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D6.1 Social and economic aspects in the CCAM planning and policy framework

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Deliverable 6.1 Social and economic aspects in the CCAM planning and policy framework

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Executive Summary

Connected, Cooperative and Automated Mobility (CCAM) is often framed as a technological innovation, but its deployment is expected to lead to broader socio-economic transformation. It affects how mobility services are organised, how people access opportunities, how costs and benefits are distributed, how labour markets evolve, and how data and digital systems are governed. Ensuring that these impacts are addressed in a structured and inclusive way is essential for a socially sustainable transition to CCAM.

Deliverable 6.1 examines how socio-economic aspects are currently addressed in mobility planning and policy frameworks and identifies key gaps and requirements. The analysis is based on two complementary approaches. First, the Sustainable Urban Mobility Planning (SUMP) cycle is used as a process-oriented framework to assess how socio-economic considerations are integrated across different phases of planning. Second, nine socio-economic factors are used as an analytical lens: accessibility and connectivity; affordability; equity and inclusion; employment, skills and labour conditions; public health and safety; public acceptance, trust and awareness; data governance, privacy and cybersecurity; digital coverage and connectivity; and funding and financing.

The empirical basis of the analysis includes a review of eleven recent CCAM policy and strategic documents at European, national and international level, and twenty local and regional mobility planning documents, including SUMPs and mobility strategies. This combined review provides a comprehensive overview of current practices across governance levels.

The findings show that socio-economic aspects are widely recognised in both policy and planning documents, but they are not yet systematically integrated into decision-making processes. Accessibility and public safety are relatively well addressed, reflecting their established role in mobility planning. In contrast, affordability, equity, employment impacts, digital inclusion, public trust, and data governance are less consistently operationalised. These aspects are often treated as expected outcomes of CCAM rather than as explicit planning requirements supported by concrete measures, indicators, and governance structures.

Across the SUMP cycle, several structural gaps emerge. In the preparation and analysis phase, socio-economic diagnostics remain limited, with insufficient attention to labour markets, affordability, digital access, and institutional capacity. In the strategy development phase, CCAM is not yet fully reflected in visions, scenarios, and targets, and socio-economic objectives are rarely translated into measurable indicators. In the measure planning phase, there is a lack of integrated CCAM-related measures, particularly those addressing workforce transition, affordability, and digital inclusion. In the implementation and monitoring phase, existing systems focus mainly on transport and environmental performance, while socio-economic and technological impacts are only partially captured.

The analysis also highlights a disconnect between policy ambition and planning practice. Policy documents articulate broad societal goals and recognise the importance of socio-economic aspects, but they often lack detailed guidance on implementation, monitoring, and enforcement. At the same time, planning documents provide structured processes for mobility planning but do not yet incorporate the full range of socio-economic implications associated with CCAM. This results in a gap between strategic intent and practical application.

In addition, governance structures are not yet fully adapted to the cross-sectoral nature of CCAM. Addressing socio-economic aspects requires the involvement of actors beyond the transport sector, including labour market institutions, social policy actors, digital and data authorities, and economic development bodies. However, current planning and policy frameworks remain largely centred on traditional transport and infrastructure actors.

Based on these findings, the deliverable identifies several key needs. Socio-economic aspects should be systematically integrated across all phases of the SUMP cycle. Planning frameworks should include new indicators and analytical tools that capture both technological and socio-economic dimensions. Governance structures should be expanded to support cross-sectoral coordination. In addition, there is a need to move from general objectives towards operational requirements, including measurable targets, enforceable measures, and aligned financing and procurement approaches.

Overall, the analysis demonstrates that while strong foundations exist in both policy and planning frameworks, significant work is needed to ensure that CCAM deployment supports equitable, inclusive, and socially balanced mobility systems. The findings of Deliverable 6.1 provide the analytical basis for the development of a roadmap and policy recommendations in Deliverable 6.2, supporting the socio-economic transition to CCAM.

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List of Acronyms

5GAA	5G Automotive Association
AI	Artificial Intelligence
AV	Automated Vehicle
BMDV	Federal Ministry for Digital and Transport (Germany)
CAM	Connected and Automated Mobility
CCAM	Connected, Cooperative and Automated Mobility
C-ITS	Cooperative Intelligent Transport Systems
DRT	Demand Responsive Transport
EC	European Commission
EEA	European Economic Area
EU	European Union
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
ICT	Information and Communication Technology
ICV	Intelligent and Connected Vehicles
ITS	Intelligent Transport Systems
KPI	Key Performance Indicator
MaaS	Mobility as a Service
OPEX	Operational Expenditure
PPP	Public-Private Partnership
PT	Public Transport
PUMS	Piano Urbano della Mobilità Sostenibile
R&D	Research and Development
R&I	Research and Innovation

SUMP	Sustainable Urban Mobility Plan / Sustainable Urban Mobility Planning
V2I	Vehicle-to-Infrastructure
V2X	Vehicle-to-Everything
WEF	World Economic Forum

1 Introduction

1.1 Context

Connected, Cooperative and Automated Mobility (CCAM) represents a major transition in the mobility system, combining advances in automation, digitalisation, connectivity and data-driven services. While much of the discussion around CCAM has focused on technological development and regulatory readiness, its implications extend far beyond the transport system itself. CCAM is a socio-technical transformation that affects how mobility services are organised, how people access opportunities, how costs and benefits are distributed, and how labour markets and skills requirements evolve.

The deployment of CCAM has the potential to generate significant benefits, including improved road safety, increased efficiency of transport systems, enhanced accessibility for non-drivers and underserved areas, and new economic opportunities. At the same time, it introduces a range of socio-economic challenges. These include potential job displacement in transport sectors, the need for large-scale reskilling and upskilling, risks related to affordability and equitable access, digital exclusion, data governance and cybersecurity concerns, and the need to build and maintain public trust in automated systems.

Addressing these challenges requires moving beyond a purely technology-driven perspective and ensuring that socio-economic considerations are systematically integrated into planning and policy frameworks. In this context, Sustainable Urban Mobility Planning (SUMP) plays a key role. As the main framework guiding mobility planning across European cities and regions, SUMPs provide a structured approach to shaping mobility systems in line with broader societal goals, including accessibility, sustainability, safety, and inclusion. Integrating CCAM into SUMP processes is therefore critical to ensure that the deployment of automated mobility contributes to socially balanced and inclusive outcomes.

1.2 Objectives and scope of Deliverable 6.1

Deliverable 6.1 aims to assess how socio-economic aspects of CCAM are currently addressed in mobility planning and policy frameworks, and to identify gaps and requirements for a more inclusive and resilient transition.

The deliverable focuses on analysing the extent to which key socio-economic dimensions such as accessibility, affordability, equity, employment, skills, public health and safety, public trust, data governance, digital connectivity, and financing are considered in existing documents and processes. It examines both policy and planning levels, covering European, national and local contexts.

The scope of the analysis includes:

- a review of eleven recent CCAM-related policy and strategic documents at European, national and international level,
- a review of twenty local and regional mobility planning documents, including SUMPs and mobility strategies,

- an assessment of how socio-economic aspects are addressed across different phases of the SUMP cycle,

- and the identification of current practices, limitations, and gaps in integrating socio-economic considerations into CCAM planning and policy.

Based on this analysis, Deliverable 6.1 establishes an analytical baseline and defines key requirements for strengthening the socio-economic dimension of CCAM deployment. The findings provide the foundation for the development of the roadmap and policy recommendations in subsequent project activities.

1.3 Positioning within CCAM-ERAS

Deliverable 6.1 is part of Work Package 6 “Roadmap and policy recommendations” within the CCAM-ERAS project. It contributes to Task 6.1, which focuses on analysing the current state of CCAM planning and policy frameworks and identifying how socio-economic aspects are addressed.

Deliverable 6.1 serves as a key input for subsequent activities in Work Package 6. It provides the analytical foundation for the development of Deliverable 6.2, which will translate the identified gaps and requirements into a roadmap for supporting the socio-economic transition to CCAM. The findings of this deliverable therefore play a central role in bridging analysis and action, linking evidence on current practices with future-oriented policy and planning recommendations.

By positioning socio-economic aspects within both planning processes and policy frameworks, Deliverable 6.1 contributes to ensuring that CCAM deployment is aligned with broader societal objectives and supports a balanced and inclusive mobility transition.

1.4 Structure of the document

This deliverable is structured to provide a logical progression from conceptual framing and methodological approach to empirical analysis and conclusions.

Chapter 1 introduces the context of CCAM as a socio-technical transition, outlines the objectives and scope of the deliverable, and positions it within the CCAM-ERAS project.

Chapter 2 presents the methodological framework. It explains the conceptual approach, combining the SUMP cycle as a process-oriented framework with the nine socio-economic factors as an analytical lens. It also describes the evidence base, including the selection and review of policy and planning documents.

Chapter 3 analyses how socio-economic aspects of CCAM are addressed across the different phases of the SUMP cycle. It reviews both methodological considerations and planning practices, drawing on the analysis of eleven CCAM policy documents and twenty local and regional mobility plans. The chapter identifies entry points, current practices, and gaps in integrating socio-economic considerations throughout the planning process.

Chapter 4 examines in detail how the nine socio-economic factors are addressed in strategic and planning documents. It provides a structured assessment of the current status and identifies key gaps across governance levels, based on the review of policy documents and SUMPs.

Chapter 5 presents the main findings of the analysis and outlines key conclusions. It highlights methodological insights, identifies structural gaps in current planning and policy frameworks, and sets the basis for the development of the roadmap and policy recommendations in subsequent work.

2 Methodological Framework

2.1 Conceptual approach

This deliverable applies a dual conceptual approach that combines a process-oriented planning framework with a thematic analytical framework. The objective is to assess how socio-economic aspects of CCAM are currently considered in mobility planning and policy, and to identify where improvements are needed.

On the one hand, the SUMP cycle is used as a structuring framework to analyse how socio-economic considerations are, or should be, integrated across the different phases of the planning process. This allows the assessment to go beyond static document review and instead examine how planning processes address socio-economic aspects from early analysis to implementation and monitoring.

On the other hand, a set of nine socio-economic factors is used as an analytical lens to systematically review policy and planning documents. These factors capture key dimensions of CCAM impacts, including citizen outcomes, labour market implications, system governance, and enabling conditions. Together, they provide a comprehensive basis for assessing both the current status and existing gaps in how socio-economic aspects are addressed.

The combination of these two perspectives enables a structured and comparable analysis. The SUMP cycle defines where in the planning process socio-economic aspects should be addressed, while the socio-economic factors define what should be addressed. This integrated approach supports the identification of methodological gaps, governance limitations, and opportunities for improving the integration of socio-economic considerations in CCAM planning and policy.

2.1.1 SUMP concept as a methodological framework

The SUMP concept provides the methodological backbone for the analysis presented in this deliverable. The SUMP approach, as defined in the European Commission's SUMP Guidelines 2.0, structures mobility planning as a continuous and iterative process organised into four main phases: Preparation and Analysis, Strategy Development, Measure Planning, and Implementation and Monitoring.

This process-oriented structure is particularly relevant for analysing CCAM, as it enables a systematic examination of how new mobility technologies and their socio-economic implications can be addressed

throughout the planning cycle. Rather than treating CCAM as a standalone technological intervention, the SUMP framework allows it to be assessed as part of a broader mobility system transformation.

Each phase of the SUMP cycle provides specific entry points for integrating socio-economic considerations. In the preparation and analysis phase, socio-economic conditions and potential impacts can be identified and assessed. In the strategy development phase, these aspects can be translated into visions, objectives, and targets. In the measure planning phase, they can be operationalised through concrete actions, regulatory instruments, and investment decisions. Finally, in the implementation and monitoring phase, socio-economic outcomes can be tracked, evaluated, and used to inform adaptive planning.

At the same time, the analysis highlights limitations of current SUMP practice in relation to CCAM. Existing guidance and planning approaches are primarily designed for conventional mobility systems and do not yet fully account for the systemic changes introduced by automation, digitalisation, and data-driven mobility services. In particular, aspects such as employment transitions, data governance, digital inclusion, and public trust are not yet consistently integrated into SUMP methodologies.

By using the SUMP cycle as a methodological framework, this deliverable presents the analysis in Chapter 3 and provides a basis for identifying where socio-economic aspects are insufficiently addressed and where planning processes need to be strengthened to support a socially sustainable CCAM transition.

2.1.2 Key socio-economic aspects as an analytical framework

The framework consolidates nine socio-economic factors that have been identified together with the CCAM-ERAS consortium members and validated during various consortium meetings. The identified socio-economic factors also stem from the outputs of the WP4 (stakeholder interviews/surveys; skills and labour foresight) and WP5 (use-case lessons, operational dependencies, workforce changes). The socio-economic factors are also aligned with SUMP principles (access, affordability, safety, monitoring), EU digital and data policy (data governance, cybersecurity), and funding/market-readiness considerations (financing, infrastructure coverage).

The nine factors capture citizen outcomes (access, affordability, equity), system integrity (safety, trust, data governance), labour outcomes (employment/skills), and enablers (financing, digital coverage).

The identified socio-economic factors (Table 1) are used to evaluate how CCAM's socio-economic dimensions are addressed by authorities and stakeholders across three governance levels: at the EU, national and local (including in local strategic mobility plans). The assessment asks: (i) how these aspects are currently being addressed, (ii) what has already been considered or implemented, and (iii) where gaps remain.

The lists of reviewed documents are described in Chapter 2.2 (Evidence base and analytical sources), and the results are presented in Chapter 4 (Socio-economic aspects of CCAM in policy and planning documents: current status and gaps).

Table 1. Identified relevant socio-economic factors for CCAM planning and implementation

№	Socio-economic factor	Description
1	Accessibility & connectivity	Access to jobs, education, health, care, shopping; first/last mile; rural/remote service coverage; universal design.
2	Affordability	Fares/tariffs, total cost of mobility (incl. car ownership alternatives), concessionary pricing, targeted subsidies.
3	Equity and inclusion	Who benefits/loses by income, gender, age, disability, migration status, and geography; measures to avoid widening disparities; universal design.
4	Employment, skills & labour conditions	Job creation/relocation/displacement; new roles; reskilling/upskilling; union engagement; working conditions; regional skills gaps
5	Public health & safety	Road safety; perceived safety; mental/physical health; work-life balance; noise/air exposure
6	Public acceptance, trust & awareness	Risk perceptions (safety, jobs); transparency; citizen engagement; co-creation; communications.
7	Data governance, privacy & cybersecurity	GDPR compliance; data minimisation; cyber-resilience of mobility systems; liability around data.
8	Financing	Subsidies/grants/tax incentives; Public-private partnerships (PPPs); outcome-based procurement; affordability of deployment across regions.
9	Digital coverage and connectivity	Availability of networks/devices; digital skills for users; 5G/6G readiness; urban–rural digital divide

2.2 Evidence base and analytical sources

2.2.1 Policies, strategies and roadmaps: National and International level

To analyse the evolving policy and strategic landscape surrounding Connected and Automated Mobility (CAM/CCAM) and to examine how socio-economic factors are currently being addressed, a targeted review of 10 recent high-level strategic documents was conducted. Given the rapidly developing nature of autonomous mobility, the primary selection criterion was the publication date, ensuring that only the most recent policy frameworks and roadmaps (2023–2025) were included.

