Deliverable 5.1

Equity practices and social indicators

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Main authors:	Riccardo Enei, Silvia Gaggi
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Internal Reviewers:	Johanna Tzanidaki (ERTICO), Matthew Shelton (TfWM)
Lead contractor:	ISINNOVA
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Executive Summary

SINFONICA Deliverable 5.1 produces preliminary results that will be used as the basis for drafting the long-term recommendations on the take-up of CCAM in Europe (Del 5.3 Recommendations for large-scale demonstrations projects, in September 2024).

In doing that, this Deliverable draws on input from the SINFONICA WP1 (Setting the SINFONICA framework), in particular the literature and project review carried out in Deliverable 1.1 "Mobility needs and requirements of European citizens", to the extent that this Deliverable provided initial considerations and reflections on the identification of best practices in social equity with respect to smart mobility, focusing on CCAM solutions.

From the methodological side, the analysis of this Deliverable focuses on equity practices and social indicators emerging from a sample of 40 EU funded projects dealing with CCAM. The definition of CCAM adopted in this Deliverable relies on the SINFONICA approach, which considers CCAM as the whole of Cooperative, Connected and Automated Mobility solutions, acknowledging the fact that other terms are also used, whether in English (CAD, CAV, etc) or terms/acronyms used in other languages – which indeed feature in the list of acronyms.

The sample of 40 EU projects (funded under the Horizon 2020 and Horizon Europe framework programme), is enriched by 5 national projects in Germany and a summary of an activity under the UK Centre for Connected and Autonomous Vehicles (CCAV). A broader coverage of national initiatives and projects falling into the CCAM scope has been prevented by language barriers. Besides, we count only projects in European countries (EU or national), i.e. not Americas, Asia, Australia, etc. to not make the scope too wide and because standards are often different there.

In general, the analysis focuses on CCAM projects carried out and completed in the period between 2016 and 2022. On-going EU funded projects have not been included in the sample, due to the paucity of information.

The list of the EU funded and national projects examined in this Deliverable is shown in the Appendix. For each project, a common template provides the key information allowing for an understanding of the main contents, i.e. which dimension of equality is considered and how the CCAM vulnerable used groups are concerned.

During the analysis, to favour the identification of common patterns, the projects have been classified in four clusters of thematic areas:

1. Nine CCAM projects dealing with strategical issues (e.g., governance, emerging business models, acceptability, etc).
2. Seven CCAM projects dealing with the public transport domain, i.e., autonomous buses and shared services.
3. Twelve CCAM projects dealing with acceptance of automated vehicles (AVs), related to technological aspects, and acceptability concerning social issues. .
4. Twelve CCAM projects dealing with the implementation of new technological solutions.

On the basis of this informational knowledge base the analysis of social equity in CCAM has basically tried to answer two questions:

1. Which aspects of social equity are most frequently addressed in CCAM projects?
2. Which type of users are most frequently addressed?

The answer to the former question is that acceptability and accessibility account for 72% of all the occurrences reported in the sample of 40 EU projects., i.e., instances in which the aspects of social equity have been dealt with in the CCAM projects. The emphasis on acceptability is also shared by the five German projects.

Great contributions to the high frequency of acceptability and accessibility issues are respectively provided by the cluster of projects dealing with AVs, for which acceptability among future drivers (e.g., trust, perceived safety, comfort) accounts for 71% of all occurrences (over 17 occurrences in total), and by the cluster of projects dealing with autonomous buses and shared services, in which pursuing accessibility for everyone, regardless of physical or cognitive impairments, accounts for 45% of all occurrences (over 11 occurrences in total).

The importance of acceptability and accessibility in social equity points out the **downgrading of affordability** (**only 10% of all occurrences in EU projects and nothing in the German sample of projects), which is hardly justifiable, considering the potential discriminations on the demand side, due to lower users' spending capacity and income levels**. **The situation is slightly different in the UK national projects, in which the topic of affordability of CCAM is examined with more attention, as stressed in a recent study issued by the UK Department for Transport**[1]. In conclusion, **the recommendation is that the next SINFONICA activities, i.e. interviews, focus groups and surveys might address some gaps in this area of social equity**.

Concerning the types of users most frequently addressed in the analysis of social equity, it may be observed the importance of , elderly (people with more than 65 years) and persons with disabilities (physical and cognitive). Indeed, across the 40 EU CCAM projects and in some national project in Germany, **the overall occurrences addressing elderly and persons with disabilities account by 50% of the total (28 out of 55 occurrences), : respectively with 25% of occurrences each**.

Concerning the less numerous or less frequently studied vulnerable users' groups, it is **worthy of note that in the 40 CCAM projects low occurrences concern young, people at risk of poverty and digitally vulnerable people, respectively with only 5% (people at risk of poverty and young) and 4% (digitally vulnerable people) of total occurrences**.

This may be a gap to be filled-in with more evidence in the next SINFONICA activity, for the cluster of CCAM projects dealing with technological advancements has shown the importance of the user's interaction with digital tools and applications. **Therefore, digitally vulnerable people risk being potentially discriminated, in particular during the transition phase from traditional to full automated vehicles**.

It is therefore expected that the SINFONICA implementation of users' engagement strategies through workshops, interviews, focus groups and surveys **could provide fresh insights on some of the user's needs overlooked by the state-of-the-art research in the field: young, digitally vulnerable people and people at risk of poverty**.

[1] https://www.gov.uk/government/publications/self-driving-vehicles-public-perceptions-and-effective-communication

When considering the cluster of projects dealing with strategical issues, it can be observed the higher interest to digitally vulnerable people and other user's categories, generally neglected in the overall 40 CCAM projects.

In such a cluster of projects, digitally vulnerable people, persons at risk of poverty and persons living in remote areas account for 9% of occurrences each, against an average of 4%-5% with reference to the overall projects.

This evidence may reflect the strategic awareness among policymakers and experts about the risk that automated and connected transport in the future may exclude some share of adult population, based on their low digital skills and affordability of new services.

Concerning social indicators, while the sample of CCAM projects review has shown the ongoing lively research and discussion around the topic of social equity in CCAM, the same review has shown that there is not yet a well-established set of Key Performance Indicators (KPIs), specifically tailored to measuring social equity in CCAM.

The analysis suggests that when the four A' (Availability, Accessibility, Affordability and Acceptability) are taken into account, the definition of suitable KPIs in CCAM should include socio-economic domains as: safety, vehicle operations, economic impacts and land use.

- Safety and security. Typically measured as several fatalities, injuries, or property damage for vehicle occupants or other road users. Safety KPIs may include impacts on VRU as pedestrians, children, and bicyclists. This domain is part of the overall acceptability of CCAM. Besides, safety and security in using CCAM may have a gender biased dimension. As EU funded projects demonstrated (e.g. PASCAL) women were found to be concerned about traffic safety such as accidents, security related to violence, robbery, harassment as well as security related to hacking, terrorism and data privacy. KPIs should take all that into account.
- Vehicle operations. Influencing the reliability and acceptability of CCAM, some indicators and KPIs on vehicle operations, e.g., time headway, reaction time, adaptability time, etc, should be part of the set of the KPIs.
- Economic impacts. In terms of social equity, indicators and KPIs measuring the impacts of automated vehicles on labour market should also be considered.
- Land use. Space efficiency, in terms of number of parking slots, density of housing, location of parking, etc should be part of a framework addressing social equity.

The above domains should be integrated in the basket of KPIs addressing the four A's: accessibility, affordability, availability and acceptability. **In such a framework, SINFONICA could enrich the picture, for example including KPIs on the affordability of the CCAM services**.

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Abbreviations

ACT	Automated and Connected Transport
ADAS	Advanced Driver Assistance Systems
AVs	Automated vehicles
CAD	Connected Automated Driving
CAV	Connected, automated vehicle.
CATS	Connected Automated Transport Systems
CCAM	Connected, cooperative and automated mobility.
DRT	Demand Responsive Transport
GoI	Group(s) of Interest
IoT	Internet-of-Things
KPIs	Key Performance Indicators
MaaS	Mobility as a Service
NRA	National Road Administration
OEM	Original Equipment Manufacturers
HMI	Human Machine Interface
SAE	Society of Automotive Engineers
V2V	Vehicle-to-vehicle
V2I	Vehicle to Infrastructure
VRU	Vulnerable Road Users
WP	Work Package

1. Introduction

1.1 Structure of the document

The structure of this Deliverable reflects its key objective: the review of best practices in social equity with respect to smart mobility, focusing on CCAM solutions. Besides, the structure of this Deliverable also addresses an ancillary objective, related to first contributions to the identification of a set of measurable indicators for social equity and inclusion, a topic that will be elaborated more specifically in the Deliverable D5.5, to be issued toward the end of the project, in August 2025.

Concerning the review of best practices in social equity, Chapter 2 deals with the delimitation of the concept of social equity in CCAM, converging toward the definition of criteria for the identification of the social equity components.

This background is then applied in the review of projects and initiatives focused on CCAM solutions (whose methodology is described in Chapter 3 and in the related appendix). The review in Chapter 3 leads to the identification of four clusters of projects, on the basis of the prevailing CCAM topics: 1) projects dealing with strategic issues and scenarios, 2) projects focused on autonomous buses and shared services, 3) projects having as core interest the development of automated vehicles (AVs), with a particular emphasis on acceptability, and 4) projects focused on technological advancements, e.g. the application of Artificial Intelligence tools, 5G communication network, etc.

Chapter 4 is devoted to the analysis of the results of the project review carried out in Chapter 3. In this chapter the results focus on collecting evidence addressing two key questions:

1. Which aspects of social equity are most frequently addressed? The aspects of social equity under examination are Accessibility, Availability, Affordability, Acceptability. The analysis by cluster of projects leads to the assessment of the most relevant dimensions of social equity, pointing out where more research is needed.
2. Which CCAM type of users are most frequently addressed? The analysis leads to the identification of underrepresented users that need further research. The users correspond to the SINFONICA list of users with special mobility needs: young, older people, persons with disabilities (including cognitive disabilities), digitally vulnerable people, women and gender related vulnerabilities, persons at risk of poverty and social exclusion, etc.

Chapter 5 provides first indications on the identification of indicators of social equity, reviewing the projects in which this topic has been addresses. The objective here is to set the scene for further analysis to be undertaken in next stages of SINFONICA; namely in the work on the development of the knowledge map KPIs in WP4.

Finally, Chapter 6 draws conclusions and outlines next developments.

1.2 Background

The background of this Deliverable is represented by the work done in WP 1 “Setting the SINFONICA framework”. More specifically, the Deliverable 1.1 on “Mobility needs and requirements of European citizens” has provided the definition of the general theoretical framework across different tasks of the projects; from the analysis of CCAM end users and stakeholders’ needs to the

understanding of CCAM gaps in solutions deployment. In such a context, the Deliverable D1.1. of this project has analysed the theoretical framework underlying the analysis of social equity, defining the framework in which mobility needs relevant to CCAM solutions can be better understood, i.e., in consideration of psychological needs, motives, user characteristics, and situational factors of CCAM users.

As a result of Deliverable 1.1., the delimitation of the concept of social equity in CCAM has been outlined, i.e., what does it mean, and in the light of what components, the concept should be considered in the analysis. This represents an important background for this Deliverable, to the extent that it allows to frame the analysis of how social equity has been addressed in relevant projects and initiatives.

Deliverable 1.1. has also provided information on the most relevant projects funded by the European Union that focused on user needs and requirements as well as acceptance of CCAMs (as well as CAMs, CAVs & AVs).

The projects indicated in the Deliverable 1.1, in addition to a sample of other relevant projects showed in the Connected Automated Driving[2] knowledge base, have represented an important source of information and background for this Deliverable, both with reference to the social equity and to the analysis of indicators for social equity and inclusion.

All in all, the background to this Deliverable mainly originates from the work done in WP1 of SINFONICA, which has provided information and material to review practices and approaches dealing with social equity and related indicators in CCAM, setting in such a way the scene to identify gaps and shortcomings in terms of social equity.

[2] https://www.connectedautomateddriving.eu/projects/

2. Definition of social equity in CCAM

In general, when the focus is on transportation projects or activities, the term equity can have multiple meanings, depending on the specific context in which it is used. Three main categories can be identified:

1. **Transportation equity as fairness**: This interpretation refers to the principle of fairness in the distribution of transportation resources and benefits. It means that all members of a community, regardless of their race, income level, age, gender, ability, or location, should have equal access to safe, affordable, reliable, and convenient transportation options. Achieving transportation equity as fairness often requires addressing historical and systemic inequalities that have created transportation barriers for marginalised groups.
2. **Transportation equity as accessibility**: This interpretation refers to the degree to which different populations can reach the places they need or want to go, using the transportation modes that are most appropriate for their needs. Transportation equity as accessibility is concerned with ensuring that transportation networks and services are designed and operated in a way that maximises mobility for all users, including pedestrians, cyclists, public transport users, and drivers.
3. **Transportation equity as financial value**: This interpretation refers to the financial fairness in the distribution of the costs and benefits of transportation investments and services. Transportation equity as financial value means that the costs of transportation infrastructure and operations should be shared fairly among all users, and that the benefits of these investments should be distributed in a way that maximises economic growth, environmental sustainability, and social well-being. Achieving transportation equity as financial value often requires balancing the competing interests of different stakeholders, including taxpayers, private sector investors, and public agencies.

The interpretation of equity issues in transportation according to the **"equity as fairness" and "equity as accessibility"** seems to be the more relevant in terms of a viable definition of equity, open to different contributions.

For example, the work done by Lee, R.; Sener, I.; and Jones, N. (2017) on understanding the role equity in transportation planning, quoted in the DIAMOND project on "fair and actionable knowledge from data to support women's inclusion in transport systems" (DIAMOND, 2022, and in the appendix to this Deliverable for a summary on social equity), introduces five separate types of equity:

1. Spatial equity – a geographical level of analysis which looks to examine where the inequality is taking place.
2. Procedural equity – associated with equity in the policy making process; in the case of transport policy planning procedural equity is related to having fair and equal evaluations included in the policy making decision.
3. Modal equity – is related to ensuring that there is safe access for all groups to the range of local transport modes.
4. Distribution equity – is linked to how transportation costs and benefits are distributed across society.
5. Social equity, related to the overall societal impacts of transport policies.

The fifth category (social equity) encompasses all the others, being characterised by the analysis of how social groups address fairness and accessibility of transportation services (spatial, procedural, modal and distributional effects). This can be appraised using variables based on income, race, gender, and age, sexual orientation, etc.

It is important to stress that social equity, as defined above, also involves several **ethical** aspects:

- *Equal Opportunity*: Transportation systems should be designed and operated in a way that provides equal opportunities for all individuals to access education, employment, healthcare, and other essential services. This includes ensuring that transportation options are available in underserved areas, affordable for low-income individuals, and accessible to people with disabilities.
- *Non-Discrimination*: Transportation systems should not discriminate against any individual or group based on their race, ethnicity, gender, age, or other protected characteristics. Policies and practices should be inclusive and equitable, treating all users fairly and providing equal access and benefits to everyone.
- *Environmental Justice*: Transportation choices and infrastructure can have significant environmental impacts, including air pollution and greenhouse gas emissions. Ethical considerations involve minimising these negative environmental effects and ensuring that marginalised communities, which often bear a disproportionate burden of pollution and related health issues, are not further disadvantaged by transportation decisions.
- *Safety and Well-being*: Ethical transportation planning and policies should prioritise the safety and well-being of all individuals. This includes improving road safety measures, reducing traffic-related injuries and fatalities, and addressing the specific safety concerns of vulnerable populations, such as pedestrians, cyclists, and children and women.
- *Public Participation and Engagement*: Ethical transportation planning should involve meaningful engagement with communities and stakeholders. Public input and participation allow for the consideration of diverse perspectives and help ensure that transportation decisions reflect the needs and priorities of the affected communities.
- *Affordability and Financial Accessibility*: Transportation should be affordable for all individuals, regardless of their income level. Ethical considerations involve implementing fare structures and pricing policies that do not disproportionately burden low-income individuals and ensuring that affordable transportation options are available to all.
- *Health and Well-being*: Transportation systems can have significant impacts on public health. Ethical considerations include promoting active modes of transportation, such as walking and cycling, which contribute to physical activity and better health outcomes, as well as reducing air pollution and noise pollution to safeguard public health.

Besides, the consideration of ethical issues in the case of CCAM and AVs may address further dimensions. **Safety** for example is a paramount issue of the ethical domain when it comes to CCAM. There is a need to ensure that CCAM are developed and deployed with robust systems that prioritise the well-being and protection of both occupants and other road users. Ethical decisions must be made regarding how AVs should respond in potentially dangerous situations, such as accidents or system failures, to minimise harm to individuals.

The same can be said with reference to **liability and responsibility**. CCAM introduces indeed complex questions of liability and responsibility. Determining who is accountable in the event of accidents or incidents involving CCAM can be challenging. Ethical considerations would imply the establishing of clear guidelines for assigning responsibility between manufacturers, operators, and users of CCAM, as well as addressing issues related to insurance and compensation for damages.

Data privacy and security represents another domain in which ethical issues should be considered, insofar as CCAM generates and collects vast amounts of data, including information about the vehicle's location, passengers, and driving patterns. Ethical concerns arise regarding the privacy and security of this data. It is important to establish robust data protection measures, consent mechanisms, and transparent data governance frameworks to ensure that individuals' privacy rights are respected, and their data is safeguarded against misuse or unauthorised access.

Technological advancements raise also ethical issues when the role of **programming or algorithms** is under examination. CCAM and AVs operate based on algorithms and programming, which raise ethical questions about decision-making in complex situations. For example, AVs may encounter situations where they must make split-second decisions, such as choosing between two potentially harmful outcomes. Ethical considerations involve determining the principles and values that guide AV decision-making and ensuring that these align with societal norms and values.

The use of **Human-Machine Interaction** shares the same concern. AVs introduces ethical questions regarding the interaction between humans and machines. As several EU projects demonstrate (see the cluster 3.4 in this Deliverable), it is crucial to design interfaces and systems that facilitate clear communication, trust, and understanding between humans and AVs, ensuring that humans can appropriately intervene and take control when necessary is also an important ethical consideration.

Addressing these ethical issues in the assessment of social equity of CCAM requires interdisciplinary collaboration among policymakers, technologists, ethicists, and stakeholders. Public engagement and dialogue are crucial to ensure that the development and deployment of CCAM align with societal values and ethical principles.

In sum, social equity in CCAM, as part of social equity in transportation, is a complex topic, encompassing ethical, safety and distributional (fairness) components. For the sake of simplification, the analysis of social equity in this Deliverable is carried out using the framework of the four A's already examined in the Deliverable 1.1. in WP1: Availability, Accessibility, Affordability, and Acceptability (see also ARUP, Urban Transport Group, 2022, for details).

Ethical and safety issues have been considered as components of acceptability of CCAM solutions, distributional aspects as part of affordability and accessibility. In the following sections, all four categories are described with a specific emphasis on their implications for CCAM.

2.1 Availability

To meet availability, CCAM solutions must satisfy several requirements. Technical components stand out as in general as the most relevant. When assessing availability, the following criteria should be considered.

Technical Reliability: CCAM needs to be designed and built with a high level of technical reliability to ensure their availability. This includes robust hardware and software systems that can operate

under various environmental conditions and handle different driving scenarios without failure. Regular maintenance and software updates are also crucial to maintain the reliability and availability of these vehicles.

Redundancy and Fail-Safe Systems: Automated vehicles may incorporate redundant systems to ensure availability in case of component failures. For example, redundant sensors, computer systems, and power sources can help maintain vehicle functionality even if one or more components fail. Fail-safe mechanisms are also implemented to detect failures and safely bring the vehicle to a stop or switch to a manual driving mode if necessary.

Connectivity and Communication: Availability can be enhanced by ensuring reliable connectivity and communication capabilities in automated vehicles. These vehicles often rely on real-time data exchange with infrastructure, other vehicles, and central control systems to make informed decisions. The implementation and development of Artificial Intelligence and 5G communication standards can improve sensibly connectivity and communication (see *infra* the cluster 3.5 in this Deliverable). A robust and uninterrupted network connection is indeed essential to maintain availability and enable seamless communication between automated vehicles and their surroundings.

Monitoring and Diagnostics: Automated vehicles can incorporate advanced monitoring and diagnostic systems that constantly assess the vehicle's health and performance. These systems can detect potential issues or malfunctions proactively, allowing for timely maintenance or repair actions. By identifying problems early on, availability can be maximised, as preventive measures can be taken before a failure occurs.

Fleet Management and Serviceability: In the case of automated vehicle fleets, efficient fleet management practices are crucial for ensuring availability. This includes optimising vehicle deployment, scheduling maintenance activities, and managing vehicle charging or refuelling operations effectively. Having a well-organised system ensures that vehicles are readily available for use and minimises downtime due to maintenance or logistical issues.

Emergency Response and Recovery: Planning for emergency situations is essential to maintain availability. Automated vehicles should be equipped with appropriate emergency response systems to handle critical scenarios such as safety risks, accidents or system failures. Additionally, recovery procedures should be in place to address incidents that may temporarily affect availability, such as software glitches or cybersecurity attacks.

Overall, it can be said that ensuring the availability of automated vehicles involves a combination of technical reliability, redundancy, connectivity, monitoring, fleet management, and emergency response measures. By considering these factors, stakeholders can strive to maintain high levels of availability, which is crucial for the successful deployment and operation of automated vehicles.

2.2 Accessibility

Accessibility is an important and ambitious CCAM requirement, with high expectations. The arrival of a technical revolution in the automotive sector, with the development and large-scale deployment of Connected and Automated Mobility (CAM) could change accessibility, as we know it today.

Automated mobility could indeed provide access to mobility for people with physical constraints, such as those with diverse mobility, the elderly, or those living in remote areas. For these groups, automated vehicles could improve social inclusion, providing them with increased access to a range of services and a degree of social life that was previously denied to them.

Accessibility in the context of automated vehicles refers to ensuring that these vehicles are designed and implemented in a way that accommodates the needs of individuals with disabilities or limited mobility. Here are some considerations regarding accessibility in relation to automated vehicles:

Inclusive Design: Automated vehicles should be designed with a focus on inclusivity from the outset. This involves considering the needs of individuals with diverse abilities and ensuring that the vehicle's features, controls, and interfaces are accessible to a wide range of users. Design considerations may include accessible seating arrangements, easy-to-use controls, and customizable interfaces that can adapt to different user requirements.

Mobility Assistance: Automated vehicles can be equipped with features to assist individuals with disabilities or limited mobility. This may include ramps or lifts for wheelchair access, deployable handrails for stability, and adjustable seating arrangements to accommodate various mobility aids. By incorporating these features, automated vehicles can provide a more inclusive transportation option for a broader segment of the population.

User Interfaces: The user interfaces of automated vehicles should be designed with accessibility in mind. This includes employing accessible design principles for digital displays, control panels, and interactive systems. Features such as large text options, high contrast displays, tactile feedback, and audible prompts can enhance accessibility for individuals with visual impairments or cognitive disabilities.

Communication and Alerts: Automated vehicles should have effective communication systems that can provide clear and understandable information to passengers with different communication needs. Visual displays, audible announcements, and tactile feedback can help relay important information about the vehicle's status, upcoming stops, or emergency situations.

Training and Support: Adequate training and support should be provided to individuals with disabilities, digitally challenged or vulnerable or limited mobility to ensure their effective use of automated vehicles. This may include specialised training programmes, informational materials, and assistance from trained personnel. It is essential to address any barriers that may prevent individuals from fully benefiting from the accessibility features of automated vehicles.

By considering and incorporating these accessibility factors, automated vehicles can be designed and implemented in a way that caters to the needs of individuals with disabilities or limited mobility, promoting inclusivity and equal access to transportation.

2.3 Affordability

Affordability plays an important role when it comes to automated vehicles, as their widespread adoption and accessibility depend on their cost-effectiveness. This requirement may be analysed from a twofold perspective: **on the supply side**, affordability addresses primarily OEMs, car manufacturers and software developers; **on the demand side**, affordability matters for the willingness to pay from consumers and users.

