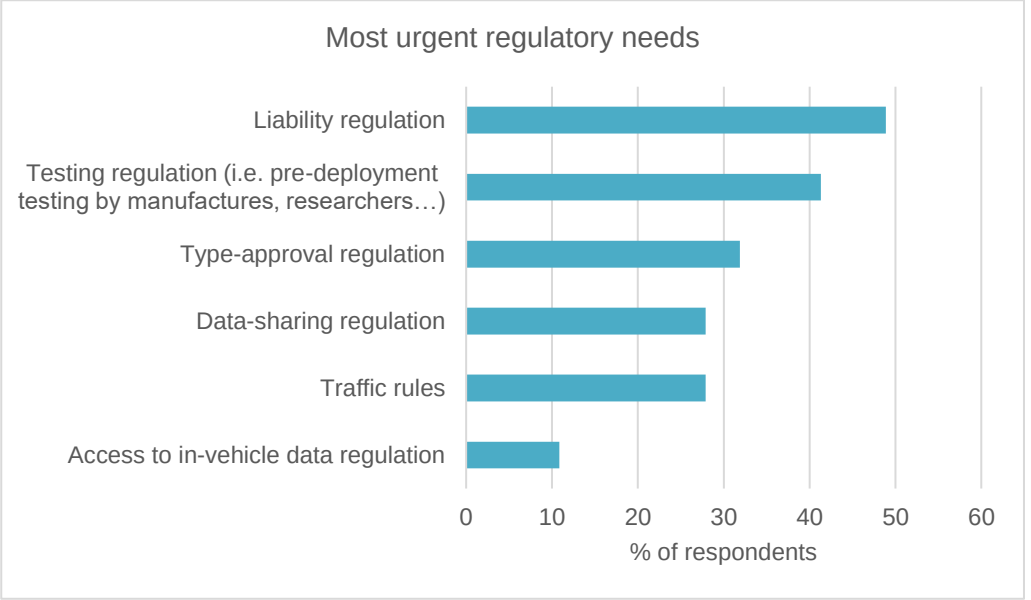


Figure 18. The most urgent regulatory needs when it comes to the deployment of automated driving systems (2 highest priorities).

3.15. Barriers

Respondents were asked to rate the following barriers to the widespread deployment of CCAM solutions in Europe, in terms of urgency, on a scale from 1 = least urgent, to 7 = most urgent (Question Q24):

- Lack of adequate roads and signage
- Lack and/ or poor quality of digital infrastructure
- Insufficient data sharing frameworks between public and private actors
- Concerns about data privacy and security
- High implementation costs
- Legal and regulatory barriers
- Job displacement and impact on employment in the transportation sector
- Safety and liability concerns in case of accidents
- Limitations in the systems' reliability and technical capabilities
- No relevant use-cases / usefulness of CCAM
- Lack of understanding of CCAM potential and usefulness
- Lack of awareness at operator level / city level / implementer level
- Lack of sufficiently mature technology

Legal and regulatory barriers were considered to be the most urgent (average rating 5.7, 62% of respondents rating it 6–7, Figure 19), followed by lack of and/or poor quality of digital infrastructure (average rating 5.4), high implementation costs (average rating 5.4), limitations in the systems' reliability and technical capabilities (average rating 5.2) and safety and liability concerns in case of accidents (average rating 5.1) which were all rated as most urgent (6–7) by 50–54% of respondents. Job displacement and impact on employment in the transportation sector (average rating 3.4), and lack of relevant use-cases or usefulness of

CCAM (average rating 3.5) were considered as least urgent barriers. They were rated least urgent (1–2) by 35% and 39% of respondents respectively.

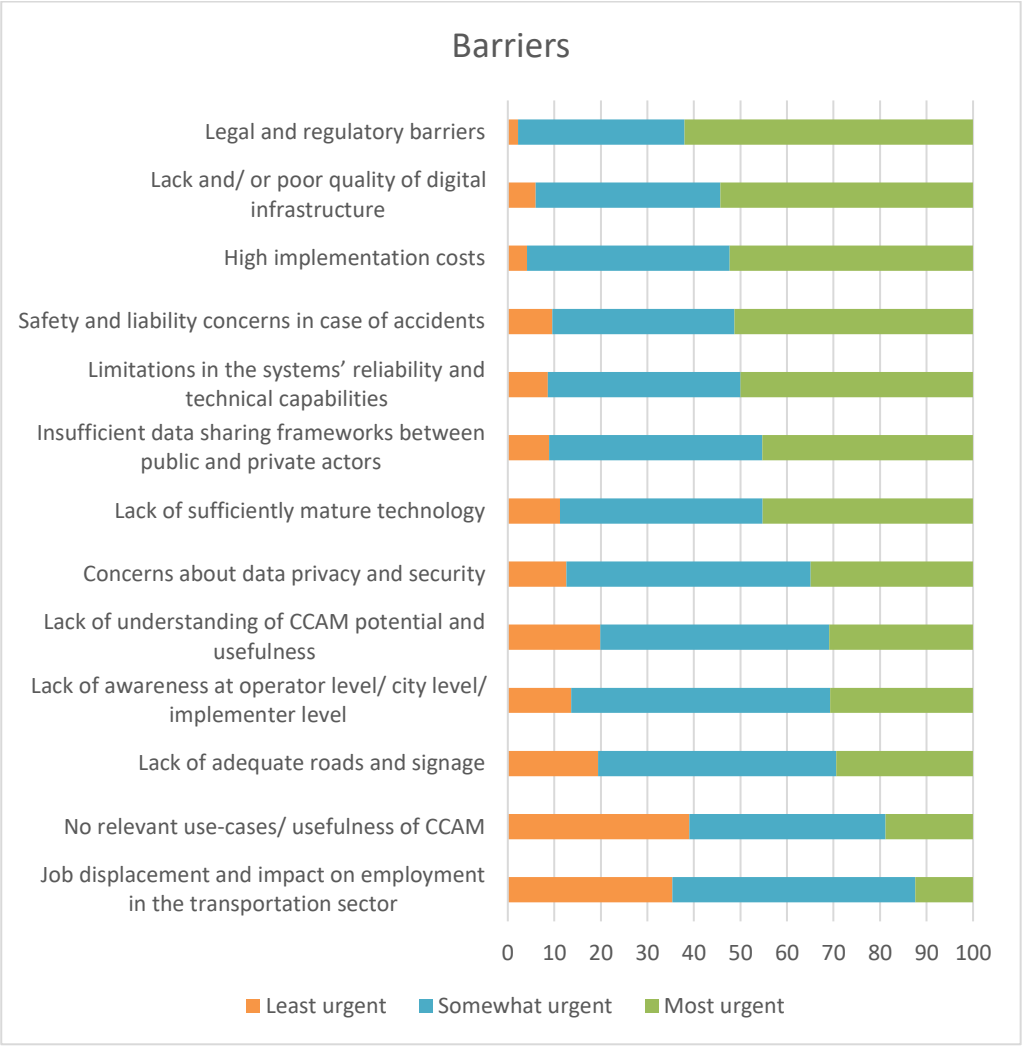


Figure 19. The urgency of barriers to the widespread deployment of CCAM solutions in Europe.

The top three barriers of those who worked in the public sector and for automotive industry were related to legal and regulatory framework, digital infrastructure and implementation costs. These were the same as the result for all respondents above. Mobility and transport service providers rated highest legal and regulatory barriers and the high implementation costs, the third one for them being limitations in the systems' reliability and technical capabilities.

3.16. International collaboration

The respondents assessed whether international collaboration would be beneficial to accelerate the development of CCAM in the following areas, on a scale from 1 = least important to 7 = most important (Question Q21):

- Regulatory aspects
- Technological development
- Societal impact

International collaboration was seen important overall. Regulatory aspects and technology development were considered the most important topics, with average ratings 6.2 and 5.9, and 77% and 66% of respondents rating them 6–7 (Figure 20). International collaboration on societal impacts was also seen beneficial, but with lower importance (average rating 5.3, 48% of respondents rating it 6–7). Only a few rated any of these topics unimportant (rating 1–2 by 2% of respondents for the first two topics and by 5% of respondents for the last).