The analysed sample (Table 2) consists of strategic documents issued by national governments, European institutions, international organisations, and sectoral bodies. The countries and organisations represented are China, Czech Republic, European Commission, Germany, Luxembourg, Sweden, the United Kingdom, the World Economic Forum, and PAVE Europe. The portfolio includes strategies, roadmaps, white papers, reports and implementation handbooks, thereby capturing both high-level policy direction and more operational guidance for implementation.

The majority of documents were published in 2024 and 2025, reflecting the acceleration of regulatory development, digitalisation strategies, and deployment planning in the field of autonomous mobility. The selected documents address not only technological and regulatory readiness but also labour market

implications, skills requirements, public acceptance, and broader socio-economic impacts associated with CCAM deployment.

This set of documents provides a comprehensive and up-to-date overview of how autonomous mobility is being strategically framed and how socio-economic dimensions are being integrated into national, European and global policy agendas.

Table 2. List of national and global connected and automated driving strategic policy documents

ID	Document title	Country / Contributor	Document type	Governance level	Publication date
1	The Luxembourg Strategy for Automated Driving	Luxembourg	Strategy	National	2025
2	UK Connected and Automated Mobility Roadmap to 2035 – Opportunities for CAM	UK	Roadmap	National	2025
3	Autonomous Vehicles: Timeline and Roadmap Ahead	World Economic Forum	Roadmap	International / Global	2025
4	The Future of Public Transportation: Embracing Autonomous Mobility	PAVE Europe	Report	Regional (Europe)	2025
5	Autonomous Mobility Plan until 2025 with a Prospect to 2030	Czech Republic	Strategy	National	2024
6	Roadmap – Digitalisation of the Road Transport System	Sweden	Roadmap	National	2024
7	The future is autonomous. German Federal Government's strategy for autonomous driving in road traffic	Germany	Strategy	National	2024
8	Autonomous driving in public transport. A handbook with suggestions for implementation in municipal practice	Germany	Handbook	Subnational / Local	2024
9	COMMISSION STAFF WORKING DOCUMENT. Status of progress on Connected, Cooperative and Automated Mobility in Europe	European Commission	Report	Regional (Europe)	2024
10	A visionary roadmap for advanced driving use cases, connectivity, and technologies	5GAA Automotive Association	White Paper	International	2024
11	ICV Roadmaps: A Worldwide Perspective	China	White Paper	National	2023

2.2.2 Strategy and planning documents: local and regional level

To assess how local authorities across Europe are addressing the socio-economic dimensions of mobility, a structured review of 20 recent strategic mobility documents was conducted. The sample includes SUMPs, Sustainable Mobility Strategies, Mobility Plans and Action Plans at city and metropolitan level.

The analysed documents cover 11 European countries: Denmark, France, Georgia, Germany, Ireland, Italy, Luxembourg, the Netherlands, Poland, Portugal and Spain – ensuring broad geographical representation. Priority was given to documents published from 2023 onwards in order to reflect the most recent policy orientations and planning assumptions. In addition, cities and metropolitan areas of varying demographic scale were deliberately selected to enable comparative insights across different urban contexts. The population size of the selected territories ranges from approximately 190,000 to 3.7 million inhabitants, thereby ensuring coverage of small, medium and large urban areas.

Table 3. List of analysed local strategic mobility documents

ID	City / Area	Country	Document type	Governance Level	Population	Publication date
1	Barcelona	Spain	SUMP	Regional (Metropolitan)	3,720,333	2024
2	Kraków Metropolitan Area	Poland	SUMP	Regional (Metropolitan)	1,489,912	2023
3	Greater Dublin Region	Ireland	Mobility Plan	Regional (Metropolitan)	1,242,000	2023
4	Tbilisi	Georgia	Mobility Plan	Local	1,158,700	2025
5	Lecce	Italy	SUMP	Regional (Metropolitan)	767,356	2024
6	Luxemburg	Luxemburg	Mobility Plan	Regional (Metropolitan)	672,050	2024
7	Łódź	Poland	SUMP	Local	664,860	2024
8	Las Palmas Metropolitan Area	Spain	Sustainable mobility strategy	Regional (Metropolitan)	633,900	2023
9	Stuttgart	Germany	Action plan	Local	626,275	2023
10	Dresden	Germany	SUMP	Local	555,351	2024
11	Szczecin–Świnoujście	Poland	SUMP	Regional (Metropolitan)	394,482	2023

12	Sintra	Portugal	SUMP	Local (Municipality)	388,767	2024
13	Bydgoszcz	Poland	Mobility Plan	Local	334,026	2023
14	Münster	Germany	Mobility Plan	Local	317,713	2024
15	Aarhus	Denmark	Mobility Plan	Local	295,688	2023
16	Eindhoven	Netherlands	Mobility Plan	Local	284,148	2023
17	Gijón	Spain	SUMP	Local	267,706	2023
18	Gelsenkirchen	Germany	Mobility Plan	Local	260,126	2023
19	Czestochowa	Poland	SUMP	Local	210,773	2023
20	Le Havre	France	Mobility Plan	Local	190,421	2024

2.3 Limitations

This deliverable provides a structured analysis of how socio-economic aspects of CCAM are addressed in current policy and planning frameworks. While the approach enables systematic comparison across documents and governance levels, several limitations should be acknowledged.

First, the analysis is based on a selected sample of eleven CCAM policy documents and twenty local and regional mobility plans. The selection was intentionally designed to prioritise recent publications, reflecting the rapidly evolving nature of CCAM technologies, regulatory frameworks, and deployment strategies. In the case of policy documents, most were published between 2024 and 2025, with the oldest document dating from 2023. This ensures that the analysis captures current policy directions, but it also means that earlier policy developments and longer-term evolution trends are not covered.

Second, the selection of policy documents aimed to ensure geographical diversity beyond the European context. The sample includes documents from different regions and governance levels, including national strategies, European-level reports, and global perspectives. While this supports a broader understanding of CCAM development, it also introduces variation in policy maturity, institutional contexts, and strategic priorities, which may limit direct comparability.

Third, the selection of planning documents followed a similar logic. The analysed SUMPs and mobility strategies were chosen based on recency and diversity in terms of geography, urban scale, and planning context. The sample includes cities and metropolitan areas of different sizes and from multiple European countries, allowing for comparative insights across different types of urban environments. However, as with the policy analysis, the sample is not exhaustive and does not capture the full diversity of planning practices.

Fourth, the assessment relies on document-based analysis. The findings therefore reflect what is explicitly stated in policy and planning documents, rather than how these frameworks are implemented in practice. In some cases, socio-economic aspects may be addressed through pilot projects, institutional arrangements, or informal practices that are not fully documented. Conversely, the presence of a topic in a document does not necessarily indicate effective implementation.

Fifth, the level of detail and scope vary significantly across the analysed documents. Policy documents tend to operate at a strategic level, while planning documents are more operational but differ in structure, depth, and methodological approach. This affects the visibility and comparability of certain socio-economic aspects across documents.

Sixth, the analytical framework is based on nine predefined socio-economic factors. While these factors were developed through project activities and reflect key dimensions of CCAM impacts, they necessarily simplify a complex and evolving field.

Despite these limitations, the approach ensures a robust and up-to-date analysis of current policy and planning practices. It provides a solid basis for identifying key gaps and informing the development of targeted recommendations in subsequent project activities.

3 Addressing Socio-Economic Aspects of CCAM through the SUMP Cycle

This chapter analyses how socio-economic aspects of CCAM should be addressed and to what extent they are currently addressed within mobility planning, using the SUMP cycle as a structuring framework. It combines a methodological perspective with insights from planning practice, reviewing both the underlying methodological approach and its application in current planning processes. The analysis draws on a review of eleven selected CCAM policy documents and 20 planning documents, including SUMPs and mobility strategies, to identify where and how socio-economic considerations are considered across the different phases of the planning cycle.

While CCAM is often framed primarily as a technological innovation, the analysis of both policy documents and local mobility plans demonstrates that it represents a broader socio-economic transformation. CCAM affects not only how mobility services are delivered, but also how access to opportunities is structured, how costs and benefits are distributed, how labour markets evolve, how data is governed, and how public trust is established.

At the same time, the review reveals a consistent pattern. Socio-economic aspects are widely acknowledged at the level of ambition, but they are not yet systematically reflected in planning and decision-making processes. Issues such as accessibility, safety and innovation are relatively well integrated, whereas affordability, equity, labour conditions, digital inclusion and public trust are often treated as expected outcomes rather than as explicit planning requirements supported by concrete measures, indicators and governance arrangements.

To move from ambition to implementation, CCAM needs to be addressed within a structured planning framework that ensures the consistent consideration of social, economic and environmental impacts. The SUMP cycle provides such a framework. By organising mobility planning into four phases, Preparation and Analysis, Strategy Development, Measure Planning, and Implementation and Monitoring, it enables a systematic examination of where socio-economic aspects should be introduced, operationalised and evaluated.

Building on this approach, the chapter assesses how the nine identified socio-economic factors, accessibility and connectivity; affordability; equity and inclusion; employment, skills and labour conditions; public health and safety; public acceptance, trust and awareness; data governance, privacy and cybersecurity; digital coverage and connectivity; and funding and financing, are currently addressed

across the SUMP cycle. It highlights key gaps and structural limitations in current planning and policy practices and identifies entry points for strengthening the integration of socio-economic considerations in CCAM deployment.

3.1 Socio-economic considerations across the SUMP cycle

Socio-economic aspects of CCAM arise across all phases of the SUMP cycle and require continuous consideration throughout the planning process. As illustrated in Figure 1, the SUMP 2.0 cycle structures mobility planning into four interlinked phases, providing a useful framework to examine where and how these aspects should be considered, translated into actions, and followed up over time.

In the Preparation and Analysis phase, socio-economic aspects define the baseline conditions, including accessibility gaps, affordability challenges, labour market dynamics, digital inclusion, and existing inequalities. Addressing these aspects at an early stage is essential, as it shapes problem definition, stakeholder involvement, and the overall scope of planning.

During Strategy Development, these aspects need to be translated into objectives, scenarios, and targets. This phase determines whether CCAM contributes to inclusive and equitable mobility outcomes or risks reinforcing existing disparities.

In the Measure Planning phase, socio-economic priorities are translated into concrete actions, service design choices, procurement approaches, and governance arrangements. Decisions at this stage directly influence how benefits and risks are distributed across user groups and territories.

Finally, in the Implementation and Monitoring phase, socio-economic impacts need to be systematically assessed and managed over time. This requires appropriate indicators, adaptive governance processes, and transparent communication to ensure that outcomes remain aligned with policy objectives.

Across all phases, effective consideration of socio-economic aspects requires coordination beyond the transport sector, involving actors from social policy, labour markets, digital infrastructure, and public health. Without such coordination, socio-economic aspects risk remaining general objectives rather than influencing planning and decision-making in practice.

Figure 1. The SUMP 2.0 Cycle (Rupprecht-Consult, 2019)

3.2 SUMP Phase 1 – Preparation and Analysis

Phase 1 of the SUMP cycle *preparation and analysis* establishes the institutional, strategic, and analytical foundations for all subsequent decisions. In the context of CCAM integration, this phase is particularly important, as it determines whether automated and connected mobility is approached merely as a technological deployment or as a mobility policy instrument aligned with broader social, economic, and environmental objectives.

CCAM introduces significant structural changes to mobility systems, including new service models, evolving labour dynamics, increased digital dependencies, new pricing structures, and emerging data governance challenges. If socio-economic considerations – such as accessibility, affordability, equity, labour transition, public trust, and digital inclusion are not considered from the outset, they risk being addressed only later, in a reactive manner during pilot implementation. SUMP-oriented CCAM guidance therefore emphasises that automated mobility should not be pursued as an objective in itself but rather aligned with overarching mobility goals and assessed through scenario development, impact analysis, and participatory governance processes from the beginning.

Phase 1 is therefore the stage at which socio-economic governance needs to be systematically integrated into working arrangements, planning frameworks, and baseline analyses. The review of the

eleven CCAM policy documents shows that while socio-economic aspects are widely acknowledged, they are not yet consistently translated into practical planning approaches at this early stage.

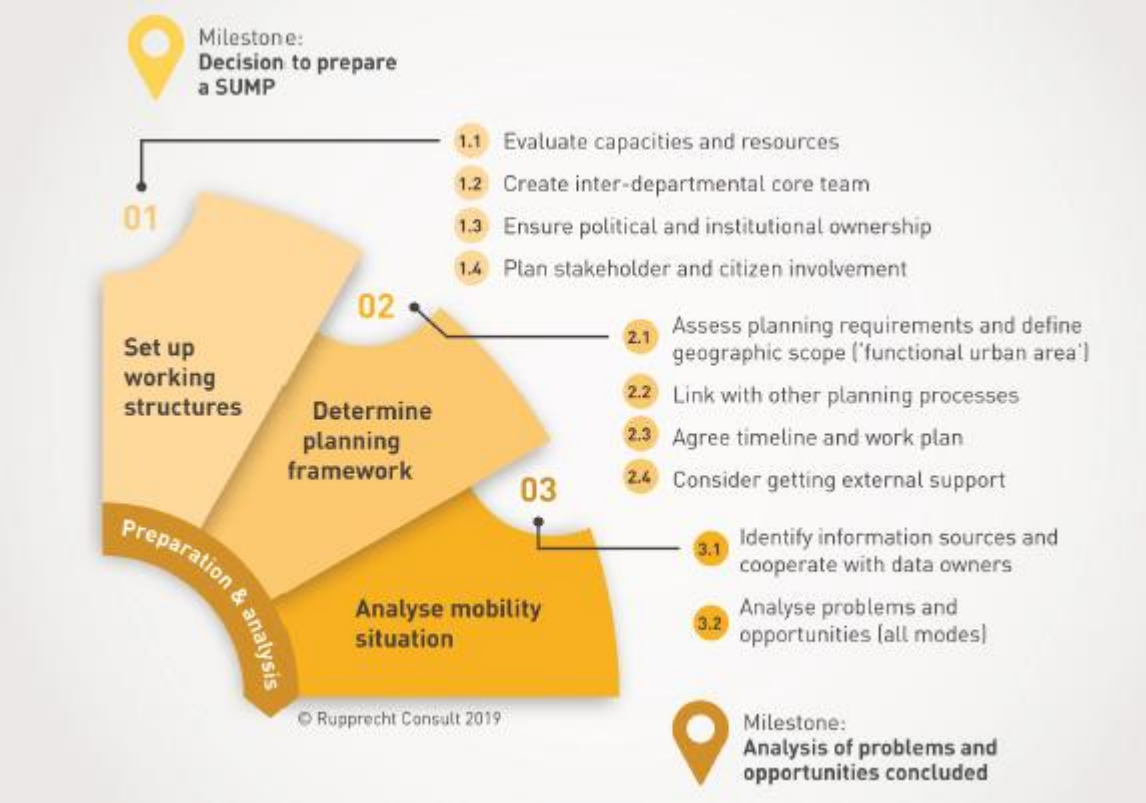

Figure 2. SUMP 2.0 Phase "Preparation & Analysis" (Rupprecht-Consult, 2019)

3.2.1 Set up working structures

3.2.1.1 Implications of planning documents at local and regional level

The review of the 20 mobility plans shows that cities and metropolitan areas already establish multi-actor working structures for SUMP preparation, but these structures are still mainly designed for conventional mobility planning and rarely include CCAM aspects. In almost all cases, the core structure is led by the mobility or transport department, supported by other municipal units such as traffic, infrastructure, urban planning, environment, climate, or technical services, and complemented by public transport operators, metropolitan or inter-municipal bodies, consultants, and participatory processes involving citizens and stakeholders. Clear examples include Stuttgart, where the plan was prepared by the AG Mobilität for the steering group "Nachhaltig mobil in Stuttgart"[1] (a coordination platform across departments, stakeholders, and institutions) under the Mayor, with permanent participation from city administration, the public transport operator SSB, and the regional transport association VVS; Gijón[2], where the plan is clearly structured around the municipal mobility service, mobility office, traffic unit, and

[1] City of Stuttgart (2023). Aktionsplan Nachhaltig Mobil in Stuttgart.
Available at: https://www.stuttgart.de/nachhaltig-mobil

[2] City of Gijón (2023). Plan de Movilidad Urbana Sostenible de Gijón.
Available at: https://www.gijon.es/es/programas/plan-de-movilidad-sostenible

external drafting team; and Gelsenkirchen[3], where a "Facharbeitskreis" (a technical working group composed of experts and institutional stakeholders involved in the development of the mobility plan), political actors, and a public dialogue process were all integrated into the preparation process. Similar participatory or multi-level arrangements are documented across analysed SUMP documents.