On the supply side, over time, **advancements in technology and manufacturing processes** tend to reduce costs. As automated vehicle technologies mature and become more widespread, economies of scale should be achieved, leading to cost reductions in components, sensors, computing systems, and other hardware necessary for automation. This can help make automated vehicles more affordable.

The same holds true for **R&D Investments**. Continued research and development investments in automated vehicle technologies can lead to cost reductions. Public and private entities investing in research and innovation can help drive technological advancements, optimise system designs, and identify cost-effective solutions. Collaboration between industry, academia, and government can foster innovation and accelerate progress towards more affordable automated vehicles.

On the demand side, shared mobility services, such as ride-hailing or car-sharing, can contribute to affordability by **spreading the costs** of automated vehicles across multiple users. By leveraging shared mobility and developing efficient business models, the cost per user can be reduced, making automated transportation more affordable compared to owning a personal vehicle. This can encourage a shift towards mobility-as-a-service (MaaS) models.

The consumer of CCAM services could be also interested in lowering the **Total Cost of Ownership** (TCO). From this point of view, affordability goes beyond the initial purchase cost of automated vehicles. Evaluating the total cost of ownership, including maintenance, insurance, energy consumption, and other operational expenses, would be crucial for the consumer/user.

Besides, affordability could also address the **public and private finance** dimension, e.g. when corporate policy is to support employees with a transport card (CCAM service) or shared vehicle (CCAM product). Through incentives and subsidies, governments and policymakers could play a role in promoting affordability by offering tax breaks to encourage the adoption of automated vehicles. These measures can help offset the higher upfront costs associated with automated technologies, making them more accessible to a wider range of consumers.

Establishing a **supportive regulatory framework** can also contribute to affordability. Regulations that facilitate the testing, deployment, and operation of automated vehicles, while ensuring safety and public trust, can encourage investment and innovation in the industry. Clear and consistent regulations can help reduce uncertainties and costs associated with compliance.

In sum, by considering these factors and implementing strategies to address them, the cost of automated vehicles can be reduced, making them more affordable and accessible to a broader population. This, in turn, can accelerate their adoption and contribute to the transformation of transportation systems.

2.4 Acceptability

Acceptability is probably the crucial aspect to consider when it comes to automated vehicles, being such a relatively new technology and mobility concept. The successful adoption and integration into society depend ultimately on how CCAM are perceived and accepted by various stakeholders.

The user experience plays a significant role in determining the acceptability of automated vehicles. Factors such as comfort, convenience and trustworthiness can influence users' perception and acceptance of this technology. Designing user interfaces that are intuitive, easy to understand, and

provide clear communication of the vehicle's actions and capabilities can enhance the acceptability of automated vehicles.

Considering CCAM, it can be said that one of the primary concerns is **safety** (including perceptions of safety). Establishing rigorous safety standards, conducting comprehensive testing, and demonstrating the reliability and effectiveness of automated systems are crucial to gain public acceptance. Transparent communication about safety features, risk mitigation strategies, and accident statistics can help address concerns and build trust among potential users. An important topic in this domain is pursuing on board safety and security with other passengers, e.g. surveillance.

Besides, as discussed above, automated vehicles may face **ethical dilemmas** on the road, such as situations where a collision is unavoidable, and the vehicle must decide about the lesser harm. Developing ethical frameworks and guidelines for automated systems to handle such situations can address concerns related to moral decision-making and improve the acceptability of these vehicles.

On the same level of importance for raising acceptability stands **data privacy and security concerns.** They are essential for the acceptability of automated vehicles. Clear policies and measures to protect personal data collected by these vehicles should be established. Robust cybersecurity protocols should also be implemented to safeguard against potential hacking or malicious attacks that could compromise the safety and privacy of passengers.

In general, **engaging the public and providing accurate information** about automated vehicles is crucial for fostering acceptability. Public awareness campaigns, educational programmes, and demonstrations can help familiarise people with the technology, its benefits, and its limitations. In such a context, a well-defined and **adaptive regulatory framework** can contribute to the acceptability of automated vehicles. Regulations should balance safety requirements, technological innovation, and societal concerns. Public participation in the development of regulations can help ensure that diverse perspectives and concerns are considered, enhancing the overall acceptability of automated vehicles.

From a strategic point of view, implementing **transition strategies** that facilitate the gradual introduction of automated vehicles into existing transportation systems can improve acceptability. This can include phased deployment, pilot programmes, and integration with existing public transportation services.

All in all, addressing acceptability in the context of automated vehicles involves a multidimensional approach that considers user experience, safety assurance, ethical considerations, data privacy and security, public engagement, regulatory frameworks, and transition strategies. By addressing these factors, stakeholders can work towards the widespread acceptance and integration of automated vehicles into society.

3. Clusters of CCAM projects

The identification of the four components deemed necessary for the analysis of social equity in CCAM projects is followed in this chapter by the clustering of CCAM projects in four groups. The rationale behind clustering is to classify the CCAM projects under examination in homogeneous groups in terms of prevailing topics, in order to draw conclusions on how social equity is dealt with according to specific domains of CCAM: 1) CCAM projects dealing with scenarios and strategic issues; 2) CCAM projects focused on autonomous bus and shared services, 3) CCAM projects addressing Automated Vehicles (AVs) and 4) CCAM projects based on technological advancements in automated mobility.

It is important to stress that such clustering is based on the identification of the **prevailing or most common** topics in CCAM projects, which does not prevent that some topics are common to all the examined projects. For example, a topic like the implementation of technological tools among CCAM users and supplier can be considered as a transverse topic common to several projects, independently from the cluster.

The proposed clustering serving the review of practices in social equity is supported by two methodological tasks:

1. Identification of the sources, which represents the set-up of the informational basis of the analysis.
2. Creation and utilisation of a template for project screening, which points out the key information underpinning the analysis.

3.1 Identification of the sources

The identification of sources consists in preparation of the informational basis for the selection of a sample of CCAM projects. These projects, once selected, are assumed as reference material for the analysis of social equity and for the provision of first indications on measurable indicators for social equity and inclusion.

More specifically, to make the selection viable, three main sources have been used:

1. Deliverable 1.1 “Mobility needs and requirements of European citizens”, more specifically the relevant EU funded projects focused on user needs and requirements, including some national projects in which the SINFONICA groups of interest based in Trikala, Hamburg, in the region of West Midlands and in the Noord-Brabant province were involved.

2. Deliverable 1.3 “Understanding the gap of CCAM solutions development”, in particular the list of completed or undergone CCAM projects.

3. The Knowledge Base on Connected and Automated Driving (CAD) https://www.connectedautomateddriving.eu/projects/, showing more than 300 projects dealing with automated driving.

The Deliverable 1.1 “Mobility needs and requirements of European citizens” shows in the Appendix a list of the most relevant projects funded by the European Union that focused on user needs and

requirements as well as acceptance of CCAMs (and CAMs, CAVs & AVs), e.g., SUaaVE, TRIPS, Cities4People and REBALANCE.

The individual CCAM projects and initiatives are accompanied by the project acronym, website, duration, the partners of SINFONICA involved, if any, a box on the relevant findings and a brief indication on the focus of the project in terms of technology or user oriented and CCAM or other mobility services involved.

The Deliverable 1.3 "Understanding the gap of CCAM solutions development" shows several projects and initiatives to test and validate CCAM technologies in real-world settings, aiming to identify potential issues and barriers to their implementation, as well as demonstrate the benefits of CCAM to stakeholders and the public. The list of projects is accompanied by the indication of the project acronym, website, duration, objectives and key aspects in terms of CCAM topics addressed.

The Knowledge Base on Connected and Automated Driving (CAD) is the one-stop shop for data, knowledge and experiences on CAD/CCAM in Europe and beyond. Initially developed as part of the Horizon 2020 Action ARCADE (Aligning Research & Innovation for Connected and Automated Driving in Europe) and currently maintained and extended in the frame of the FAME project (Framework for coordination of Automated Mobility in Europe) funded under Horizon Europe, the Knowledge Base gathers the scattered information among a broad network of CAD stakeholders to establish a common baseline of CAD knowledge and provide a platform for a broad exchange of knowledge.

The above-mentioned sources, considered as a whole, can potentially provide information on hundreds of EU funded projects and national initiatives carried out over the past 20 years on CCAM. In the context of this Deliverable, this huge knowledge base must be treated through specific criteria, in order to be manageable and targeted to the objectives of the analysis.

Four criteria have been used:

1. Duration: a special attention has been devoted to projects completed over the past 10 years (finished in 2013 or after). Projects with an older lifetime (completed 15 years ago or more) risk being outdated, in particular in the light of recent technological advancements focused on CCAMs (e.g., technologies facilitating CCAM, as C-ITS, Artificial Intelligence, etc,).
2. Availability: the availability of results is fundamental to draw conclusions on social equity. This may lead to consider primarily completed projects for which results are available (excluding in such a way ongoing projects or national projects with no material available in English. For an overview on national projects dealing with CCAM, with a specific reference to the UK case, see section 4.3 in this Deliverable).
3. Manageability: the number of projects to be considered must be manageable, i.e., allowing the analysis of results in a timeframe consistent with the resources allocated to the task.
4. Synergy: some of the projects considered in the analysis have been conceived in a common framework of topics, as the H2020 EU projects and initiatives dealing with new scenarios of mobility and autonomous vehicle, creating synergies among different as SUaaVE, PASCAL, DIAMOND, TRUSTONOMY and DRIVE2FUTURE. In such a case, the identification of a cluster is made easier.

In sum, applying the above criteria to the three types of sources, the resulting knowledge base consists of **40 EU projects**, classified in the following four clusters:

1. Cluster of **9 projects** dealing with strategic issues, e.g., planning for future CCAM integration with infrastructure (COEXIST), definition of scenarios of CCAM availability at different level of integration and development (ARCADE, TransAID, SCOUT), analysis of socio-economic impacts (PAV), new technologies (CITYMOBIL2), strategic consensus building, impacts assessment and key challenges: in general, LEVITATE, WISE-ACT and for specific stakeholders, STAPLE.
2. Cluster of **7 projects** dealing autonomous buses and shared services, e.g., solutions and integration of autonomous buses in Public Transport network (CATAPULT, SOHJOA BALTIC), automated shared solutions (SHOW), pilots on new concepts of automated buses (FABULOS, L3PILOT), mini-buses (AVENUE) and integration of shuttle-bus in PT (RIDE2AUTONOMY).
3. Cluster of **12 projects** dealing with Autonomous Vehicles user's needs and acceptance, e.g., needs of women (DIAMOND), drivers (DRIVE2THEFUTURE, MEDIATOR, HEADSTART, INTERACT), passengers, including VRU (SUUAVE), specific stakeholders as National Road Administrations (DIRIZON, MANTRA), evaluation of factors affecting trust in CCAM (TRUSTONOMY), acceptance (PASCAL) and user-centric factors influencing the approach towards new technologies during autonomous driving (BRAVE, HADRIAN).
4. Cluster of **12 projects** focused on technological solutions, e.g., tests and pilots on technological tools for CCAM in road infrastructure (INFRAMIX, MAVEN, ICT4CART), conditional automation in mixed traffic conditions (TRUSTVEHICLE), IoT (AUTOPILOT), AI (CARAMEL), C-ITS services (C-ROAD), satellite-based positioning systems (HIGHTS), 5G communications (G-DRIVE, G-IANA, G-CARMEN) and automated parking (UP-DRIVE).

Sections 3.3-3.6 below provide more information on the respective clusters of projects.

A part the sample of EU funded projects, we checked national initiatives (in Europe) that fell into the scope. They are reported in the section 4.3, addressing the limitations of the case: e.g. language barrier. Besides, we count only projects in European countries (EU or national), i.e. not the Americas, Asia, Australia, etc. to not make the scope too wide and because standards are often different there.

3.2 The template for projects screening

Each project has been reviewed using the screening template shown in Table 1.

Table 1: Template for projects screening

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity:	
Background to the project/initiative:	
Intended aims and outcomes with reference to social equity:	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	

How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old)	
Older people (65 years old and over)	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

The template distinguishes Part 1, in which generic information necessary for the identification of the project are shown, including the project website, the background and the intended aims with reference to social equity, and Part 2, which collects information on the dimensions of social equality (the four A's examined above) and the way in which the SINFONICA users' categories potentially affected or at risk of discrimination are addressed.

A brief description of the SINFONICA user's categories is shown in Table 2[3].

Table 2: SINFONICA user categories

Users	Description
Young people (18-25 years old).	The United Nations, for statistical purposes, defines youth as those persons between the ages of 15 and 24 years old, without prejudice to other. Age is the easiest way to define this group, particularly in relation to education and employment, because 'youth' is often referred to a person between the ages of leaving compulsory education and finding their first job. We include in this group all those people between 18 and 25.
Older people (65 years old and over)	The elderly population is defined as people aged 65 and over. Moreover, elderly population is particularly vulnerable to loneliness and social isolation which in turn can have a serious effect on health (high blood pressure, heart disease, obesity, a weakened immune system, anxiety, depression, cognitive decline, Alzheimer's disease, and even death).
Persons with disabilities	Physical disability indicates any "limitation on a person's physical functioning, mobility, dexterity or

[3] The description of the SINFONICA users' categories in this table is based on the "Description of the categories that need to be involved in each Groups of interest" as defined in SINFONICA WP1, T1.4.

Users	Description
	stamina" that has a 'substantial' and 'long-term' negative effect on an individual's ability to do normal daily activities. The causes of this kind of disease are various. Any person can acquire it through accident, injury, illness post-surgery effects and heredity. There are different forms of physical impairments: physical disabilities (for example: damage to the skeletal system, amputation or muscle system disease), hearing impairment (deafness and hearing loss), visual impairment (blindness and visual impairment), speech impediment (voice, speaking).
Digitally vulnerable people	Digital vulnerable people do not have access/do not want to have access/have difficulties to deal with information and communication technology. These forms are primarily computers, smartphones and the Internet.
Women and gender related vulnerabilities	Gender-based violence, harassment, and a general feeling of being unsafe largely affect peoples' mobility patterns. To guarantee high-quality, accessible, and affordable public transport for all, a gender-sensitive approach to transport policy is necessary. Within this category we ideally aim to involve women, transgender, cisgender, non-binary, agender, gender non-conforming, gender fluid, genderqueer and, in general, LGBTQ+ representatives.
Persons at risk of poverty	Someone who is experiencing financial hardship due to a lack of sufficient income from employment. This could include individuals who are working but not earning enough to cover their basic needs, as well as those who are currently unemployed or underemployed (meaning they are working fewer hours than they would like or are qualified for). The UK Government report regularly on income levels. Households are classed as being low income if they live on less than 60% of the average (median) net disposable equivalised UK household income
People affected because of their place of living (rural-urban areas)	People living in rural areas refers to people of any gender or age that reside in a rural area. A rural area is everything but an urban area. An urban area in the Netherlands is defined as an area with at least 1500 addresses per square kilometres. Concepts that are included in a rural area are countryside, villages, and hamlets. People living in a rural area often face large distances between home, work, schools, shops, and services, and are generally

Users	Description
	heavily dependent on their car, motorbike and public transportation in order to commute or travel.
Other potential users, e.g., single parent family, university students, cyclists, etc.	This residual category includes other users at risks, like children, migrants, students, cyclists, single parents' family, etc.

3.3 Projects dealing with strategic issues

The key feature of the projects classified in this cluster is **their long-term visions on implications, barriers and enablers** for a wide range of stakeholders, arising from the implementation of connected automated driving, at various level of implementation and deployment of CCAM (i.e., at different SAE levels). For example, implications on spatial planning and governance for policy makers and urban planners, business models for car manufactures, etc. The SAE levels categorise the capabilities and functions of automated vehicles, ranging from no automation to full automation, as described in Table 3.

Table 3: Level of automation (SAE) of automated driving

SAE level	Description
Level 0 - No Automation	At this level, the driver is in full control of the vehicle, and there is no automation involved. All aspects of driving, such as steering, braking, and acceleration, are solely performed by the human driver.
Level 1 - Driver Assistance	Level 1 introduces driver assistance technologies. These systems can assist the driver with specific functions, such as adaptive cruise control or lane-keeping assistance. However, the driver is still responsible for most aspects of driving and must remain always engaged.
Level 2 - Partial Automation	Level 2 represents partial automation, where the vehicle can simultaneously control two or more primary functions of driving. Examples include advanced cruise control, which can adjust speed and distance to the vehicle ahead, and lane-centring assistance, which keeps the vehicle within its lane. However, the driver is still required to monitor the driving environment and be prepared to take control if necessary.
Level 3 - Conditional Automation	Level 3 introduces conditional automation, where the vehicle can manage most driving tasks under certain conditions. The system can make decisions and control the vehicle, but the driver must be ready to intervene if alerted by the system. In Level 3, the driver can disengage from driving tasks and engage in non-driving activities, but they must be

	able to regain control within a reasonable timeframe when requested by the system.
Level 4 - High Automation	At Level 4, the vehicle can perform all driving functions under specific conditions and environments without human intervention. The system can handle various road scenarios, and the driver may not need to be attentive or ready to take control. However, Level 4 is limited to certain operational domains, such as specific geographic areas or favourable weather conditions.
Level 5 - Full Automation:	Level 5 represents full automation, where the vehicle can perform all driving tasks under all conditions that a human driver could handle. There is no need for human intervention or control, and the vehicle can operate autonomously in any scenario or location.

Table 4 shows the key stakeholders involved and the main results in this cluster of CCAM projects.

Table 4: CCAM projects on strategic issues: key stakeholders involved and main results.

Main stakeholders	**Type of results**
Local authorities & policymakers	**Preparing towards spatial planning and governance issues**. Considerations of social challenges.
National Road Administrations	Understanding the impacts **on business models**
Users	Analysis of the **pre-conditions for acceptability**.
Industry, software providers	Technological overview on **potential applications and tools** to ensure the transition to automated vehicles

In general, this cluster of projects **can provide food for thoughts concerning future scenarios on CCAM deployment and take-up**. Explorative analysis supported by forecasting techniques, including in some cases rough impact assessment, can potentially provide a wide range of options and priorities to be considered as well as the pre-conditions to prepare stakeholders at different SAE level scenarios. Particular emphasis, in such a context, has been put on the "transition phases" in which there will be the coexistence between automated driving and conventional vehicles and driving styles, both concerning infrastructure and driving conditions (e.g., conditional automation at SAE level 3).

3.4 Projects dealing with autonomous bus and shared services

The topic of this group of projects **is public transport, and in particular autonomous buses and shared transport services.** As such, this topic is directly related to the main field of interest of SINFONICA. Indeed, in terms of SINFONICA impacts, it is expected that the SINFONICA knowledge and tools will be a precious allay for the public administrations that aim to involve CCAM in the public transport.

The seven CCAM projects included in this cluster have been carried out between 2017 and 2022. Most of the projects deal with autonomous buses, providing tests and pilots in several European cities involving automated mini-buses and autonomous shuttles, with a particular emphasis on the problems arising from the integration of the new automated services in the public transport network. Other fields of interest are the provision of such new services in low-demand areas and the factors affecting users' acceptability.

Sometimes, the projects deal with strategic issues, preparing the future public transport systems to accommodate for automated solutions. In such a case, the focus is both on technical solutions and future mobility planning challenges.

Concerning the shared public services, one project, SHOW[4] (see the Appendix for details), deals with the discussion of business models, priority scenarios (for policy makers) and technical solutions for a wide range of automated shared mobility services involving public transport (Demand Response Services, Mobility as a Service, Logistics as a Service). The project is mainly oriented to the understanding of the user requirements on the supply side, for example OEM (Original Equipment Manufacturer), Transport/Mobility operators, Service companies and Suppliers technology providers.

Table 5 shows the key stakeholders involved and the main results expected in this cluster of CCAM projects.

Table 5: CCAM projects on autonomous buses and shared services: key stakeholders involved and main results.

Main stakeholders	Type of results
Local authorities & policymakers	Guidelines, including legal and organisational aspects, underpinning the **set-up of efficient integration of automated public transport solutions** in the public transport network.
Public Transport operators	**Analysis of business models** and the commercially sustainability of automated public transport solutions integrated in the public transport network, i.e., viability of multimodal integration.
Users	S**urveys on individual and public response to automated public transport services,** in terms of users' perception of safety and comfort.

To sum up, the projects in this cluster address the following important issues in view of the deployment of automated transport services:

- demonstrating the advantages of the use of autonomous vehicles in urban and suburban shared transport,
- evaluating the cost-benefits, socio-economic and environmental impacts of the use of autonomous shared public transport vehicles
- assessing the safety and reliability of autonomous shared public transport vehicles.

[4] https://show-project.eu/objectives/

Finally, the projects in this cluster can provide **roadmaps and business plans for the large-scale adoption and deployment of autonomous vehicles for public transport**.

3.5 Projects dealing with automated vehicles (AVs)

The 12 projects dealing with AVs focus in general on private AVs, preparing vehicles drivers, operators and policy makers to a future in which AVs could became a standard modality supporting mobility patterns. This cluster of projects can be classified in a couple of big sub-categories:

1. Five projects focused on human-centred topics, in which the relationships between new technologies for automated driving and their interaction with human behaviour play an important role.
2. Three projects interested in AVs user's needs, when public acceptance is at stake.

Other residual categories concerns with the needs, challenges and impacts for specific stakeholders, e.g. (National Road Authorities), and strategic issues arising from the implementation of SAE level 3 of automatic driving and the implementation of a stream of enabling technologies supporting Connected Automated Driving functions (e.g., advanced drivers assistance systems, positioning systems, etc).

Concerning the first sub-group of CCAM projects, the four EU projects Drive2theFuture, Mediator, Trustonomy and HADRIAN[5] address similar human-cantered topics characterising the development of automated driving in Europe. Indeed, the four projects convened in a clustering event on March 10th, 2022, to identify common themes across their project. The main outcomes were summarised in a series of recommendations to the EU and OEMs to foster the human-centred development of automated driving in Europe from the user perspective point of view. A synthesis of these outcomes follows:

- Establish an EU regulatory institution that develops and applies a high-level framework for the design, development, and operations of automated driving across Europe. Specifically: common principles for the interactions between vehicles, road infrastructure and setting common standards for human computer interfaces for automated driving.
- To organise the long-lasting transition from current road operations to high levels of automated driving. Establish Europe-wide competence centres for automated driving that can bring together members states, public, OEMs to develop converging standards for automated driving.
- Establish harmonised and consistent curricula for drivers to develop the appropriate knowledge and competences for using automated driving schemes.

Concerning the 3 projects dealing with acceptability (DIAMOND, SUaaVE and PAsCAL, in appendix for details), the focus of the analysis is generally **in gathering information through surveys and data collection on user's needs and requirements supporting acceptance of automated vehicles**.

The range of the analysis is broad, i.e., several user's categories are involved: e.g., passengers, current and future drivers (children, senior citizens and people with disabilities), VRUs Vulnerable Road Users, etc associated to the main stakeholders (public authorities, industries, etc).

[5] See the Appendix for detailed information on these projects.

Sometimes, as in the case of the DIAMOND project, the focus on acceptance is related to a specific user category: women, addressing in such a way gender equality.

Table 6: CCAM projects on AVs acceptance and user's needs: key stakeholders involved and main results.

Main stakeholders	Type of results
Local authorities & policymakers	**How the development of various types of automated vehicles is going to change mobility**. The introduction of automation will impact the mobility and travel behaviour, driving behaviour and traffic flow, traffic safety, energy and environment with relevant implications for policymakers.
National Road Authorities (NRAs)	Understanding how **the core business of NRAs** will be affected by the development of automated vehicles: operational maintenance, investment, revenues, etc.
Users and user's associations	**Better understanding of the requirements for safer and more efficient automated vehicles**. The analysis sometimes is carried out by type of user's categories, with a specific reference to vulnerable categories (elderly, people with disabilities, etc.,).
Industry, software providers	Better vehicle design, user interface, technological equipment to meet user's needs.

The CCAM projects addressing AVs acceptance and user's needs **can provide a wide range of important results for SINFONICA**, both on technological and socio-political side.

Among the socio-political topics addressed by the projects, the most relevant ones concerning social equity are those related to the identification and clustering of the different categories of "drivers", travellers and stakeholders involved in or affected by autonomous vehicles, recognising their needs and defining relevant use cases, taking into account issues of transferability of solutions between different transport modes.