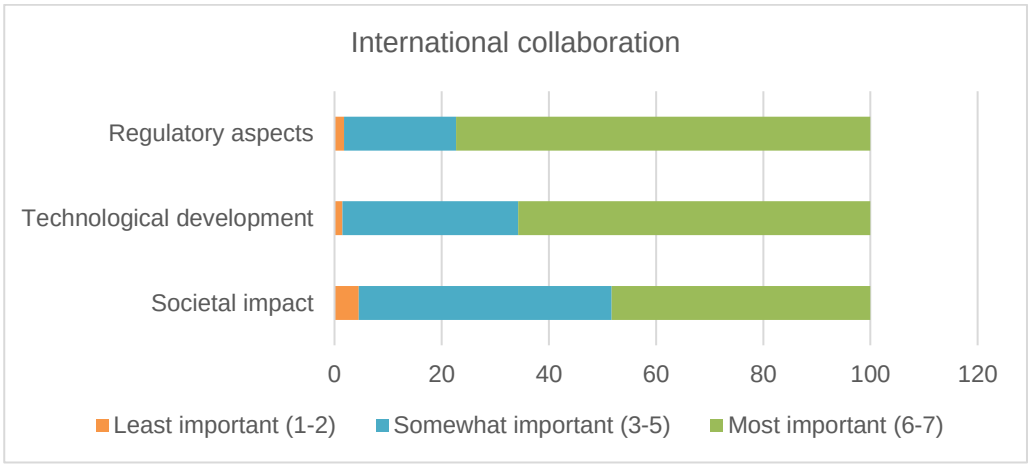


Figure 20. Importance of international collaboration.

4. Discussion

4.1. Potential and impact of CCAM

4.1.1. Improving road safety

Road safety was considered important, and there were high expectations for CCAM solutions for contributing to it. Reducing the number of people killed and seriously injured on roads was the most often chosen priority for improving transport system. Most respondents believed that CCAM could improve road safety by minimising human error and accidents, and only a few strongly disagreed with this. The respondents trusted the companies developing CCAM to make sure that they are safe, with only few having concerns about this. Evidence of safety benefits was seen as the best factor for encouraging the adoption of CCAM.

Despite high expectations, most respondents were concerned with high-risk driving scenarios and potential dilemmas, and half of them rated the safety and liability concerns highly, in case of accidents among the most urgent barriers to the widespread deployment of CCAM solutions in Europe. Thus, further research and development of automated driving in high-risk scenarios is needed to ensure their safe operation regardless of the situation, in for example complex intersections or in situations with occlusion, and when in complex interaction with other road users, including vulnerable road users. It should also be ensured that the liability questions related to accident situations are solved.

4.1.2. Enhancing traffic efficiency and reducing congestion

A little more than half of respondents strongly believed that CCAM could enhance traffic efficiency and reduce congestion on roadways, and only a few disagreed with this. Two thirds of respondents saw automated driving systems to be very helpful for driving on motorways. However, only little less than a third believed CCAM to be very helpful in traffic congestion in urban areas, a quarter of respondents seeing it as unhelpful. Almost half of respondents saw CCAM as very helpful in easing the lack of parking space in urban areas, only some disagreeing with this strongly. Thus, research and development should focus on solutions which ensure traffic efficiency in urban areas. Without smooth interaction in mixed traffic with all kinds of road users, it is hard to achieve this efficiency, and use-cases in urban areas would remain useful in only confined spaces.

4.1.3. Expanding mobility options

Making the transport system affordable for everybody to move around, regardless of their financial means, was among the most highly rated priorities for improving the transport system. Better service offering was seen as an important factor for encouraging the adoption of CCAM. Two thirds of respondents believed that CCAM could expand mobility options for individuals who are unable to drive, and only a few of respondents disagreed with this. Little more than half of the respondents believed that CCAM could facilitate access to transport for young, elderly and disabled people, and for people with limited access to mobility services. Only few disagreed with this.

Only a minority of respondents had concerns that CCAM would add inequity between urban and rural areas, namely that people living outside cities and towns would lose out more than people living in cities and towns. In fact, a more than half of the respondents believed that CCAM could be very helpful in providing access to mobility services in rural areas, and half of the respondents believed that CCAM could be very helpful for commuting to and from peri-urban areas. Only few believed that CCAM could improve equity between different socio-

economic groups, namely that poorer people would benefit more than richer people, almost half of respondents disagreed with this strongly. The cost to the CCAM solution user is a key factor here. This result may relate to service providers seeing high implementation cost as a major barrier. Thus, it seems that they did not believe in better cost-efficiency of service operation with automation. Therefore, the affordability of CCAM based mobility services was of concern and the deployment and operation costs should be a focus in the service development and design. It is also important to ensure that the services are developed for rural and peri-urban areas as well.

4.1.4. Reducing environmental impact and improving energy efficiency

Reducing pollution and decreasing the environmental cost of transportation was the second most often chosen priority for improving the transport system. Evidence of environmental benefits was identified as an important factor for encouraging the adoption of CCAM. Almost half of respondents believed that CCAM could reduce environmental impact and energy efficiency through optimised driving behaviour, and only some disagreed with this. Yet, compared to other objectives, this proportion was low. Therefore, in the development of CCAM solutions, minimisation of their environmental impact and maximising their energy efficiency should be encouraged. This should take into account not only the automated vehicles and their driving behaviour, but the overall changes in mobility patterns caused by the introduction of new CCAM solutions and services.

4.1.5. Promoting job diversity, creation, and growth

CCAM was seen to lead to jobs growth and creation. Impact was assessed to be highest for IT and data analytics and for the automotive sector, with a clear majority of respondents assessing high impact. The creation of new jobs were also assessed for operations and planning, maintenance and repair, service provision, and for administrative and customer service. Only driving professions were believed to suffer from job losses and displacement, with more than half of respondents assessing a high impact. However, taking into account the driver shortage in Europe[7], reduced demand for drivers may also be seen as means to overcome this challenge to the mobility and transport sector. When asked about barriers for widespread deployment, two thirds of respondents saw job displacement and impact on employment in the transportation sector as a urgent barrier.

All the sectors were assessed to have medium to high impact for reskilling/upskilling. Thus, in fact, the socio-economic impact of CCAM, in terms of employment, would be more a question on capacity building, skilling and reskilling, than necessarily major job losses or gains. In the transition to CCAM, education and training programs should respond to this shift in skill demand. Drivers should be accompanied in this transition to ensure their skills match the demand for innovative mobility services.

4.2. Expectations of CCAM

CCAM use-cases were considered promising overall. Public transport and freight were considered the most promising CCAM use-cases by a great majority of respondents. Delivery

[7] IRU (2023). Driver Shortage Report 2023 Passenger – Europe 2023.

services was also seen as promising by almost all of them. Passenger cars got a medium rating compared to the other use-cases.

Respondents indicated a higher willingness to use shared automated mobility solutions than private ones. However, the willingness to pay extra for using automated vehicles was highest for passenger cars, compared to automated shuttle, taxi, ride-hailing or delivery services. Thus, different forms of shared mobility options were considered promising but only if the cost of their use does not increase with automation. This puts pressure into development of the cost-efficient shared CCAM solutions.

Almost half of the respondents thought that CCAM solutions were coming regardless of whether they are wanted or not, and that the EU's industrial competitiveness would suffer unless it is at the forefront of CCAM development, with only few disagreeing with this. Little more than half of respondents thought that the companies that make and operate CCAM solutions would benefit the most from CCAM's potential and deployment. The proportion was somewhat lower for companies that transport goods and materials.

A majority of the respondents did not agree with scepticism claiming that CCAM would never work on public roads or that human-driven vehicles and CCAM vehicles should not share the same stretch of road. Despite these positive expectations, many had concerns related to CCAM. A great majority of respondents were at least somewhat concerned with data sharing and privacy issues and with a lack of transparency and explainability of AI-based systems. Respondents were also concerned with accountability and liability issues, as well as with unfair governance of the CCAM mobility transition meaning that both public and private actors should guide the vision for CCAM, with only minority of respondents feeling unconcerned. These concerns should be addressed properly as a lack of understanding of CCAM's potential and usefulness was seen as an urgent barrier for widespread deployment by most respondents.

4.3. CCAM governance

Strong agreement was indicated, that there should be international standards regulating automated driving technology and its driving environment, to make it easier for CCAM to work everywhere. Respondents assessed international collaboration beneficial also for technology development. Therefore, the active participation of the Europeans to activities of the international standardisation bodies and other collaboration platforms should be ensured.

The view was clear that CCAM should not be regulated by technology companies. Automated driving technology was mostly seen as not too complex for government agencies to understand and to regulate, and little more than half of respondents thought that it should be regulated by national governments. Yet, there was no agreement on whether local authorities should make the decisions about which roads CCAM solutions should be allowed to use. Lack of awareness at operator/city/implementer level was seen as an urgent barrier for widespread deployment backed. As a result, training should be targeted to all levels where CCAM and its deployment related decisions are made. This training could focus on awareness-raising by dissemination of research and innovation results towards local players, implementers and decision-makers to make sure they are aware of the potential and benefits that a CCAM transition could bring, and of the current limitations with these solutions.

Almost all respondents saw legal and regulatory issues as an urgent barrier for the widespread deployment of CCAM solutions in Europe. The most urgent regulatory needs were about liability and testing regulations. For example, harmonisation of admission regulation for testing on public

roads across Europe would facilitate testing in diverse environments and conditions, cross-borders. Also type-approval regulation, data-sharing regulation and traffic rules were deemed urgent by almost one third of respondents. It is important that these regulatory issues are solved.