Across the reviewed plans, the actors most commonly involved in SUMP preparation include municipal transport and mobility departments, spatial planning and urban development departments, traffic management units, environmental and climate departments, infrastructure and engineering services, metropolitan or regional transport authorities, and public transport operators. In addition, cities often involve technical consultants, universities or research institutions, and organise public participation processes with citizens, neighbourhood organisations, business associations, and civil society organisations. These working structures demonstrate that cities already have established mechanisms for interdepartmental coordination and stakeholder engagement in mobility planning.

From the perspective of CCAM deployment, the analysis indicates that existing governance structures need to be expanded to include additional actors who can address the digital, social, economic and labour implications of automated mobility systems. In particular, working structures should integrate labour and employment institutions such as public employment services, transport worker unions, professional driver associations, and vocational training organisations, which can support the assessment of workforce impacts and skills requirements linked to automation. Social and accessibility actors, including social affairs departments, disability organisations, elderly associations and organisations representing vulnerable or low-income groups, should also be involved to ensure that automated mobility services do not create new inequalities in access to mobility. While some plans already include accessibility bodies, such as the accessibility commission referenced in the Le Havre mobility plan[4], such representation remains limited across the analysed documents.

In addition, CCAM planning requires the involvement of actors responsible for digital infrastructure and data governance, which are largely absent from current SUMP working structures. These include municipal ICT and smart city departments, telecommunications operators, digital infrastructure providers, national data protection authorities, cybersecurity agencies, and organisations responsible for urban data platforms. Their participation is necessary to address issues related to vehicle-to-infrastructure communication, connectivity, data sharing frameworks, privacy protection, and cybersecurity risks associated with automated mobility systems. Similarly, CCAM planning should involve technology and industry actors, including automated vehicle developers, vehicle manufacturers, technology suppliers, and mobility-as-a-service platform providers, whose expertise is essential for understanding technological capabilities and deployment pathways.

Finally, the governance structures for CCAM-ready mobility planning should also include road safety authorities, vehicle approval bodies, insurance regulators, economic development agencies, innovation clusters, and chambers of commerce, which can support the assessment of safety implications, regulatory frameworks, and economic opportunities linked to automation.

[3] City of Gelsenkirchen (2023). Masterplan Mobilität der Stadt Gelsenkirchen. Available at: https://www.gelsenkirchen.de/de/stadtprofil/stadtthemen/mobilitaet_und_klima/zukunft_mobilitaet/masterplan_mobilit%C3%A4t/index.aspx

[4] Le Havre Seine Métropole (2024). Plan de Mobilité.
Available at: https://www.lehavreseinemetropole.fr/plan-de-mobilite

3.2.1.2 Implications of policy documents and roadmaps at national and international level

Across the CCAM policy documents, socio-economic aspects are acknowledged, but they are only partly translated into the kind of structured governance arrangements that Phase 1 of the SUMP cycle requires. Most strategies assume that positive outcomes – better accessibility, improved safety, new skilled jobs, secure data systems will follow from technological progress combined with regulatory readiness. However, they rarely define stable coordination mechanisms that would ensure these socio-economic priorities remain central throughout planning, piloting and scaling.

Working structures are most clearly implied where documents adopt an ecosystem perspective. Luxembourg's *Strategy for Automated Driving*[5] explicitly describes deployment as a coordinated ecosystem challenge, which suggests the need for structured cooperation between transport authorities, digital infrastructure actors, industry and regulators. The UK's *CAM Roadmap 2035*[6] similarly frames CCAM as a system-wide transition requiring alignment across public authorities, infrastructure providers and innovation actors. In contrast, more technology-oriented documents such as *5GAA Roadmap III*[7] or the *China ICV Roadmaps*[8] focus primarily on standards, connectivity and industrial alignment, with less attention to internal public-sector structures responsible for social outcomes.

This creates a gap for socio-economic aspects such as affordability, equity, labour conditions and public trust. While accessibility and rural inclusion are frequently highlighted (Germany's *Die Zukunft fährt autonom*[9]; the *EU Commission 2024 CCAM progress report*[10]; the *PAVE Europe White Paper*[11]), the documents do not consistently establish governance arrangements that would ensure these objectives are actively pursued and monitored. Similarly, data governance and cybersecurity are treated as

[5] Government of Luxembourg (2025). Automatiséiert Fueren 2028: the Luxembourg Strategy for Automated Driving.
Available at: https://www.connectedautomateddriving.eu/wp-content/uploads/2025/12/20251210104900_brochure-automatiseiert-fueren-2028-en.pdf

[6] Zenzic (2025). UK Connected and Automated Mobility Roadmap to 2035 – Opportunities for CAM.
Available at: https://zenzic.io/wp-content/uploads/2025/06/UK-CAM-Roadmap-2035-Why-CAM-PDF.pdf

[7] 5G Automotive Association (5GAA) (2024). A Visionary Roadmap for Advanced Driving Use Cases, Connectivity, and Technologies.
Available at: https://5gaa.org/content/uploads/2025/01/5gaa-wi-cv2xrm-iii-roadmap-white-paper.pdf

[8] China Society of Automotive Engineers (CSAE) & China Industry Innovation Alliance for Intelligent & Connected Vehicles (CAICV) (2023). ICV Roadmaps: A Worldwide Perspective.
Available at: https://www.connectedautomateddriving.eu/wp-content/uploads/2023/06/1683186774656 28g4t1.pdf

[9] Federal Ministry for Digital and Transport (BMDV) (2024). Die Zukunft fährt autonom: Strategie der Bundesregierung für autonomes Fahren im Straßenverkehr.
Available at: https://www.connectedautomateddriving.eu/wp-content/uploads/2025/06/die-zukunft-faehrt-autonom.pdf

[10] European Commission (2024). Status of progress on Connected, Cooperative and Automated Mobility in Europe.
Available at: https://www.ccam.eu/wp-content/uploads/2024/04/swd_2024_92-compressed_1.pdf

[11] PAVE Europe (2025). The Future of Public Transportation: Embracing Autonomous Mobility.
Available at: https://www.connectedautomateddriving.eu/wp-content/uploads/2025/07/June_PAVE-Europe-White-Paper-The-Future-of-Public-Transportation-Embracing-Autonomous-Mobility.pdf.pdf

essential for trust (Germany, EU, 5GAA, WEF[12]), yet the implication for working structures – clear data stewardship roles, incident coordination mechanisms, public transparency responsibilities is rarely described.

The implication for inclusive CCAM planning is that socio-economic objectives risk remaining policy intentions unless they are embedded in dedicated governance structures. In Phase 1, working structures should therefore be deliberately designed to reflect the full range of socio-economic priorities already identified in the strategies. This means going beyond a transport-only coordination model and formally involving public transport authorities, social inclusion and accessibility experts, labour and skills institutions, data protection and cybersecurity bodies, public health actors, and finance and procurement departments. Without this broader structure, CCAM planning risks being technically coherent but socially unbalanced.

3.2.2 Determine planning framework

3.2.2.1 Implications of planning documents at local and regional level

The review of the 20 analysed SUMP and mobility planning documents indicates that the planning framework is generally defined around transport system performance, environmental sustainability, and urban development objectives. In most cases, cities frame their mobility strategies through objectives such as reducing congestion, improving traffic flow, optimising infrastructure use, strengthening public transport, reducing emissions, and improving accessibility. These priorities are reflected in documents such as the Stuttgart Action Plan for Sustainable Mobility[1]1 above, the Barcelona Urban Mobility Plan (PMU)[13], the Greater Dublin Area Transport Strategy[14], the Masterplan Mobilität Münster 2035[15], and the Gelsenkirchen Mobility Masterplan[3], where the planning framework is built around goals related to modal shift, climate protection, traffic efficiency, and infrastructure optimisation. Similar orientations are

[12] World Economic Forum (2025). Autonomous Vehicles: Timeline and Roadmap Ahead.
Available at: https://www.connectedautomateddriving.eu/wp-content/uploads/2025/06/WEF_Autonomous_Vehicles_2025.pdf

[13] City of Barcelona (2024). Pla de Mobilitat Urbana de Barcelona (PMU).
Available at:
https://www.barcelona.cat/mobilitat/sites/default/files/documentacio/pmu_bcn_2024_per_ceuim_20201214_compressed.pdf

[14] Greater Dublin Area (2022). *Transport Strategy for the Greater Dublin Area 2022–2042.*
Available at: https://www.nationaltransport.ie/wp-content/uploads/2023/01/Greater-Dublin-Area-Transport-Strategy-2022-42-1.pdf

[15] City of Münster (2024). Masterplan Mobilität Münster 2035.
Available at: https://mobil-in-muenster.de/masterplan-mobilitaet/

visible in the mobility plans of Kraków[16], Łódź[17], Bydgoszcz[18], Sintra[19], Aarhus[20], Las Palmas[21], Le Havre[4], Gijón[2], and Monteroni di Lecce[22], where the planning framework focuses primarily on transport demand management, sustainable mobility transitions, and environmental objectives.

In these documents, the planning framework is typically established through a set of strategic objectives, policy priorities, and sectoral policies that guide the mobility plan, often aligned with national climate strategies, EU mobility and sustainability policies, or regional development strategies. For example, the Barcelona PMU aligns its objectives with metropolitan sustainability and climate policies, while the Greater Dublin Area Transport Strategy integrates land-use planning and transport development across the metropolitan region. Similarly, the Münster Masterplan Mobilität 2035 and Gelsenkirchen Masterplan Mobilität frame their planning objectives around sustainable urban mobility, improved accessibility, and climate neutrality. In this sense, the analysed SUMPs demonstrate a strong integration between mobility policy and broader urban sustainability goals.

However, the analysis also shows that the planning frameworks in the reviewed documents remain largely centred on transport system impacts, particularly congestion management, traffic efficiency, infrastructure capacity, and environmental performance. Economic aspects are occasionally referenced, typically in relation to urban attractiveness, accessibility to employment centres, or support for local economic development, but these considerations are rarely analysed in a structured or systematic way. For example, several plans emphasise the role of mobility in supporting economic activity and access to jobs, but they do not explicitly assess the economic impacts of technological transformation within the transport sector itself. As a result, aspects such as labour market transitions, technological innovation in mobility industries, or economic restructuring related to automation are not explicitly addressed in the planning frameworks of the analysed SUMPs.

From the perspective of CCAM deployment, this represents an important gap in the way the planning framework is defined. The introduction of automated mobility technologies has the potential to affect not only transport performance but also economic structures, employment patterns, technological competitiveness, and innovation ecosystems. In particular, CCAM may influence job creation in digital mobility services and technology sectors, job displacement among professional drivers or transport

[16] City of Kraków (2023). Plan Zrównoważonej Mobilności Miejskiej dla Krakowa.
Available at: https://www.krakow.pl/klimat/278522,artykul,plan_zrownowazonej_mobilnosci.html

[17] Łódź Metropolitan Area (2024). SUMP dla Łódzkiego Obszaru Metropolitalnego.
Available at: https://www.lom.lodz.pl/plan-zrownowazonej-mobilnosci-miejskiej/

[18] Bydgoszcz Functional Urban Area (2023). Plan Zrównoważonej Mobilności Miejskiej (PZMM).
Available at: https://www.bydgoszcz.pl/miasto/zit-bydof/aktualnosci/plan-zrownowazonej-mobilnosci-miejskiej-dla-bydgoskiego-obszaru-funkcjonalnego/

[19] City of Sintra (2024). Plano de Mobilidade Urbana Sustentável de Sintra.
Available at: https://cloud.cm-sintra.pt/s/cd5KY9J2eMWA3wA

[20] City of Aarhus (2023). Mobilitetsplan Aarhus Midtby.
Available at: https://aarhus.dk/media/oy1m1yrq/mobilitetsplan-aarhus-midtby.pdf

[21] Las Palmas de Gran Canaria (2023). Estrategia de Movilidad Sostenible.
Available at: https://lpgcmueve.es/files/estrategia_movilidad_2023.pdf

[22] City of Monteroni di Lecce (2024). Piano Urbano della Mobilità Sostenibile (PUMS).
Available at:
https://servizi.comune.monteroni.le.it/openweb/pratiche/dett_registri.php?sezione=territorio&id=5039&codEstr=NEXT

workers, and new skills requirements related to automated vehicle operation, maintenance, and data management. These impacts extend beyond the traditional scope of transport planning and therefore require the planning framework to integrate economic and labour market considerations alongside transport system objectives.

To address these challenges, CCAM-ready mobility planning frameworks should explicitly incorporate economic development and labour market perspectives when defining the scope and objectives of the SUMP. This implies that, during the determining planning framework sub-phase of the SUMP process, cities should involve municipal or regional economic development departments, labour market authorities, innovation agencies, and research institutions specialising in mobility technologies and labour market analysis as technical partners in the planning process. Their role should not be limited to stakeholder consultation but should include technical analysis of economic impacts, assessment of employment transitions, evaluation of innovation opportunities, and identification of new skills requirements associated with automated mobility systems.

In addition, the planning framework should explicitly address questions related to sectoral competitiveness and technological innovation, particularly in cities or regions with automotive, logistics, or technology industries that may be affected by the deployment of automated vehicles. Economic development agencies, technology clusters, and chambers of commerce can contribute to understanding how CCAM deployment may influence local industrial ecosystems, new mobility services, and investment opportunities in the digital mobility sector.

3.2.2.2 Implications of policy documents and roadmaps at national and international level

When defining the planning framework, the eleven documents show strong attention to technical and infrastructure needs such as connectivity, data availability, safety systems and investment readiness. However, they are less clear about how social and economic goals will be protected in practice.

Accessibility and inclusion are often presented as key benefits. Germany's *Die Zukunft fährt autonom*, the UK's *CAM Roadmap 2035*, the *EU Commission 2024 report*, and the *PAVE Europe White Paper* all describe CCAM as a way to improve mobility for underserved areas and vulnerable users. Yet these documents rarely define clear targets or requirements that would guarantee this outcome.

Affordability is mainly discussed in terms of possible cost savings. The UK roadmap and PAVE suggest that automation could reduce operating costs, especially in rural areas. However, most documents do not explain how this would translate into affordable fares, integrated ticketing or protected public service models. It often remains unclear whether CCAM services will be part of the public transport system or operate as separate commercial services.

Financing is acknowledged as important, especially in the Czech plan[23], Luxembourg strategy, EU reporting and WEF roadmap. However, procurement is rarely highlighted as a tool to enforce social standards. This is a gap, because procurement could require accessibility features, cybersecurity safeguards, labour standards and equitable service coverage.