3.6 Projects dealing with technological solutions

The group of 12 projects classified under this cluster is by far more homogenous than the groups of projects in the other clusters. It includes the following topics which may be classified in two sub-groups:

1. 3 projects testing and evaluating the impacts on users of key automated functions; from using the Internet of Things to digital services made possible by the development of 5-G based Automotive-related services.
2. 5 projects testing technological solutions addressing new configurations of the infrastructure road network for a better traffic management (e.g., allowing V2I and V2V communication).

The other projects in this cluster deal with new applications (i.e., satellite-based positioning systems, Artificial Intelligence (AI) applications, new advanced communication protocols) which may improve specific aspects of automated driving. Namely:

- Cybersecurity: AI may improve AVs cyber security, reducing the impacts of breaches in data protection and sharing.
- Geo-positioning: more accurate AVs geo-positioning may provide more reliable information, improving safety and traffic management.

The first sub-group of projects is focused on a group of technologies (in particular linked to the Internet-of-Things) that can improve the user's feeling of safety, reliability, and comfort when experiencing automated driving. Tests and pilots try to fill the knowledge and behavioural gaps in the passage between manual and automated driving modes. In one case, (the project TRUSTVEHICLE) driving scenarios focused on the SAE Level 3, in which mixed-traffic scenarios are considered and unexpected weather conditions taken into account.

The second sub-group of projects focused on the overall management of infrastructure in mixed traffic flow conditions, testing new solutions for the management of hybrid network, combining direct short range V2V (vehicle to vehicle) and V2I (vehicle to infrastructure) communications with long-range V2N (vehicle to network) communications.

Table 7 shows the key stakeholders and the types of results reached in this cluster of projects.

Table 7 CCAM projects dealing with technological solutions: key stakeholders involved and main results.

Main stakeholders	Type of results
National Road Authorities	**Testing technologies for a better management of the road network**, with reference to traffic flows and accidents.
Users	**Technologies to prevent and/or mitigate dangerous situations,** with a particular reference to Vulnerable Road Users (e.g., pedestrians and/or cyclists).
Industry, software providers	**Development of new applications** serving automated driving.

4. Analysis of results

Chapter 4 is devoted to the analysis of the results arising from the projects review. The reviewed projects have been classified in the four clusters of projects described in Chapter 3. The review of the 40 projects has been carried out through the lens of the template described in section 3.2, collecting evidence addressing two key questions:

1. Which aspects of social equity are most frequently addressed? The aspects of social equity under examination are represented by the four As; Accessibility, Availability, Affordability and Acceptability. **Such an analysis is expected to point out the most frequent dimensions of social equity examined by the projects, indicating where more research is needed**.
2. Which CCAM type of users are most frequently addressed? **The analysis leads to the identification of underrepresented users that need further research in order to fill-in the knowledge gaps.** The users under examination correspond to the SINFONICA list of users with special mobility needs: young, older people, persons with disabilities (including cognitive disabilities), digitally vulnerable people, women and gender related vulnerabilities, persons at risk of poverty and social exclusion.

The answers to the two questions are shown respectively in the next two sections.

4.1 Which aspects of social equity are most frequently addressed?

Figure 1 shows the frequency of the social equity components addressed in the sample of 40 CCAM projects.

Evidence come from contingency tables showing the count (frequency) of observations that fall into the specific combination of the aspects of social equity (the four As) discussed in Chapter 2 and the cluster of CCAM projects.

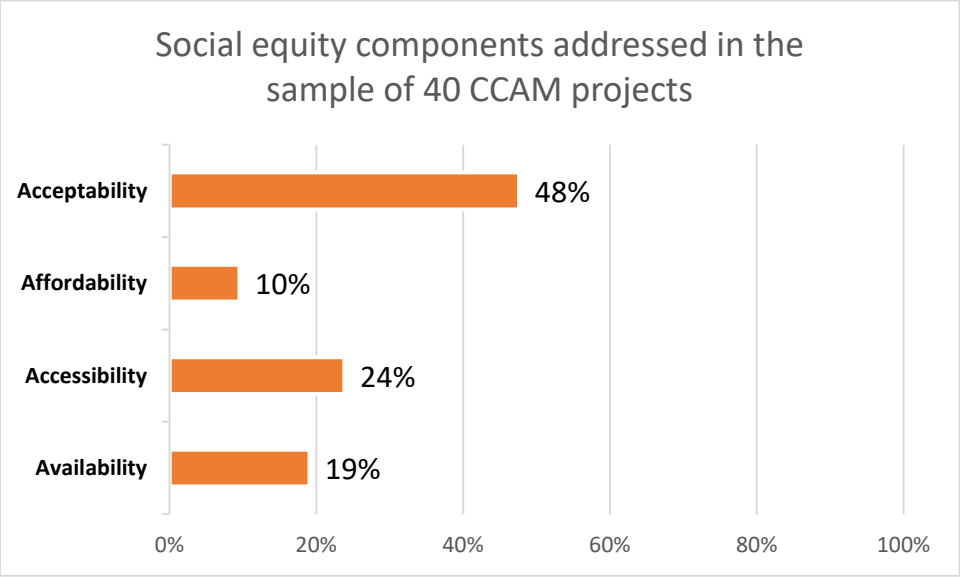

Figure 1: Overview of social equity components addressed in the overall sample of CCAM projects.

The graph points out that the acceptability and accessibility components of social equity together account for 72% of all occurrences.

In the case of availability, the 19% of occurrences are mainly related to **technical reliability** issues like the robustness of sensors and ICT applications applied to automated vehicles, which make availability possible, while the rest is related to the availability of different levels of automated vehicles, depending on different scenarios.

The low share of occurrences regarding affordability (10%) is surprising. Affordability, i.e., both on the supply side (e.g., investment from OEMs) and the demand side (e.g., the willingness to pay for the automated services) should play an important role in social equity, in particular when considering the demand side, in order to avoid discriminations based on users' spending capacity and income levels.

It may be interesting to look at the distribution of occurrences across the components of social equity by cluster of projects.

Figure 2 considers the 9 projects dealing with strategic issues.

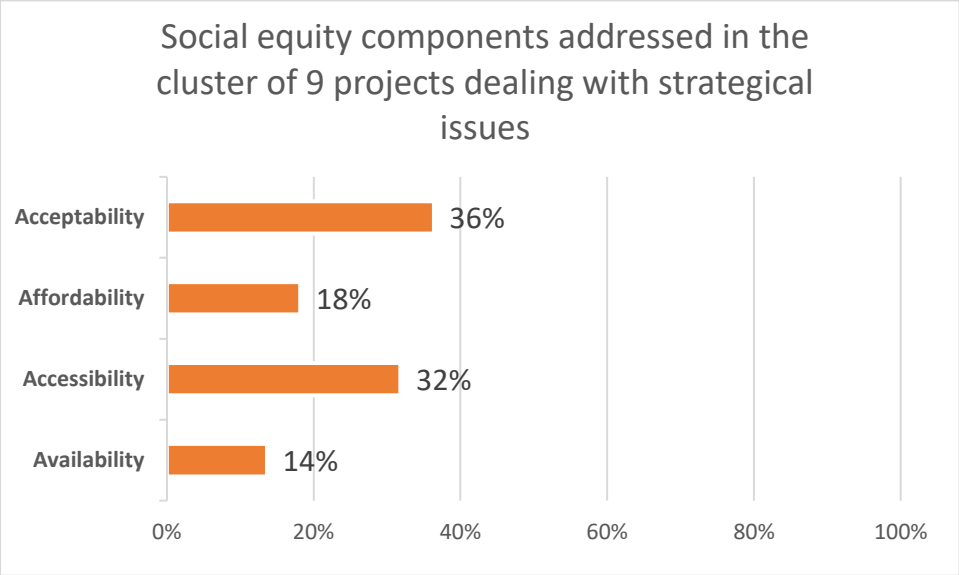

Figure 2: Overview of social equity components addressed in the cluster of CCAM projects dealing with strategic issues.

It can be observed that the strategic features of the projects, e.g., long term scenarios encompassing wide technological and socio-economic trends, social and business challenges as well as considerations on the most appropriate framework conditions for the take-up of automated vehicles, are reflected in a balanced distribution of the social equity components.

Concerns over the **affordability** of automated vehicles reaches the peak of 18%, compared to the average of 10% related to the overall sample of projects.

The same can be said for **accessibility**, that reaches 32% of occurrences, compared to the average of 25% related to the overall sample of projects. In this cluster of projects, dealing with the future of automated driving, there is the concern about new challenges that may undermine accessibility. For example, the CITYMOBIL2 project scenario emphasises the risk that the growing trend in private automated mobility (increase in total mileage) may exert contrasting results on accessibility (congestion, accidents).

Figure 3 shows how the main components of social equity are addressed in the cluster of 7 projects dealing with autonomous bus and shared services.

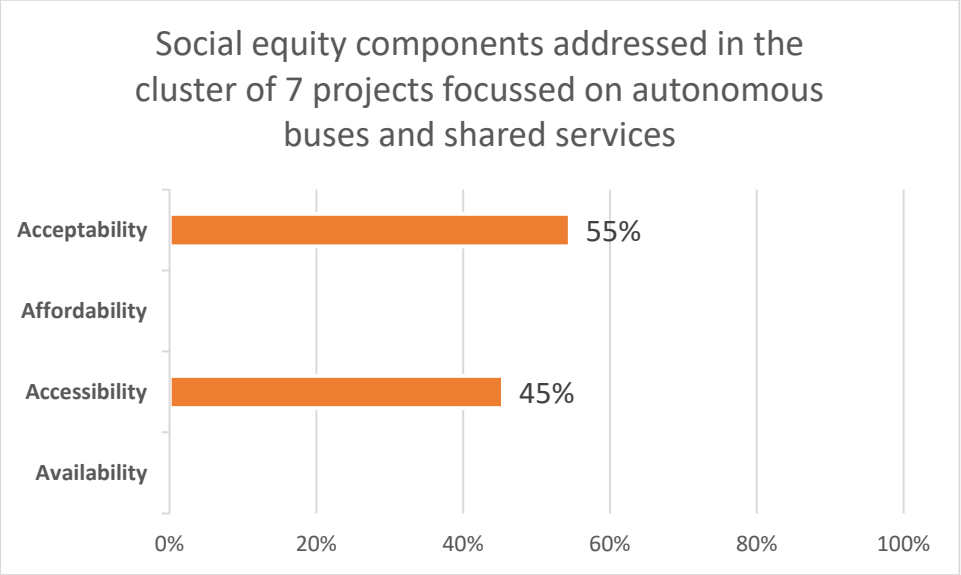

Figure 3: Overview of social equity components addressed in the cluster of CCAM projects dealing with autonomous buses and shared services.

In this cluster of projects, social equality is basically an issue in terms of acceptability and accessibility. Acceptance in automated public transport solutions and shared services needs to be raised in terms of more safety and comfort, while accessibility must be guaranteed to everyone, regardless physical condition, and place of living. These topics have inspired demonstrations and analysis about the framework conditions to ensure better acceptance and accessibility.

Concerning acceptability, there is a common understanding across the projects that social acceptance is the most important pre-condition for a full development of autonomous public transport vehicles: **comfort and safety seem to be the most frequent requirements for raising social acceptability.**

Accessibility is another relevant component: it is considered important that automated public transport means are accessible to everyone, including vulnerable groups as elderly, people with disability.

On the other hand, affordability and availability play no relevant role in these projects, probably based on the public nature of the automated transport services under examination, which could embed affordability and availability as normative requirements, regulated by laws, e.g., capped tariffs and public service obligations.

Figure 4 shows the social equity components addressed in the cluster of projects dealing with AVs.

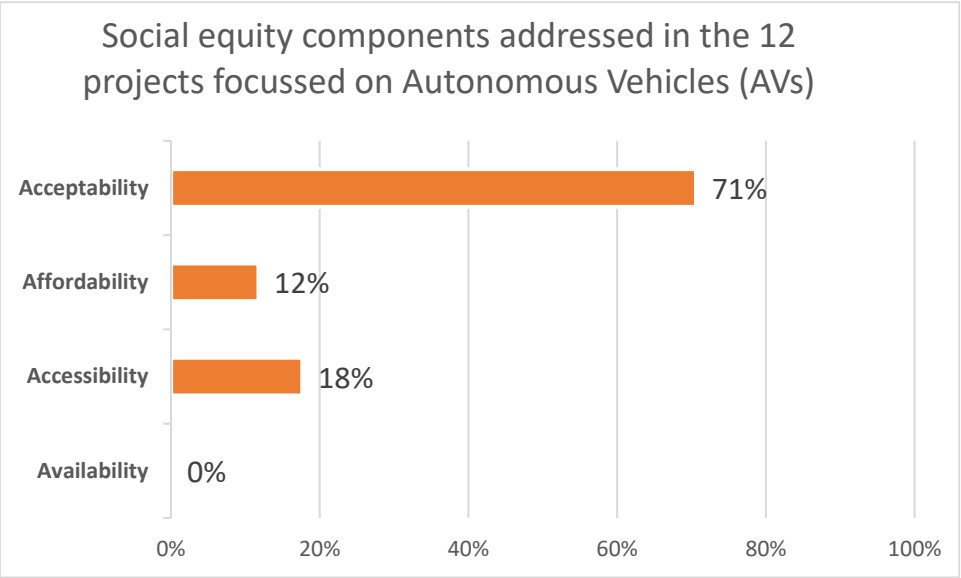

Figure 4: Overview of social equity components addressed in the cluster of CCAM projects dealing with AVs.

Acceptability represents the social equity component most frequently addressed (71%). In the sub-category of CCAM projects dealing with AVs with a particular emphasis on human-centred topics, acceptability means to prepare drivers to cooperate efficiently with automated driving technologies.

On-line simulation-based training courses, information campaigns, design of advanced human machine interfaces are considered necessary to raise **acceptance in the future drivers (trust, perceived safety, comfort), specifically in the transition to full automation scenarios, in which the coexistence with semi or non-autonomous vehicles may raise unexpected challenges**.

In another sub-group of projects of this cluster, raising acceptability is explicitly indicated as the main objective (e.g., SUaaVE, PAsCAL and DIAMOND). In such a case, the analysis of factors leading to distrust leads to the development of a Human-Driven Design (HDD) in which the focus is working to improve more "intangible" aspects as safety perception, attitudes and, in general, emotional appraisal of AVs driving and acceptance.

In general, the strategy improving acceptance of AVs is complex. It encompasses a wide range of factors; behavioural, psychological, social.

This is also reflected in the considerations about the complex pattern required to improve accessibility, the other components of social equity considered in this cluster of projects (18%). It has been stressed, as in the SUaaVe project, that the various public policies analysed in the project emphasise the fact that accessibility will be improved, not only insofar as the transport offer will be more diversified ('on-demand' transport in particular **is often targeted), but also adapted to the user and their possible physical, cultural, medical, social and intellectual constraints.**

Figure 5 shows the social equity components addressed in the cluster of projects dealing with new technological solutions in CCAM.

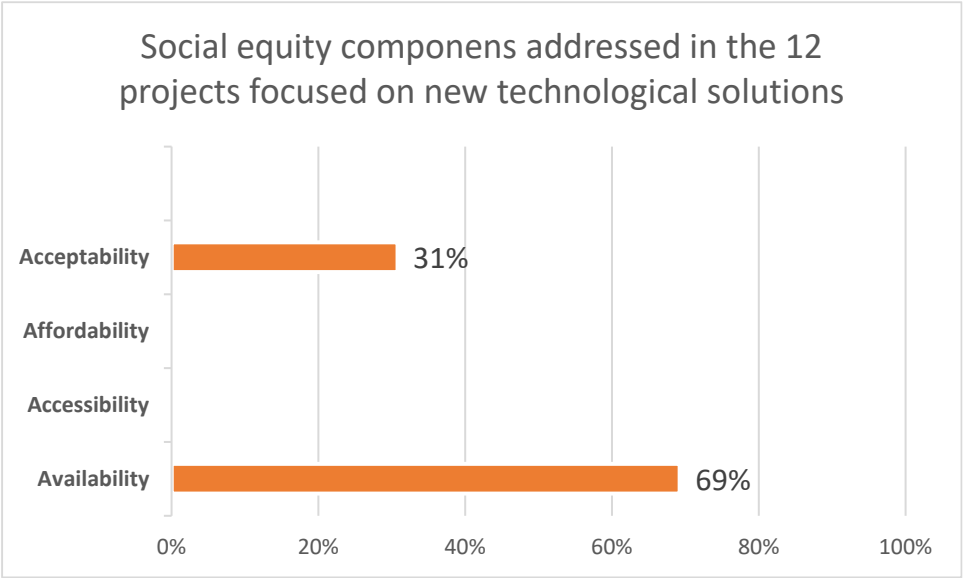

Figure 5: Overview of social equity components addressed in the cluster of CCAM projects dealing with new technological solutions.

In this cluster of projects, not surprisingly, the most frequent component of social equity is the **availability** of new technological solutions in CCAM (69%).

The wide range of new technological advancements in the sector is promising and massive: from new communication protocols (5-G) to new C-ITS services, AI and Machine Learning techniques. These advancements may potentially disclose new services for the users (drivers and transport operators), for example new traffic management tools, better geo-positioning tools, improving in general security, accuracy, efficiency.

When it comes to deal with acceptability (31% of occurrences), from the point of view of the passengers, the **issue of control** was very important. Participants wanted to be able to stop the automated driving and take over control of the vehicle, if the case. **Safety and security** were also seen as key factors emerging during discussions, focus groups and in the user' questionnaires.

More in general, it has been stressed that whether the introduction of new technology is going to be a success, depends strongly on the acceptance of the stakeholders at all levels. **And the acceptance of stakeholders depends strongly on whether they are well informed about the changes and their consequences**.

4.2 Which CCAM types of users are most frequently addressed?

This second question aims at providing a picture on the degree of coverage of the different types of vulnerable users when automated mobility is under consideration. The degree of coverage can be considered as a criterion in the direction of social equity, to the extent that the more the different types of vulnerable users are addressed by CCAM projects, i.e., discussing their needs and requirements, the more social equity is pursued, at least in terms of equal consideration of all the types of vulnerabilities, as identified by SINFONICA. (*Infra*, Table 2: SINFONICA user categories).

In any case, answering to this question can also provide insights on **how** the SINFONICA user' categories are addressed in the CCAM sample of projects, e.g., considering the types of indications and priorities envisaged.

Figure 6 shows the overall picture of the degree of coverage by types of user's categories in the sample of 40 CCAM projects.

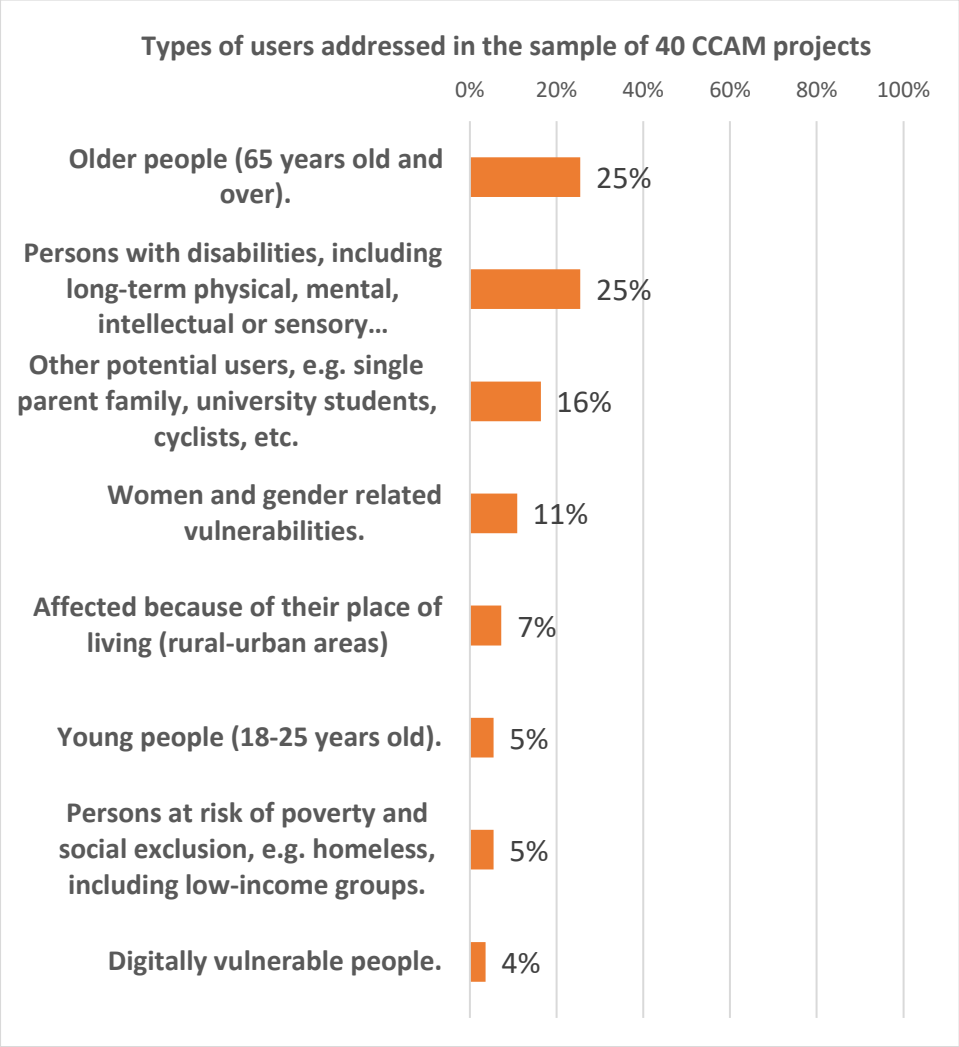

Figure 6: Types of users addressed in the sample of 40 CCAM projects.

It may be observed that across the 40 CCAM projects elderly (people with more than 65 years) and persons with disabilities (physical and cognitive) account together with 50% of the overall occurrences and can thus be considered as the most frequent types of users' categories: respectively with 25% of occurrences.

Other potential users (16%) represent a residual category, including types of users which in general fall under the VRU (vulnerable road users) category: children, cyclists, pedestrians. In some cases, (e.g., as in the WISE-ACT project, in Appendix) this residual category includes immigrants, who could benefit from automated mobility to the extent that this can prevent the release of license guide, usually considered a barrier for immigrant.

For the rest, other than projects addressing "women and gender related vulnerabilities" (11%) and people affected by place of living (7%), it is **worthwhile to note the low occurrences addressing**

young, people at risk of poverty and digitally vulnerable people, respectively with only 5% (people at risk of poverty and young) and 4% (digitally vulnerable people) of occurrences.

In case of young people, the low coverage may depend on the consideration of their assumed higher acceptance of new technologies and automated mobility (e.g., DRIVE2THEFUTURE project in Appendix).

But the low degree of coverage of "**people at risk of poverty" is hardly justified, given that it is likely that the price of automated mobility (in particular the private mobility) could be high, at least in the initial stage of market penetration**. In any case, the low occurrences reported for people at risk of poverty are consistent with the evidence discussed in the previous section on the coverage of the dimensions of social equity, in which affordability showed the lowest shares.

The same shortcoming in social equity coverage can be pointed out with reference to the 4% (the lowest share) of occurrences concerning digitally vulnerable people. **The cluster of CCAM projects dealing with technological advancements has shown the importance of the user's interaction with digital tools and applications.** Therefore, digitally vulnerable people tend being discriminated, in particular during the transition phase from traditional to full automated vehicles.

The analysis by clusters of CCAM projects may provide additional insights.

Figure 7 shows the types of users' categories addressed in the cluster of 9 projects dealing with strategic issues. The overall pattern in these projects reflects the general trend discussed with reference to the 40 CCAM projects. However, the higher consideration to users neglected in the overall 40 CCAM projects should be stressed.

Indeed, digitally vulnerable people, persons at risk of poverty and persons living in remote areas account for 9% of occurrences each, against an average of 4%-5% with reference to the overall projects. **This evidence may reflect the strategic awareness among policymakers and experts about the risk that automated and connected transport in the future may exclude some share of adult population based on low digital skills and affordability of new services**.