A majority of respondents had concerns about data privacy and security. Insufficient data sharing frameworks between public and private actors was also seen as a barrier to the widespread deployment. These data topics should be solved. At least half of the respondents identified lack and/or poor quality of digital infrastructure, high implementation costs, and the limitations in the systems' reliability and technical capabilities among most urgent barriers. Thus, research and development of cost-efficient CCAM solutions able to operate reliably in all environments, should be made. In addition, the digital infrastructure should be adapted to CCAM operations to ensure that it is no longer a barrier for deployment.

4.4. CCAM readiness

A majority of respondents assessed all CCAM use-cases to be at least somewhat developed. Yet, a lack of sufficiently mature technology was considered an urgent barrier for the widespread introduction of CCAM. Public transport got the highest ratings with almost half of the respondents rating it as most developed. Delivery services were seen as less developed than other use-cases. Freight transport, which was seen as the most promising use-case together with public transport above, received a rather low rating for being most developed. Consequently, the development of CCAM based freight solutions could be beneficial as well as further development of CCAM solutions for public transport, yet development work is still needed for all use-cases.

The expectations regarding the timing for automated vehicles to become a common occurrence on European roads varied rather equally. Almost one third assessed it would take more than 15 years and only few for less than 5 years. Of those who worked for the automotive industry, mobility or transport service providers or the public sector, almost half of them believed automated vehicles would be commonly available and deployed in 5–10 years. However, this requires that the challenges and issues listed above are solved rapidly.

Annex – Survey questions with results

Q1. How familiar are you with the concept of Connected, Cooperative, and Automated Mobility (CCAM)?

	% of respondents
Somewhat familiar	21%
Very familiar	79%

Q2. Is your field of work directly related to CCAM?

	% of respondents
No	13%
Yes	88%

Q3. What is your age group?

	% of respondents
18-25	1%
25-30	10%
30-40	53%
40-50	0%
50+	35%

Q4. What is your gender?

	% of respondents
Female	26%
Male	71%
Prefer not to say	2%

Q5. To which kind of organisation/entity are you affiliated? You can provide multiple answers. If other (please specify).

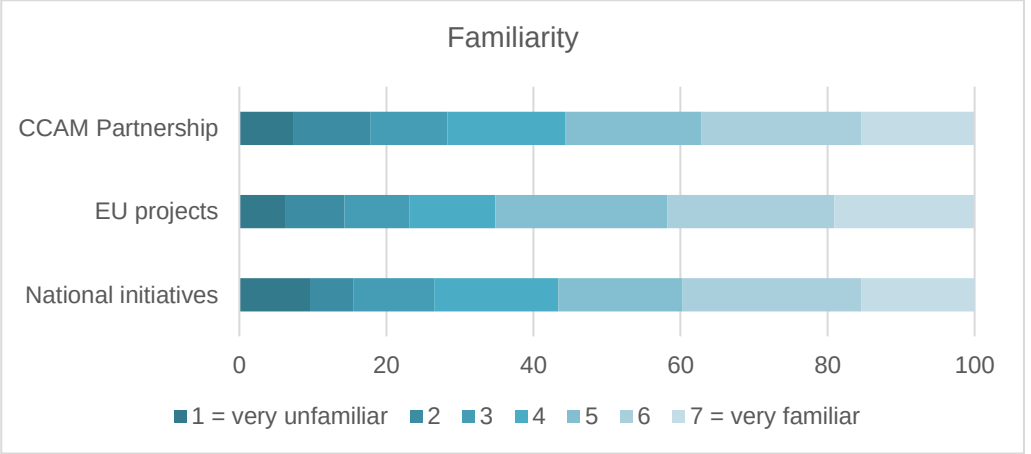
	% of respondents
Public sector	24%
Non-Governmental Organisation (NGO)	2%
European institutions	2%
Industry (automotive)	16%
Research organisation	34%
Small or medium sized enterprise (SME)	21%
Academia	16%
Non-Profit Organisation	10%
Industry (telecom, IT)	5%
Mobility/ transport service provider	11%
National Association	5%
European Association	3%
Press	0%

Q5. Other:

- Startup
- Consultancy
- Transport and mobility consultancy
- In-car service provider
- Student
- Energy Management
- Insurance
- Consultant and researcher
- Allied Health private practice
- IT company working for public administration
- Reinsurance
- Consultancy, Civil Engineering
- Digital KPI and Market research
- The 5G Automotive Association (5GAA)
- ECTRI
- Periodic Technical Inspection for vehicles
- Industry (logistics)
- Industry (transport infrastructure)

Q6. How familiar are you with current CCAM initiatives and projects taking place in Europe? (1= very unfamiliar, 7= very familiar)

	Mean	Std
CCAM Partnership	4.6	1.8
EU projects	4.8	1.8
National initiatives	4.6	1.8



Q7. Are you personally involved in projects that focus on the development and deployment of CCAM related technologies and solutions, funded by the following instruments? Please select all that apply. If other (please specify). Yes/No.

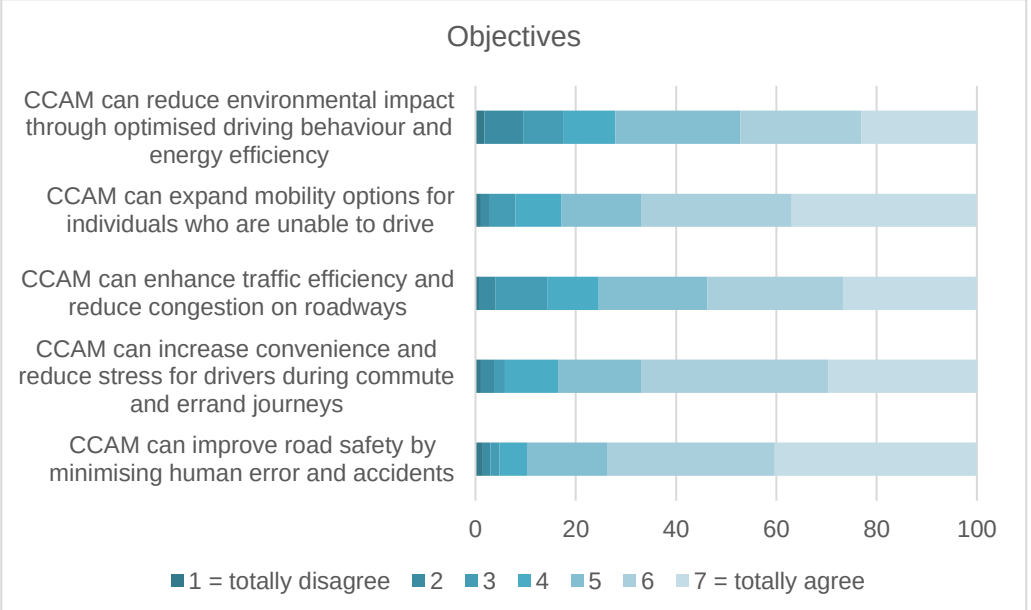
	% of respondents
EU funded research programmes (e.g. Horizon 2020, Horizon Europe)	59%
National initiatives	47%
Connecting Europe Facility Programme	13%
Digital Europe Programme	2%
EU Regional Funds	7%
Key Digital Technologies JU	3%
N/A	16%

Q7. Other:

- C-Roads
- Collaborative research platforms (Such as ECTRI or another national ones)
- Not currently involved in CCAM-related funded projects. In the past, coordination of Horizon 2020-funded project.
- Our members are involved in a range of projects funded and the indicated instruments. 5GAA is only involved in an advisory capacity to a project funded under CEF2 Digital and previously under Horizon 2020/Horizon Europe.
- Nordic funded projects
- Periodic Technical inspection for (connected) vehicles.