[23] Ministry of Transport of the Czech Republic (2024). Autonomous Mobility Plan until 2025 with a Prospect to 2030. Available at: https://www.connectedautomateddriving.eu/wp-content/uploads/2024/10/Autonomous-Mobility-Plan-until-2025-with-a-Prospect-to-2030.pdf

Data governance and cybersecurity are more clearly addressed. Germany[24], the Czech Republic, the EU and 5GAA all stress secure systems and data protection. Still, these issues are often treated as technical requirements rather than as planning commitments with clear accountability and transparency mechanisms.

For Phase 1, the planning framework should clearly commit to all nine socio-economic aspects. Accessibility, affordability, equity, workforce impacts, safety, trust, digital inclusion, data governance and financing should be defined as measurable planning principles.

3.2.1 Analyse mobility situation

3.2.1.1 Implications of planning documents at local and regional level

The analysis of the mobility situation represents a key step in the preparation phase of the SUMP process. The reviewed mobility plans demonstrate that cities generally conduct a comprehensive diagnosis of existing transport systems, including travel behaviour, infrastructure capacity, safety performance, and environmental impacts. Typical analyses include indicators related to modal split, traffic volumes, congestion levels, accessibility to public transport, road safety statistics, air quality, and greenhouse gas emissions. These indicators provide a solid basis for understanding the performance of the transport system and identifying key mobility challenges.

Examples from the reviewed plans illustrate this traditional focus. The Barcelona Urban Mobility Plan (PMU) analyses modal split, travel demand, congestion, air pollution and noise impacts, while the Greater Dublin Area Transport Strategy assesses transport demand, network capacity, and travel behaviour patterns. Similarly, the Münster Mobility Masterplan 2035 and the Gelsenkirchen Masterplan Mobilität include extensive analyses of transport flows, modal share, accessibility of public transport, cycling infrastructure, and road safety indicators. Other plans, such as those of Stuttgart, Kraków, Łódź, Bydgoszcz, Sintra, Aarhus, Las Palmas, Gijón, and Le Havre, follow similar diagnostic approaches, focusing primarily on infrastructure performance, traffic flows, environmental indicators, and accessibility to mobility services.

While these analyses provide valuable insights into the functioning of the transport system, the review of the mobility plans shows that the diagnostic phase remains largely centred on transport system indicators, with limited systematic assessment of socio-economic impacts of mobility systems. Indicators related to employment in the mobility sector, affordability of transport services, digital access to mobility services, labour market implications of mobility transitions, or public acceptance of technological innovations are rarely included in the diagnostic phase. As a result, important socio-economic dynamics that may shape the future deployment of CCAM are not systematically captured in current mobility planning processes.

To better understand the analytical scope of the reviewed SUMPs, Table 4 summarises the main indicator categories assessed in the diagnostic phase of the analysed plans. The table highlights both commonly used indicators and areas where socio-economic considerations remain limited.

[24] BMDV (2024), Autonomes Fahren im öffentlichen Verkehr.
Available at: https://www.connectedautomateddriving.eu/wp-content/uploads/2025/06/BMDV_Handbuch_Autonomes_Fahren_Im_Oeffentlichen_Verkehr.pdf

Table 4. Indicators within analysed SUMP documents

Indicator category	Example indicators analysed in SUMPs	Coverage in analysed plans
Mobility demand and modal split	Modal share, trip purposes, travel distance, travel time	Very common (almost all SUMPs)
Traffic performance	Congestion levels, traffic volumes, network capacity, traffic flow	Very common
Public transport performance	PT coverage, service frequency, ridership, intermodality	Very common
Active mobility	Cycling infrastructure, walking accessibility, cycling modal share	Very common
Accessibility	Access to PT stops, proximity to services, accessibility for vulnerable groups	Common
Safety	Traffic accidents, fatalities, injuries	Very common
Environmental indicators	CO_2 emissions, air pollution, noise levels	Very common
Land-use and spatial indicators	Density, urban structure, land-use patterns	Common
Economic indicators	Accessibility to employment centres, role of mobility for economic activity	Limited
Transport affordability	Cost of public transport, transport expenditure	Rare
Employment in the mobility sector	Number of transport workers, labour market impacts	Rare
Skills and workforce indicators	Workforce skills related to mobility services	Not observed
Digital mobility indicators	Availability of ITS systems, digital mobility platforms	Limited
Data governance / cybersecurity indicators	Data sharing, privacy frameworks	Not observed
Public acceptance indicators	Public attitudes towards mobility changes	Rare

Equity and social inclusion indicators	Mobility access for vulnerable groups	Limited

This gap is particularly relevant in the context of CCAM deployment, which may significantly affect labour markets, mobility service business models, and accessibility to mobility services. Automation may create new employment opportunities in digital mobility services and technology sectors, while simultaneously reducing demand for certain categories of transport workers such as professional drivers. Without analysing these dynamics during the diagnostic phase, mobility plans risk overlooking important socio-economic impacts of technological transformation in the transport sector. Additionally, indicators capturing transport affordability, transport poverty, and digital accessibility of mobility services are rarely included, despite their importance for ensuring fair access to future mobility services.

To support CCAM-ready mobility planning, the diagnostic phase should expand beyond traditional transport indicators and incorporate socio-economic and technological indicators that capture the broader impacts of automated mobility systems. In addition to conventional transport indicators, cities should analyse: employment in transport and mobility sectors; workforce skills related to digital mobility systems; affordability of mobility services and transport poverty; access to mobility services for vulnerable groups; digital connectivity and availability of intelligent transport infrastructure; public perceptions and acceptance of automated mobility technologies; economic impacts of mobility innovation on local industries.

3.2.1.2 Implications of policy documents and roadmaps at national and international level

In the analysis stage, most documents focus more on technological readiness than on social baseline conditions. Expected benefits are better access, improved safety, economic growth. They are described in detail, but fewer documents require a clear assessment of current social and economic challenges before deployment.

Accessibility is frequently mentioned, especially rural gaps and barriers for non-drivers (Germany, UK, EU, PAVE). Sweden[25] adds an important dimension by linking accessibility to digital integration and transfer points. However, many documents do not require detailed data on service gaps, cost burdens, disability access or digital exclusion.

Affordability and equity are even less systematically analysed. While inequality risks are occasionally mentioned (notably in the WEF roadmap), there is little requirement to assess who currently faces high transport costs or limited digital access. Without such analysis, CCAM deployment could unintentionally favour already well-served areas.

Employment and skills are addressed more clearly in the Czech plan and mentioned in Germany and the UK. However, baseline assessments of how many workers may be affected, where risks are highest, or what retraining needs exist are limited.

[25] Swedish Transport Administration (2024). Roadmap – Digitalisation of the Road Transport System, version 2024. Available at: https://www.connectedautomateddriving.eu/wp-content/uploads/2024/10/Trafikverket-Report-Roadmap-Digitalisation-of-the-Road-Transport-System-Version-2024.pdf

Public health and safety are strongly emphasised, mainly in terms of reducing road crashes (Germany, UK, EU, 5GAA). Broader health aspects such as changes in walking and cycling, congestion or emissions are less consistently analysed.

Public acceptance and trust are widely recognised as important, particularly in the Czech and Luxembourg strategies, but few documents require systematic assessment of public attitudes or digital literacy levels. Data governance and cybersecurity are treated as important, yet institutional readiness and capacity are rarely analysed as part of the baseline situation.

The result is that CCAM planning often starts with a strong understanding of technology requirements but a weaker understanding of existing social inequalities and institutional capacities. In Phase 1, a more complete baseline assessment should include accessibility gaps, affordability challenges, equity barriers, workforce exposure, health impacts, public trust levels, digital inclusion conditions, data governance capacity and current financing structures.

3.3 SUMP Phase 2 – Strategy Development

Phase 2 of the SUMP cycle – strategy development translates the analytical foundations of Phase 1 into a coherent long-term mobility vision, objectives, targets and policy packages. This phase determines the direction of change and defines what kind of mobility system a city or region intends to build.

In the context of CCAM integration, Phase 2 is critical because it frames whether automated and connected mobility will reinforce or undermine socio-economic objectives. At this stage, decisions are made about priorities: whether CCAM supports public transport, how it contributes to territorial cohesion, whether it strengthens accessibility for vulnerable users, how labour transition will be managed, and how affordability and digital inclusion will be safeguarded. If socio-economic considerations are weakly embedded in the strategy phase, CCAM risks becoming a supply-driven innovation pathway rather than a policy instrument aligned with inclusion, equity and public value.

Integrating socio-economic considerations in this phase requires that CCAM strategies be assessed not only for technical feasibility but also for their impacts on access, affordability, labour conditions, safety, public trust and territorial balance. Scenario-based planning is particularly important here, as different automation pathways can lead to very different socio-economic outcomes. Embedding these considerations at the strategy level ensures that CCAM becomes a lever for achieving SUMP objectives rather than a parallel innovation agenda.

Figure 3. SUMP 2.0 Phase "Strategy Development" (Rupprecht-Consult, 2019)

3.3.1 Build and jointly assess scenarios

3.3.1.1 Implications of planning documents at local and regional level

The review of the analysed SUMP and mobility planning documents shows that scenario development is a well-established component of the strategy development phase. Cities typically construct scenarios to explore future mobility demand, modal split evolution, infrastructure needs, and environmental impacts, often comparing a baseline (do-nothing or trend scenario) with one or more policy or intervention scenarios. These scenarios are commonly used to assess the effects of measures such as modal shift, public transport improvements, traffic demand management, and emissions reduction strategies.

For example, the Luxembourg City mobility plan[26] develops scenarios up to 2035 to assess changes in travel demand and modal split under different policy conditions, while the Barcelona PMU and the Gijón mobility plan use scenario-based approaches to evaluate environmental impacts, mobility patterns, and system performance under alternative planning strategies. Similarly, the Greater Dublin Area Transport Strategy, Münster Masterplan Mobilität 2035, and Gelsenkirchen Masterplan Mobilität include scenario modelling to assess infrastructure needs, transport demand, and network performance under future growth assumptions. Other plans, including those of Kraków, Łódź, Bydgoszcz, Sintra, Aarhus, Las

[26] City of Luxembourg (2024). Plan de Mobilité de la Ville de Luxembourg.
Available at: https://www.vdl.lu/de/unterwegs/unser-mobilitaetsplan-fuer-morgen/mobilitaetsplan

Palmas, Le Havre, Stuttgart, and Monteroni di Lecce, also apply scenario analysis to compare different mobility futures, often supported by transport modelling tools and stakeholder input.

However, the analysis of these scenarios shows that they are predominantly designed to assess traditional transport planning variables, including traffic volumes, infrastructure performance, modal distribution, environmental indicators, and accessibility outcomes. While these scenario frameworks are robust for evaluating sustainable mobility policies, they rarely incorporate explicit CCAM-related variables such as vehicle automation, artificial intelligence, or large-scale deployment of connected mobility systems.

Across the analysed plans, explicit references to automation or autonomous vehicles within scenario development are largely absent. Scenarios do not typically model the potential effects of automated vehicle deployment on travel behaviour, congestion patterns, or public transport demand. Instead, future mobility is generally framed in terms of modal shift towards public transport, walking and cycling, combined with gradual improvements in system efficiency. This indicates that automation is not yet treated as a structural driver of change within scenario-building exercises.

Some elements related to intelligent transport systems (ITS) and digitalisation do appear in several plans, but they usually act as measures rather than scenario drivers. For example, plans such as those of Münster, Szczecin–Świnoujście[27], Kraków, and Las Palmas include ITS deployment, traffic management systems, or digital mobility services as part of future strategies, but these are not systematically modelled as transformative factors in scenario analysis. Similarly, references to Mobility-as-a-Service (MaaS), real-time passenger information, or integrated ticketing systems are present in several plans, yet they are treated as supporting tools rather than as variables shaping alternative future scenarios.

Digital infrastructure and connectivity – key enablers for CCAM are also only partially reflected in scenario frameworks. While some plans acknowledge the importance of digitalisation and smart mobility solutions, they do not typically assess different levels of digital infrastructure deployment (e.g. high vs. low connectivity scenarios) or their implications for mobility patterns and socio-economic outcomes. Likewise, artificial intelligence and data-driven mobility management are not explicitly included into scenario-building exercises, even when digital tools are referenced in the broader strategy.

From a methodological perspective, the scenarios in the reviewed SUMPs are generally based on transport modelling and forecasting techniques that extrapolate current trends or assess policy interventions within existing system boundaries. This limits their ability to capture disruptive technological changes, such as those associated with CCAM, which may fundamentally alter travel demand, vehicle ownership patterns, logistics systems, and labour markets.

For CCAM-ready mobility planning, scenario development should therefore be expanded to include technology-driven and socio-economic scenarios alongside traditional transport scenarios. They should consider varying levels of automation deployment, different configurations of shared vs. private automated mobility, the role of digital infrastructure and connectivity, potential labour market impacts and service model transformations, etc.

[27] Szczecin–Świnoujście Functional Area (2023). SUMP SOM.
Available at: http://som.szczecin.pl/sump/

Such scenarios should be developed and assessed jointly with stakeholders, including not only transport planners but also technology providers, data and digital infrastructure actors, labour and employment stakeholders, and social policy actors, ensuring that both transport system performance and broader socio-economic implications are considered. Expanding scenario-building in this way would enable cities to better anticipate the transformative effects of CCAM and support the development of mobility strategies.

3.3.1.2 Implications of policy documents and roadmaps at national and international level

Across the policy documents, scenario-building is generally implicit rather than systematically developed as a participatory planning tool. Most strategies describe expected future pathways such as scaling of automated shuttles, expansion of connected infrastructure, integration with public transport or workforce transformation. However, they rarely present structured alternative scenarios that compare different socio-economic outcomes.

For example, Germany's *Die Zukunft fährt autonom*, the UK's *CAM Roadmap 2035*, and the *EU Commission 2024 progress report* outline progressive deployment pathways linked to technological readiness and regulatory milestones. However, they do not consistently model how different deployment choices (e.g., public transport integration versus commercial robotaxi dominance) would affect affordability, equity, employment, digital inclusion or public health.

The *World Economic Forum – Autonomous Vehicles 2025* roadmap explicitly highlight uncertainty and the need for scenario-based thinking. The WEF warns that automation could either reduce inequality or exacerbate it, depending on governance choices.

Accessibility and connectivity are often assumed to improve under automation scenarios, particularly in rural areas (Germany, UK, PAVE Europe), but few documents explore scenarios where connectivity gaps persist or where deployment concentrates in profitable urban areas. Similarly, affordability is generally assumed to benefit from efficiency gains, but few strategies test what happens if early automated services remain high-cost or poorly integrated into public transport fare systems.

Employment and skills transitions are acknowledged (especially in the Czech plan and UK roadmap), yet alternative labour market scenarios, ranging from gradual transformation to rapid displacement are rarely compared. Public health and safety are treated primarily through crash reduction expectations, without scenario analysis of possible rebound effects such as increased vehicle kilometres travelled. Data governance and cybersecurity are presented as essential enablers, but few documents explore scenarios of cyber incidents, data misuse, or uneven digital coverage.

The implication for Phase 2 is that socio-economic aspects are not yet systematically stress-tested against alternative futures. Scenario-building should deliberately examine how different policy choices affect inclusion, affordability, workforce conditions, digital access and trust. Joint assessment with stakeholders, including vulnerable users, labour representatives, public transport operators and digital authorities would help identify trade-offs early. Without this step, CCAM strategies risk assuming positive social outcomes rather than testing them.