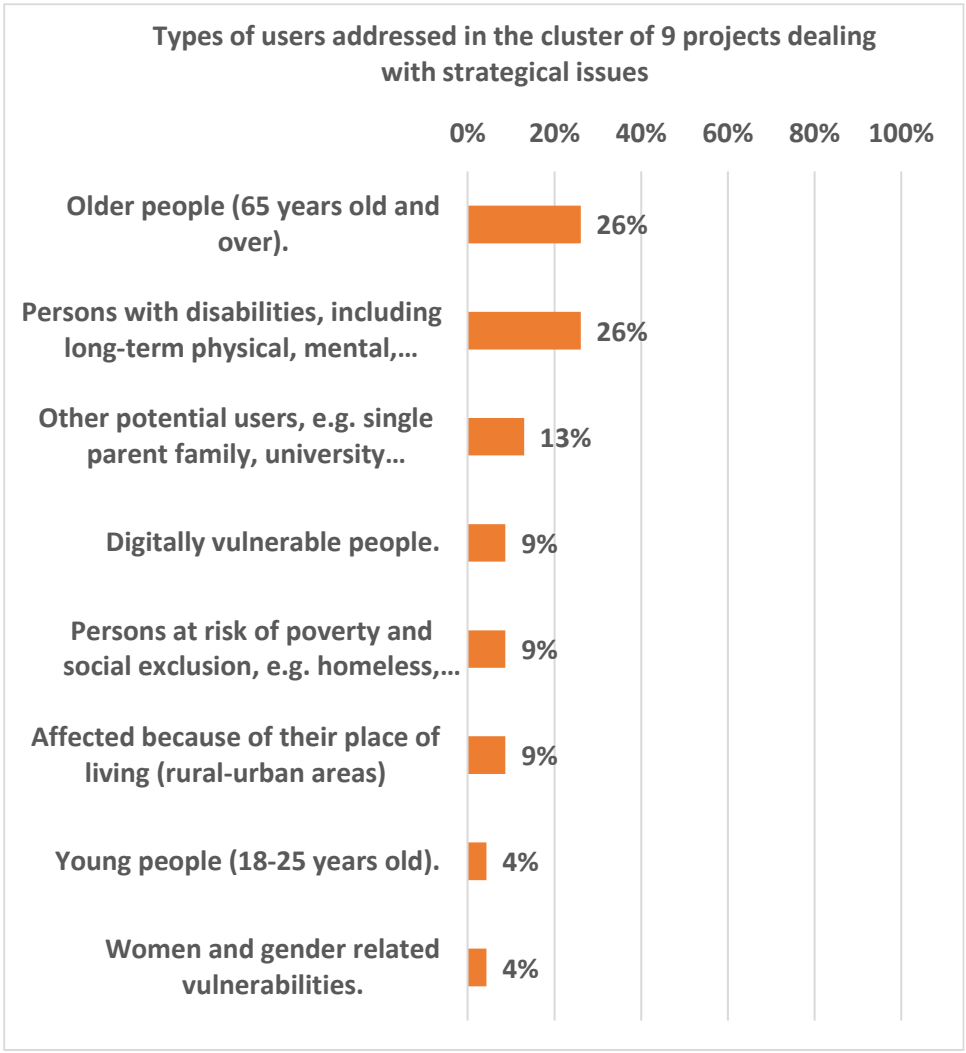

Figure 7: Types of users addressed in the cluster of 9 CCAM projects dealing with strategic issues.

Concerning the cluster of CCAM projects focused on public transport (autonomous buses and shared services), the analysis **shows a strong emphasis on people with disabilities and older people, accounting for about 65% of the occurrences** (Figure 8).

This evidence is consistent with the dimensions of emphasis on accessibility and acceptability characterising the considerations on social equity in this cluster of projects. There is a concern that automated public transport services should be accessible to everyone, in particular to disabled people and elderly, meeting their requirements of major safety and comfort.

Young people, women and persons at risk of poverty are in general not considered among the key categories at risk of discrimination (6% of occurrences) in the use of automated public transport, even if in some specific cases, e.g., CATAPULT project, in Appendix, it has been found that gender may play a role in the propensity to use automated buses, showing a lower attitude of women in using a self-driving bus at nights.

It may be of interest to note that in the residual category of other users, an important role is played by children, that could potentially represent a user's category (shuttle bus to school), given that appropriate information and design have been provided, e.g., CATAPULT and SOHJOA BALTIC projects, in the Appendix).

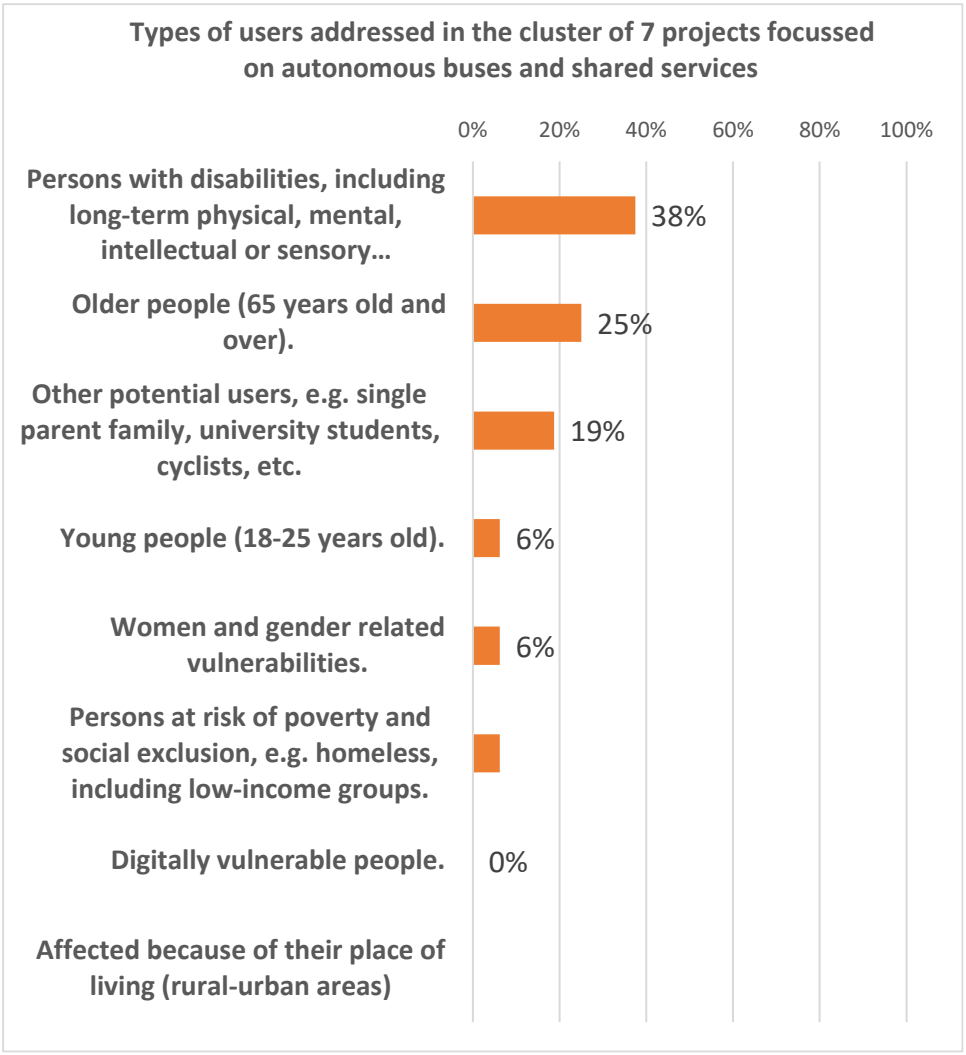

Figure 8: Types of users addressed in the cluster of 7 CCAM projects focused on autonomous buses and shared services.

When the analysis is focused on Autonomous Vehicles in general (Figure 9), it can be observed the importance of gender-related discrimination (generally overlooked when the focus in on public transport).

In private AVs, gender-related discrimination account for 27% of total occurrences, compared to 6% in public transport. It is stressed (e.g., DIAMOND, PAsCAL projects, in Appendix) that women are more reluctant to give power to the vehicle, and that the key elements to remedy this situation may be proper training and communication between the vehicle and the passenger.

Besides, aspects as women ergonomics must be applied in design such as anthropometrics, reaches, forces and consider women's variability and pregnancy.

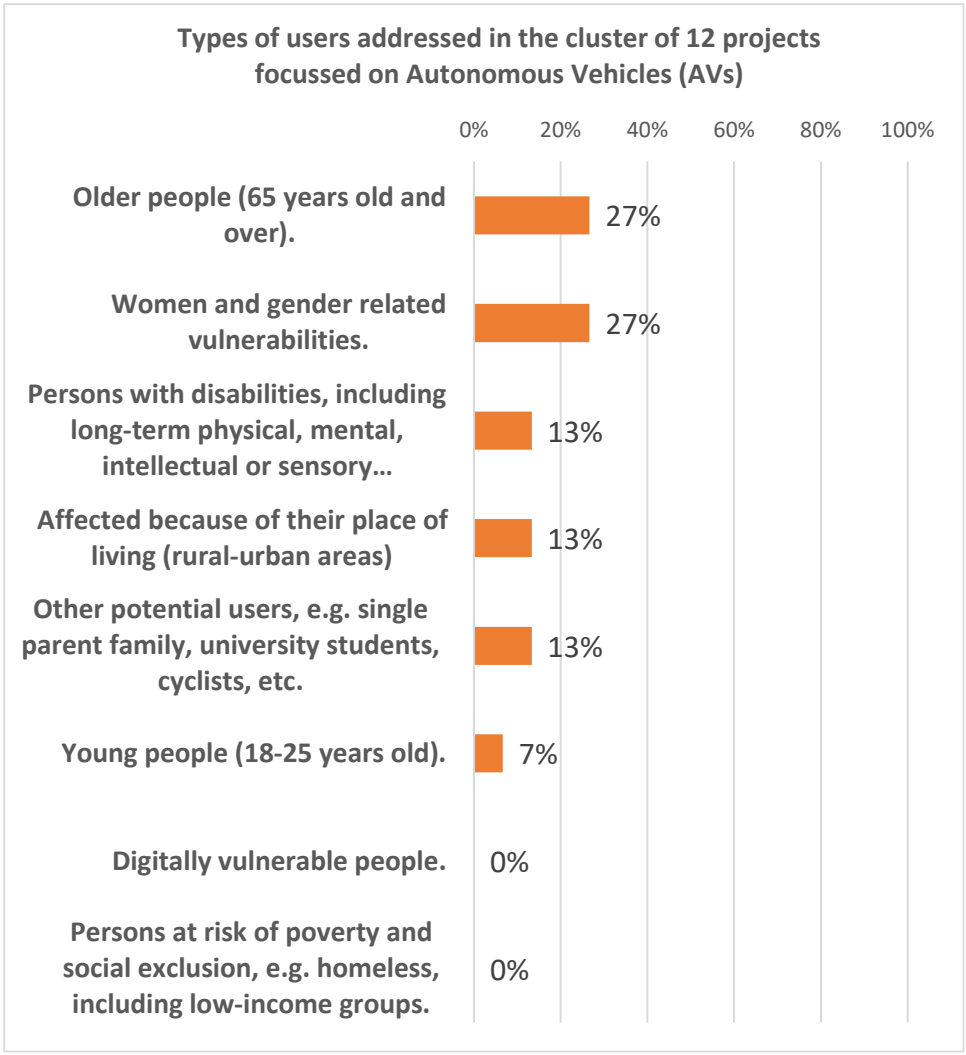

Figure 9: Types of users addressed in the cluster of 12 CCAM projects focused on Autonomous Vehicles (AVs).

A part the concerns for elderly (accounting for 27% of total occurrences), AVs projects also consider the potential discrimination for persons with disabilities and persons living in remote areas (both with 13% of occurrences).

As already stressed when considering the general trends related to the overall projects, the **overlooking of potential discriminations for digitally vulnerable people and persons at risk of poverty is not justified, given the importance respectively played by digital tools and price components in the accessibility and affordability of AVs**.

Concerning the cluster of 12 CCAM projects dealing with technological advancements, no specific reference is made to social equity issues by type of users. Availability and acceptability of technological solutions and tools are basically examined in terms of technical pre-conditions and acceptance from stakeholders (OEMs and infrastructure managers).

4.3 An overview of national -based CCAM projects: the cases of UK and Germany

The 40 CCAM projects examined in the previous chapters share one characteristic: they are EU funded projects, basically under H2020 or Horizon Europe framework research programmes. However, as the knowledge base repository on Connected and Automated Driving (CAD) shows[6], national (regional and local) projects dealing with automated driving should be considered as well, other than those funded by EU institutions.

In particular, it may be of interest to verify whether national projects follow the same pattern of EU funded projects.

Unfortunately, as already mentioned in Chapter 3, the availability of national project results analysed in the respective national languages represents a fundamental barrier to carry out further analysis. Abstracts of national (regional, local) projects results are usually available in English[7], but not at the required detailed level necessary to report about impacts on social equity.

However, a more complete overview of national CCAM projects can be provided in the case of UK, for which national language is not a barrier and Germany, for which the German partner in SINFONICA, i.e., TUD, has provided the translation in English of recent projects dealing with CCAM (in Appendix the related summary sheets from 8.41 to 8.45).

Despite the low geographical coverage, according to the Connected and Automated Driving (CAD) repository, in the period 2016-2022 UK and Germany are among the most active countries in funding and promoting national CCAM projects (Table 8).

Table 8: National CCAM projects by country (2017-2022)

Country	Number of CCAM funded projects
Austria	6
Belgium	6
Czech Republic	1
Finland	2
France	3
Italy	2
Germany	35
Greece	1
Netherlands	8
Spain	15
Sweden	7
Switzerland	4
UK	28

In UK, pursuing CCAM deployment and take-up is part of a more general national policy on transport and R&D, which can make the difference in terms of strategic and political commitment, resources allocation and definition of targeted objectives.

[6] https://www.connectedautomateddriving.eu/projects/

[7] They have been reported in the SINFONICA Del 1.1 “Mobility needs and requirements of European citizens”.

In 2015, the UK government established the Centre for Connected and Autonomous Vehicles (CCAV) as a joint Department for Strategy, Industry & Trade (DSIT) and Department for Transport (DfT) unit. CCAV works closely with industry and academia to make self-driving vehicles and services on UK roads safer and inclusive.

More specifically, the CCAV's objectives are to:

- Make the movement of people and goods in the UK safer, fairer, greener, and more efficient.
- Set strategic direction and provide investment certainty through policy and other interventions, for example through the Connected and Automated Mobility 2025 paper and the Future of Mobility: Urban Strategy.
- Develop and implement the legislative and safety frameworks necessary to enable the safe commercial deployment of self-driving vehicles, including the CAVPASS programme.
- Provide joint investment with industry through 2025 to overcome the barriers to commercial deployment thereby attracting, de-risking, and anchoring global investment, creating jobs, and strengthening their supply chain so that the UK is a maker of these technologies and services, not just a taker.
- Engage with the public to gain an insight into public opinion and to increase the public's understanding of emerging technologies.

Concerning social equity issues, it is worthwhile to mention the study recently published (June 2023) on public perception of Self-Driving Vehicles (SDV) in UK (DFT, 2023)[8].

The study acknowledges that public understanding and acceptability of the technology as well as its governance will be vital for meeting the goals of SDV diffusion and affirmation, including enabling the development and implementation of the required policies. Equally, it is necessary to understand what end users need from transport so that SDVs can be developed and deployed in a way that provides for those societal needs.

The study, therefore, is extremely relevant for SINFONICA. It may be mentioned that, diversely from the sample of EU funded projects, the UK national CCAM initiative emphasises the importance of affordability. The study stresses that for "SDVs to truly have a positive impact on local transport systems it was important that they are not prohibitively expensive at the point of use, ideally reducing, if not maintaining, the current cost of travel in the local area". This is considered important from a fairness perspective, preventing SDVs from becoming an exclusive, high-cost technology only available to 'the elite', but also to help resolve the issue of high-cost public and private transport. The study points put that "there was a perception that if SDVs were prohibitively expensive to use people would not use them. This would make them redundant and prevent them from enabling better local transport systems".

In Germany, several organisations, including government agencies, research institutions, and industry players, are involved in CCAM projects. These projects aimed to develop and test various aspects of connected and automated mobility, such as vehicle-to-vehicle (V2V) and vehicle-to-

[8] https://www.gov.uk/government/publications/self-driving-vehicles-public-perceptions-and-effective-communication

infrastructure (V2I) communication, autonomous vehicle technology, and smart transportation infrastructure.

Over the past years, the sample of projects dealing with CCAM (in Appendix the details) show a pattern similar to the EU projects as a whole: the attention is mainly focused on **acceptability, along the two dimensions of individual acceptance (based on one's own preferences) and societal acceptance (based on consideration of opposing interests)**.

When considering public transport, as in the RAMONA project (see 8.43 in Appendix) the emphasis is on the technologies for booking and ordering the automated vehicles, testing the pre-conditions for a full acceptability from seniors and young people as well.

5. Contributions to the identification of KPIs to measure social equity

While the sample of CCAM projects review has shown the ongoing lively research and discussion around the topic of social equity in CCAM, the same review shows that there is not yet a well-established set of Key Performance Indicators (KPIs), specifically tailored to measuring social equity in CCAM.

This Deliverable provides a first overview of measurable indicators of social equity, based on the CCAM sample of projects, setting the scene for future developments in SINFONICA, namely in the Deliverable 5.5, which will consider the definition of suitable KPIs to benchmark ongoing and future projects in the final recommendations for large-scale demonstrations projects.

The next two sections describe the indicators addressing social equity in transportation and in CCAM from literature, followed by examples on indicators and KPIs drawn from the sample of CCAM projects.

Social equity indicators in transportation

In general, transport indicators focused on social equity in transportation reflect the four As: accessibility, affordability, availability and acceptability, including the fairness of the distribution of environmental and safety risks to the different segments of population, as described in the following bullet points:

- **Availability**: indicators measure the availability and proximity of different modes of transportation, such as public transit, walking, biking, and driving, in different neighbourhoods or regions. Examples include the number of stops per capita, the percentage of households with access to cars, the average distance to the nearest transit-stop, or the time required to travel to a destination using different modes.
- **Affordability**: indicators measure the cost of transportation relative to income, and the ability of different populations to afford different modes of transportation. Examples include the percentage of income spent on transportation, the availability of low-cost transportation options, such as discounted transit fares, and the impact of transportation costs on household budgets.
- **Accessibility**: indicators measure the accessibility and quality of transportation-related services, such as job training, healthcare, and education, and the impact of transportation on social and economic opportunities. Examples include the accessibility of transit service to key destinations, the quality of transit service, and the impact of transportation on employment rates, educational attainment, and health outcomes.
- **Safety**: indicators measure the risks and hazards associated with different modes of transportation, and the incidence of transportation-related injuries and fatalities among different segments of population. Examples include the number of traffic accidents per capita, the frequency and severity of pedestrian and cyclist injuries, and the impact of transportation safety on vulnerable populations, such as children, seniors, and people with disabilities.
- **Environment**: indicators measure the environmental footprint of different modes of transportation, and the distribution of environmental benefits and harms among different populations. Examples include the amount of greenhouse gas emissions per capita, the

proximity of transportation facilities to sensitive environmental areas, and the impact of transportation-related pollution on public health.

Indicators of equity in CCAM

The indicators and KPIs related to CCAM follow the same pattern of the indicators of social equity in transportation. Accessibility, acceptability, availability and affordability are accompanied by indicators on inclusivity and fairness of impacts on safety, environment and economic opportunities.

1. **Availability**: indicators may address the availability of CAVs at different times of day and geographical contexts (remote area, low density areas, etc).
2. **Accessibility and Affordability**: Indicators assess the extent to which CCAM technology is accessible and affordable to diverse population groups. They can be measured by evaluating the availability of CCAM services in different geographical contexts (e.g., rural and urban areas) and the affordability of CCAM services compared to traditional transportation options.
3. **Inclusivity**: These indicators measure the extent to which CCAM are designed to meet the needs of diverse populations, including people with disabilities, elderly, and people with limited digital proficiency. They can be measured by the availability of accessibility features, such as wheelchair ramps and audio announcements, and the extent to which CCAM interfaces are designed to be user-friendly for different populations.
4. **Impacts on employment and economic opportunity**: indicators measure the impact of CCAM on employment and economic opportunity, and the distribution of these impacts among different populations. They can be measured by the extent to which CCAM create new job opportunities, the impact of CCAM on existing transportation jobs, and the extent to which CCAM improve access to economic opportunities for marginalised populations.
5. **Acceptability, safety and security**: indicators measure acceptability, safety and security of CCAM, and the extent to which these technologies mitigate transportation-related risks and hazards. They can be measured by the frequency and severity of CCAM-related accidents, the security of CCAM systems against cyber-attacks, and the impact of CCAM on pedestrian and cyclist safety.
6. **Environmental impact**: Indicators measure the environmental impact of CCAM, and the distribution of environmental benefits and harms among different populations. They can be measured by the amount of greenhouse gas emissions and other pollutants generated by CCAM, the impact of CCAM on land use patterns and urban sprawl, and the extent to which CCAM contribute to or mitigate climate change.

Examples of CCAM indicators and KPIs can be shown from the sample of CCAM projects under examination.

In the context of an ideal monitoring and evaluation framework of CCAM services, the project CO-EXIT (CO-EXIST, 2019), points out the need of KPIs addressing the following three domains:

1. Traffic flow efficiency: impacts of CCAM on traffic e.g., travel time, Volume-Delay functions, etc
2. Space efficiency: road space consumption, e.g., parking area (before and after CCAM development and deployment)

3. Safety: e.g., increased safety due to less accidents (comparing CCAM with area with traditional vehicles).

Furthermore, the SHOW project use cases (SHOW, 2020) provide useful examples of KPIs, applied to a wide range of use cases:

- Autonomous traffic in real city environment
- Seamless autonomous transport chains of Automated PT, DRT, MaaS, LaaS
- Mixed passenger/cargo automated transport
- Platooning for efficiency
- Automated service at bus stop

With reference to social equity, the following KPIs are of interest for SINFONICA.

Table 9: Social equity Indicators and KPIs (SHOW project, 2020)

Domain	Description
Safety	Road accidents: Total number of injury accidents (i.e. accidents with at least one person slightly injured) in a specific area
	Conflicts: Total number of conflicts encountered per 100 million kilometres
	Conflicts with VRUs: Total number of traffic conflicts instances that include pedestrians or cyclists.
	Time headway: Time difference between the time the front of a vehicle arrives at a point on the road and the time the front of the following vehicle arrives at the same point.
	Reaction time: The time it takes for the operator of a vehicle to respond to a stimulus on the road (e.g. an obstacle).
	Safety enhancement: % of expected safety enhancement.
Societal	Person km travelled: Person km travelled by special groups of citizens (elderly, PRMs, children) per type of AV/service type.
	Number of passengers: Number of people transported throughout the project per automated vehicle/service type.
Equity	Inequality in transport: To which degree are transport services used by socially disadvantaged and vulnerable groups, including people with disabilities.
Employability	Job loss: Percentage of jobs that have a high probability of being replaced by computer automation within the next two decades.
	Job gain: Number of jobs created by the implementation of computer automation, and other systems (sensors, cameras etc.) used in autonomous vehicles within the next two decades
User perception	User perception of travel quality
	User perception of travel reliability
	User feeling of trust in the autonomous vehicle
	User feeling of safety during travel
	User perception of travel comfort
	Traveller acceptance rating
	Perceived usefulness

Table 9 provides an excellent starting point for the analysis to be done in SINFONICA.

First, it can be observed that a part the important domains of accessibility for all (inclusivity) and acceptability in terms of comfort, reliability and quality, the KPIs for CCAM solutions should also cope with the safety issues, aspects that cannot be left out when moving into automated vehicles

as individuals can find themselves alone in the vehicle and safety is crucial for customer attraction and user friendliness.

Besides, social equity should also consider the impacts on employability, i.e., through an assessment of equity for the society at large, not just for transport users. This implies the inclusion of KPIs addressing the expected socio-economic impacts of automation- and CCAM-related policies.