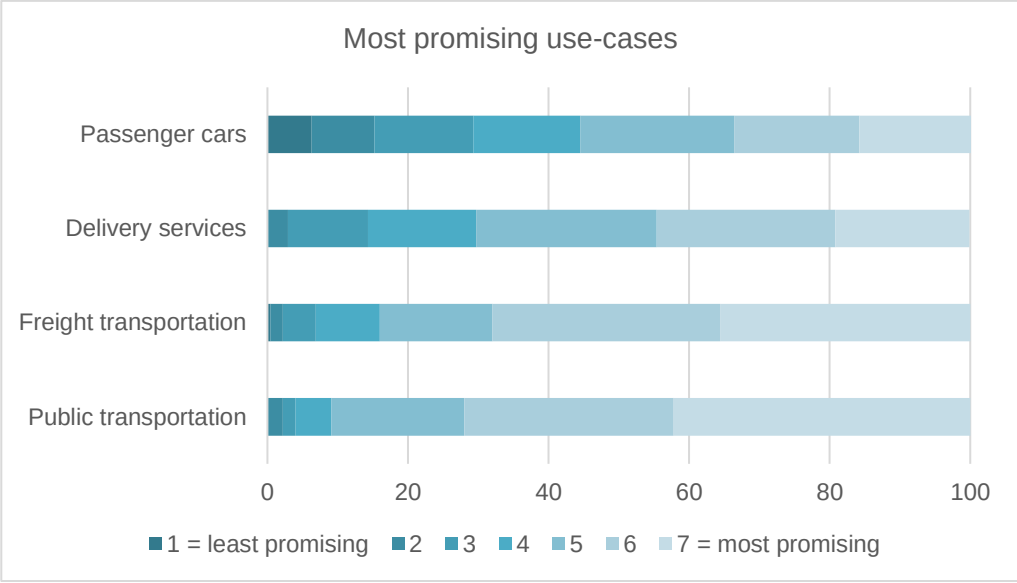
Q8. How can the wide deployment of CCAM contribute to the following objectives? Please rate the following statements (1 = totally disagree, 7 = totally agree).

	Mean	Std
CCAM can improve road safety by minimising human error and accidents	6.0	1.2
CCAM can increase convenience and reduce stress for drivers during commute and errand journeys	5.7	1.3
CCAM can enhance traffic efficiency and reduce congestion on roadways	5.4	1.5
CCAM can expand mobility options for individuals who are unable to drive	5.7	1.4
CCAM can reduce environmental impact through optimised driving behaviour and energy efficiency	5.1	1.6



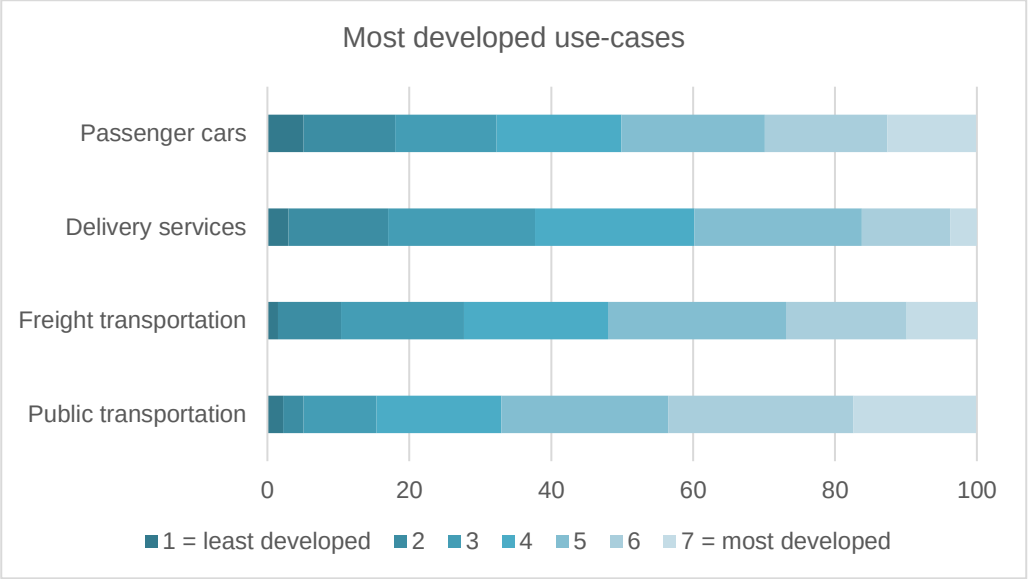
Q9. Which mobility sector has the most promising CCAM use-cases? (1 = least promising, 7 = most promising)

	Mean	Std
Public transportation	6.0	1.2
Freight transportation	5.8	1.3
Delivery services	5.2	1.4
Passenger cars	4.5	1.8



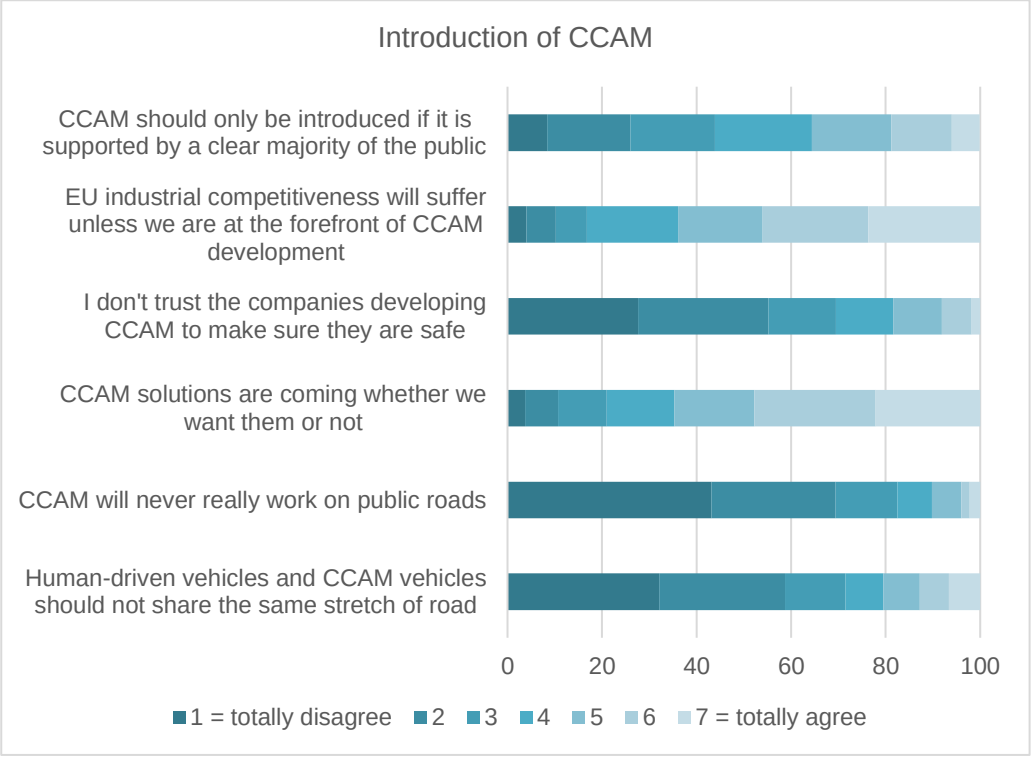
Q10. Which mobility sector has the most developed CCAM use-cases? (1 = least developed, 7 = most developed)

	Mean	Std
Public transportation	5.1	1.5
Freight transportation	4.5	1.5
Delivery services	4.0	1.5
Passenger cars	4.4	1.7



Q12. Thinking about the potential introduction of CCAM, please rate the following statements. (1= totally disagree, 7= totally agree)

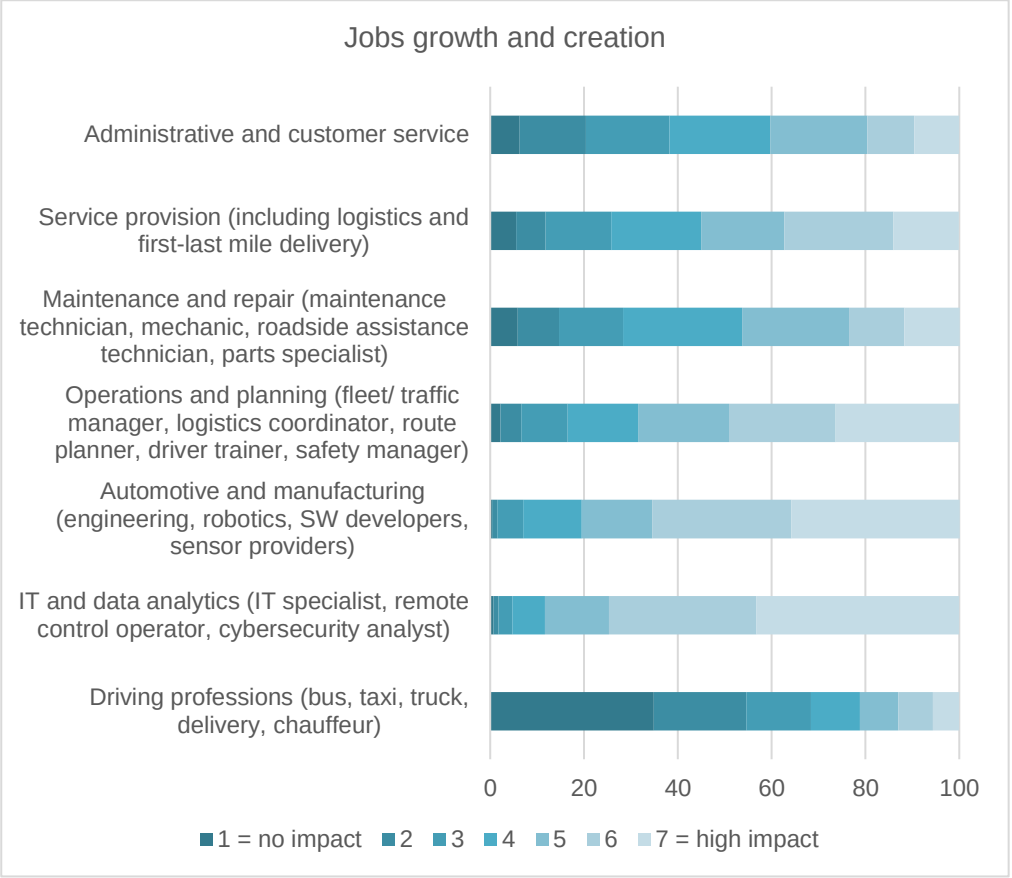
	Mean	Std
Human-driven vehicles and CCAM vehicles should not share the same stretch of road	2.8	1.9
CCAM will never really work on public roads	2.2	1.5
CCAM solutions are coming whether we want them or not	5.0	1.7
I don't trust the companies developing CCAM to make sure they are safe	2.8	1.7
EU industrial competitiveness will suffer unless we are at the forefront of CCAM development	5.0	1.7
CCAM should only be introduced if it is supported by a clear majority of the public	3.8	1.7