3.3.2 Develop vision and strategy with stakeholders

3.3.2.1 Implications of planning documents at local and regional level

The analysis of the SUMP and mobility planning documents shows that vision and strategy components are more progressive in acknowledging digitalisation and smart mobility but still do not systematically integrate CCAM as a transformative paradigm. Instead, visions are typically framed around sustainability, accessibility, safety, and quality of life, with digital and technological elements positioned as supporting enablers rather than strategic pillars.

Across the reviewed plans, visions commonly emphasise the transition towards sustainable, inclusive and multimodal mobility systems, prioritising public transport, walking and cycling, and reductions in emissions and car dependency. For example, strategies in Münster, Gelsenkirchen, Barcelona, Dublin, Kraków, and Stuttgart outline long-term visions centred on climate neutrality, liveable urban environments, and improved accessibility for all users. Similarly, plans such as Luxembourg City, Sintra, Aarhus, Las Palmas, and Le Havre highlight integrated and user-oriented mobility systems, often linking mobility with broader urban development and environmental objectives.

Within these visions and strategies, digitalisation and smart mobility concepts are present but unevenly developed. Several plans include objectives related to intelligent transport systems (ITS), real-time information, digital ticketing, and mobility-as-a-service (MaaS). For instance, plans such as those of Barcelona, Münster, Szczecin–Świnoujście, Kraków, and Las Palmas refer to the deployment of ITS, traffic management systems, and integrated digital mobility services as part of their strategic objectives. In these cases, digital technologies are framed as tools to improve system efficiency, user experience, and intermodally. However, even in these more advanced examples, digitalisation is typically positioned as an operational enhancement rather than a driver of structural transformation, and explicit references to automation, artificial intelligence, or connected and automated mobility systems remain limited or absent in the vision statements.

From a CCAM perspective, this creates a clear disconnect between the long-term strategic vision and the potential transformative role of automation and connectivity. While the analysed plans recognise the importance of innovation and digital tools, they do not generally define how emerging technologies such as automated vehicles, AI-driven traffic management, or connected mobility ecosystems could reshape urban mobility systems. As a result, CCAM is not explicitly integrated into the overarching vision of future mobility, nor is it consistently translated into strategic objectives.

In terms of socio-economic aspects, the reviewed visions and strategies demonstrate stronger integration compared to technological aspects. Many plans explicitly include objectives related to accessibility, social inclusion, safety, public health, and environmental justice, and some refer to the role of mobility in supporting economic development and urban attractiveness. For example, accessibility for all users, including persons with reduced mobility, is a recurring objective across plans such as Le Havre, Luxembourg City, and Gijón, while economic vitality and access to employment are highlighted in strategies such as the Greater Dublin Area Transport Strategy and Barcelona PMU. However, similar to the findings in earlier phases, these socio-economic objectives are typically framed in general terms and are not explicitly linked to the impacts of digitalisation or automation. In particular, employment impacts, skills transitions, digital inclusion, and affordability of emerging mobility services are rarely addressed as strategic priorities.

While cities are already developing comprehensive and participatory visions for sustainable mobility, these visions remain largely technology-neutral and do not yet fully incorporate the implications of

CCAM. Compared to the absence of CCAM considerations in scenario-building, the vision and strategy phase shows slightly greater openness to digitalisation but still lacks explicit strategic positioning of automation and connected mobility systems.

For CCAM-ready mobility planning, this implies that the vision and strategy phase should go beyond viewing digitalisation merely as a supporting tool. Instead, it should explicitly define the role of CCAM within the future mobility system, while also recognising the scale of cross-sectoral disruption involved and the corresponding need for proactive strategic planning and appropriate regulatory frameworks. This includes explaining how automation and connectivity can contribute to achieving policy goals related to sustainability, accessibility, and efficiency, while also addressing potential risks and negative impacts. In parallel, socio-economic objectives should be expanded to explicitly include employment transitions, skills development, affordability of automated services, digital inclusion, and public trust in new technologies. Developing such a vision requires active involvement of stakeholders not only from the transport sector but also from technology, labour, social policy, and economic development domains, ensuring that the strategic direction of mobility planning reflects both technological innovation and its broader societal implications.

3.3.2.2 Implications of policy documents and roadmaps at national and international level

Visions for CCAM are typically innovation-driven and future-oriented. They emphasise safety, competitiveness, connectivity and system efficiency. Social objectives such as improved accessibility, inclusion and sustainability are frequently included, but stakeholder co-creation of these visions is less consistently described.

Germany, the UK and Luxembourg frame CCAM as part of broader digital and mobility transformation agendas. The EU report situates CCAM within European industrial and mobility policy. However, these visions are often developed at national level with strong industry involvement and less explicit reference to structured citizen participation or inclusion-focused engagement processes.

The Czech strategy places greater emphasis on societal acceptance and trust, recognising the need for communication and awareness. Luxembourg also explicitly links acceptance, security and integration into its strategic model. Still, across most documents, public acceptance is treated as something to be achieved through communication and safe performance rather than through continuous co-design with affected groups.

Equity, affordability and labour impacts are usually framed as intended benefits or manageable risks rather than central pillars of the strategic vision. While accessibility for rural and underserved users is frequently highlighted (Germany, UK, EU, PAVE), the extent to which these groups are actively involved in shaping the vision is less clear. Similarly, workforce transition is recognised in the Czech and UK documents, but social dialogue mechanisms are not strongly embedded in the strategic narrative.

In Phase 2 of SUMP, vision development should go beyond innovation ambition and explicitly integrate socio-economic priorities. Stakeholder engagement should not be limited to industry and technology actors. It should also include disability organisations, rural communities, low-income user groups, trade unions, public health representatives, data protection authorities and digital inclusion advocates. A socially robust CCAM vision should clearly state that automation will only be pursued if it improves accessibility, safeguards affordability, protects labour standards, strengthens digital inclusion and maintains high safety and data protection standards.

Without broad stakeholder involvement in shaping the vision, CCAM strategies risk being perceived as technology-led rather than socially anchored.

3.3.3 Set targets and indicators

3.3.3.1 Implications of planning documents at local and regional level

Following the scenario-building phase (Section 3.3.1), where CCAM-related drivers are largely absent, and the vision and strategy phase (Section 3.3.2), where digitalisation and smart mobility appear only selectively and mostly as enabling tools, the review of the analysed SUMP and mobility planning documents shows that the target-setting and indicator phase remains strongly focused on traditional transport and sustainability metrics. In almost all of the reviewed plans, objectives are translated into targets and monitoring systems that focus on modal split, accessibility, traffic safety, environmental performance, public transport quality, implementation progress, and in some cases digitalisation of transport services. This means that cities generally do set measurable goals, but these are still primarily framed around transport system performance and environmental outcomes, rather than around the broader socio-economic transformations associated with CCAM.

Across these plans, the most common target areas are modal shift, traffic reduction, CO_2 and pollutant reduction, improvement of road safety, public transport accessibility and quality, and growth of walking and cycling. These areas are consistently translated into measurable targets such as increases in public transport share, reductions in car traffic, cuts in emissions, numbers of accidents, or implementation rates of infrastructure measures. Accessibility is also often expressed through measurable indicators, for example in relation to stop accessibility, barrier-free design, or access to key services. This means that some socio-economic themes, especially accessibility, safety, and environmental justice are already relatively well integrated in target-setting.

However, the review also shows that socio-economic indicators remain much less developed than transport and environmental indicators. In the SUMPs, the socio-economic factors most frequently reflected in objectives and indicators are accessibility and inclusion, followed by public health and safety. These often appear as strategic objectives and, in some plans, are supported by dedicated indicators. By contrast, indicators related to affordability, employment, skills, labour conditions, public trust, digital inclusion, privacy, and cybersecurity are either absent or only weakly reflected. Even where economic development is mentioned in visions or strategic narratives, as in the Greater Dublin Area Transport Strategy, Luxembourg City, or Barcelona this is rarely translated into measurable indicators. Similarly, where plans refer to digital systems such as ITS, MaaS, or real-time passenger information, these are usually not accompanied by indicators measuring digital access, digital readiness, data governance capacity, or social acceptance of digital mobility systems.

If scenario-building does not explicitly model CCAM futures (Section 3.3.1), and visions/strategies do not yet fully define CCAM-related social and economic objectives (Section 3.3.2), then the target-setting phase also cannot yet translate these issues into measurable outcomes. As a result, the reviewed SUMPs are generally not equipped to monitor whether automation and connected mobility would improve or worsen outcomes such as job quality, workforce transition, affordability of new services, digital inclusion, public trust, or data protection.

For CCAM-ready SUMP development, the target and indicator phase would therefore need to expand beyond conventional transport and sustainability KPIs. In addition to existing indicators on modal share,

accessibility, safety, and emissions, cities would need measurable targets for employment impacts and re-skilling, affordability of automated and on-demand services, digital accessibility and digital divide, public acceptance and trust, and data governance, privacy and cybersecurity preparedness. Without such indicators, CCAM may remain invisible within the implementation and monitoring architecture of urban mobility planning, even where digitalisation and innovation are part of the strategy narrative.

3.3.3.2 Implications of policy documents and roadmaps at national and international level

Targets and indicators are most developed in relation to technological deployment milestones, safety validation and infrastructure readiness. Socio-economic targets are less consistently defined.

Safety is the strongest area in terms of measurable ambition, often linked to road safety improvements and system reliability (Germany, UK, EU, 5GAA). Connectivity and infrastructure rollout are also commonly linked to measurable objectives. However, explicit indicators for affordability, equity, digital inclusion, workforce transition or public trust are rarely specified.

Accessibility goals are often described in qualitative terms, improving rural coverage or supporting non-drivers but measurable benchmarks (e.g., coverage thresholds, travel time improvements, accessibility compliance rates) are rarely formalised. Affordability indicators, such as fare integration rates or cost burden reductions, are largely absent. Equity is generally referenced as a guiding principle rather than measured through distributional indicators.

Employment and skills policies, particularly in the Czech strategy, reference qualification development and retraining, but do not consistently define measurable labour transition indicators. Public acceptance and trust are widely acknowledged but rarely operationalised through indicators such as public confidence surveys, transparency metrics or engagement participation levels.

Data governance and cybersecurity receive strong normative emphasis, yet measurable public accountability indicators such as incident reporting standards, audit frequency or transparency metrics are not widely defined.

3.4 SUMP Phase 3 – Measure Planning

Phase 3 of the SUMP cycle – measure planning – operationalises the chosen strategy into concrete actions, regulatory instruments, procurement processes, pilot designs and investment decisions. This phase transforms vision into practice.

For CCAM integration, this is where socio-economic governance becomes tangible. Decisions regarding service design, operational domains, fare integration, data governance requirements, procurement criteria, labour standards and digital access mechanisms directly shape who benefits from automation and who may be adversely affected. The socio-economic implications of CCAM become material at this stage, as abstract objectives are translated into service specifications and infrastructure investments.

Integrating socio-economic considerations in Phase 3 requires that measures be designed with explicit safeguards. This includes accessibility standards for vehicles and interfaces, fare integration into existing public transport systems, procurement clauses addressing cybersecurity and open data governance, retraining and workforce transition frameworks, and mechanisms for continuous

stakeholder engagement during deployment. Monitoring indicators established in earlier phases must now be embedded in contracts and operational agreements to ensure enforceability.

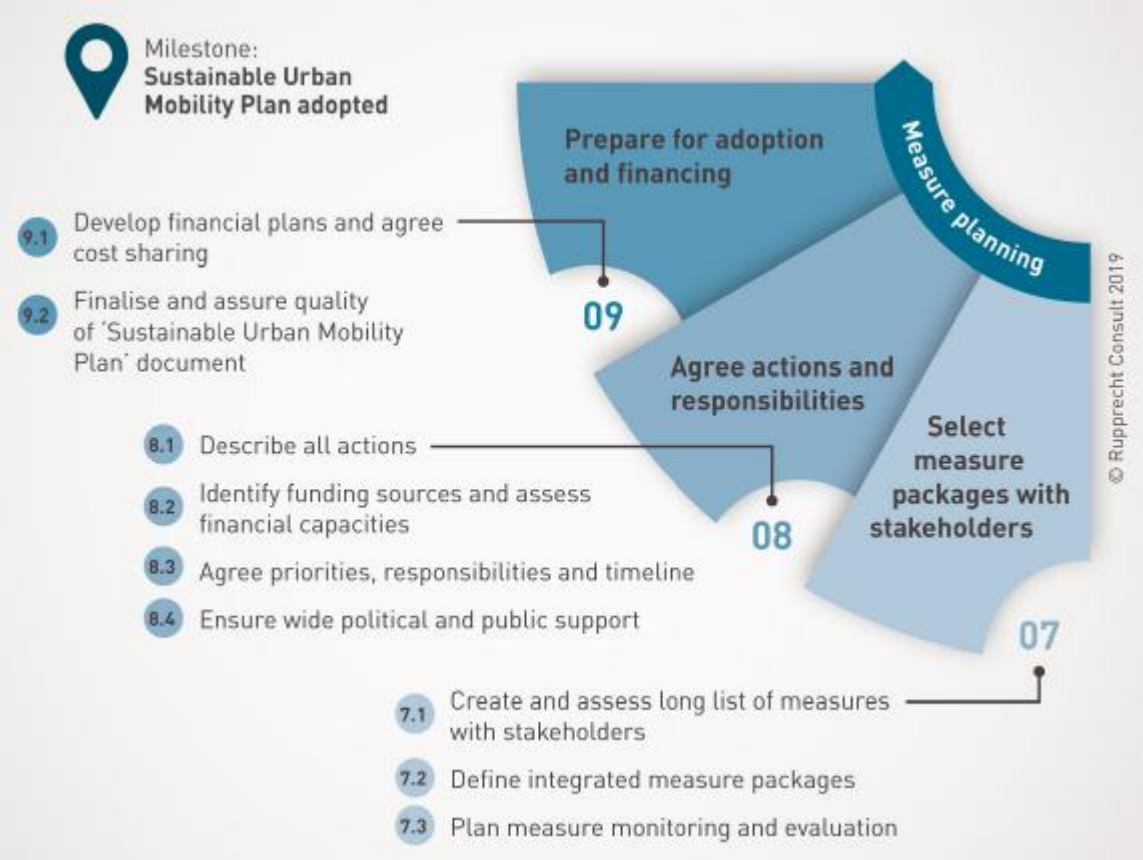

Figure 4. SUMP 2.0 Phase “Measure Planning” (Rupprecht-Consult, 2019)

3.4.1 Select measure packages with stakeholders

3.4.1.1 Implications of planning documents at local and regional level

The analysis of the SUMP and mobility planning documents shows that measure packages remain predominantly focused on conventional sustainable mobility interventions, with only limited and indirect relevance to CCAM.

Across all 20 analysed plans, cities define comprehensive sets of measures, typically structured into thematic packages such as public transport improvements, active mobility, traffic management, environmental measures, and urban logistics. The number of measures varies significantly depending on the scale of the plan, ranging from several dozen measures in smaller municipal SUMPs to several hundred measures in metropolitan strategies (e.g. Barcelona, Dublin, Polish metropolitan SUMPs, Münster). These measures are usually grouped into policy packages or action fields and prioritised through stakeholder consultation processes.