Another contribution to the definition of KPIs on social equity in CCAM is provided by the projects MANTRA (MANTRA, 2019) and CADRE (Rämä, P., Kuisma, S., 2018). The two projects focused on user acceptance and use of automated vehicle in the road sector. While the MANTRA project was more oriented on the KPIs addressing National Road Administrations business cases, the CADRE projects was specifically focused on the societal level[9]. The related list of KPIs, with reference to social equity, is shown in Table 10.

Table 10: KPIs for user acceptance according to CARTRE project (Rämä, P., Kuisma, S. (2018)

Domain	Description
Safety	Feeling of safety (from the perspective of vehicle users) Subjectivity safety (Likert scale)
	Number of injuries
	Number of fatalities
	Number and severity of conflicts
Mobility and travel behaviour	Use of automated driving functions: Share of kms driven within the ODD (conditions where automated driving can be used) when the driver decides to use automation
	Requirement of attention and concentration (for driving): whether the driver has to be attentive to driving or not, and to what extent (varies with SAE level).
	Number of trips Value of travel time Total kilometres travelled Share of car and public transport
User perception	User perception of travel quality
	User perception of travel reliability
	User feeling of trust in the autonomous vehicle: a) Feeling of being able to control the vehicle at any time b) Feeling of control over the vehicle while the system is driving (Likert scale or share of time when feeling able to have control)
	User feeling of safety during travel
	Trust (Connected and Automated Driving, CAD, users)
	General feeling/acceptance of general public
	Perceived usefulness

Table 10 shows that KPIs addressing user perception (safety, comfort, perceived trust and reliability) should also involve components related to vehicle operations and more in general to the use of automated driving.

The following indicators, therefore, should be considered as part of social equity, to the extent that they measure the degree of reliability and, finally, the user acceptance of CCAM.

[9] The project contribution to KPIs should be read in association to the work done by the Impact Assessment Subgroup of the European Union-United States-Japan Trilateral Working Group on Automation in Road Transportation (ART WG), in VTT (2018).

- Number of instances where the driver must take manual control / 1000 km.
- Mean and maximum duration of the transfer of control between operator/driver and vehicle (when requested by the vehicle)
- Mean and maximum duration of the transfer of control between operator/driver and vehicle (manual overrule)
- Number of emergency decelerations per 1000 km
- Mean and minimum time-headway to the vehicle in front in car following situations.
- Minimum accepted gap at intersections or in lane changes
- Mean and minimum distance (m) to the vehicle in front in car following situations (headway 5 s or less).

All in all, the definition of suitable KPIs to benchmark ongoing and future projects to measure social equity in CCAM should include the following domains:

- Safety. Typically measured as several fatalities, injuries, or property damage for vehicle occupants or other road users. Safety KPIs may include impacts on VRU as pedestrians, children, and bicyclists. This domain is part of the overall acceptability of CCAM.
- Vehicle operations. Influencing the reliability and acceptability of CCAM, some indicators and KPIs on vehicle operations, e.g., time headway, reaction time, adaptability time, etc, should be part of the set of the KPIs.
- Economic impacts. In terms of social equity, indicators and KPIs measuring the impacts of automated vehicles on labour market should be also considered.
- Land use. Space efficiency, in terms of number of parking slots, density of housing, location of parking, etc should be also considered.

The above domains should be integrated in the basket of KPIs addressing the four A's: accessibility, affordability, availability and acceptability. In such a framework, SINFONICA could enrich the picture, for example including KPIs on the affordability of the CCAM services.

6. Conclusions

This Deliverable draws on input from the SINFONICA WP1 (Setting the SINFONICA framework, in particular the literature and project review in Task 1.1), providing initial considerations and reflections on the identification of best practices in social equity with respect to smart mobility, focusing on CCAM solutions.

The preliminary conclusions drawn in this analysis will be further developed and refined in the next stages of the projects, culminating in the long-term policy recommendations on the take-up of CCAM in Europe.

The analysis of social equity in CCAM projects is based on a sample of 40 EU funded projects (basically under the Horizon 2020 and Horizon Europe framework programme), plus 5 national projects in Germany and a summary of UK Centre for Connected and Autonomous Vehicles (CCAV) activity. The CCAM projects considered generally have been carried out and completed in the period between 2016 and 2022. On-going EU funded projects have not been included in the sample, due to the paucity of information.

The 40 EU funded projects provide an exhaustive overview of how social equity is dealt with, according to four clusters of prevailing thematic areas, based on which the 40 EU funded projects have been classified:

5. Nine CCAM projects dealing with strategic issues (e.g., governance, emerging business models, acceptability, etc).
6. Seven CCAM projects dealing with the public transport domain, i.e., autonomous buses and shared services.
7. Twelve CCAM projects dealing with acceptance of automated vehicles, both on the technological and behavioural point of views.
8. Twelve CCAM projects dealing with the implementation of new technological solutions.

This informational basis, supported by a conceptual framework for the identification of the key components of social equity and by a template for project screening, has underpinned the analysis of social equity in CCAM. Two questions were primarily answered:

3. Which aspects of social equity are most frequently addressed?
4. Which CCAM type of users are most frequently addressed?

The answer to the former question is that acceptability and accessibility account for 72% of all occurrences. The emphasis on acceptability is also shared by the 5 German projects. Great contributions to the high frequency of acceptability and accessibility issues are respectively provided by the cluster of projects dealing with AVs, for which acceptability of future drivers (trust, perceived safety, comfort) accounts for 71% of all occurrences, and by the cluster of projects dealing with autonomous buses and shared services, in which pursuing accessibility for everyone accounts for 45% of all occurrences.

The importance of acceptability and accessibility in social equity (the other component of social equity, availability, with 19% of occurrences, basically concerns with technical reliability of new technologies among stakeholders) points out the **downgrading of affordability** (only 10% of all occurrences in EU projects and nothing in the German sample of projects), which is hardly justifiable,

considering the potential discriminations on the demand side, due to lower users' spending capacity and income levels. **The situation is slightly different in the UK national projects, in which affordability benefits of more visibility**. In conclusion, **the next SINFONICA activity might address some gaps in this area of social equity**.

It may be worthwhile noting that in national CCAM projects, when information is made available, like in UK, the **CCAM projects emphasise the importance of affordability as a way "preventing CCAM from becoming an exclusive, high-cost technology only available to 'the elite'"**.

Concerning the answer to the latter question, it may be observed that across the 40 CCAM projects, and some German projects, elderly (people with more than 65 years) and persons with disabilities (physical and cognitive) account **together with 50% of the overall occurrences and can thus be considered as the most frequent types of users' categories: respectively with 25% of occurrences**.

In particular, the cluster of projects dealing with public transport mainly focuses on persons with disability, for which the occurrences amount to 38% of the total. This evidence may reflect the public service obligations of public transport services, which must be available to everyone, regardless physical or cognitive impairments.

For the rest, it is **worthwhile to note the low occurrences in the 40 CCAM projects addressing young, people at risk of poverty and digitally vulnerable people, respectively with only 5% (people at risk of poverty and young) and 4% (digitally vulnerable people) of occurrences**.

The low occurrences reported for people at risk of poverty are consistent with the evidence discussed in the previous question on the coverage of the dimensions of social equity, in which affordability showed the lowest shares.

The same shortcoming in social equity coverage can be also pointed out with reference to the 4% (the lowest share) of occurrences concerning digitally vulnerable people. This may be a gap to be filled-in with more evidence, for the cluster of CCAM projects dealing with technological advancements has shown the importance of the user's interaction with digital tools and applications. **Therefore, digitally vulnerable people tend to be potentially discriminated, in particular during the transition phase from traditional to full automated vehicles**.

On the other hand, when considering the cluster of projects dealing with strategic issues, it can be observed the higher interest to digitally vulnerable people and other user's categories neglected in the overall 40 CCAM projects.

In such a cluster, digitally vulnerable people, persons at risk of poverty and persons living in remote areas account for 9% of occurrences each, against an average of 4%-5% with reference to the overall projects. **This evidence may reflect the strategic awareness among policymakers and experts about the risk that automated and connected transport in the future may exclude some share of adult population, based on low digital skills and affordability of new services**.

All in all, the definition of suitable KPIs to benchmark ongoing and future projects to measure social equity in CCAM should include the following domains:

- Safety. Typically measured as several fatalities, injuries, or property damage for vehicle occupants or other road users. Safety KPIs may include impacts on VRU as pedestrians, children, and bicyclists. This domain is part of the overall acceptability of CCAM.

- Vehicle operations. Influencing the reliability and acceptability of CCAM, some indicators and KPIs on vehicle operations, e.g., time headway, reaction time, adaptability time, etc, should be part of the set of the KPIs.
- Economic impacts. In terms of social equity, indicators and KPIs measuring the impacts of automated vehicles on labour market should be also considered.
- Land use. Space efficiency, in terms of number of parking slots, density of housing, location of parking, etc should be also considered.

The above domains should be integrated in the basket of KPIs addressing the four A's: accessibility, affordability, availability and acceptability. **In such a framework, SINFONICA could enrich the picture, for example including KPIs on the affordability of the CCAM services**.

6.1 Next steps

The next steps of the analysis of social equity in CCAM basically address two topics:

1. Further evidence on the key components of social equity.
2. Contributions to the KPIs to benchmark CCAM projects.

Concerning the former topic, major contributions will be provided by the implementation in WP3 of the engagement strategies and methodologies for data collection as defined in WP2. Data collected in WP3 from the Groups of Interests (GoI) through workshops, interviews, Focus Groups and Surveys will consolidate the knowledge base on user's needs.

More specifically, it is expected that SINFONICA may provide fresh insights on some of the user's needs overlooked by the state-of-the-art research in the field: young, digitally vulnerable people and people at risk of poverty.

Concerning the latter topic, the SINFONICA WP4 will define the project Knowledge Map and tool, which will be tested and validated within the SINFONICA community (GoI and followers) through scenarios.

In the next steps of the project, the refinement of KPIs in close association with the GoI implementation, will represent an important methodological step for the validation of the SINFONICA Knowledge Map and simulation tool.

7. References

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8. Appendix A: List of reviewed European CCAM projects

8.1 ARCADE - Aligning Research & Innovation for Connected and Automated Driving in Europe

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: ARCADE - Aligning Research & Innovation for Connected and Automated Driving in Europe – Coordination and Support Action funded by the European Commission's Horizon 2020 programme. Duration: 01/10/2018 - 31/07/2021 https://www.connectedautomateddriving.eu/	
Background to the project/initiative: ARCADE federates a CAD (Connected Automated Driving) Stakeholder Network through the organisation of regular workshops and co-organisation, with the European Commission, of EUCAD Conferences and Symposia. The CAD network exchanges knowledge and experiences, builds up synergies and a common approach to development, testing, and validation of CAD.	
Intended aims and outcomes with reference to social equity: The mission of ARCADE is to coordinate consensus-building across stakeholders for sound and harmonised deployment of Connected, Cooperative and Automated Driving (CAD) in Europe and beyond. The project builds on the previous CARTRE[10] scenarios. Scenarios were conceived as plausible descriptions of the future; they can be seen as stories of different alternatives for what could happen and for what the transport. system could look like Four scenarios were defined in the project (0, A, B and C). Scenario 0 describes comprehensively short-term issues. Scenario A "Disruption through market-driven services" and B "Authority driven with focus on collective transport" are deeply looking into the development of shared mobility services and public transportation as well as policies and the role of transport authorities. Scenario C is comprehensively looking into privately owned automated vehicles. In ARCADE, scenarios are used to explore the implications for a list of thematic areas in the sense of challenges, enablers and actions to be taken. The thematic area with the most relevant implications in social equity issues is "New Mobility Services" based on connected and automated vehicles at different level of development, integrated in the city transport network and MaaS platforms and accessible via public transport or private operators' platforms or apps.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**Availability of automation services differs, depending on scenarios, area of implementation, adoption rates**, etc. For example, in the project Scenario 0, short term gradual extrapolations of automated services, certain specific functions like automated manoeuvres in depots, or automated docking automated parking for car-sharing fleet are broadly available.
Accessibility	The New Mobility Services **will be completing** the existing public transport offers in low density/low demand situations and could be **complementing or competing them** in high density/high demand areas, depending on the deployment scenario.
Affordability	**It is not clear** now which CAD technologies will emerge as successful, i.e., reliable, performant, sustainable, safe and affordable.
Acceptability	**User awareness of CAD should reach a level in which users are comfortable sharing the road with CAVs**. Several aspects must be considered in order to understand the importance of the perception of society. For automated, shared fleets to operate in a safe and efficient manner, **legal and privacy issues should be clearly defined and understood by users**. Users should be aware of the different options related to their personal data and how this data is used for advertisement or insurance purposes. Most importantly, users should be informed how liability rules apply to CAVs.
How the CCAM vulnerable user groups are concerned?	

[10] CARTRE "Coordination of Automated Road Transport Deployment for Europe",

Young people (18-25 years old).	
Older people (65 years old and over).	Automated manoeuvres in depots, automated docking, automated parking can also improve **slightly** the accessibility of public transports for all users (vulnerable, elderlies, people with disabilities).
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	The initial tests will be made on deployments in **low-demand and peri-urban areas,** where the technical challenges are easier to address**.**
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.2 AUTOPILOT - AUTOmated driving Progressed by Internet Of Things

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: AUTOPILOT - AUTOmated driving Progressed by Internet Of Things - This project has received funding from the European Union's European Large Scale Pilots Programme Duration: 01/01/2017 – 31/12/2019 https://autopilot-project.eu	
Background to the project/initiative: In 2016, the European Commission funded five Large-Scale Pilots (LSPs) on the Internet of Things. The AUTOPILOT project was selected as Pilot 5: autonomous vehicle in a connected environment.	
Intended aims and outcomes with reference to social equity: AUTOPILOT (AUTOmated driving Progressed by Internet Of Things) brings together 43 partners from 14 European countries and 1 from South Korea with the objectives to increase safety, provide more comfort and create many new business opportunities for mobility services. AUTOPILOT concerns the use of Internet of Things for enabling Automated Driving. The extent and volume of information sources that can be addressed through internet of things is considered highly promising, offering potential improvements of automated driving functions (including improvement in security, efficiency, accuracy, etc.) and the information will enable services involving automated driving. Various use cases are executed implemented at the 6 pilot sites of AUTOPILOT in large scale demonstrations in order to evaluate the potential and calculate the related impacts of using Internet of Things for Automated Driving Central to the human role in the Connected Automated Driving (CAD) is the transition from automated to manual driving mode. In terms of social equity, the project addressed the acceptability of driving services. Because of the small sample size, no general conclusions regarding individual characteristics can be derived from the pilot tests.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	For many participants, the **issue of control** was very important. Participants wanted to be able to stop the automated driving and take over control of the vehicle. **Safety and security were seen as important**, in discussions, in focus groups and in the user questionnaires these were seen as important, and concerns were raised.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	

Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.3 AVENUE - Autonomous Vehicles to Evolve to a New Urban Experience

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: AVENUE - Autonomous Vehicles to Evolve to a New Urban Experience - This project has received funding from the European Union's Horizon 2020 programme. Duration: 01/05/2018 – 01/04/2022 https://h2020-avenue.eu/	
Background to the project/initiative: AVNUES's goal has been to design and carry out full-scale demonstrations of urban transport automation by deploying fleets of Automated Minibuses (AMs) in low to medium demand areas of 4 European demonstrator cities (Geneva, Lyon, Copenhagen and Luxembourg) and on 2 replicator cities (Uvrier and Esch-sur-Alzette).	
Intended aims and outcomes with reference to social equity: The AVENUE proposal targeted the validation, via full-scale trials in different European cities, of the usage of Autonomous Minibuses as a complement to public transport in urban and suburban regions. The objectives were the following: • To demonstrate the advantages of the use of autonomous vehicles in urban and suburban shared transport • To evaluate the cost-benefits, socio-economic and environmental impacts of the use of autonomous shared public transport vehicles under different public transport models • To assess the safety and reliability of autonomous shared public transport vehicles for users • To propose a roadmap and business plans for the large-scale adoption and deployment of autonomous vehicles for public transport In terms of social equity, the project addressed accessibility and factors to improve acceptability.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	The project surveys confirmed that Automated Minibuses (AMs) were seen as a viable solution to their problems by PRMs.
Affordability	
Acceptability	Most important factors for the **social acceptance are the (perceived) need for improvement of the current situation (e.g., accessibility, comfort, price)** and whether the proposed alternative service fulfils this need for improvement. **Fears towards a lack of safety or security are currently of less importance for the social acceptance.**
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	The project showed that Autonomous Minibuses will open the countryside to new **users and that they will help the elderly**.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	The consideration of the needs of people with reduced mobility (PRMs) has been at the centre of the AVENUE project teams' attention, which has strived to create the most inclusive environment possible. Surveys among people with reduced mobility (PRMs) have confirmed **the attraction of this particular population group for autonomous public transport and their desire to adopt these services as soon as possible**. However, safety may be an issue: it has turned out that some fear attacks within the buses, especially when the automated minibus is

	driving without any human component. There **are some concerns regarding the help for older people or people with reduced mobility when there is no human component available**.
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.4 BRAVE - BRidging gaps for the adoption of Automated VEhicles

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: BRAVE - BRidging gaps for the adoption of Automated VEhicles -. This project has received funding from the European Union's H2020 research and innovation programme. Duration: 01/06/2017 – 01/02/2021 https://cordis.europa.eu/project/id/723021	
Background to the project/initiative: New technologies in transport enabled systems have the capacity to improve safety, efficiency, sustainability, and comfort. Advances in vehicle automation allow the circulation of vehicles with a minimal human intervention soon. However, this irruption brings new technical and non-technical challenges that are to be addressed to ensure safe adoption of level 3 automated vehicles.	
Intended aims and outcomes with reference to social equity: BRAVE addressed Level 3 automated vehicles also called conditionally automated cars (CACs) where the human is still the driver except in specific circumstances where the vehicle itself can perform all aspects of the driving task. BRAVE developed and tested concepts for vehicle-environment interaction, specifically the inclusion of predictive capabilities that can be used for better and faster reaction by advanced driver assistance systems (ADAS). These concepts anticipate systems that identify vehicle cut-in situations and pedestrian intentions to cross the road. In terms of social equity, the project validated requirements, user acceptance and impact assessment through user-centric testing exercises under different scenario conditions.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Based on 6,608 survey data sets, the study provides findings on **acceptance and trust i**n CACs from a road user' perspective, on the use of external human-machine interfaces (HMI) as well as on **ethical and legal considerations**.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	

Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	Pedestrians, cyclists and motorcyclists, the so-called vulnerable road users (VRU) have been involved in surveys concerning acceptance of CAS. Regarding the road user groups, the **multivariate analysis shows that the acceptance of pedestrians, cyclists and riders of powered two-wheelers (PTW) – the VRUs – is lower than that of car drivers**.

8.5 CARAMEL- Artificial Intelligence based cybersecurity for connected and automated vehicles

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: CARAMEL- Artificial Intelligence based cybersecurity for connected and automated vehicles -. This project has received funding from the European Union's Horizon 2020 research and innovation programme. Duration: 01/10/2019 – 01/03/2022 https://www.h2020caramel.eu/	
Background to the project/initiative: CARAMEL's main background is to proactively address modern vehicle cybersecurity challenges applying advanced Artificial Intelligence (AI) and Machine Learning (ML) techniques and to continuously seek methods to mitigate associated safety risks.	
Intended aims and outcomes with reference to social equity: The following objectives were addressed by the project. • Enhanced protection against novel advanced threats • Advanced technologies and services to manage complex cyber-attacks and to reduce the impact of breaches. • The technological and operational enablers of co-operation in response and recovery will contribute to the development of the CSIRT Network across the EU, which is one of the key targets of the NIS Directive • Robust, transversal and scalable ICT infrastructures resilient to cyber-attacks that can underpin relevant domain-specific ICT systems (e.g., for energy) providing them with sustainable cybersecurity, digital privacy and accountability. As such, no relevant references to social equity were made by the project.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**Technical resilience to cyber-attack** and more in general fail-safe systems.
Accessibility	
Affordability	
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	

Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.6 CATAPULT - Policies for Inclusive Urban Autonomous Mobility Solutions

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: CATAPULT - Policies for Inclusive Urban Autonomous Mobility Solutions – Project funded by the European Union's Horizon 2020 research and innovation programme – URBAN EUROPE - Urban Accessibility and Connectivity Joint Call Duration: 01/11/2021 - 31/03/2023 https://catapultproject.eu/	
Background to the project/initiative: Autonomous buses could be a great means for public transportation in our cities. But they need to be available and safe for all passengers. Automated transport requires special attention in the design phase, improving solutions that are seen in busses today or needing entirely new designs.	
Intended aims and outcomes with reference to social equity: The Catapult project is aiming to improve and develop public transportation for the future. Autonomous buses are already being tested in several cities and researchers are making sure that they are safe and available for all citizens, including those with special needs. The project gathered knowledge and made guidelines for policymakers to be able to improve or create inclusive automated mobility solutions in cities and urban regions. Many potential users of these services, their willingness to use them and appropriate use cases have so far been underrepresented in the development of automated mobility solutions. In terms of social equality, the project focuses on potential user needs, including children, senior citizens and people with temporary and long-term sensory and / or physical impairments.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	**Physical accessibility of autonomous busses is important**: the following criteria have been stressed: a) distribution of bus stops. small distances: b) safe, regulated and barrier-free infrastructure in the surrounding of the bus stop (e.g., crossing help); c) physical layout and maintenance of the bus stops. On the bus, it **is important to benefit of enough spots and space for wheelchairs, walkers, strollers, cargo and animals and wheelchair-ramps.**
Affordability	
Acceptability	Considerations of pre-conditions for acceptability of autonomous buses, e.g., the presence of a responsible person, safety requirements, etc.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	The stakeholders see the potential of autonomous shuttle for the target-groups mainly as a **connection for the last mile.** It can be an important solution for **elderly citizens**, that do not own a car, are not able to drive a car, or want to give up driving to stay mobile. Senior citizens **struggle with getting tickets from vendor machines, online or via smartphone.** It is important for them in the future to get their tickets offline, be it on vendor machines or on a counter. Nearly all the participants stated the **wish or need for a responsible person** on the bus. Some stated, that they would not use an autonomous bus if there was no such person on board, others stated that they would just use a bus without a responsible person if they had to. Most of the participants **wished for video surveillance** on the bus due to safety reasons.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	There was a significant difference that it is more important for people with impairments **to get training on the use of self-driving buses** than for people without impairments.

Digitally vulnerable people.	
Women and gender related vulnerabilities.	Women agreed less than men to the statement that **they could imagine using a self-driving bus at night**.
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	Another benefit can be that **children** do not **have to be driven to daily activities** but can take a bus shuttle. Every sort of information must **be written readable and obvious**, be it the name of the bus stop, the information on the display on the bus, or the timetable.