Q13. As the deployment of CCAM solutions progresses, there may be potential for job displacement and losses, but also job opportunities and job growth. In your opinion, what kind of impact will CCAM have (for people and goods mobility) on the following employment sectors, in terms of job growth and creation, job losses and displacements, and finally potential for reskilling and upskilling. Please rate your answers on a scale of 1 to 7 (1= no impact, 7= high impact).

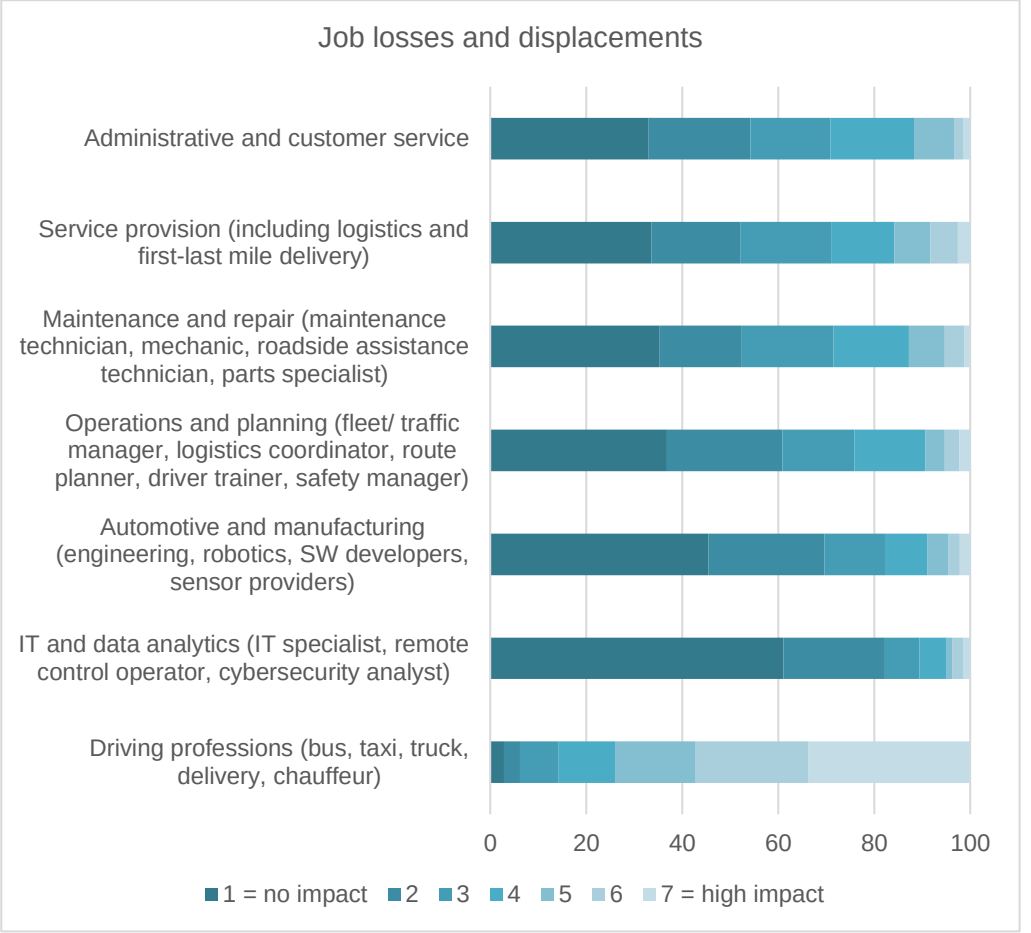
Job growth and creation:

	Mean	Std
Driving professions (bus, taxi, truck, delivery, chauffeur)	2.8	1.9
IT and data analytics (IT specialist, remote control operator, cybersecurity analyst)	6.0	1.2
Automotive and manufacturing (engineering, robotics, SW developers, sensor providers)	5.7	1.3
Operations and planning (fleet/ traffic manager, logistics coordinator, route planner, driver trainer, safety manager)	5.2	1.6
Maintenance and repair (maintenance technician, mechanic, roadside assistance technician, parts specialist)	4.3	1.6
Service provision (including logistics and first-last mile delivery)	4.6	1.7
Administrative and customer service	4.1	1.7



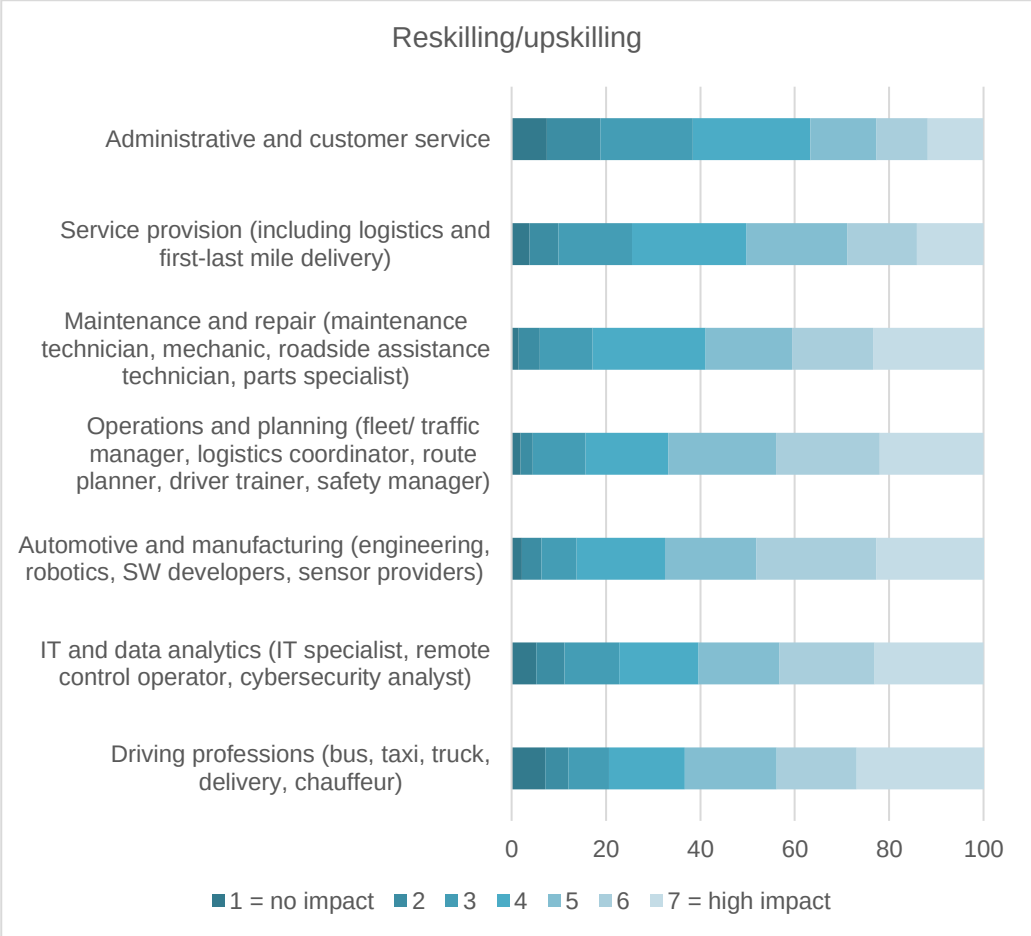
Job losses and displacements:

	Mean	Std
Driving professions (bus, taxi, truck, delivery, chauffeur)	5.4	1.6
IT and data analytics (IT specialist, remote control operator, cybersecurity analyst)	1.8	1.3
Automotive and manufacturing (engineering, robotics, SW developers, sensor providers)	2.2	1.5
Operations and planning (fleet/ traffic manager, logistics coordinator, route planner, driver trainer, safety manager)	2.4	1.5
Maintenance and repair (maintenance technician, mechanic, roadside assistance technician, parts specialist)	2.6	1.6
Service provision (including logistics and first-last mile delivery)	2.7	1.7
Administrative and customer service	2.6	1.5



Reskilling/ upskilling:

	Mean	Std
Driving professions (bus, taxi, truck, delivery, chauffeur)	4.9	1.8
IT and data analytics (IT specialist, remote control operator, cybersecurity analyst)	4.9	1.8
Automotive and manufacturing (engineering, robotics, SW developers, sensor providers)	5.2	1.5
Operations and planning (fleet/ traffic manager, logistics coordinator, route planner, driver trainer, safety manager)	5.1	1.5
Maintenance and repair (maintenance technician, mechanic, roadside assistance technician, parts specialist)	5.0	1.6
Service provision (including logistics and first-last mile delivery)	4.5	1.6
Administrative and customer service	4.1	1.7

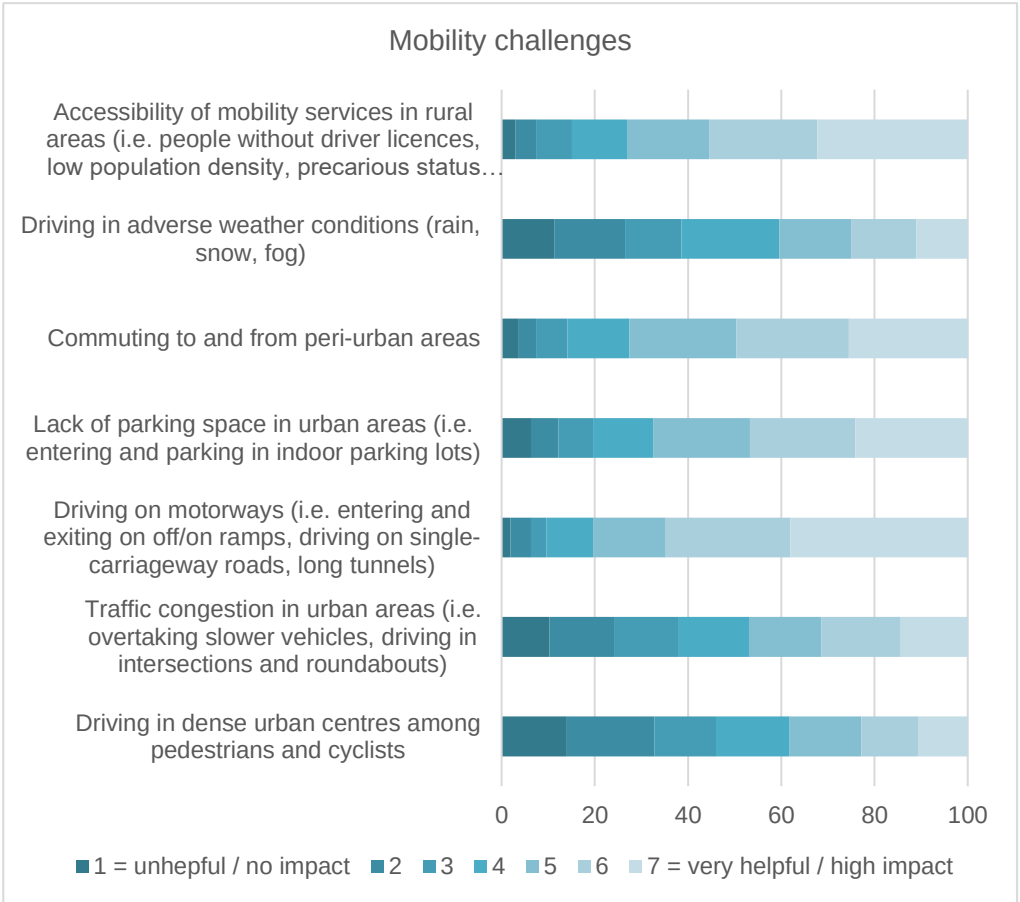


Q14. When would you expect automated vehicles to be a common feature on European roads?

	% of respondents
< 5 years	5%
5 – 10 years	34%
10 – 15 years	31%
> 15 years	30%

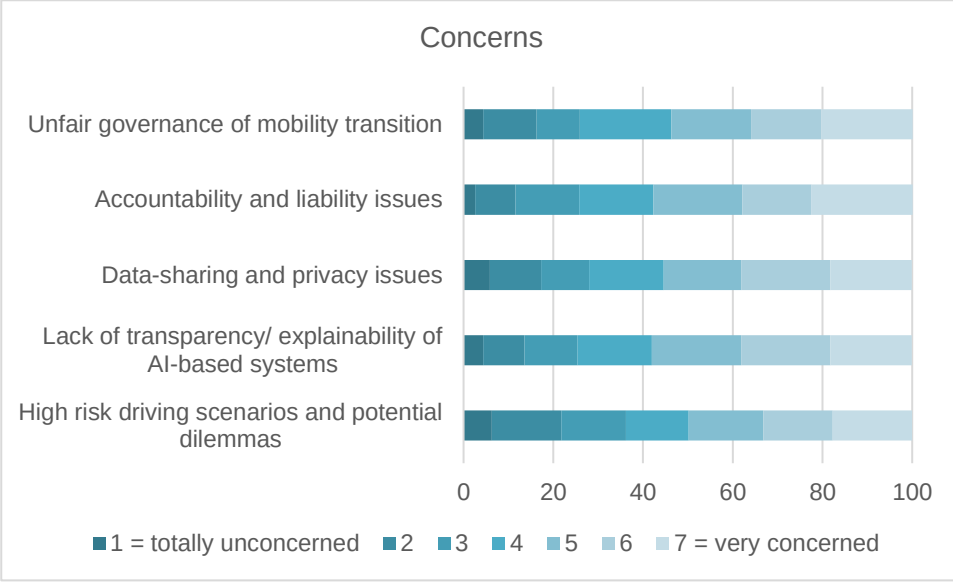
Q15. How can automated driving systems help to improve the following mobility challenges? Please rate the following statements (1 = unhelpful / no impact, 7 = very helpful / high impact)

	Mean	Std
Driving in dense urban centres among pedestrians and cyclists	3.8	1.9
Traffic congestion in urban areas (i.e. overtaking slower vehicles, driving in intersections and roundabouts)	4.2	1.9
Driving on motorways (i.e. entering and exiting on off/on ramps, driving on single-carriageway roads, long tunnels)	5.7	1.5
Lack of parking space in urban areas (i.e. entering and parking in indoor parking lots)	5.0	1.8
Commuting to and from peri-urban areas	5.2	1.6
Driving in adverse weather conditions (rain, snow, fog)	4.0	1.9
Accessibility of mobility services in rural areas (i.e. people without driver licences, low population density, precarious status of infrastructure, transport poverty)	5.4	1.6



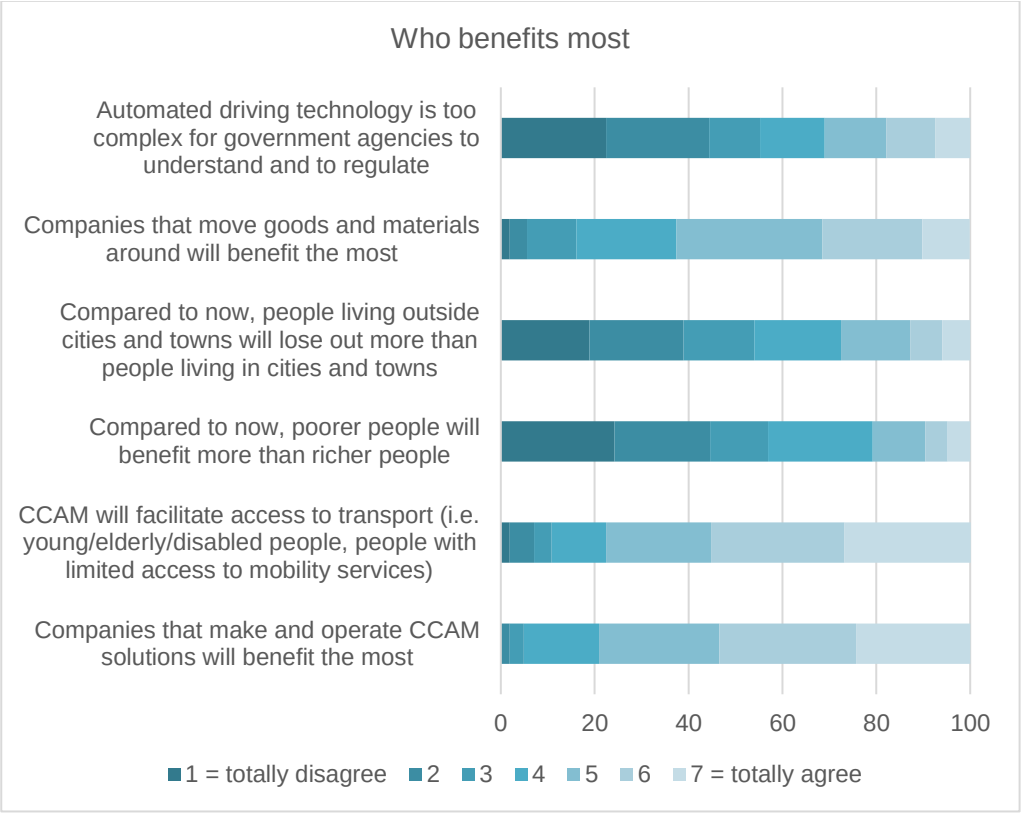
Q16. Are you concerned with the following implications generated by the development of CCAM systems? Please rate the following statements (1= totally unconcerned, 7= very concerned):