For example, the Barcelona PMU, Münster Masterplan Mobilität 2035, and the Greater Dublin Area Transport Strategy include extensive portfolios of measures covering public transport expansion, cycling infrastructure, traffic calming, parking management, and emission reduction. Similarly, plans such as Gelsenkirchen, Stuttgart, Kraków, Łódź, Bydgoszcz, Sintra, Aarhus, Las Palmas, Le Havre, and Gijón

define structured sets of actions organised around strategic objectives such as modal shift, accessibility improvement, and climate mitigation.

While explicit CCAM deployment measures (e.g. automated vehicle pilots, AV integration strategies) are largely absent across the 20 documents, a subset of measures can be considered indirectly relevant to CCAM, particularly those related to digitalisation, connectivity, and intelligent transport systems (ITS).

These measures fall into several categories:

1. Intelligent transport systems and traffic management

Many plans include measures related to traffic control systems, signal optimisation, and traffic monitoring, which are foundational for CCAM. For example, Münster, Kraków, Szczecin–Świnoujście, and Las Palmas include ITS and traffic management system upgrades as part of their measure packages. These measures aim to improve efficiency and safety but are not explicitly linked to automation.

2. Digital mobility services and MaaS

Several plans propose measures such as integrated ticketing, mobility platforms, and real-time passenger information systems, particularly in Barcelona, Dublin, Münster, and Luxembourg City. These measures support digital integration of mobility services and could serve as enablers for CCAM ecosystems, although they are not framed as such.

3. Data-driven mobility management

Some plans refer to the use of data for monitoring, planning, and operational management, including mobility observatories or digital platforms. However, these are generally described at a conceptual level and are not accompanied by detailed data governance frameworks.

4. Connectivity and infrastructure digitalisation

A limited number of measures refer to smart infrastructure or digitalisation of transport systems, but references to vehicle-to-infrastructure (V2I) communication, 5G deployment, or connected vehicle ecosystems are rare or absent.

Table 5. Types of measures included in the analysed SUMP documents

Measure category	Examples of measures in SUMPs	Relevance to CCAM	Coverage in analysed plans
Public transport measures	Network expansion, service frequency, electrification	Medium-high (service models, DRT, transport gaps)	Very common
Active mobility measures	Cycling infrastructure, pedestrian zones	Low	Very common
Traffic management measures	Signal optimisation, traffic control systems, ITS	Medium (enabler for CCAM)	Common

Parking and demand management	Parking regulation, pricing, low-emission zones	Low	Very common
Environmental measures	Emission reduction, electrification, noise reduction	Indirect	Very common
Urban logistics	Freight consolidation, last-mile logistics solutions	Medium (automation potential)	Common
Digital mobility services	MaaS platforms, integrated ticketing, real-time info	Medium–high (digital backbone for CCAM)	Limited-common
Data and monitoring systems	Mobility observatories, data platforms	Medium	Limited
Connectivity infrastructure	Smart infrastructure, digital systems	High (critical for CCAM)	Rare
Automation-specific measures	AV pilots, autonomous shuttles, regulatory sandboxes	High	Not observed

The analysis shows that although cities define extensive and well-structured measure packages, explicit CCAM-related measures are almost entirely absent. The measures that are relevant to CCAM such as ITS, digital services, and data systems are not designed or combined into integrated CCAM deployment pathways.

Three key gaps can be identified:

- First, there is a lack of automation-specific measures. None of the reviewed plans include clear actions related to testing, deploying, or regulating automated vehicles, nor do they define pilot projects or integration strategies for CCAM systems.
- Second, connectivity and digital infrastructure measures are underdeveloped. While ITS and digital services are present, measures related to connected vehicle ecosystems, communication infrastructure, and data exchange frameworks are rarely specified.
- Third, socio-economic accompanying measures are missing. There are no measure packages addressing workforce transition, skills development, affordability of automated services, or public awareness and trust in automation, despite their importance for CCAM deployment.

The findings indicate that cities are already capable of developing comprehensive, stakeholder-informed packages of measures. However, these are not yet aligned with the requirements of automated and connected mobility systems. For CCAM-ready SUMP development, the selection of measures should evolve from a focus on incremental system improvements towards an approach that anticipates, manages, and regulates the changes introduced by CCAM. This includes integrating automation pilots and deployment strategies, investments in connectivity and digital infrastructure, as well as data governance and cybersecurity measures. In addition, stronger emphasis should be placed on the integration of CCAM with public transport and shared mobility services, alongside the development of

labour transition and skills programmes, and measures that support public engagement and trust-building.

3.4.1.2 Implications of policy documents and roadmaps at national and international level

Across the eleven CCAM policy documents, the transition from strategy to concrete measure packages is generally framed around pilot projects, regulatory adjustments, digital infrastructure deployment and research funding. However, socio-economic dimensions are not always systematically included in how measures are selected and combined.

Most documents emphasise testing environments, regulatory sandboxes, infrastructure upgrades and industrial partnerships (Germany's *Die Zukunft fährt autonom*; UK's *CAM Roadmap 2035*; EU *Status of Progress 2024*; Luxembourg's strategy). These measures are typically bundled around technology readiness and market development. Accessibility improvements, rural pilots and public transport integration are often mentioned (Germany; UK; PAVE Europe), but they are rarely structured as mandatory social measure packages with clearly defined inclusion criteria.

Affordability is seldom used as a selection criterion for measures. While automation is expected to improve cost efficiency, there is limited evidence that measure packages are assessed against their impact on fares, public service obligations or low-income users. Similarly, equity and digital inclusion are not consistently used to prioritise where pilots or early deployments should take place. There is a risk that measures are selected based on technical feasibility and innovation potential rather than social need.

Employment and skills measures are more visible in the Czech *Autonomous Mobility Plan*, which links automation to qualification development and retraining. However, across the broader set of documents, workforce transition is not consistently integrated into measure packages for CCAM deployment. Public health and safety measures are strongly embedded in technical validation, operational safety procedures and connectivity reliability (Germany, UK, 5GAA), but broader health considerations are rarely part of integrated measure bundles.

Data governance and cybersecurity are widely acknowledged as essential and are often included as parallel measures (Germany; EU; 5GAA). However, these are usually treated as technical compliance components rather than as part of broader trust-building or transparency packages.

For Phase 3 in SUMP terms, this reveals an imbalance. Measure packages tend to cluster around technology deployment and regulatory readiness, while socio-economic safeguards are treated as supporting measures rather than core criteria. CCAM measures risk reinforcing existing inequalities rather than reducing them.

3.4.2 Agree actions and responsibilities

3.4.2.1 Implications of planning documents at local and regional level

In the context of CCAM deployment, agreeing on actions and responsibilities requires a shift from traditional SUMP implementation arrangements typically centred on municipal transport authorities and infrastructure providers towards multi-actor governance models that reflect the socio-technical nature of automated mobility systems. Unlike conventional mobility measures, CCAM involves complex interactions between public authorities, private technology providers, data actors, and regulatory bodies,

which makes the clear allocation of roles and responsibilities a critical success factor already at the planning stage.

From a CCAM perspective, each planned measure or action should be accompanied by a clearly defined lead actor, supporting actors, and coordination mechanisms, covering not only implementation but also operation, data management, and monitoring. Responsibilities should be explicitly assigned across different domains, including transport system management, digital infrastructure deployment, data governance, safety regulation, and socio-economic impact mitigation. This implies that the responsibility framework should extend beyond traditional actors such as municipal mobility departments and public transport operators to include ICT departments, digital infrastructure providers, technology companies, regulatory authorities, and labour and social policy institutions.

It is important to distinguish between different types of responsibilities. Strategic responsibility should remain with public authorities, ensuring that CCAM deployment aligns with public policy goals such as sustainability, accessibility, and equity. Operational responsibility for example, the operation of automated services or digital platforms may involve private sector actors such as mobility service providers or technology companies. Regulatory and oversight responsibility must be clearly assigned to competent authorities, including those responsible for road safety, data protection, cybersecurity, and market regulation. In parallel, social responsibility including the management of employment impacts, skills transitions, and public engagement should be explicitly allocated to relevant institutions such as labour agencies, training providers, and social policy departments.

CCAM planning also requires the establishment of formal coordination structures and governance mechanisms to manage interdependencies between actors. This includes defining how stakeholders collaborate across administrative levels (local, regional, national), how decisions are coordinated between transport and non-transport sectors, and how overlaps in responsibilities are addressed. Given the importance of data in CCAM systems, particular attention should be paid to data governance arrangements, including responsibilities for data collection, storage, sharing, cybersecurity, and compliance with privacy regulations.

From a socio-economic perspective, responsibilities should be clearly assigned for addressing employment, skills, and inclusion impacts. This includes identifying actors responsible for monitoring labour market effects, designing re-skilling programmes, ensuring affordability of services, and preventing digital exclusion. Without clearly defined responsibilities in these areas, socio-economic risks associated with automation may remain insufficiently addressed during implementation.

Responsibilities should be directly linked to targets and indicators, ensuring accountability for achieving both transport and socio-economic objectives. This requires defining who is responsible not only for implementing measures, but also for monitoring outcomes, reporting progress, and adapting actions where necessary.

3.4.2.2 Implications of policy documents and roadmaps at national and international level

Responsibilities are most clearly defined in relation to regulatory adaptation, safety validation and infrastructure deployment. Ministries of transport, digital authorities and industry partners are typically assigned central roles. However, responsibilities for socio-economic outcomes are less consistently specified.

Germany's strategy and handbook provide structured approaches for operational deployment in public transport contexts, implying clearer institutional roles. The Czech plan identifies responsible ministries for skills and qualification measures. Luxembourg and the UK emphasise ecosystem coordination, but specific accountability for affordability, equity monitoring or digital inclusion is often not detailed.

Data governance and cybersecurity responsibilities are more explicitly addressed in Germany and in ecosystem-oriented documents (EU report; 5GAA), where cooperation between industry and authorities is emphasised. Yet clear responsibility for ongoing monitoring, public reporting and enforcement mechanisms is not always articulated in practical terms.

Public acceptance and awareness are recognised as important (Czech Republic; Luxembourg), but few documents specify who is responsible for communication strategies, citizen engagement or long-term trust-building during scaling phases. Similarly, employment transition measures are acknowledged, but responsibility for supporting affected workers is not always operationally allocated beyond general policy references.

Agreeing actions and responsibilities is critical to avoid diffusion of accountability. Socio-economic aspects require clearly assigned roles. Accessibility targets need accountable implementing bodies. Affordability safeguards require transport authorities and finance departments to define fare integration rules. Workforce transition requires cooperation between labour ministries, education systems and employers. Data governance requires designated authorities responsible for oversight, audits and incident management. Public trust requires ongoing communication and engagement responsibilities.

3.4.3 Prepare for adoption and financing

3.4.3.1 Implications of planning documents at local and regional level

Review of the SUMP and mobility planning documents confirms that financing and adoption aspects are generally addressed at a strategic and programmatic level, but remain limited in detail, particularly regarding digital-related investments.

Across the analysed plans, cities typically include sections on implementation frameworks, investment planning, and funding sources, often linked to broader municipal or regional budgets, national funding programmes, and EU funding instruments. Plans such as those of Barcelona, Münster, Gelsenkirchen, Dublin, Kraków, Łódź, Bydgoszcz, Szczecin–Świnoujście, and Sintra outline financing approaches for infrastructure investments, public transport improvements, and active mobility measures. These typically include combinations of public funding (municipal, regional, national), EU funds (e.g. cohesion policy, recovery funds), and in some cases private co-financing, particularly for large-scale infrastructure or service delivery components.

In most cases, financing is presented at a programme or portfolio level, without detailed cost breakdowns for individual measures. Cost estimation is often indicative, and implementation timelines are linked to multi-annual investment plans. While this provides a strategic overview of funding needs, it also means that financial planning remains relatively high-level and not always linked to specific technological pathways or emerging mobility systems.

The analysis highlights that while cities are already planning and allocating resources for mobility investments, financing frameworks are not yet aligned with the requirements of CCAM deployment.

First, there is a clear absence of dedicated investment strategies for digital and connected infrastructure. CCAM systems require substantial investments in communication networks, data platforms, and system integration, yet these elements are not explicitly costed or prioritised in the reviewed plans.

Second, cost-sharing mechanisms remain underdeveloped. While some plans mention public-private partnerships or operator involvement, there is little discussion of how costs and revenues associated with automated mobility systems would be distributed among public authorities, private operators, and users.

Third, there is limited consideration of value capture mechanisms. The potential for capturing value from new mobility services such as through pricing schemes, data-driven services, or increased land values linked to improved accessibility is rarely addressed, despite its relevance for financing future mobility systems.

Fourth, socio-economic financing aspects are largely absent. The reviewed plans do not address how funding mechanisms could support affordability of new mobility services, workforce transition programmes, or digital inclusion measures, all of which are critical for equitable CCAM deployment.

For CCAM-ready mobility planning, financing approaches need to evolve from infrastructure-focused investment planning to integrated financial strategies that reflect digital and service-based mobility systems. This implies:

- defining who finances CCAM infrastructure, including digital and connectivity components,
- developing cost-sharing models between public authorities, private operators, and technology providers,
- exploring value capture mechanisms linked to improved accessibility, data usage, and new mobility services,
- ensuring funding for socio-economic measures, including skills development, affordability, and inclusion,
- integrating financing strategies with long-term operational and maintenance costs of digital systems.

3.4.3.2 Implications of policy documents and roadmaps at national and international level

Financing preparation focuses strongly on research funding, innovation grants, infrastructure investment and industrial support mechanisms (Germany; Czech Republic; Luxembourg; EU; WEF). There is clear recognition that CCAM requires significant public and private investment. However, the link between financing structures and socio-economic outcomes is less developed.

Pilot funding and public R&D support are common. The Czech *Autonomous Mobility Plan* explicitly references state funding for implementation measures. Luxembourg embeds financing within its ecosystem model. EU-level coordination highlights funding programmes that support cross-border deployment and infrastructure alignment. Yet long-term operational financing models, especially in public transport contexts are not always clearly articulated.

Affordability is rarely linked directly to financing mechanisms. There is limited discussion of how subsidies, fare integration policies or public service obligations will be financed once pilot phases end.

Procurement, which could embed social requirements into contracts, is not consistently presented as a strategic tool.

Equity and digital inclusion are also weakly connected to financing strategies. While rural access is often highlighted as a goal (Germany; UK; PAVE), financing models do not always prioritise disadvantaged areas or define redistribution mechanisms. Employment transition funding is most clearly addressed in the Czech context but is less consistently integrated across other strategies.

Data governance and cybersecurity investments are widely recognised as necessary, yet funding for long-term institutional capacity such as public-sector cyber expertise and regulatory oversight is not always explicitly considered.

Preparing for adoption and financing should ensure that funding mechanisms reinforce socio-economic commitments. This means linking investment decisions to accessibility and equity outcomes, ensuring affordability safeguards are financially viable, allocating resources for workforce transition, and funding institutional capacity for data governance and cybersecurity oversight.

3.5 SUMP Phase 4 – Implementation and Monitoring

Phase 4 of the SUMP cycle – implementation, monitoring and evaluation – ensures that planned measures are delivered, impacts are assessed and policies are adjusted over time. In the context of CCAM, this phase is particularly important because automated mobility systems are dynamic, software-driven and subject to continuous updates and technological evolution.

Socio-economic considerations are crucial at this stage because real-world impacts often diverge from projections. Accessibility outcomes, affordability levels, employment effects, safety performance, digital inclusion and public trust must be continuously monitored to detect unintended consequences. Without structured monitoring, automation may gradually exacerbate inequality, shift costs to users, or create new vulnerabilities without timely policy correction.