8.7 CoEXist – "AV-Ready" transport models and road infrastructure for the coexistence of automated and conventional vehicles

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: CoEXist – "AV-Ready" transport models and road infrastructure for the coexistence of automated and conventional vehicles. This project has received funding from the European Union's Horizon 2020 Duration: 05/2017 – 04/2020 https://cordis.europa.eu/project/id/723201	
Background to the project/initiative: AV manufacturers are planning for the market introduction of vehicles with more and more automated functionalities. Although steps towards the deployment of AVs are progressing fast, the success of the transition towards automated vehicles will largely be determined by the acceptance of stakeholders. The majority of those have not been part of the debate, such as urban road authorities and others with a stake in urban road infrastructure. Consequently, most European urban road infrastructure authorities are ill-prepared for the introduction of this "new technology" on their road network, because their road infrastructure is "only" designed for conventional vehicles.	
Intended aims and outcomes with reference to social equity: CoEXist is a European project which prepares the transition phase during which automated and conventional vehicles will co-exist on cities' roads. It bridges the gap between automated vehicles (AVs) technology, transportation and infrastructure planning, by strengthening the capacities of urban road authorities and cities to plan for the effective deployment of Avs. AV-ready transport and infrastructure planning in cities is a key precondition for fulfilling the promises of automated vehicles to reduce road space demand and improve traffic efficiency and safety – without it, automated vehicles could simply increase the urban mobility problems that road authorities are currently facing. In this context, CoEXist intends to increase the capacity of road authorities and other urban mobility stakeholders to get ready for the transition towards a shared road network with increasing levels of automated vehicles. In terms of social equity, the project endorses a vision in which accessibility and acceptability will be improved.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	CCAM are expected to improve accessibility in cities.
Affordability	
Acceptability	The participation of civil society groups is important to increase acceptability and help co-create solutions that are user centric.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	Elderly and disabled are expected to be among the key beneficiaries of CCAM in terms of **major accessibility**.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	

Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.8 C-ROADS- The Platform of harmonised C-ITS deployment in Europe

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: C-ROADS- The Platform of harmonised C-ITS deployment in Europe-. This project has received funding from the European Union's Connecting Europe Facility programme. Duration: 01/02/2016 – 01/12/2022 https://www.c-roads.eu/platform.html	
Background to the project/initiative: The C-Roads Platform is a joint initiative of European Member States and road operators for testing and implementing C-ITS services considering cross-border harmonisation and interoperability.	
Intended aims and outcomes with reference to social equity: The deployment of C-ITS faces many important issues still unresolved, such as legal, organisational, administrative, governing aspects, technical and standardisation issues as well as implementation and procurement issues. The C-Roads Platform is a cooperation of Member States and road operators working on the deployment of harmonised and interoperable C-ITS services in Europe. the participation Members are committed to the Terms of Reference. Concerning CCAM, the project provided contributions towards a harmonised data layer and data exchange process in the field of certification schemes as well as reliable testing procedures. The future vision of 100% Cooperative, Connected and Automated Mobility (CCAM) requires this as one essential building block. As such, no implications on social equity were considered.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**Technical Reliability**: providing contributions towards the set-up of an optimal technological environment for the development C-ITS services.
Accessibility	
Affordability	
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.9 CityMobil2- Cities demonstrating cybernetic mobility

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: CityMobil2- Cities demonstrating cybernetic mobility - This project has received funding from the European Union's FP7-TRANSPORT - Transport (Including Aeronautics) - Horizontal activities for implementation of the transport programme (TPT) Duration: 09/2012 -08/2016 https://trimis.ec.europa.eu/project/cities-demonstrating-cybernetic-mobility	
Background to the project/initiative: European cities face four main mobility problems: congestion, land use, safety and environment. One of the main causes of such problems is the car-ownership rate. The centres of large cities address this issue combining efficient mass transits with car restriction policies, but peripheral areas and smaller cities remain dominated by private cars. The development of Automated Road Transport System (ARTS) may be a solution.	
Intended aims and outcomes with reference to social equity: The CityMobil2 goal is to address the main barriers highlighted by CityMobil and finally to remove them. To ease the implementation process CityMobil2 has addressed the uncertainties which presently hamper procurement and implementation of automated systems. CityMobil has demonstrated how automating road vehicles can lead to different transport concepts, from partly automated car-share schemes through CyberCars and PRT, to BRT which can make urban mobility more sustainable. CityMobil2 has also highlighted three main barriers to the deployment of automated road vehicles: the implementation framework, the legal framework and the unknown wider economic effects. Social equity impacts as such were not considered. In terms of social equity, the project focused mainly on pre-cponditions for improving acceptability.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	The social impacts computed with the qualitative methodology include **safety and accessibility for disabled and elderly people**. According to the computations, these social impacts will be positive in the collective automated scenario, for all urban contexts, while in the private automated scenario the impact on safety is assumed moderately negative, as the reduction of self-driving vehicle **accident risk would be more than offset by a significant increase in the total mileage**.
Affordability	
Acceptability	Survey on the factors improving acceptability among the users: over 1 500 ARTS users were interviewed to assess their perception of the ARTS service. ARTS users were rather satisfied with the performance of the ARTS vehicles with **higher-than-average ratings on comfort, information availability and safety**. The factor mapping of user acceptance and quality of service showed that there is room for improvement, although the later demonstrations with the more advanced vehicles showed an improvement in user views of service quality. ARTS users were willing to pay for ARTS services, but not at a price higher than that of the conventional equivalent
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	Since elderly-related incidents have greater impact and likelihood of occurrence, **safety regarding the elderly should define the baseline for the safe integration of ARTS in urban areas**. **Accessibility is considered to improve substantially for people with disability**.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	

Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.10 DIAMOND - Revealing fair and actionable knowledge from data to support women's inclusion in transport systems

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: DIAMOND - Revealing fair and actionable knowledge from data to support women's inclusion in transport systems This project has received funding from the European Union's Horizon 2020 research and innovation programme Duration: 11/2018 - 01/2022 https://diamond-project.eu/	
Background to the project/initiative: DIAMOND project analysed and converted data into knowledge with notions of impartiality to support gender inclusion in current and future transport systems from the perspective of women as transport users and as professionals in the sector.	
Intended aims and outcomes with reference to social equity: DIAMOND developed tools and guidelines to promote gender equality in the transport and mobility sector, based on the assessment of transport users' needs and drawing on big data and machine learning techniques. A toolbox for assessing the inclusivity of transport services, including recommendations for assisting profiles, was tested and validated with transport sector companies across Europe, to be targeted at transport operators, public planners and transport employers. DIAMOND focused on three key areas impacting women's engagement with public transport: capacity to address basic mobility needs, physical and monetary accessibility, and safety and security. The team carried out trans-European qualitative and quantitative data collection on diversity and gender-sensitive issues focused on: railways and public multimodal transport, autonomous vehicles, bicycle-sharing services, alongside Corporate Social Responsibility and employment.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	Accessibility focuses on **major flexibility in use** (nomadic traveller), design, e.g., children friendly and ergonomics.
Affordability	Affordability has a **strong gender bias** and attention to functional diversity.
Acceptability	Analysis of priority recommendations addressing key factors to improve the acceptance of autonomous vehicles by women.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	Women are **more reluctant to give power to the vehicle**, the key elements to remedy this situation may be proper training and communication between the vehicle and the passenger. **Women ergonomics** must be applied in design such as anthropometrics, reaches, forces and consider women variability and pregnancy. In addition to the physical and physiological differences CAV should consider gender factors for a fair design. • Gender differences must be explored to study different patterns of use for defining product users' needs and in design solutions. • Gender and other related intersectional variables should be identified and considered to stablish a proper user centred design. process and validation ensuring any disadvantage in the identified groups. CAV HMI provides a Gender-Neutral Conversation.

Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.11 DIRIZON – Planning for Autonomous Vehicles

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: DIRIZON – Planning for Autonomous Vehicles Project funded by the CEDR (Conference of European Directors of Road) Transnational Road Research Programme Call 2017 "Automation". Duration: 01/09/2018 - 31/08/2020 https://www.dirizon-cedr.com/	
Background to the project/initiative: The Digitalisation of road networks and the rapid developments in Automated Driving will affect the core activities that NRAs (National Road Administration) carry out, offering new (business) opportunities and providing NRAs with new and more efficient ways to achieve goals for road safety, traffic efficiency, the environment and customer service. DIRIZON was a two-year project funded under the CEDR 2017 Automation call which commenced in September 2018, and aimed to assist the NRAs in moving towards the Digitalisation of their road networks and Automated Driving.	
Intended aims and outcomes with reference to social equity: The DIRIZON project's goal was to support NRAs in identifying how the above developments will affect their operations and their interaction with other actors. In order to achieve this goal, the project. • Determines the implications of digitalisation and automated driving on use cases, and their consequences on data needs and requirements for both the NRAs and for a data-exchange platform. • Understands the current and future relationships with other actors around data exchange and how these relationships may evolve in the future. • Understands the current and future roles and responsibilities of NRAs and other actors in respect of digitalisation and automated driving. • Determines the requirements for data-sharing platforms. • Explores business model archetypes for the exploitation of a data exchange platform. • Develops a step-by-step transition towards full digitalisation of NRAs Road networks. The project focuses on the pre-conditions for acceptance with reference to the following groups of stakeholders: NRA, Communication Network, Road Operators (public/private), Transport authorities (national/regional), Communication network providers, (Digital) Map Providers and OEMs (Original Equipment Manufacturers). Road users' point of view is marginal.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Acceptance: data needs and requirements for **data-exchange** are especially based on the selected use cases (core topics) as follows: 1. Provision of High-Definition (HD) maps for automated mobility 2. Distribution of digital traffic regulations 3. Infrastructure support services for Cooperative Automated Driving.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	

Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.12 Drive2thefuture - Needs, wants and behaviour of 'Drivers' and automated vehicle users today and into the future

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: Drive2thefuture - Needs, wants and behaviour of 'Drivers' and automated vehicle users today and into the future. This project has received funding from the European Union's Horizon 2020 research and innovation programme Duration: 05/2019 – 04/2022 https://www.drive2thefuture.eu/	
Background to the project/initiative: Drive2theFuture's mission is to prepare "drivers", travellers and vehicle operators of the future to accept, and use connected, cooperative and automated transport modes and the industry of these technologies to understand and meet their needs and wants.	
Intended aims and outcomes with reference to social equity: The overall goal of the Drive2TheFuture project is to raise awareness and enhance acceptance for automated vehicles (AV) in the public. In this view, AVs development should be coherent, in order to support their behaviour understanding and their acceptability by the public. Among the topics of the project, the most relevant ones concerning social equity are those related to the identification and clustering of the different categories of "drivers", travellers and stakeholders involved in or affected by autonomous vehicles, recognising their needs and defining relevant use cases, taking into account issues of transferability of solutions between different transport modes.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	Benefits in terms of accessibility, by providing the **opportunity to offer independent mobility to communities** who are underserved at present (i.e., isolated rural communities, disabled groups etc.)
Affordability	The project claims that it **Avs should also be financially affordable** to avoid a rejection from a population category that might not be able to afford this kind of mobility.
Acceptability	Drive2TheFuture analysed people's thoughts and perceptions regarding CCAM via pilot results, a survey (over 11 500 participants) and a social media sentiment analysis (over 100 000 posts analysed). **Lack of knowledge about and experience** with CCAM technologies was the most common reason for hesitancy in CCAM acceptability.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	Acceptance of the technology depends largely on **the age of the users, being easier to involve users under 50 years of age in its use,** and even easier if they are young people who are more accustomed to being daily users of public transport.
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	Benefits in terms of **accessibility (disabled groups etc.)** are considered particularly high.
Digitally vulnerable people.	
Women and gender related vulnerabilities.	Several studies show that **women and men express different** attitudes about autonomous cars (PEW Research Centre study,

	2022). In general, **men are more likely than women to respond positively to the proposed use of autonomous cars**, most women report they probably do not want to use driverless vehicles, even reporting that they would feel uncomfortable to share the road with driverless passenger vehicles. Also**, women have greater doubts about the safety of autonomous vehicles**, saying that they have doubts about the effect of autonomous vehicles wide spreading on the number of injured and killed people.
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	Benefits in terms of accessibility are considered relevant (i**.e., isolated rural communities)**
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.13 FABULOS - Future Automated Bus Urban Level Operation Systems

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: FABULOS - Future Automated Bus Urban Level Operation Systems This project has received funding from the European Union's Horizon 2020 research and innovation programme, Duration: 01/01/2018 - 01/03/2021 https://fabulos.eu/	
Background to the project/initiative: The FABULOS project seeks new solutions and technologies to prepare cities for the future of mobility, including concepts such as self-driving buses. Novel transport solutions are developed and acquired by utilising a Pre-Commercial Procurement (PCP), which allows the Procuring Partners to share the risks and benefits with the suppliers. The expected outcome of the FABULOS project is the demonstration of automated minibus service as part of the public transport system.	
Intended aims and outcomes with reference to social equity: The FABULOS solutions demonstrate that they can be fully commercialised and implemented into the public transport systems, provided that several legislative aspects and technical features are improved. Solid political planning and inclusion of all relevant stakeholders from the planning phase onwards was a key to the success of the project. Also, more harmonised and EU-wide regulation is needed to enable implementation of such pilots and the eventual integration of automated transportation in cities. In terms of social equity, the project mainly focused on acceptability among users. Several passenger surveys were carried out. Due to the COVID-19 pandemic from spring 2020 onwards, only a limited number of passengers were allowed on board the shuttles and therefore the number of completed surveys was relatively low during the field tests.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	User acceptance for **driverless vehicles is high** and attitudes positive, but the real need for such last-mile transport solution needs further investigation and testing**, notably in circumstances without any on-board steward.**
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	Disabled passengers tested the bus in Helsinki, **with lower personal safety scores compared** to other sites with no disabled users.
Digitally vulnerable people.	
Women and gender related vulnerabilities.	

Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.14 HADRIAN - Holistic Approach for Driver Role Integration and Automation Allocation for European Mobility Needs

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: HADRIAN - Holistic Approach for Driver Role Integration and Automation Allocation for European Mobility Needs This project has received funding from the European Union's H2020 research and innovation programme. Duration: 01/12/2019 - 31/05/2023 https://hadrianproject.eu/	
Background to the project/initiative: Fully autonomous driving consists of a vehicle operating without human interaction under virtually all operating conditions. Because such fully autonomous operations will be practically infeasible over the next 10 years on public roads in Europe at large, the human will likely remain key to create acceptable and practicable automated driving solutions. During manual driving, the main role of the driver is to manage the vehicle in a variety of environmental conditions and must remain continuously attentive and thus prepared to fulfil the requirements associated with the current conditions.	
Intended aims and outcomes with reference to social equity: The HADRIAN experimental studies examine specific aspects of the f-HMI (fluid Human Machine Interface) key elements that are particularly relevant for the understanding of the new driver role in highly automated vehicles and the associated necessary technical developments for the f-HMI. Different study designs and methods are used. In terms of social equity, the project addressed acceptability among users. No specification has been made by type of users (socio-economic groups, disabilities, etc).	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Among the scales that can be employed to evaluate several dimensions of user experience, two main tools have been selected, namely the User Experience Questionnaire (UEQ and UEQ+); and the System Usability Scale (SUS). The UEQ/UEQ+ cover a comprehensive impression of usability (three scales: efficiency, perspicuity, dependability) **and user experience aspects (three scales: originality, stimulation).** The participant is asked to rate the system along at least 26 dimensions (which number can increase in the UEQ+ version). The dimensions take the form of a semantic differential, meaning that each of them is represented by two words with opposite meanings (e.g., "boring" vs. "exciting", "fast" vs. "slow"), indicating the two polarities of a 7-point Likert scale.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	**Specific needs of specific populations are often overlooked**, need to be taken into consideration (e.g., professional or elderly drivers)
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	

Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.15 HEADSTART– Harmonised European Solutions for Testing Automated Road Transport

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: HEADSTART– Harmonised European Solutions for Testing Automated Road Transport Project funded by the European Commission's H2020 Societal Challenges - Smart, Green and Integrated Transport Duration: 01/01/2019 - 31/12/2021 https://cordis.europa.eu/project/id/824309	
Background to the project/initiative: Automated driving is expected to enable both safer and more sustainable transport on the European roads. The HEADSTART research project provides test methods to demonstrate that the functions used for automated driving will provide adequate safety.	
Intended aims and outcomes with reference to social equity: The HEADSTART (Harmonised European Solutions for Testing Automated Road Transport) project defines testing and validation procedures of Connected and Automated Driving (CAD) functions including its key enabling technologies (i.e. communications, cyber-security, positioning) by cross-linking of all test instances such as simulation, proving ground and real world field tests to validate safety and security performance according to the needs of key user groups (technology developers, consumer testing groups and type approval authorities). The project identifies five groups of users: 1. Vehicle manufacturers 2. Automotive suppliers 3. Policy Makers, Member States 4. Consumer organisation 5. Research institutes In terms of social equity, the project focuses on the conditions improving acceptability, considering the user as a future customer. No specific analysis has been carried out by type of users.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Social acceptance: AV. **Social acceptance will take time because not many people are concerned by these use cases**. If the CAD functions are working fine and do not cause accidents, then the public will accept them. Overall, the function will be socially accepted: - if the driver feels safe. - If the driver is not too confident in the system's abilities. - If there are very few accidents and fatal accidents.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	

Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.16 HIGHTS - High Precision Positioning for cooperative ITS applications

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: HIGHTS - High Precision Positioning for cooperative ITS applications This project has received funding from the European Union's Horizon 2020 research and innovation programme, Duration: 01/05/2015 - 01/04/2018 https://cordis.europa.eu/project/id/636537/	
Background to the project/initiative: Cooperative intelligent transport system (C-ITS) applications rely on the knowledge of the geographical positions of vehicles. Unfortunately, satellite-based positioning systems (e.g., GPS and Galileo) are unable to provide sufficiently accurate position information for many important applications and in certain challenging but common environments (e.g., urban canyons and tunnels).	
Intended aims and outcomes with reference to social equity: This project addresses this problem by combining traditional satellite systems with an innovative use of on-board sensing and infrastructure-based wireless communication technologies (e.g., Wi-Fi, ITS-G5, UWB tracking, Zigbee, Bluetooth, LTE...) to produce advanced, highly accurate positioning technologies for C-ITS. The results are integrated into the facilities layer of ETSI C-ITS architecture and made available for all C-ITS applications, including those targeting the challenging use cases Traffic Safety of Vulnerable Users and Autonomous Driving/platooning. The project as such did not address social equity issues.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**Fleet Management and Serviceability**: In the case of automated vehicle fleets, efficient fleet management practices are crucial for ensuring availability of some automated driving typologies, e.g., platooning.
Accessibility	
Affordability	
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.17 ICT4CART- Infrastructure for Connected and Automated Road Transport

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: ICT4CART- Infrastructure for Connected and Automated Road Transport This project has received funding from the European Union's H2020 research and innovation programme. Duration: 01/09/2018 – 01/08/2021 https://www.ict4cart.eu/	
Background to the project/initiative: The background of the project is the identification of functional and technical connectivity requirements, in addition to implement and test a standards-based distributed IT environment for data aggregation in an automated and interoperable way, leveraging also cloud technology. Other topics concern with the implementation of cyber-security and data protection privacy mechanisms and the improvement of localisation and adapt tools and algorithms for data fusion.	
Intended aims and outcomes with reference to social equity: The main goal of ICT4CART is to design, implement and test in real-life conditions a versatile ICT infrastructure that will enable the transition towards higher levels of automation (up to L4) addressing existing gaps and working with specific key ICT elements, namely hybrid connectivity, data management, cyber-security, data privacy and accurate localisation. As such, no implications on social equity were considered.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**Identification of connectivity requirements** to implement new services and IT applications, including data protection and cyber security
Accessibility	
Affordability	
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.18 INFRAMIX- Road Infrastructure ready for mixed vehicle traffic flows

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: INFRAMIX- Road Infrastructure ready for mixed vehicle traffic flows This project has received funding from the European Union's H2020 research and innovation programme. Duration: 01/06/2017 – 01/05/2020 https://www.inframix.eu

Background to the project/initiative: As the construction of new roads is an expensive and time-consuming project while Europe has already a quite mature road network, and because roads have a quite long lifecycle (especially compared with vehicles), the only way to prepare our existing road network for automation is through targeted interventions both physical and digital. This is even more important for the long transition period where we expect a step-by-step introduction of automation and mixed traffic on roads with different capabilities and installed equipment.
Intended aims and outcomes with reference to social equity: The main objective of INFRAMIX is to prepare the road infrastructure with specific affordable adaptations and to support it with new models and tools, to accommodate for the stepwise introduction of automated vehicles. INFRAMIX is expected to have an important impact as it will deliver specific solutions with tangible integrated interventions, both physical and digital. These are tested and validated beforehand using innovative modelling technologies (new traffic flow models and advanced simulation tools) guaranteeing this way their efficiency, traffic safety but also users' appreciation and acceptance. No specific analysis has been conducted by type of users.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	The evaluation of users 'appreciation **has been conducted in terms of specification of digital and physical elements** (e.g., new visual signs) of the road infrastructure. Target users were mainly located in the supply side: industry, infrastructure and Road authorities, service providers, public administrations and scientific community.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.19 INTERACT - Designing cooperative interaction of automated vehicles with other road users in mixed traffic environments

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: INTERACT - Designing cooperative interaction of automated vehicles with other road users in mixed traffic environments This project has received funding from the European Union's H2020 research and innovation programme. Duration: 01/05/2017 - 30/04/2020 https://www.interact-roadautomation.eu/
Background to the project/initiative: As Automated Vehicles (AVs) will be deployed in mixed traffic, they need to interact safely and efficiently with other traffic participants. The interACT project works towards the safe integration of AVs into mixed traffic environments. In order to do so, interACT analyses todays' human-human interaction strategies, and implement and evaluate

solutions for safe, cooperative, and intuitive interactions between AVs and both their on-board driver and other traffic participants.
Intended aims and outcomes with reference to social equity: The project aims at studying human interactions and develop psychological models of interaction between different road users that help with the design and selection of appropriate and safe interaction strategies for AVs. In more detail, interACT: • Improve methods for assessing the intentions and predicting the behaviour of other traffic participants. • Develop a novel Cooperation and Communication Planning Unit (CCP Unit) to enable the integrated planning and control of AV's behaviour, and the provision of time-synchronised Human Machine Interfaces for both the user on-board and surrounding road users. • Develop a safety layer and provide fail-safe trajectory planning using formal verification methods to ensure safety in mixed traffic environments and reduce certification costs. • Develop novel human-vehicle interaction designs and HMI elements to assist the interaction of the on-board user, the AV, and other road users, thus ensuring expectation-conforming behaviour by the AV. • Establish new evaluation methods for studying the interactions of road users with AVs, and user acceptance of these vehicles.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	The study revealed positive effects of the eHMI (External Human-Machine Interface). **A three-way log linear model revealed that the gap acceptance increased with the level of signal**.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.20 L3PILOT - Design and carry out full scale demonstrations of urban transport automation by deploying fleets of autonomous mini-buses in low to medium demand areas in cities

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: L3PILOT – Piloting Automated Driving on European Roads Project has received funding from the European Union's Horizon 2020 research and innovation programme. Duration: 01/09/2017 - 31/10/2021 https://l3pilot.eu/
Background to the project/initiative: Automated driving technology has matured to a level motivating a final phase of road tests which can answer key questions before market introduction of the systems. The European research project L3Pilot tests the viability of automated driving as a safe and efficient means of transportation on public roads. It focuses on large-scale piloting of SAE Level 3 functions, with additional assessment of some Level 4 functions. The functionality of the systems is

exposed to variable conditions with 1,000 drivers and 100 cars across ten European countries, including cross-border routes.
Intended aims and outcomes with reference to social equity: The technologies being tested cover a wide range of driving situations, including parking, overtaking on highways and driving through urban intersections. The tests provide valuable data for evaluating technical aspects, user acceptance, driving and travel behaviour, as well as impact on traffic and safety. With the comprehensive piloting of automated driving functions in test vehicles, L3Pilot paves the way for large-scale field tests of series cars on public roads. In terms of social equity, the project focuses on the pre-conditions and requirements for a better users' acceptance.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	**User acceptance and trust** are key factors for the success of automated driving on the market.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	**The effect of age on the acceptance and use of conditionally automated was generally small, but not in the case of gender**. Males had indeed higher intentions to use conditionally automated cars in all four environments (i.e., on urban roads, motorways, in parking, traffic jams). People aged between 30-39 had the highest intention to use, followed by people aged between 18 and 29. People aged +60 had the lowest intention to use scores across all four environments.
Older people (65 years old and over).	The project has investigated the influence of age and gender on the intention to use conditionally automated cars. The project found small negative effects of age and gender ($r < 0.10$). **This suggests that elderly people were less likely than younger people to intend to use conditionally automated cars.**
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	A negative correlation was found between a country's developmental status and the overall intention to use conditionally automated driving functions. There was a significant negative correlation between a country's developmental status (GDP per capita) and the overall intention to use Automatic Driving Functions (ADFs). **On average, respondents from higher-GDP countries were more neutral regarding their intention to use ADFs, compared to those from lower-GDP countries, who tended to have higher Intention to use scores**.
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.21 LEVITATE - Societal Level Impacts of Connected and Automated Vehicles

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: LEVITATE - Societal Level Impacts of Connected and Automated Vehicles This project has received funding from the European Union's Horizon 2020 research and innovation programme, Duration: 01/12/2018 - 01/12/2021 https://levitate-project.eu

Background to the project/initiative: Connected and automated transport systems (CATS) are expected to be introduced in increasing numbers over the next decade. Automated vehicles have attracted the public imagination and there are high expectations in terms of safety, mobility, environment and economic growth. With such systems not yet in widespread use, there is a lack of data and knowledge about impacts. Furthermore, the potentially disruptive nature of highly automated vehicles makes it very difficult to determine future impacts from historic patterns. Estimates of future impacts of automated and connected mobility systems may be based on forecasting approaches, yet there is no agreement over the methodologies nor the baselines to be used. The need to measure the impact of existing systems as well as forecast the impact of future systems represent a major challenge.	
Intended aims and outcomes with reference to social equity: LEVITATE's aim is to develop a new impact assessment framework to enable policymakers to manage the introduction of connected and automated transport systems, maximise the benefits and generally harness the technology to achieve societal objectives. In terms of social equity, the project focused on the pre-conditions to improve accessibility and acceptability	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	Improved accessibility to mobility services. According to experts in the Delphi study, **automation is expected to improve the equal accessibility of transport to people of all means and abilities**.
Affordability	
Acceptability	Public acceptance and trust are considered fundamental for the implementation of connected and automated urban transport systems. **For this reason, authorities must use social media to promote automated urban transport**.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	The use of automated vehicles may **make vehicle transport possible for travellers who do not drive**, such as children, the elderly, those with a disability, or others without a driver's license.
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.22 MANTRA - Making full use of Automation for National Road TRansport Authorities

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: MANTRA - Making full use of Automation for National Road TRansport Authorities This project has received funding from the 2017 CEDR (Conference of European Directors of Roads) call "Automation". Duration: 01/09/2018 - 30/09/2020 https://mantra-research.eu/
Background to the project/initiative: The development of various types of automated vehicles is progressing slowly towards higher levels of automated driving. Introduction of automation will impact the mobility and travel behaviour, driving behaviour and traffic flow, traffic safety and energy and environment. This impacts the core business of National Road Authorities (NRAs), including operational processes and maintenance. Therefore, this project assesses the implications of connected and automated driving using simulation studies, followed by the impact of automation on operational processes and the overall impacts of automation on NRA key policy targets.