	Mean	Std
High risk driving scenarios and potential dilemmas	4.4	1.9
Lack of transparency/ explainability of AI-based systems	4.7	1.7
Data-sharing and privacy issues	4.6	1.8
Accountability and liability issues	4.8	1.7
Unfair governance of mobility transition	4.6	1.8



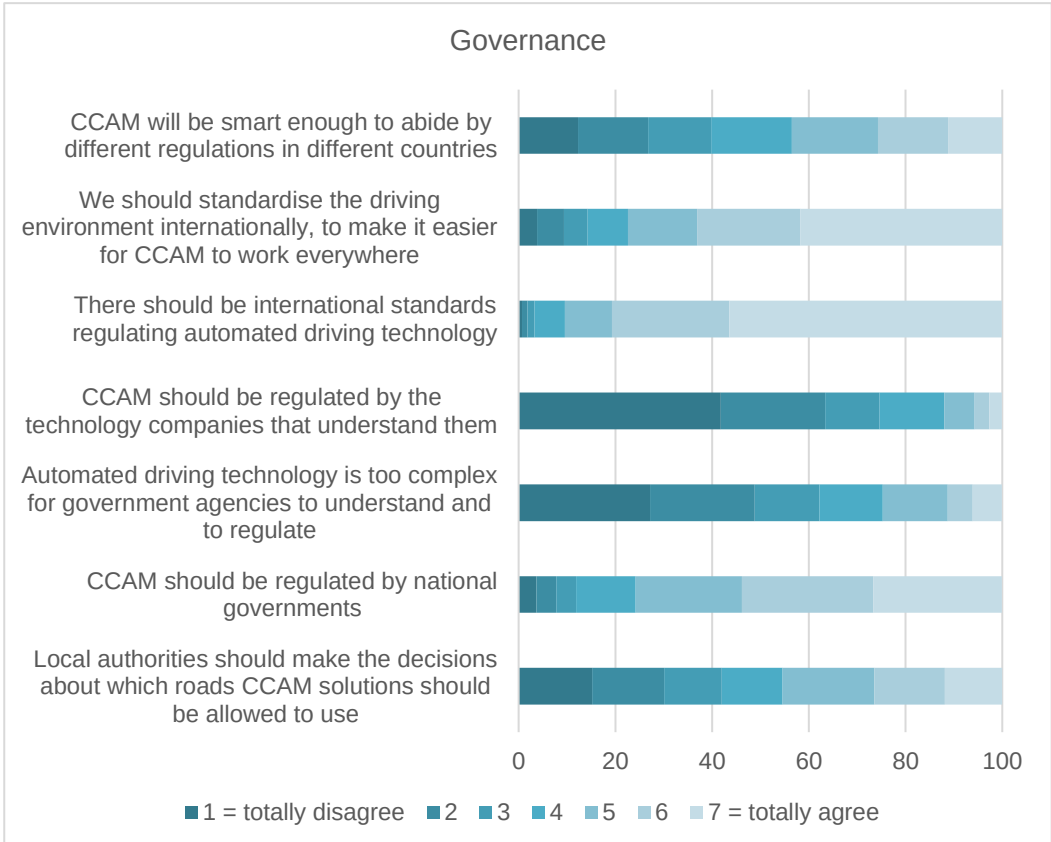
Q17. Who do you think will lose out or benefit most from the introduction of CCAM? Please rate the following statements (1= totally disagree, 7= totally agree)

	Mean	Std
Companies that make and operate CCAM solutions will benefit the most	5.5	1.2
CCAM will facilitate access to transport (i.e. young/elderly/disabled people, people with limited access to mobility services)	5.4	1.5
Compared to now, poorer people will benefit more than richer people	3.1	1.7
Compared to now, people living outside cities and towns will lose out more than people living in cities and towns	3.4	1.8
Companies that move goods and materials around will benefit the most	4.8	1.4
Automated driving technology is too complex for government agencies to understand and to regulate	3.3	2.0



Q18. Who should decide on the rules of the road for CCAM vehicles, and the rules governing how human drivers and CCAM vehicles should share the road? Please rate the following statements (1= totally disagree, 7= totally agree).

	Mean	Std
Local authorities should make the decisions about which roads CCAM solutions should be allowed to use	4.0	2.0
CCAM should be regulated by national governments	5.3	1.6
Automated driving technology is too complex for government agencies to understand and to regulate	3.0	1.8
CCAM should be regulated by the technology companies that understand them	2.4	1.6
There should be international standards regulating automated driving technology	6.2	1.2
We should standardise the driving environment internationally, to make it easier for CCAM to work everywhere	5.6	1.7
CCAM will be smart enough to abide by different regulations in different countries	4.0	1.9



Q19. What you would like governments, highway authorities and cities to prioritise when it comes to improving transportation systems? Please select your two highest priorities.

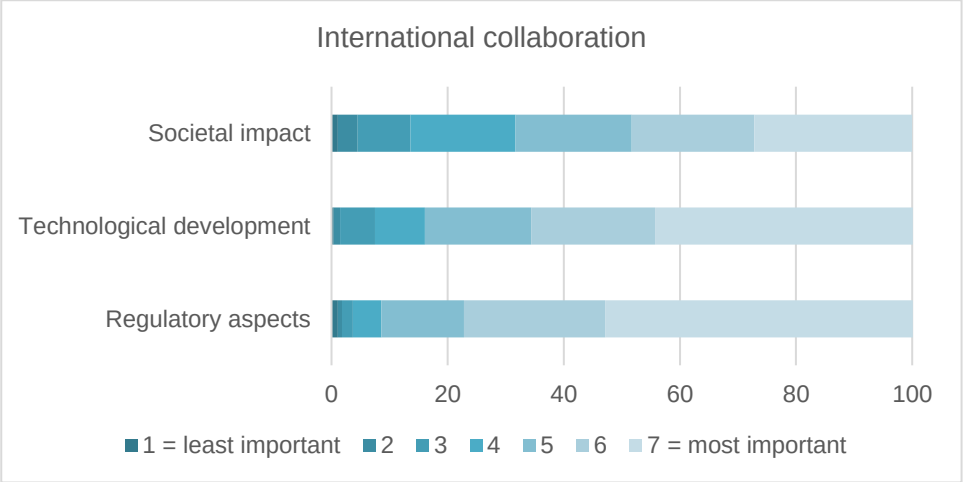
	% of respondents
Making it affordable for everybody regardless of their financial means, to move around	28%
Reducing the number of people killed and seriously injured on the roads	55%
Giving individuals the ability to travel when and how they want	22%
Reducing traffic congestion	22%
Making travel easier for those currently unable to drive as a result of age or physical disability	18%
Reducing the pollution and environmental cost of transportation	49%

Q20. Which regulatory needs are most urgent when it comes to the deployment of automated driving systems? Please select your two highest priorities. If other (please specify).

	% of respondents
Liability regulation	49%
Traffic rules	28%
Testing regulation (i.e. pre-deployment testing by manufactures, researchers…)	41%
Data-sharing regulation	28%
Type-approval regulation	32%
Access to in-vehicle data regulation	11%

Q21. To what extent is international collaboration in the following areas beneficial to accelerate the development of CCAM? (1= least important, 7= most important). If other (please specify).