CCAM deployment requires lifecycle governance rather than one-off approval. Software updates, expansion of operational domains, scaling to new territories and integration with other mobility services all have socio-economic implications. Monitoring frameworks must therefore include not only technical performance metrics but also distributional indicators: who uses the service, who is excluded, how pricing evolves, how employment patterns shift, and how trust and acceptance change over time.

Evaluation processes must also be transparent and participatory. Public reporting on safety performance, data use, cybersecurity incidents and accessibility outcomes strengthens accountability and reinforces legitimacy. Feedback loops with stakeholders, including vulnerable user groups and labour representatives, allow continuous adaptation and mitigation.

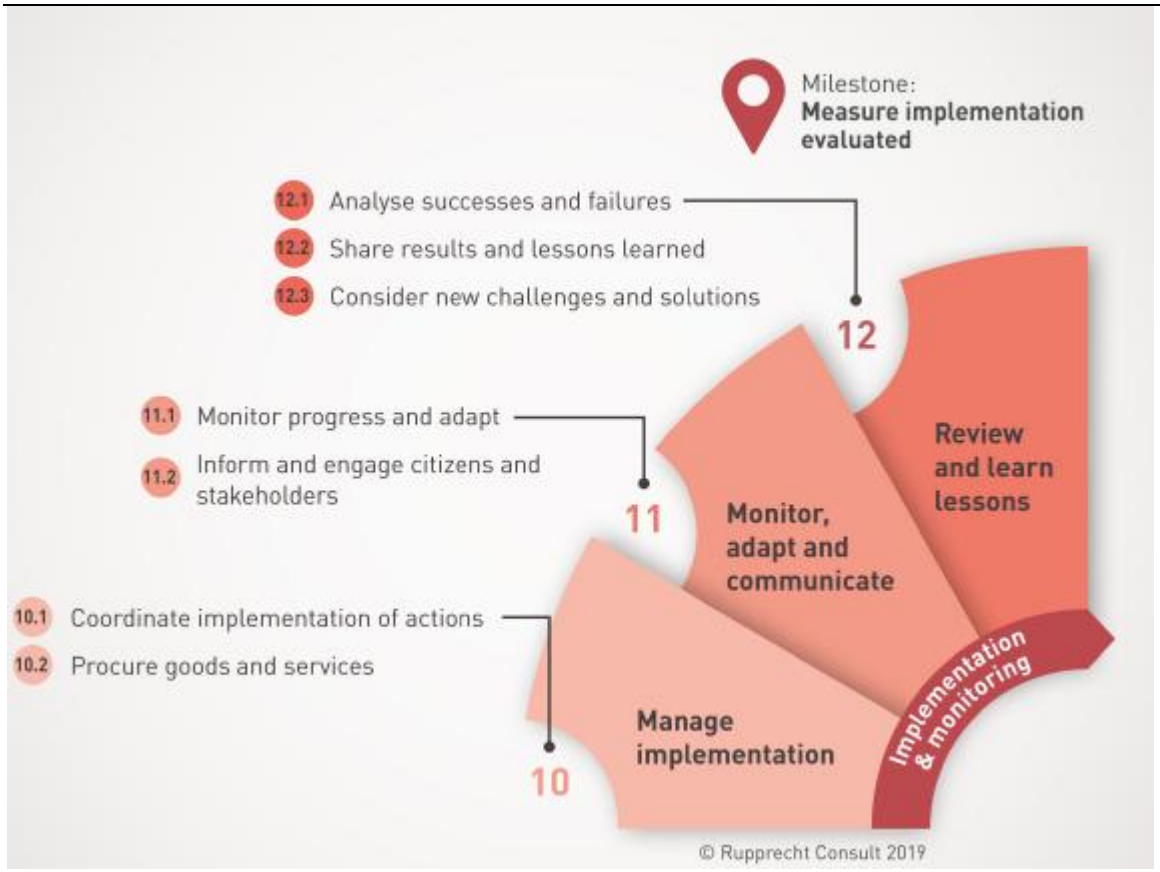

Figure 5. SUMP 2.0 Phase “Implementation and monitoring” (Rupprecht-Consult, 2019)

3.5.1 Header 3 Measure implementation

3.5.1.1 Implications of planning documents at local and regional level

In most of the analysed SUMP documents, implementation management is only described at a general and procedural level, typically referring to timelines, responsible authorities, and monitoring structures, without detailed operational governance models. Given the complexity of CCAM systems, this level of detail is insufficient. CCAM deployment requires a much more structured, adaptive, and cross-sectoral implementation management approach, as it involves not only infrastructure delivery but also continuous system operation, digital integration, and socio-economic adaptation.

From a CCAM perspective, implementation management should be conceived as a dynamic, iterative process, rather than a linear execution of predefined measures. This is because CCAM technologies evolve rapidly, and their impacts particularly socio-economic ones are uncertain and context dependent. Therefore, cities need to establish flexible implementation frameworks that allow for testing, learning, and adjustment over time. This includes embedding pilot phases, regulatory sandboxes, and phased rollouts of automated and connected mobility services, enabling cities to assess impacts before large-scale deployment.

A key requirement is the establishment of dedicated coordination and management structures for CCAM-related implementation. These could take the form of cross-departmental task forces or programme management units that bring together expertise from transport planning, ICT, urban

planning, legal/regulatory units, data governance, and socio-economic policy domains. Such structures should be responsible for coordinating implementation across sectors, managing dependencies between infrastructure and services, and ensuring alignment with strategic objectives.

Implementation management should also explicitly address the integration of public and private actors. Since many CCAM components such as automated vehicle services, digital platforms, and data systems are likely to be delivered or operated by private entities, cities need to define clear mechanisms for contract management, performance monitoring, and regulatory oversight. This includes setting requirements for service quality, data sharing, safety standards, and socio-economic outcomes (e.g. accessibility, affordability).

From a socio-economic perspective, implementation management must include mechanisms to anticipate, monitor, and mitigate impacts on employment, skills, and inclusion. This requires establishing processes for: continuous labour market monitoring in the mobility sector; implementation of re-skilling and up-skilling programmes; ensuring affordable access to new mobility services; preventing digital exclusion, particularly for vulnerable groups.

Another critical element is the management of data, digital infrastructure, and cybersecurity during implementation. CCAM systems rely heavily on real-time data exchange and digital platforms, which means that cities must ensure: secure and interoperable data ecosystems; clear protocols for data sharing and ownership; robust cybersecurity measures; compliance with data protection regulations.

Implementation management should therefore include dedicated roles and processes for overseeing digital system performance and risks.

Furthermore, effective implementation of CCAM requires continuous stakeholder engagement and communication. Public acceptance and trust are critical for the uptake of automated mobility systems, and therefore implementation processes should include communication strategies, user engagement activities, and feedback mechanisms. This allows cities to respond to user concerns, adapt services, and build legitimacy for new technologies.

3.5.1.2 Implications of policy documents and roadmaps at national and international level

Implementation is usually described through pilots, phased roll-out, and coordination between public authorities and industry. The strongest guidance is typically on managing technical and regulatory conditions such as safe operation, connectivity, testing, and compliance, while socio-economic issues are less often treated as day-to-day management priorities with clear routines, responsibilities, and safeguards.

Where CCAM is linked to public transport, implementation appears more structured. Germany's *BMDV Handbook on Autonomous Driving in Public Transport* and the broader framing in *Die Zukunft fährt autonom* imply operational discipline, service management and public accountability, which can support inclusion goals if these are built into service design. Similarly, the UK's *CAM Roadmap 2035* and Luxembourg's strategy imply staged roll-out and ecosystem coordination. However, even in these cases, implementation management is not always described in terms of ensuring affordability, equity, digital inclusion, labour conditions, or continuous public trust-building.

In practice, the documents tend to manage CCAM implementation as a technology deployment challenge rather than as a service transformation challenge. Accessibility is often the main social

objective discussed during implementation (Germany, UK, EU report, PAVE Europe), but affordability and equity are less consistently treated as implementation priorities. Employment and skills are addressed earlier in policy framing (Czech plan; UK; Germany), yet implementation management rarely describes how workforce transition is handled during pilots and early operations, for example through training plans, job redesign, or labour safeguards in operating contracts.

Data governance and cybersecurity are recognised as fundamental (Germany; Czech Republic; EU; 5GAA; WEF), but implementation management often assumes these will be handled through compliance and technical design rather than through active operational governance (continuous risk management, incident coordination, public reporting). Public health and safety are strongly prioritised, but broader health impacts beyond crashes are rarely treated as implementation issues to manage over time.

The gap is that socio-economic outcomes are not consistently treated as "implementation performance goals." If CCAM is meant to improve access and inclusion, then implementation management needs routines for ensuring services reach underserved users, remain affordable, protect labour standards, and remain accessible both physically and digitally. Without this, early roll-out decisions may drift toward what is easiest to deploy rather than what best serves public value.

3.5.2 Monitor, adapt and communicate

3.5.2.1 Implications of planning documents at local and regional level

Building on the findings from Phase 2 "set targets and indicators", where monitoring systems are already established but predominantly focused on traditional transport and environmental KPIs, the analysis of the SUMP and mobility planning documents confirms that monitoring frameworks are relatively well developed, but adaptation and communication processes remain less detailed, and technological and socio-economic outcomes are only partially covered.

Across the analysed plans, cities typically define monitoring systems aligned with previously established targets, using indicators related to modal split, emissions, safety, accessibility, and implementation progress. Monitoring is often organised through periodic reporting mechanisms, mobility observatories, or evaluation frameworks. For example, plans such as Münster, Barcelona, Dresden[28], Gelsenkirchen, Dublin, Luxembourg City, and the Polish metropolitan SUMPs (Łódź, Bydgoszcz, Szczecin–Świnoujście) include structured monitoring approaches with defined indicators, reporting cycles, and institutional responsibilities.

However, when examining technological dimensions, the analysis shows that these are only weakly integrated into monitoring systems. Although some plans include references to intelligent transport systems, digital ticketing, or mobility-as-a-service platforms, these elements are rarely accompanied by dedicated indicators. Monitoring tends to focus on whether infrastructure or systems have been deployed, rather than on how effectively they operate or how they contribute to system-wide performance. There is no systematic tracking of digital system performance, interoperability, data quality, or cybersecurity. Moreover, indicators related to automation, connected mobility, or readiness

[28] City of Dresden (2024). Verkehrsentwicklungsplan (VEP).
Available at: https://www.dresden.de/vep

for CCAM are not observed. As a result, even where digitalisation is part of the strategy, cities lack the tools to evaluate its real impact.

A similar pattern emerges for socio-economic outcomes. Accessibility and safety are the only socio-economic aspects that are consistently monitored, reflecting their long-standing role in mobility planning. Beyond these, other dimensions such as affordability, employment impacts, workforce skills, digital inclusion, and public trust are rarely translated into measurable indicators. Even when these themes are mentioned in strategic narratives, they are not operationalised in monitoring frameworks. This creates a significant blind spot, as cities are unable to assess whether mobility policies are delivering equitable and inclusive outcomes, particularly in the context of technological transformation.

With regard to adaptation, most plans foresee periodic reviews and updates, often linked to predefined reporting cycles. However, the mechanisms through which monitoring results inform decision-making are not described in detail. There is limited evidence of structured feedback loops that would allow cities to adjust measures dynamically in response to new data or emerging trends. This is particularly relevant for CCAM, where uncertainty and rapid technological evolution require flexible and responsive planning approaches. Without clearly defined processes for adaptation, monitoring risks becoming a reporting exercise rather than a tool for continuous improvement.

Communication is generally addressed through dissemination of results, stakeholder engagement activities, and public information campaigns. While these elements are present, communication is typically treated as a supporting function rather than an integral component of governance. There is little emphasis on using communication strategically to build trust, explain technological changes, or engage citizens in interpreting monitoring results. In the context of CCAM, where public acceptance is closely linked to perceptions of safety, transparency, and fairness, this represents a critical gap.

From a CCAM perspective, the findings indicate that existing monitoring systems provide a strong foundation but require significant expansion. Cities need to complement traditional indicators with measures that capture technological performance, such as connectivity, system reliability, and data governance, as well as socio-economic impacts, including employment effects, affordability, digital access, and user trust. At the same time, monitoring should be embedded within adaptive governance frameworks that ensure that evidence directly informs policy adjustments and implementation strategies. Communication should also evolve into a continuous and transparent process that supports public understanding and acceptance of increasingly complex mobility systems.

3.5.2.2 Implications of policy documents and roadmaps at national and international level

Monitoring is most developed around technical performance, safety validation and infrastructure readiness. Socio-economic monitoring, especially affordability, equity outcomes, labour impacts, digital inclusion, and public trust is much less consistently defined, even though many documents state these as key benefits or conditions for scaling.

Safety monitoring and system reliability receive the most consistent attention (Germany; UK; EU; 5GAA). Data governance and cybersecurity are also frequently treated as ongoing requirements, particularly in Germany's strategy and 5GAA's emphasis on secure interfaces. However, most documents provide limited guidance on how to monitor these issues in a transparent, citizen-facing way. Public trust is often presented as dependent on safety and secure data systems, but monitoring of trust

itself such as regular public attitude surveys, complaint systems, or structured feedback loops is seldom described, despite explicit recognition of acceptance issues in the Czech and Luxembourg strategies.

Accessibility is more visible than other socio-economic themes in monitoring discussions, especially where CCAM is linked to rural connectivity and public transport reinforcement (Germany; UK; PAVE). Yet even here, concrete monitoring indicators such as service availability for vulnerable users, waiting times, accessibility compliance, and coverage by area are not consistently specified. Affordability monitoring is notably weak: few documents discuss tracking fare impacts, user cost burdens, or whether CCAM services remain integrated with public transport pricing.

Employment impacts and labour conditions are also rarely part of monitoring frameworks. While the Czech plan is explicit on skills and qualification needs, the broader set of documents does not clearly describe how employment displacement risks, new job quality issues, or workforce conditions in remote supervision roles will be monitored over time.

Communication is widely acknowledged as important, but often in general terms. The Czech Republic stresses that trust depends on awareness and justified data use, and Luxembourg highlights acceptance as a strategic pillar, yet long-term communication plans tied to operational performance, safety reporting, and data practices are seldom detailed across the corpus. This matters because acceptance and trust are shaped not only by initial information campaigns, but by how incidents are handled, how performance is reported, and whether public concerns are responded to over time.

The implication is that CCAM monitoring may become heavily technology-focused unless socio-economic indicators are built into the monitoring system from the start. A SUMP-aligned approach would require that monitoring and adaptation cover not only technical safety but also who benefits, who is excluded, and how trust evolves during real-world operations. Communication should be treated as a continuous two-way process linked to these monitored outcomes, not only as promotional messaging.

3.5.3 Review and learn lessons

3.5.3.1 Implications of planning documents at local and regional level

The review of the 20 SUMPs and mobility planning documents indicates that formal evaluation and learning processes are generally acknowledged but rarely operationalised and are primarily focused on assessing progress against predefined targets rather than generating structured knowledge on emerging mobility systems or technological transitions. While most plans foresee periodic updates and evaluations, these are typically framed as plan revisions or reporting exercises, with limited emphasis on systematic learning, institutional capacity-building, or reflection on innovation processes.