Intended aims and outcomes with reference to social equity: MANTRA responds to CEDR 2017 call: How automated vehicle will change the core business of NRA's? In practice this means finding out what are the influences of automation on the NRAs core business in relation to road safety, traffic efficiency, the environment, customer service, maintenance and construction processes. Furthermore, how will the current core business on operations & services, planning & building and ICT change in the future? The work is divided in five work packages: • Project management • Deployment of automated functions up to 2040 • Impacts of automation functions on NRA policy targets • Consequences of automation functions to infrastructure • Changes in road operator core business. In terms of social equality, the project addresses acceptability, but no specific analysis has been carried out by type of users.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	User acceptance and hence use of automated vehicles is important when estimating the impacts. **User acceptance can guide the adoption or rejection of systems** and must therefore be examined in detail to understand what is acceptable and what is not, and for what kind of reasons.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.23 MAVEN - Managing Automated Vehicles Enhances Network

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: MAVEN - Managing Automated Vehicles Enhances Network This project has received funding from the European Union's Horizon 2020 research and innovation programme, Duration: 01/09/2016 - 01/08/2019 http://www.maven-its.eu/
Background to the project/initiative: The MAVEN background lies in managing automated vehicles at signalised intersections and corridors. This is achieved through platoon organisation and negotiation algorithms, which extend and connect vehicle systems for trajectory and manoeuvre planning and infrastructure systems for adaptive traffic light optimisation.
Intended aims and outcomes with reference to social equity: The main aim of MAVEN is to enhance intelligent urban road transport network and cooperative systems for highly automated vehicles. Sub-objectives are: • Develop a generic multi-level system for the guidance of highly automated vehicles, applied to dynamic platoons at signalised intersections and signalised corridors.

• Contribute to the development of C-ITS communication standards, in particular message sets for vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) interactions to support vehicle platooning and negotiation and scheduling algorithms. • Develop and integrate ADAS techniques to prevent and/or mitigate dangerous situations considering Vulnerable Road Users (e.g., pedestrians and/or cyclists). • Develop, test, demonstrate and evaluate the MAVEN system for signalised intersections and signalised corridors, including local level routing strategies, traffic light optimisation and trajectory planning, by means of a real-world prototype vehicle and traffic simulation studies. • Produce a roadmap for the introduction of future traffic management systems. In terms of social equity, the project mainly focused on acceptability, involving stakeholders in workshops to discuss the relevant topics.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**Monitoring and Diagnostics**: Automated vehicles can incorporate advanced monitoring and diagnostic systems that constantly assess the vehicle's health and performance, including techniques to **prevent and mitigate dangerous situations** to users.
Accessibility	
Affordability	
Acceptability	**Awareness and education:** Whether the introduction of new technology is going to be a success depends strongly on the acceptance of the stakeholders at all levels. **And the acceptance of stakeholders depends strongly on whether they are well informed** about the changes and their consequences.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	The project showed the need to develop and integrate **Advanced Driver Assistance Systems** (**ADAS) techniques to prevent and/or mitigate dangerous situations considering Vulnerable Road Users** (VRUs, e.g., pedestrians and/or cyclists).

8.24 MEDIATOR MEdiating between Driver and Intelligent Automated Transport systems on Our Roads

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: MEDIATOR - Project MEDIATOR MEdiating between Driver and Intelligent Automated Transport systems on Our Roads This project has received funding from the European Union's H2020 research and innovation programme. Duration: 01/05/2019 - 30/04/2023 https://mediatorproject.eu/
Background to the project/initiative: Automated transport technology is developing rapidly for all transport modes, with huge safety potential. The transition to full automation, however, brings new risks, such as mode confusion, overreliance, reduced situational

awareness and misuse. The driving task changes to a more supervisory role, reducing the task load and potentially leading to degraded human performance. Similarly, the automated system may not (yet) function in all situations.
Intended aims and outcomes with reference to social equity: The objective of the mediator system is to intelligently assess the strengths and weaknesses of both the driver and the automation and mediate between them, while also considering the driving context. MEDIATOR optimises the safety potential of vehicle automation during the transition to full (level 5) automation. It aims at reducing risks, such as those caused by driver fatigue or inattention, or on the automation side imperfect automated driving technology. MEDIATOR facilitates market exploitation by actively involving the automotive industry during the development process. In terms of social equity, the project addressed acceptability among users of the MEDIATOR tool, including the analysis of driver characteristics effects such as age, gender and driving experience.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	It has been found that Mediator tool is **rated positively (e.g., high acceptance, trust, experienced comfort, perceived safety**) and will be preferred compared to manual driving.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	The oldest age groups expected greater increases in safety as well as greater decreases in number of accidents and their severity, as well as felt slightly safer than the other age groups. However, these differences **were still relatively small and the statistical analyses for the acceptance scale and trust in automation scale did not reveal any significant effects of the driver characteristics**.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	Overall, **the driver characteristics seemed to have relatively little or no systematic influences on the participants' responses**. For instance, participants' **gender seemed to have the least strong influence on their responses**, since no noticeable, systematic differences were found between female and male participants.
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.25 PAsCAL - Enhance driver behaviour & Public Acceptance of CAVs

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: PAsCAL - Enhance driver behaviour & Public Acceptance of CAVs This project has received funding from the European Union's Horizon 2020 research and innovation programme. Duration: 06/01/2019 - 05/01/2022 https://www.pascal-project.eu/
Background to the project/initiative:

The PAsCAL project, funded under the "Horizon 2020" Research and Innovation program, has the goal to provide insights and develop a better understanding about citizens' and stakeholders' expectations for connected and automated vehicles (CAVs), and the acceptance of CAVs.
Intended aims and outcomes with reference to social equity: The outputs of project surveys and virtual experiments provide a better understanding of the reasons for the distrust towards CAVs currently expressed by many European citizens. They describe reactions and behaviours in different situations and allow conclusions to be drawn in terms of vehicle design, human-machine interface layout and a more holistic organisation of the transport system.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Acceptability among CCAM users is the key equality dimension addressed by the project.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	The project analysed acceptance from the perspective of demographics: the main finding was that a clear relationship exists between **age and the intention to use CAVs, with older participants having lower intentions**. This relationship is especially prominent for factors safety and privacy.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	A specific focus, as part of the PAsCAL project, is reserved for people who are currently unable to drive traditional vehicles; **blind or partially sighted citizens** are a specific user group being considered by the project. For these road users, connected autonomous driving potentially offers **many advantages in terms of freedom of movement and increased personal autonomy**. Frustrations with ease of use and safety might be especially pronounced for visually impaired citizens, who despite this evaluate CAVs more optimistically.
Digitally vulnerable people.	
Women and gender related vulnerabilities.	A gender variation was found for intention to use as well, with men. providing **higher mean ratings than women on average**. In terms of expected consequences, this was the case for almost all factors, i.e., safety, privacy, sustainability, affordability, and ease of use.
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.26 PAV – Planning for Autonomous Vehicles

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: PAV – Planning for Autonomous Vehicles Project funded by the European Commission's ERDF programme Interreg North-Sea Region Duration: 01/09/2019 - 31/08/2022 https://northsearegion.eu/pav/partners/
Background to the project/initiative: Autonomous Vehicles (AVs), or self-driving vehicles, promise widely available, low-cost, clean, door-to-door transport for people and goods. Widespread use on Europe's roads is anticipated by the 2030s and is expected to have numerous societal implications for equity, health, economy, and governance resulting in potential impacts on city development and design (from street to district- and regional development).

Intended aims and outcomes with reference to social equity: AV aims to stimulate the uptake of electric, shared AVs by developing green transport and spatial planning strategies that incorporate AVs. PAV brings together four local/transport authorities (UK, DE, NL and SE), four knowledge groups and four network organisations that aims at: • Developing and improving green transport and spatial planning strategies for the participating local- and transport authorities. • Preparing a publicly available series of expert analysis on the socio-economic impact of AVs. • Creating an open and scalable innovation community connecting cities, regions and knowledge providers on AVs. • Implementing four urban/regional AV pilots integrated with other, existing transport modes. In terms of social equity, the project deals with all the four dimensions of social equity, with a special attention given to social impacts for vulnerable and disadvantaged groups (i.e., children, elderly, women, single parents, people living in deprived areas, people with reduced mobility, low-skilled people, unemployed people, low-income groups, ethnic minorities, migrants).

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**Commercial availability** acting as key milestones needs to make CCAM profitable, feasible and of good quality compared to non-automated services
Accessibility	By reducing operating costs, CCAM has the potential to increase transport offerings at affordable prices, **boosting transport accessibility and inclusivity**.
Affordability	CCAVs need to **become commercially viable in terms of affordability** and availability on the market to ensure increased profitability of public transport fleets.
Acceptability	Social acceptance: public perceptions of CCAM that either increase or limit the **adoption of the technology is considered one of the key barriers hampering future developments and take-up of AV**.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	Disadvantaged and vulnerable groups like elderly, children, low-income groups, etc. **will be able to travel independently.**
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	Low-income groups, ethnic minorities, migrants, that might be considered as "transport poor", **could mainly benefit from CCAM introduction**.
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.27 Ride-to-Autonomy - EU-funded project that demonstrates autonomous shuttles' integration into the transport system in ten EU cities

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: Ride-to-Autonomy - Demonstrating autonomous shuttles' integration into the transport system in ten EU cities Project funded by EU DG Connect 2020. Work Programme for Pilot Projects and Preparatory Actions in the field of "Communications Networks, Content and Technology" – Pilot Project Smart urban mobility involving autonomous vehicles Duration: 04/2021 – 11/2022 https://summalab.nl/r2a/
Background to the project/initiative:

The project aims at harmonising research and innovation efforts around automated shuttle solutions by assembling the lessons learned not just from the project's ten pilot sites from ten EU member states, but also from several further sites and national networks like Summalab that have expressed their willingness to exchange their knowledge and lessons learned through their own demonstration projects and activities.
Intended aims and outcomes with reference to social equity: The Project was awarded under the 2020 Work Programme for Pilot Projects and Preparatory Actions in the field of "Communications Networks, Content and Technology" – Pilot Project Smart urban mobility involving autonomous vehicles. The project ended on 30 November 2022. One of the key outcomes is the creation of the "Scalable Model" Toolbox, guiding cities to integrate autonomous shuttle solutions into their public transport system. It is available on the dedicated website: https://ride2autonomy.eu/. Due to the variety in approach and context in the ten pilot sites, the project provides guidelines for other cities to replicate the experience and lessons learned. The project analyses the system performance in view of safety and environmental impact, as well as its multimodal integration with the transport network. The individual and public response, as well as socio-economic potential of the services, are also looked at. Ride2Autonomy helps to develop new mobility concepts for passengers leading to healthier, safer, more accessible, sustainable, cost-effective and demand-responsive transport. In terms of social equity, the focus is on the pre-conditions for elderly, disabled and children.
PART 2 – THE DIMENSIONS OF EQUALITY
What are the main dimensions of equality addressed by the project/initiative?

Availability	
Accessibility	To increase Users demand, **autonomous shuttles should be act as a 'feeder-service' with the existing public transport options**. This shared service would act as a feeder service to public transport for the first/last mile.
Affordability	
Acceptability	Before the implementation of new autonomous vehicles**, it is important to give citizens opportunities to see, experience, and study them to improve their understanding of such transport modes** and therefore increase their trust.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	If used more by certain user groups (like elderly/persons with reduced mobility/children) **then slower speed is acceptable and even preferred**.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	**Blind and visually impaired people (BVIP) could face difficulties in the outdoor navigation of the urban environment**, such as physical surroundings understanding, obstacle avoidance, crossing the street and using public transportation systems, due to their vision restrictions. With respect to the latter case, on top of the availability of information on board, **BVIP need accurate information when accessing public transport CAV services**. Information could cover aspects such us the location of stops and oncoming services at each stop.
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.28 SCOUT - Safe and COnnected aUtomation in road Transport

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: SCOUT - Safe and COnnected aUtomation in road Transport This project has received funding from the European Union's Horizon 2020 research and innovation programme,

Duration: 01/07/2016 - 30/06/2018 https://cordis.europa.eu/project/id/713843
Background to the project/initiative: The analysis starts from a thorough consideration of the concerns and expectations from the perspectives of users, suppliers of the technology and experiences from projects and field tests. Alternative strategies for the implementation of automated driving have been developed in the project, under due consideration of different innovation cycles in the related industries (automotive, telecom, infrastructure, services) and the pending challenges regarding framework conditions (legal, testing & validation, safety & security).
Intended aims and outcomes with reference to social equity: The project ""Safe and COnnected aUtomation in road Transport"" (SCOUT) aims at identifying pathways for an accelerated proliferation of safe and connected high-degree automated driving in Europe, considering user needs and expectations, technical and non-technical gaps and risks, viable business models as well as international cooperation and competition. Regarding the perceived use cases for connected automation in road transport, technical und non-technical gaps and risks for the implementation have been identified, assessed, and ranked.
PART 2 – THE DIMENSIONS OF EQUALITY
What are the main dimensions of equality addressed by the project/initiative?

Availability	
Accessibility	Under the different scenarios, providing **accessibility to people currently unable to drive (e.g., elderly, and disabled people) or to those that cannot afford to own a car**; etc. are considered as an important feature of connected and automated transport.
Affordability	**Affordability is still seen as one of the biggest hurdles** for customers to buy these technologies.
Acceptability	**Customer and societal acceptance** represent one of the key issues underpinning the success of automated driving. Societal acceptance is pending with issues like **safety, trust, security, privacy concerns**. Acceptance will depend on the likely deployment scenarios and feelings towards it and may be very different for example towards truck platoons on the motorway or low speed delivery vehicles on separate infrastructure in urban areas. Furthermore, the acceptance is linked to a unanimous understanding and agreement of **the benefits from automated driving (comfort, efficiency, safety, social inclusion**, etc.).
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	Elderly and disabled people could indeed benefit of automated driving **because they would not have to drive** (if CAD level 5) or would not have to drive constantly would also share vehicles with other occupants (in case of car sharing).
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	Social inclusion is considered important, **by enabling automated public transport in remote areas where today it is not feasible**.
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.29 SHOW - Shared automation Operating models for Worldwide adoption

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: SHOW - Shared automation Operating models for Worldwide adoption This project has received funding from the European Union's Horizon 2020 research and innovation programme, Duration: 01/01/2020 - 01/01/2024 https://show-project.eu/objectives/

Background to the project/initiative: The arrival of automated vehicles (AVs) represents a unique opportunity for a fundamental change in urban mobility. That is, when AVs are integrated into an integrated public transport network. If AVs are use in shared and connected fleets, they could dramatically reduce the number of cars on the road by reaching people and places it was too difficult to before, plugging first/last-mile gaps and feeding into public transport trunk lines.	
Intended aims and outcomes with reference to social equity: The SHOW project aims to advance sustainable urban transport through technical solutions, business models and priority scenarios for impact assessment, by deploying shared, connected, electrified fleets of automated vehicles in coordinated Public Transport (PT), Demand Responsive Transport (DRT), Mobility as a Service (MaaS) and Logistics as a Service (LaaS) operational chains in real-life urban demonstrations across Europe. The project is mainly oriented to the understanding of the user requirements on the supply side: OEM (Original Equipment Manufacturer), Transport/Mobility operators, Services companies, Suppliers technology providers, etc. In terms of social equity, the results are not available, the project being still on going. Final impacts are expected to be estimated with reference to Vulnerable Road Users (cyclists, passengers).	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	As much as any collective transportation option, shared **CCAM services should be accessible to all passengers**, including people with disabilities, visually impaired people, older people, children and families.
Affordability	
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	Inequality in transport: Expected analysis to which degree are transport services used by socially disadvantaged and **vulnerable groups, including people with disabilities and with reduced mobility**.
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	**Automated vehicles need to interface with pedestrians and passengers** at stops and to communicate to other vehicles like public transport busses in order to free bus stops.

8.30 SOHJOA BALTIC - Researches, promotes and pilots automated driverless electric minibuses as part of the public transport chain, especially for the first/last mile connectivity

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: SOHJOA BALTIC - Researches, promotes and pilots automated driverless electric minibuses as part of the public transport chain, especially for the first/last mile connectivity. This project has received funding from the EU Interreg – Baltic Sea Region programme. Duration: 01/10/2017 - 01/09/2020 https://www.sohjoabaltic.eu/

Background to the project/initiative: The volume aims to aid piloting and implementing automated shuttles in the public transport sector in the short time frame of 2020 – 2025. Prospects and possible impacts are forecasted for a longer time frame as the technology is rapidly evolving and most of the more promising applications will not realize in the shorter time frame. The projected future scenarios are essential to aid the short-term decision-making.	
Intended aims and outcomes with reference to social equity: Sohjoa Baltic research promotes, and pilots automated driverless electric minibuses as part of the public transport chain, especially for the first/last mile connectivity. The project brings knowledge and competence on organising environmentally friendly and smart automated public transport. It also provides guidelines on legal and organisational setup needed for running such a service in an efficient way. Sohjoa Baltic consortium has partners from Finland, Estonia, Sweden, Latvia, Germany, Poland, Norway and Denmark with area and public transportation planning expertise as well as legal expertise combined with strong technical understanding which are the requirements for enabling autonomous traffic. The project deals with social equity in terms of major accessibility for vulnerable groups and acceptance for everyone.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	Automated shuttle buses need **to provide at least equal accessibility** for vulnerable passenger groups, such as the elderly, people with disabilities, or children, compared to other modes of public transport
Affordability	
Acceptability	According to the study, **passenger acceptance of automated shuttle buses seems high, even though the technology is not fully mature**. Perception of personal security may change, for example when services are provided during the night without an operator on board. This remains to be seen when automated public transport is used more widely.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	Currently, the most widely acknowledged downside of automated public transport is **the risk of worsening accessibility for people with physical disabilities**.
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	In Sohjoa Baltic pilots, passengers were asked whether the automated shuttle bus would be suitable as a school bus. **While the responses show variation, as seen, most consider it suitable at least if children are attended and many (40-60% of responses) would allow children to use the automated shuttle bus alone for trips to and from school.**

8.31 STAPLE - SiTe Automation Practical Learning

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: STAPLE - SiTe Automation Practical Learning This project has received funding from the 2017 CEDR (Conference of European Directors of Roads) call "Automation". Duration: 01/08/2018 - 31/08/2023 https://www.stapleproject.eu/about
Background to the project/initiative:

The project builds on previous work by CEDR and others (EU and national level projects) as well as on FEHRLs test sites experience gained through various Scanning Tours organised in recent years. The consortium partners have been involved in several relevant research projects (BRAVE, COBRA & ANACONDA, Forever Open Road, SCOOP@F, UDRIVE) and therefore, already have an in-depth knowledge of the methodologies and approached developed around automated driving. This pre-existing knowledge is combined with desk research and consultations with selected automated driving test sites to produce a comprehensive catalogue of the latest information and guidance on connected and automated driving test sites in Europe and beyond, with specific emphasis on NRAs (National Roads Administration) core business influence.
Intended aims and outcomes with reference to social equity: The overall aim of STAPLE is to provide a comprehensive review of technological and non-technological aspects of the most relevant connected and automated driving test sites in order to understand the impact of these sites on the NRA's (National Road Administrations) core business and functions. This project will provide NRAs with the necessary know-how on connected and automated driving test sites, with the aim of supporting their core business activities, such as road safety, traffic efficiency, customer service, maintenance, and construction. In terms of social equity, two sites have considered pre-conditions for social inclusion, with one trialling facial recognition as a payment model and one analysing data to better understand how social inclusion is covered.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Customer perception of CAVs is likely to be a **key factor in their adoption,** yet only three of the sites are either working to understand perception or to ensure that VRUs are involved.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	In terms of social inclusion, as presumably there would need to be some sort of smart payment device; there **is an inherent risk in excluding a proportion of society who either do not own or are not technologically proficient** in using smart devices such as smart phones or tablets.
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.32 SUaaVE - SUpporting acceptance of automated Vehicles

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: SUaaVE - SUpporting acceptance of automated Vehicles This project has received funding from the European Union's Horizon 2020 research and innovation programme. Duration: 01/05/2019 – 30/10/2022 https://www.suaave.eu/results/
Background to the project/initiative: SUaaVE involves current and futures users and other agents in a broad sense: passengers, current and future drivers (children, senior citizens and people with disabilities), VRUs Vulnerable Road Users; and the main stakeholders leaning on a well-regarded and complementary Advisory Board (public authorities, industry, other sectors and user associations).

Intended aims and outcomes with reference to social equity: SUaaVE aims to make a change in the current situation of public acceptance of CAV by leaning on a Human-Driven Design (HDD) approach, where the user is not only the centre of the process but actively contributes and even leads the definition of concept, development of technology and participates in its testing. SUaaVE focuses on the human side, working to improve more "intangible" aspects as safety perception, attitudes and, in general, emotional appraisal of CAV.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	The various public policies analysed in the project emphasise the fact that **accessibility will be improved**, not only insofar as the transport offer will be more diversified ('on-demand' transport is very often targeted), but also adapted to the person of the user and their possible physical, cultural, medical, social and intellectual constraints.
Affordability	
Acceptability	Assessing and enhancing public acceptance is one of the key components of the project (with a dedicated WP).
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	All texts reviewed highlight that CAV aims to provide **solutions to the real mobility problems of citizens**, especially of: - elderly people - people with reduced mobility and disabilities - inhabitants of sparsely populated or landlocked territories
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	See above, implications on people living in rural or remote areas.
Other potential users, e.g., single parent family, university students, cyclists, etc.	The project investigated whether environmental sustainability of CAV is also important **for cyclists interacting with CAV**.