	Mean	Std
Regulatory aspects	6.2	1.2
Technological development	5.9	1.3
Societal impact	5.3	1.5

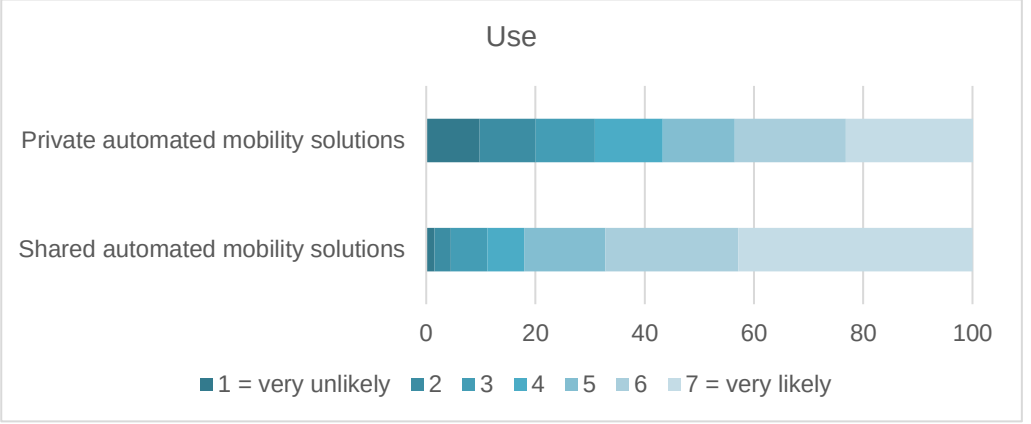


Q21. Other:

- Data and privacy issues
- Uniform road infra structure and digital infra structure
- DSGVO
- Connecting public and shared transport through CCAM
- Link between public transports and CCAM
- Participation of persons that are unable to drive (e.g., persons with disabilities)
- Acceptability by the public
- Safety Improvement
- International meaning outside EU is not so important.
- Global (or at least regional) cooperation within recognised SDOs for technology development and standardisation is preferred as it allows for harmonisation and economies of scale (e.g. 3GPP global telecommunications standards). Fore regulatory aspects, regional harmonisation (e.g. at EU level) is always preferable to a patchwork of national laws and a fragmented network.
- Climate impact: fostering public transport rather than individual car usage
- International assurance of an operational PKI service

Q22. Are you most likely to use shared or personal automated mobility solutions if they were readily available and well established in your region? Please rate your preference for both scenarios (1= very unlikely, 7= very likely)

	Mean	Std
Shared automated mobility solutions	5.8	1.5
Private automated mobility solutions	4.6	2.0

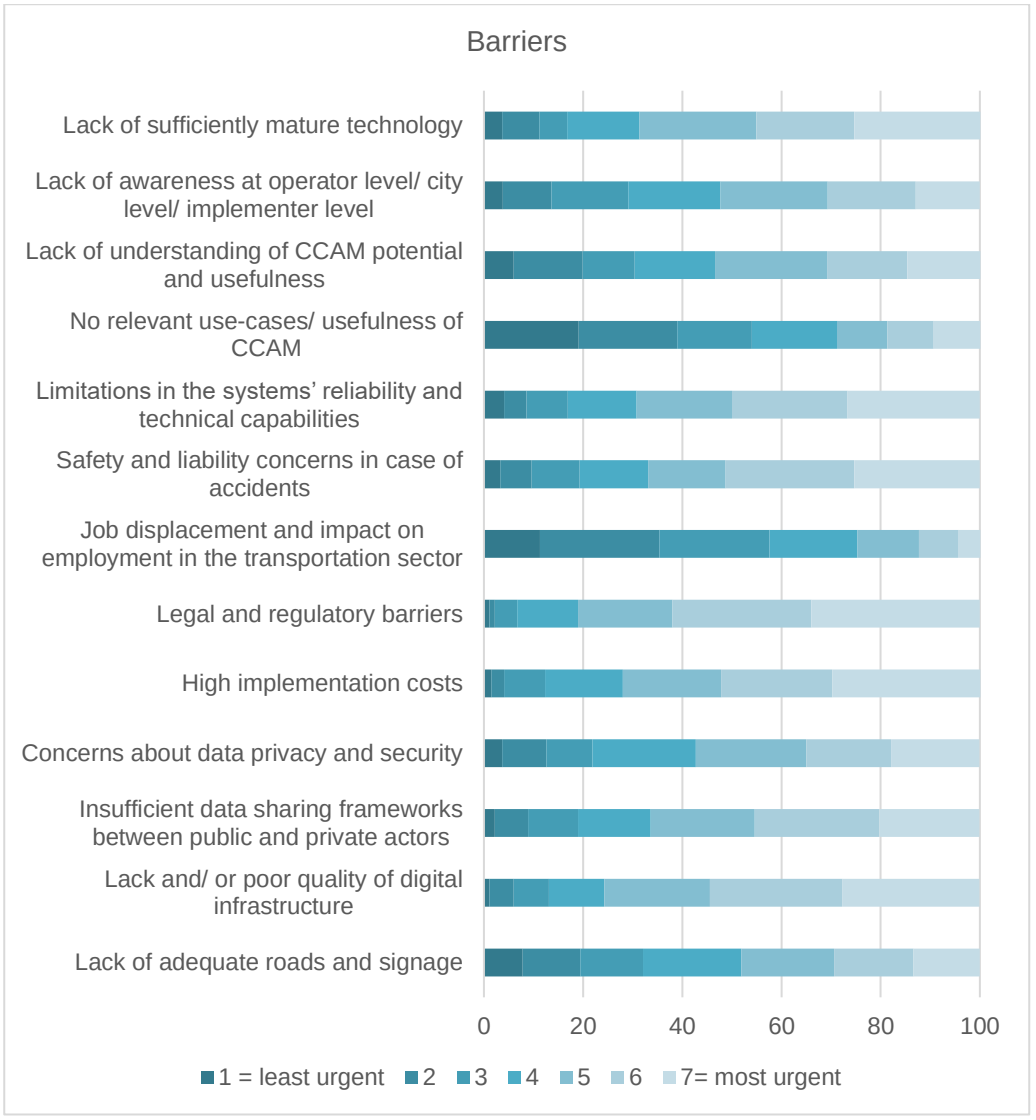


Q23. Would you be willing to pay extra for using the following vehicles equipped with automated driving systems?

	% of respondents
Automated taxis or ride-hailing services	25%
Automated shuttle buses	26%
Automated delivery systems	22%
Privately owned automated passenger cars	45%

Q24. Please rate the following barriers to the widespread deployment of CCAM solutions in Europe, in terms of urgency. (1= least urgent, 7= most urgent):

	Mean	Std
Lack of adequate roads and signage	4.3	1.8
Lack and/ or poor quality of digital infrastructure	5.4	1.5
Insufficient data sharing frameworks between public and private actors	5.0	1.6
Concerns about data privacy and security	4.7	1.7
High implementation costs	5.4	1.5
Legal and regulatory barriers	5.7	1.3
Job displacement and impact on employment in the transportation sector	3.4	1.6
Safety and liability concerns in case of accidents	5.1	1.7
Limitations in the systems' reliability and technical capabilities	5.2	1.7
No relevant use-cases/ usefulness of CCAM	3.5	1.9
Lack of understanding of CCAM potential and usefulness	4.4	1.8
Lack of awareness at operator level/ city level/ implementer level	4.5	1.7
Lack of sufficiently mature technology	5.1	1.7


Barriers
Lack of sufficiently mature technology
Lack of awareness at operator level/ city level/ implementer level
Lack of understanding of CCAM potential and usefulness
No relevant use-cases/ usefulness of CCAM
Limitations in the systems' reliability and technical capabilities
Safety and liability concerns in case of accidents
Job displacement and impact on employment in the transportation sector
Legal and regulatory barriers
High implementation costs
Concerns about data privacy and security
Insufficient data sharing frameworks between public and private actors
Lack and/ or poor quality of digital infrastructure
Lack of adequate roads and signage
0
20
40
60
80
100
1 = least urgent
2
3
4
5
6
7= most urgent

Q25. Which of the following factors are most important when it comes to encouraging the adoption of CCAM solutions?

	% of respondents
Evidence of safety benefits (for drivers, passengers, pedestrians, VRUs)	82%
Availability of financial incentives (for adopting in-vehicle purchases, for using mobility alternatives, e.g.: lower insurance premium, low circulation tax)	23%
Improved comfort and possibility to engage in non-driving related activities while travelling	30%
Evidence of environmental benefits	44%
Better service offering (e.g. first and last mile services)	48%
Extensive public education and awareness campaigns	17%
Better use of travel time	33%

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In July 2023, the European Commission published a stakeholder survey designed to gather valuable insights from road transport experts concerning the current state of Connected, Cooperative, and Automated Mobility (CCAM) in Europe. The survey delved into four pivotal themes — potential and impact, expectations, governance, and readiness— to paint a comprehensive picture. With a robust dataset of 276 expert replies, this report analyses the survey results. The findings and key takeaways presented herein contribute to a timely and refreshed understanding of the evolving landscape of CCAM in Europe.

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