8.33 TransAID - Transition Areas for Infrastructure-Assisted Driving

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: TransAID - Transition Areas for Infrastructure-Assisted Driving This project has received funding from the European Union's H2020 research and innovation programme. Duration/: 01/09/2017 – 01/02/2021 https://www.transaid.eu
Background to the project/initiative: As the introduction of automated vehicles becomes feasible, even in urban areas, it is necessary to investigate their impacts on traffic safety and efficiency. This is particularly true during the early stages of market introduction, where automated vehicles of all SAE (Society of Automotive Engineers) levels, connected vehicles (able to communicate via V2X), and conventional vehicles share the same roads with varying penetration rates.
Intended aims and outcomes with reference to social equity: TransAID develops and demonstrates traffic management procedures and protocols to enable smooth coexistence of automated, connected, and conventional vehicles, especially at Transition Areas. A hierarchical approach is

followed where control actions are implemented at different layers including centralised traffic management, infrastructure, and vehicles. In terms of social equity, the project has addressed acceptability through stakeholder workshops (cities and other public authorities, OEMs, industry, and academia), discussing deployment aspects of proposed TransAID services, identify further stakeholder needs, and validate TransAID recommendations.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Public acceptance of automated driving systems focused on customer perception and acceptance of CAVs, i.e., including the pre-conditions for internal and external human machine interface acceptability. **The presence of operators in a control room was a factor that contributed to the public acceptance of autonomous vehicles.**
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.34 Trustonomy - Building Acceptance and Trust in Autonomous Mobility

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: Trustonomy - Building Acceptance and Trust in Autonomous Mobility This project has received funding from the European Union's Horizon 2020 research and innovation programme. Duration: 01/05/2019 - 30/04/2022 https://h2020-trustonomy.eu/
Background to the project/initiative: The vision of Trustonomy (a neologism from the combination of trust + autonomy) is to raise the safety, trust and acceptance of automated vehicles by helping to address technical and non-technical challenges through a well-integrated and inter-disciplinary approach, bringing domain experts and ordinary citizens to work closely together.
Intended aims and outcomes with reference to social equity: Autonomous vehicles are becoming a reality and most of the major automakers have plans to commercially release an autonomous vehicle (nearly or fully self-driving, i.e., SAE levels L4 or L5 vehicles, respectively) by 2020-2024. However, the human factor will remain essential for the safety and performance of road transport in the forthcoming decades, mainly for two reasons: • due to the necessary driver-vehicle interaction in cases where the boundaries of the Operational Design Domain (ODD) of an Automated Driving System (ADS) are being reached. • because of the co-existence of fully-, semi- and non- autonomous vehicles, which is likely to be raising unexpected challenges. Central to the human role in the Connected Automated Driving (CAD) is the transition from automated to manual driving mode. This might be system-initiated or user-initiated. In such a dynamic driver-vehicle interaction scheme,

several challenges arise: to evaluate the driver's availability to intervene; the transition must be supported by an appropriate and comprehensible Human-Machine Interfaces; a proper driver training; legal and ethics perspective. No specific attention is paid to social equity.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	The focus of Trustonomy is to raise acceptance of automated vehicles by investigating, testing and assessing different relevant technologies and approaches in a variety of autonomous driving scenarios. In particular**, the consortium suggests making use of online simulation-based training courses**. They ensure satisfactory results of the driver-system cooperation efficiency, by precisely defining the operating principles, requirements and limitations of the system, and above all thanks to the possibility of gaining new skills in a safe and realistic environment.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.35 TRUSTVEHICLE - Improved trustworthiness and weather independence of conditionally automated vehicles in mixed traffic scenarios

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: TRUSTVEHICLE - "Improved trustworthiness and weather independence of conditionally automated vehicles in mixed traffic scenarios This project has received funding from the European Union's Horizon 2020 research and innovation programme, Duration: 01/06/2017 - 31/05/2020 https://www.trustvehicle.eu/
Background to the project/initiative: Automated vehicle technology has the potential to be a game changer on the roads, altering the face of driving as we experience it by today. Many benefits are expected ranging from improved safety, reduced congestion and lower stress for car occupants, social inclusion, lower emissions, and better road utilisation due to optimal integration of private and public transport. Automated vehicle technology has arrived rapidly on the market and the deployment is expected to accelerate over the next years. As a matter of fact, most of the core technologies required for fully automated driving (SAE level 5) are available today, however, reliability, robustness, and finally trustworthiness must be significantly improved to achieve end-user acceptance. System and human driver uncertainty pose a significant challenge in the development of trustable and fault-tolerant automated driving controllers, especially for conditional automation (SAE level 3) in mixed traffic scenarios under unexpected weather conditions. The TrustVehicle consortium gathers European key partners who cover the entire vehicle value chain and form a European eco-system: OEMs, Tier1 suppliers, semiconductor industry, software, engineering, and research partners to enhance safety and user-friendliness of level 3 automated driving (L3AD) systems
Intended aims and outcomes with reference to social equity: TrustVehicle aims at advancing L3AD functions in normal operation and in critical situations (active safety) in mixed traffic scenarios and even under harsh environmental conditions. TrustVehicle follows a user-centric approach and

will provide solutions that will significantly increase reliability and trustworthiness of automated vehicles and hence, contribute to end-user acceptance. The objectives were fulfilled by using 4 vehicle classes and 6 use cases, resulting in 6 different demonstrations rounded off by the assessment of driver behaviour and trust, on the one hand assessed in a driving simulator on the other hand by user acceptance studies. Due to the COVID-19 pandemic, the project consortium decided to conduct the user acceptance studies online instead of physically on the demonstrator. Nevertheless, throughout the development process within TrustVehicle, end-user acceptance was a key priority.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Acceptability has been evaluated through i) measuring subjective experiences of **human drivers during conditionally automated driving (CAD)**, such as trust in automation, mental workload and usability, ii) determining the physical state of human driver during CAD by looking at heart rate (variability), skin resistance and temperature, pupil size, and brain activity, iii) determining the eye gaze direction and upper body movement, and finally iv) using five different scenarios and two controller outputs as independent variables and examine their possible effects on the subjective experience and physical state of human drivers. **Safety has resulted as the key requirement among users.**
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.36 UP-DRIVE - Automated Urban Parking and Driving

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: UP-DRIVE - Automated Urban Parking and Driving This project has received funding from the European Union's Horizon 2020 research and innovation programme, Duration: 01/01/2016 - 01/12/2019 https://up-drive.ethz.ch/
Background to the project/initiative: Automated transportation in combination with novel transportation concepts and associated services (both for citizens as well as for goods), is envisioned eventually to greatly alleviate future mobility challenges and provide additional benefits. Via better coordination of vehicles, traffic would become more efficient; via removal of human error, safety for all citizens, not only drivers, could be increased; via a virtual chauffeur and pick-up at the doorstep service, car-sharing will become more attractive, full individual mobility could become more affordable, mobility for the elderly or citizens with handicaps will be drastically improved, and the delivery of goods on the last mile could be effectively and innovatively approached).
Intended aims and outcomes with reference to social equity: UP-Drive aims to address the outlined transport-related challenges by providing key contributions that will enable gradual automation of and collaboration among vehicles – and as a result facilitate a safer, more inclusive and more affordable transportation system. In order to adequately address this complexity UP-Drive focuses on advancing the following technologies:

• Robust, general 360° object detection and tracking employing low-level spatio-temporal association, tracking and fusion mechanisms. • Accurate metric localisation and distributed geometrically consistent mapping in large-scale, semi-structured areas. • Representations and mechanisms for efficient and cost-effective long-term data management across devices. • Scene understanding, starting from detection of semantic features, classification of objects, towards behaviour analysis and intent prediction. The project as such did not address social equity issues.

PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**Improving the availability** of new services (e.g., autonomous self-parking services).
Accessibility	
Affordability	
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.37 WISE-ACT – Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: WISE-ACT – Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport Project funded by the European Commission's H2020 COST Action CA16222 Duration: 01/10/2017 - 31/10/2021 https://wise-act.eu/
Background to the project/initiative: Autonomous Vehicle (AV) and Automated and connected transport (ACT) trials are currently taking place worldwide and Europe has a key role in the development of relevant technology. Yet, very limited research exists regarding the wider implications of the deployment of such vehicles on existing road networks and infrastructure, since it is unclear if and when the transition period will start and conclude. It is anticipated that improved accessibility and road safety will constitute the primary benefits of the widespread use of AVs, whilst co-benefits may also include reduced energy consumption, improved air quality or better use of urban space.
Intended aims and outcomes with reference to social equity: Therefore, the focus of this COST Action is on observed and anticipated future mobility trends and implications on travel behaviour, namely car sharing, travel time use or residential location choice to name a few. Other important issues to be explored under different deployment scenarios are social, ethical, institutional and business impacts. This COST Action has five Working Groups (WGs) which focus on the diverse issues surrounding Autonomous and Connected Transport. Although WGs aim at meeting individual objectives through planned tasks and activities, there are strong links and collaborations among all WGs: • WG1 Thematic Report: Institutional & Regulatory Challenges • WG2 Thematic Report: Social Challenges • WG3 Thematic Report: Business Challenges

• WG4 Thematic Report: Transport Demand and User Challenges • WG5 Thematic Report: Simulation & Scenario Evaluation. The project deals with several dimensions of social equity, analysed through meta-analysis of relevant literature review.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	Availability of ACT is considered through the following scenarios: 1. Privately-owned partial automated, 2. Privately-owned fully automated, 3. Sequential carsharing services, 4. Partially automated ACT-based public transport and 5. Fully automated ACT-based public transport.
Accessibility	Accessibility to ACT is considered by the following types of users, depending on the type of scenario: Low income, Young, Older, Disabled, Women without driving licence, living remotely, digitally unconfident and unprotected road users.
Affordability	Although full automation would be available, to reap the full benefit of that still depends on how affordable ACT (Autonomous and Connected Transport) would be in the future.
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	The **financial barrier of ACT use is also likely to affect the young**, most of whom will have to depend on their caretakers to cover most of their mobility expenses**.**
Older people (65 years old and over).	People who have lost the ability to drive at an older age, which is likely to increase in absolute numbers with the ageing of the population in virtually **all countries may greatly benefit from ACT**.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	This group may benefit (substantially) from fully automated ACT vehicles, because they are currently **prevented from driving a regular or low-level ACT because of motor-related, sensory-related, or cognition-related disabilities**.
Digitally vulnerable people.	ACT, and specifically shared ACT service, is likely to require substantial digital skills and the ability to make online payments (thus requiring bank accounts or credit cards), **which may exclude some share of the adult population clearly raising equity concerns**.
Women and gender related vulnerabilities.	Women are **more anxious** about using an AV and have less pleasure compared to men, resulting in an even lower likelihood to drive an AV. Women prefer conventional vehicles over automated vehicles. This result is consistent with previous findings which showed that men are more open than women to automated technologies.
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	The group of **low-income persons is hardly likely to reap any benefits,** since ACT vehicles will be expensive to own and maintain. Low-income households will certainly be among the last to gain access to fully automated ACT vehicles.
Affected because of their **place of living (rural-urban areas)**	A substantial share of *the group is likely to enjoy increased mobility or accessibility* in the ACT scenario (Privately-owned fully automated ACT-vehicles).
Other potential users, e.g., single parent family, university students, cyclists, etc.	Immigrant groups may benefit from the introduction of fully automated ACT vehicles, provided the requirement of a driving license is eliminated altogether or replaced by a more modest technical test or 'riding test'.

8.38 5G-CARMEN - 5G for Connected and Automated Road Mobility in the European Union

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: 5G-CARMEN - 5G for Connected and Automated Road Mobility in the European Union

This project has received funding from the European Union's Horizon 2020 research and innovation programme, Duration: 01/11/2018 - 01/07/2022 https://5gcarmen.eu/
Background to the project/initiative: The key 5G-CARMEN innovations are centred around developing an autonomously managed hybrid network, combining direct short range V2V (vehicle to vehicle) and V2I (vehicle to infrastructure) communications with long-range V2N (vehicle to network) communications.
Intended aims and outcomes with reference to social equity: Focusing on the Bologna-Munich corridor (600 km, over three countries) the objective of 5G-CARMEN is to leverage on the most recent 5G advances to provide a multi-tenant platform that can support the automotive sector delivering safer, greener, and more intelligent transportation with the goal of enabling self-driving cars. In terms of social equity, the project as such does not address relevant topics, being focused mainly on the demonstrations of V2x communication capabilities. The Munich-Bologna Corridor has been equipped with 5G in 4 locations (Munich, Trento, Italy-Austria border at Brennerpass and Germany Austria border at Kufstein) and two important technical achievements were developed to minimise latency and service interruption caused by standard network reselection procedures across borders.
PART 2 – THE DIMENSIONS OF EQUALITY
What are the main dimensions of equality addressed by the project/initiative?

Availability	**Availability** can be enhanced by ensuring reliable connectivity and communication capabilities in automated vehicles.
Accessibility	
Affordability	
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.39 5G-DRIVE - 5G HarmoniseD Research and TrIals for service Evolution between EU and China

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: 5G-DRIVE - 5G HarmoniseD Research and TrIals for service Evolution between EU and China This project has received funding from the European Union's Horizon 2020 research and innovation programme, Duration: 01/06/2018 - 01/06/2021 https://5g-drive.eu/
Background to the project/initiative: The global deployment and market adoption of 5G in one of the industry's main priorities, but a global technology consensus and spectrum harmonisation remains a key issue before 5G standardisation is finally approved. International collaboration and alignment among key regions are essential to facilitate this process, with Europe and China being two of the main regions in this regard. The European Commission (EC) has taken the first step to boost 5G global cooperation with many countries and regions, including through jointly funded projects, global 5G events and other initiatives. The EC and China have agreed to fund joint projects on 5G trials to address two of the most promising 5G deployment scenarios, namely enhanced Mobile Broadband (eMBB) and Vehicle-to-Everything (V2X) communications. 5G-DRIVE, in collaboration with its Chinese twinning counterpart, has the ambition to fulfil this goal.

Intended aims and outcomes with reference to social equity: The Horizon 2020 project 5G-DRIVE: 5G HarmoniseD Research and TrIals for serVice Evolution between EU and China (2018-2021) trials and validates the interoperability between EU & China 5G networks operating at 3.5 GHz bands for enhanced Mobile Broadband (eMBB) and 3.5 & 5.9 GHz bands for V2X scenarios. The project as such did not address social equity issues.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**Testing new communication protocols** for the availability of 5G new connectivity and communication services.
Accessibility	
Affordability	
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

8.40 5G-IANA - 5G Intelligent Automotive Network Applications

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: 5G-IANA - 5G Intelligent Automotive Network Applications This project has received funding from the European Union's Horizon 2020 research and innovation programme Duration: 01/06/2021 - 01/11/2024 https://www.5g-iana.eu	
Background to the project/initiative: 5G-based Automotive-related services (i.e., Connected and Automated Mobility services) are a broad range of digital services in and around vehicles including both safety-related and other commercial services provided, enabled, or supported by 5G networks. The imminent rollout of 5G is expected to become a "game changer". For the first time, mobile networks will offer a broad range of connectivity performances including gigabit speeds and mission critical reliability.	
Intended aims and outcomes with reference to social equity: The objectives of the projects addressed several 5G technological domains: specify and provide an Automotive Open Experimental Platform (AOEP); specify and implement a repository environment for Network Applications and VNFs to ease the design and chaining of new Automotive-related services – to be integrated with 5G-PPP open repositories; provide accurate localisation and low latency mission-critical applications; define, implement and trial Connected and Automated Driving relevant Use Cases to validate and assess the AOEP suitability and functional improvements; improve service creation time and create new business opportunities and boost market for start-ups and SMEs with Automotive Network Applications The project as such did not address social equity issues.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	**A robust and uninterrupted network connection** is essential to maintain availability and enable seamless communication between automated vehicles and their surroundings.
Accessibility	

Affordability	
Acceptability	
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

9. Appendix B: List of reviewed National CCAM projects

9.1 Germany: DiVa: Gesellschaftlicher Dialog zum vernetzten und automatisierten Fahren [Social dialogue about connected and automated travel]

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: DiVA This project has received funding from the Federal Ministry for Digital and Transport. Duration: 07/2017 - 12/2022 https://verkehrsforschung.dlr.de/de/projekte/diva	
Background to the project/initiative: The DiVA project is developing a comprehensive concept for social dialogue on connected and automated driving in Germany. Unlike many similar projects, DiVA is not focused on the technical aspects but rather on the effects of automated transport on society, the economy, and traffic.	
Intended aims and outcomes with reference to social equity: DIVA aims to bring the greatest possible benefits for society as a whole from the networking and automation of (road) traffic by focusing on dialogue with relevant actors and stakeholders. This is done to ensure that the implementation of technology in road transport will meet the mobility needs of the population in the best possible way, contribute to designing an efficient and sustainable transport system, help describe new markets, and secure and strengthen Germany as a location for innovation. Potentials and benefits, risks and challenges, as well as user expectations and requirements, are examined on the basis of existing scientific studies and empirical work. A continuous exchange of knowledge about current research and project activities took place, and a uniform system was developed to consistently record project, pilot, and demonstration projects for automated and connected driving. The need for action to integrate automated and connected driving into the existing transportation system was identified and a structured concept for further social dialogue was developed, particularly with regard to higher levels of automation, different areas of application, and different user groups.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	There are two dimensions of acceptability considered: individual acceptance (based on one's own preferences) and societal acceptance (based on consideration of opposing interests).
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	A group of people over 69 years old was considered separately, and ca. 19% of them indicated readiness to use automated transport.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	A group of people with physical disabilities was considered. 21% of them were interested in using automated transport.
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

9.2 Germany: Realisierung Automatisierter Mobilitätskonzepte im Öffentlichen Nahverkehr [Realisation of Automated Mobility Concepts in Public Transport]

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: RAMONA This project has received funding from the Federal Ministry for Digital and Transport. Duration: 07/2017 - 06/2020 https://www.hs-esslingen.de/mobilitaet-und-technik/forschung-labore/projekte/ramona	
Background to the project/initiative: The RAMONA research project focuses on how the use of automated and networked mobility concepts can be integrated into existing public transport systems. It is mainly concerned with questions as to what opportunities and risks arise from the use of automated and flexible mobility concepts and what framework conditions are necessary for successful implementation.	
Intended aims and outcomes with reference to social equity: The project aimed to develop and evaluate automated and connected mobility concepts focusing on integration into the traffic pattern and the existing public transport system. It also aimed to analyse the reactions and interactions of passengers and other road users with highly automated vehicles in public transportation, as well as the requirements of potential users. To achieve these goals, the project combined empirical surveys, simulations, and potential analyses for the use of automated and connected mobility concepts. The RAMONA project has developed new mobility concepts (e.g., automated bus on demand in lifelab) and evaluated acceptance and potential uses by applying innovative research methods. In addition, the social and legal framework conditions were investigated, and based on this, legal adaptation requirements were formulated.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	The importance of public transport being provided frequently and at the right times was highlighted.
Accessibility	
Affordability	
Acceptability	Before the implementation of automated public transport, it was deemed important to give users an opportunity to experience booking/ordering and using such transport modes in a living lab. The satisfaction of potential users was also considered.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	Younger people were considered, and they showed the highest levels of acceptance and satisfaction with new mobility concepts.
Older people (65 years old and over).	Seniors were considered, and they rejected new mobility concepts more often than young adults but less often than middle-aged users.
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

9.3 Germany: @CITY-AF: Automated Driving in the City

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: RAMONA This project has received funding from the Federal Ministry for Economic Affairs and Climate Action. Duration: 01/07/2018 – 01/06/2022 https://www.atcity-online.de/	
Background to the project/initiative: The @CITY-AF is the second and final part of a major @CITY initiative and is taking up a challenge to turn automated driving functions for the much more complex urban environment into reality in the form of prototypical test vehicles and tests them in real-life conditions. A major focus is placed on automated driving when bottlenecks occur, driving through intersections and roundabouts. The way the automated system interacts with pedestrians and cyclists is also considered. The project consists of different subprojects, one of them being interaction with vulnerable road users.	
Intended aims and outcomes with reference to social equity: @CITY-(AF) aims to establish a shared understanding of automated driving in the city. It aims to automate driving in the city and thus generate benefits for all road users. The focus of the @CITY-AF project is on the most important challenges for comfortable, safe, and efficient driving in the city. A major goal of the project is to gain a common understanding of automated city driving, minimum operational requirements, system concepts including data requirements, identification and analysis of vulnerable road users as well as examine interfaces and interactions among drivers, automated vehicles, and other road users. Implicit communication channels, processes, and parameters are investigated for relevant scenarios and checked on acceptance, safety, and comprehensibility in user studies. The resulting solutions provide a basis for the technical implementation of user-centred implicit communication in automated vehicles.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Expectations of human road users influence the acceptance of autonomous vehicles. Therefore, user expectations must be examined to increase their acceptance of automated systems. Additionally, individual factors such as a risk-taking personality can influence users' acceptability.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	The project focused on vulnerable road user groups: pedestrians and cyclists and their interaction with automated vehicles. Reactions/behaviors (e.g., gestures) of vulnerable road users were tested via traffic observations, simulator studies, and real driving to predict their potential trajectories in traffic.

9.4 Germany: PAKoS: Personalised, adaptive cooperative systems for automated vehicles

PART 1 – GENERAL INFORMATION	
Name of the project, initiative or activity: PAKoS This project has received funding from the Federal Ministry of Education and Research. Duration: 01/01/2017 - 31/12/2019 https://www.interaktive-technologien.de/projekte/pakos	
Background to the project/initiative: The project intends to develop advanced systems of human-technology interaction, which will contribute to more safety, comfort, and reliability. Developing a safe, holistic, and cooperative concept for personalised cooperation between the driver and the automated vehicle will create a basic condition to approve future highly automated vehicles.	
Intended aims and outcomes with reference to social equity: The goal of the project PAKoS is to provide an adaptation concept for vehicle automation and to develop a safe, holistic, and universal concept for individualised and personalised cooperation between driver and automated vehicle. To do so, the driver's state is identified from observation and combined with a personalised user profile to assess the driver's current performance capability. Using this information, the automation in the vehicle should be personalised and adapted to match users' requirements and needs.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	Users who are usually less mobile have difficulty learning and accessing all the functions of automated systems.
Affordability	
Acceptability	A different degree of effort is needed to increase intentions of use and acceptance based on the prior mobility behavior (e.g., less active traffic users needing more persuasion),
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	The project compares users who are already limited in their mobility with users who usually travel moderately often or very often.

9.5 Germany: TANGO: Technology for Automated Driving optimized for the user

PART 1 – GENERAL INFORMATION
Name of the project, initiative or activity: TANGO This project has received funding from the Federal Ministry of Economic Affairs and Climate Action. Duration: 01/12/2016-18/09/2020 https://tangoversuch1.wordpress.com/
Background to the project/initiative: The main focus of the TANGO project is developing an attention and activity assistant that will provide drivers with diverse secondary tasks depending on their current traffic situation, automation level, etc. Therefore, the project combines already-known environment sensors with new cabin-interior sensors and new HMI concepts.

Intended aims and outcomes with reference to social equity: TANGO aims to improve the user experience and the acceptance of automated driving functions for trucks. To do so, new technologies are developed, providing significant added value while ensuring the required level of comfort for the driver at different levels of automation. This process is user-oriented and involves various stages starting with user research and requirements analysis, followed by concept creation and prototyping, and all the way to the evaluation phase.	
PART 2 – THE DIMENSIONS OF EQUALITY	
What are the main dimensions of equality addressed by the project/initiative?	
Availability	
Accessibility	
Affordability	
Acceptability	Interaction (cues and tips) provided by the automated system increased users' satisfaction.
How the CCAM vulnerable user groups are concerned?	
Young people (18-25 years old).	
Older people (65 years old and over).	
Persons with disabilities, including long-term physical, mental, intellectual or sensory impairments.	
Digitally vulnerable people.	
Women and gender related vulnerabilities.	
Persons at risk of poverty and social exclusion, e.g., homeless, including **low-income groups**.	
Affected because of their **place of living (rural-urban areas)**	
Other potential users, e.g., single parent family, university students, cyclists, etc.	

For more information

SINFONICA Project Coordinator

UNIMORE – University of Modena and Reggio Emilia

Via Giovanni Amendola, 2

42122 Reggio Emilia, IT

sinfonica@sinfonica.eu

www.sinfonica.eu

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