In most cases, evaluation is linked to the monitoring frameworks described in the previous phase, with cities expected to assess whether targets related to modal split, emissions, safety, and accessibility have been achieved. However, there is little evidence of dedicated evaluation methodologies that go beyond quantitative performance assessment to examine broader system changes, unintended effects, or lessons learned from implementation. This is particularly evident in relation to smart mobility systems, where references to digitalisation, ITS, or MaaS are rarely accompanied by structured evaluation of their effectiveness, scalability, or integration into the wider mobility system.

Across the analysed plans, discussions on smart systems are generally limited to their deployment or expected benefits, with very limited reflection on implementation challenges or lessons learned. Where digital measures are included, there is little evidence of systematic evaluation of issues such as system

interoperability, data quality, user uptake, or institutional readiness. As a result, cities are not yet building a comprehensive evidence base on how digital and smart mobility solutions perform in practice, nor how they can be improved or scaled.

Another important finding is the limited attention given to skills, knowledge management, and institutional capacity-building. While some plans acknowledge the need for innovation and digitalisation, they do not systematically address how public authorities will develop the competencies required to plan, implement, and regulate increasingly complex mobility systems.

Similarly, the potential impacts of new mobility technologies on the labour market are not reflected in evaluation or learning frameworks. There are no mechanisms to assess how jobs are changing, what new skills are required, or how workforce transitions should be managed over time. This limits the ability of cities to anticipate and respond to socio-economic impacts associated with automation.

In terms of governance, learning processes are not typically embedded within institutional structures or decision-making cycles. While some plans refer to stakeholder engagement or participatory processes, these are not systematically linked to evaluation and learning. There is limited evidence of feedback loops where insights from implementation are used to inform future planning, adjust strategies, or update regulatory frameworks.

From a CCAM perspective, reviewing and learning should be understood as a continuous, structured process of knowledge generation and institutional adaptation. This requires moving beyond periodic evaluation towards the establishment of learning systems that integrate monitoring data, stakeholder feedback, and practical experience from pilots and deployments.

Cities also need to invest in capacity-building and knowledge management mechanisms. This includes developing training programmes for public sector staff, establishing partnerships with research and innovation actors, and creating platforms for knowledge exchange between cities and regions. It also involves ensuring that lessons learned are documented, shared, and translated into actionable improvements in planning and implementation processes.

3.5.3.2 Implications of policy documents and roadmaps at national and international level

Learning and review are often discussed through the language of pilots, experimentation and scaling. The documents generally assume that evidence from pilots will inform future regulation, investment and deployment. However, most review approaches focus more on technical feasibility, safety validation and operational performance than on long-term social outcomes.

Germany's public transport handbook approach, for example, reflects a learning-by-doing logic in real operational settings, which can support structured review if socio-economic outcomes are included in evaluation criteria. The EU report also reflects a broader learning process across Member States and projects. The WEF roadmap similarly stresses that scaling depends on coordinated learning across stakeholders. Yet across most strategies, the social lessons that need to be captured such as affordability impacts, equity outcomes, labour changes, digital exclusion risks, and public trust dynamics are not systematically defined as core learning priorities.

Where public acceptance is explicitly highlighted (Czech Republic; Luxembourg), the documents still provide limited guidance on how to evaluate trust-building efforts, how to interpret public concerns, or how to redesign systems and policies based on societal feedback. Employment and skills issues are

recognised (Czech; UK; Germany), but structured review of labour outcomes, especially job quality and working conditions is not common.

Data governance and cybersecurity are often treated as continuous requirements rather than as learning topics. Yet in practice, cyber incidents, near misses, and evolving vulnerabilities are major sources of operational learning. Few documents describe structured feedback mechanisms that connect incident learning to improved governance, updated procurement requirements, or public reporting standards.

The gap is that review processes are not always designed to produce “social learning,” even though CCAM strategies often justify deployment through social benefits. A stronger approach would treat socio-economic outcomes as core evaluation criteria alongside technical performance. Lessons learned should not only inform the next technical iteration, but also inform how services are targeted, how pricing is set, how accessibility is improved, how workforce impacts are mitigated, and how trust is maintained.

3.6 Summary and Conclusions

3.6.1 Key Insights

The analysis of the 20 SUMP and mobility planning documents demonstrates that European cities have established robust and well-structured planning frameworks for sustainable mobility, with strong emphasis on environmental performance, modal shift, safety, and accessibility. However, the findings consistently show that connected, cooperative and automated mobility (CCAM) and its socio-economic implications are not yet systematically integrated into these frameworks. While elements of digitalisation and inclusion are present, they are typically addressed in isolation and not as part of a comprehensive, system-level transformation. This finding is reinforced by the review of eleven CCAM policy documents, which similarly acknowledge socio-economic aspects as important but do not yet embed them consistently into planning, implementation, and monitoring processes.

Across both SUMP practice and CCAM policy frameworks, a consistent gap emerges between technological ambition and socio-economic governance. CCAM-related aspects, including automation, connectivity, data ecosystems, and AI, are only marginally reflected in urban mobility planning, and where they appear, they are framed as incremental innovations rather than transformative forces. At the same time, socio-economic dimensions such as employment, skills, affordability, equity, digital inclusion, and public trust are not sufficiently operationalised. Policy documents often present these as expected benefits of CCAM, particularly in relation to accessibility and safety, but they are rarely translated into binding requirements, measurable indicators, or enforceable governance mechanisms. This limits the capacity of cities and policymakers to anticipate and manage the broader impacts of CCAM deployment.

In the preparation and analysis phase, cities demonstrate strong capabilities in assessing transport systems and accessibility conditions, but socio-economic diagnostics remain narrow in scope. Key aspects such as labour market impacts, affordability of mobility services, digital access, and institutional readiness for technological change are rarely analysed. Similarly, CCAM policy documents tend to start from technological readiness and infrastructure needs rather than from a comprehensive assessment of who is underserved, who may be excluded, and how costs and benefits are distributed. Institutional structures in both domains remain centred on traditional transport and technology actors, with limited involvement of stakeholders from labour, education, social policy, and economic development domains. This constrains the early identification of socio-economic risks and opportunities.

In the strategy development phase, visions and objectives reflect ambitions for sustainability, inclusiveness, and quality of life, and increasingly acknowledge digitalisation. However, CCAM is not explicitly positioned within SUMP visions, and its socio-economic implications are not systematically addressed. While policy documents demonstrate strong innovation ambition and emphasise benefits such as improved accessibility and safety, they place comparatively less emphasis on measurable social targets. Scenario-building rarely tests alternative socio-economic outcomes, and visions are often technology-driven rather than co-developed with affected groups, including vulnerable users and the workforce. As a result, monitoring frameworks do not capture critical aspects such as employment transitions, skills development, affordability, digital inclusion, or public acceptance.

In the measure planning phase, cities define extensive and well-structured packages of actions, but these are primarily focused on traditional mobility interventions. Measures related to digitalisation, including ITS or MaaS, are present but fragmented and not integrated into coherent CCAM strategies. There is a clear absence of automation-specific measures, connectivity infrastructure planning, and data governance frameworks. At the same time, socio-economic accompanying measures—such as workforce transition programmes, inclusive pricing models, or digital inclusion initiatives—are largely missing. This is consistent with CCAM policy documents, where actions focus on pilots, infrastructure deployment, and regulatory adaptation, while socio-economic safeguards are not systematically used as criteria for selecting or designing measures. Financing approaches in both domains further reflect this gap, as they prioritise innovation and infrastructure investment without sufficiently addressing affordability, equitable access, or long-term distributional impacts.

In the implementation and monitoring phase, cities demonstrate relatively mature systems for tracking transport and environmental performance, but these systems are not designed to monitor technological performance or socio-economic outcomes. Indicators related to accessibility and safety are well established, reflecting their prominence in both SUMP and policy documents, but other dimensions such as affordability, employment, skills, digital inclusion, and public trust are not systematically measured. Monitoring frameworks in CCAM policies similarly focus on safety and technical performance, with weaker coverage of social outcomes. Adaptation mechanisms are not sufficiently developed to respond to rapid technological change, and evaluation processes focus on performance tracking rather than continuous learning and institutional adaptation. In addition, there is limited attention to capacity-building, skills development, and knowledge management, despite their importance for managing technological transitions.

Overall, the combined analysis highlights that the main challenge is not the absence of planning structures or policy ambition, but the lack of systematic integration of socio-economic considerations into CCAM-related planning and governance frameworks. Existing SUMP frameworks provide a strong foundation, and CCAM policies articulate clear technological and innovation goals, but both remain insufficiently aligned in addressing the full spectrum of societal impacts. Socio-economic objectives are often presented as expected outcomes of automation rather than as enforceable planning commitments, creating a structural risk that benefits may not be distributed equitably.

3.6.2 Recommendations

From a CCAM and socio-economic perspective, several key conclusions can be drawn. Mobility planning needs to evolve towards a system-level approach that integrates transport, digital infrastructure, data governance, economic development, and social policy. Socio-economic aspects

must be systematically embedded across all phases of the SUMP cycle and policy frameworks, ensuring that issues such as employment, skills, affordability, equity, and digital inclusion are not only acknowledged but also analysed, monitored, and addressed through concrete measures and responsibilities. Governance structures need to become more interdisciplinary and inclusive, involving actors from technology, labour markets, education and training, social services, and regulatory authorities.

Furthermore, there is a need to develop new tools, indicators, and methodologies to assess both technological performance and socio-economic outcomes, alongside financing and implementation models that reflect the characteristics of digital and service-based mobility systems. Strengthening institutional capacity, skills, and knowledge management will be essential to support this transition. Without these changes, CCAM deployment risks reinforcing existing inequalities or benefiting primarily those already well served by current systems.

In conclusion, bridging the gap between SUMP practice and CCAM policy requires not only integrating new technologies into mobility planning, but also ensuring that their deployment is guided by clear socio-economic objectives, accountability mechanisms, and inclusive governance structures, enabling a transition towards mobility systems that are not only smart and efficient, but also equitable and socially resilient.

4 Socio-Economic Aspects of CCAM in Policy and Planning Documents: Current Status and Gaps

This chapter analyses how the nine identified socio-economic factors of CCAM are addressed in strategic and policy documents across different governance levels, including European, national, and local mobility planning documents such as SUMPs. The objective is to assess the current status of how these aspects are considered in existing frameworks and to identify key gaps that may affect the socially balanced deployment of CCAM.

Building on the methodological framework presented in Chapter 2 and the SUMP-based process analysis in Chapter 3, this chapter shifts the focus from the planning process to the content of policy and planning documents. It examines how socio-economic considerations are reflected in strategies, roadmaps, and mobility plans, and to what extent they are translated into concrete objectives, measures, and governance approaches.

The analysis covers the nine socio-economic factors identified in this deliverable: accessibility and connectivity; affordability; equity and inclusion; employment, skills and labour conditions; public health and safety; public acceptance, trust and awareness; data governance, privacy and cybersecurity; digital coverage and connectivity; and funding and financing. For each factor, the chapter reviews how it is currently addressed in planning and policy documents and identifies limitations in terms of scope, depth, and operationalisation.

The chapter is based on the review of eleven CCAM-related policy and strategic documents and 20 local and regional mobility planning documents, including SUMPs and mobility strategies. This combined perspective enables a comparison between strategic ambition and planning practice, highlighting where socio-economic aspects are consistently considered and where important gaps remain.

The chapter provides a structured assessment of the extent to which current policy and planning frameworks address the socio-economic dimensions of CCAM, and it identifies areas where further development is needed to support inclusive, equitable, and socially robust deployment.

4.1 Accessibility and Connectivity

4.1.1 Status quo analysis of planning documents at local and regional level

How is it currently addressed in planning documents?

Across the 20 analysed mobility plans, accessibility and connectivity are treated as core structural objectives of mobility policy. The dominant approach is infrastructure-based: cities prioritise barrier-free public transport stops and stations (e.g. Stuttgart 2023; Luxembourg 2024; Le Havre 2024), universal accessibility principles (Barcelona PMU; Kraków SUMP), and improvements to pedestrian and cycling continuity (Münster 2024; Dresden 2014).

Connectivity is frequently strengthened through intermodality and interchange hubs, including development or upgrading of multimodal centres and integrated nodes (Łódź Metropolitan Area; Szczecin–Świnoujście; Gijón; Kraków). Several documents also incorporate intelligent transport systems and real-time passenger information as tools to improve network usability (Stuttgart; Szczecin–Świnoujście; Greater Dublin Area).

Overall, accessibility is consistently considered as a combination of physical access (barrier-free design), spatial connectivity (removal of severance and improved links), and system integration (interchanges, information systems, network coordination).

Challenges and Gaps Evidenced in the planning documents

Across the plans, accessibility is predominantly framed through infrastructure and network improvements. While this strengthens spatial and physical access, the documents provide limited detail on service-level accessibility under evolving digital or on-demand mobility systems. In several cases, accessibility measures focus on nodes, corridors and structural upgrades, while issues such as consistency of service frequency, last-mile coverage, or information asymmetries are acknowledged but not fully resolved.

Summary

In summary, all 20 documents demonstrate strong commitment to improving accessibility and connectivity through barrier-free design, intermodality and network strengthening. However, they also evidence ongoing gaps related to inherited urban barriers, uneven implementation of universal design standards, and service-level limitations that affect effective access to opportunities.

4.1.2 Status quo analysis of policy documents and roadmaps at national and international level

How is it currently addressed in policy documents?

Across the eleven analysed national and strategic CCAM documents, accessibility is consistently framed as a core societal justification for deployment. Germany, the United Kingdom, Luxembourg and the Czech Republic explicitly link automated mobility to improved access for rural and peri-urban areas,

non-drivers, elderly citizens and people with reduced mobility (Germany – *Die Zukunft fährt autonom*; UK – *CAM Roadmap 2035*; Luxembourg – *Strategy for Automated Driving*; Czech Republic – *Autonomous Mobility Plan*). EU-level reporting reinforces this narrative, identifying broader mobility options for underserved users and territories as a key expected benefit of CCAM (*European Commission – Status of progress on CCAM in Europe 2024*).

Public transport integration is a dominant theme. Germany's national strategy and public transport handbook position autonomous shuttles and on-demand services as complements to existing public transport operations rather than replacements (Germany – Die Zukunft fährt autonom; BMDV Handbook on Autonomous Driving in Public Transport). The UK roadmap and the PAVE Europe white paper similarly frame automated buses and demand-responsive transport as mechanisms to improve service frequency and viability in underserved or low-demand areas (UK – CAM Roadmap 2035; PAVE Europe White Paper).

Connectivity is presented as the main supporting factor of accessibility. Luxembourg, the UK and Sweden emphasise digitalisation, V2X communication, interoperable data systems and integrated service platforms as prerequisites for seamless mobility ecosystems (Luxembourg – Strategy for Automated Driving; UK – CAM Roadmap 2035; Sweden – Trafikverket Digitalisation Roadmap). Sweden, in particular, links accessibility to combined mobility platforms and common data access points, while EU reporting highlights high-accuracy positioning and secure digital infrastructure as critical enablers (European Commission – Status of progress on CCAM in Europe 2024). The 5GAA roadmap further reinforces connectivity as a structural requirement for scalable automated mobility services (5GAA – Roadmap III).

Challenges and Gaps Evidenced in the policy documents

Despite strong strategic commitment, accessibility is frequently presented as an anticipated benefit rather than an enforceable service obligation. Most documents do not define measurable accessibility standards, distributional targets, or concrete performance indicators to ensure that rural areas, vulnerable users or non-drivers systematically benefit (Germany; EU Commission; Luxembourg; Czech Republic).

Connectivity governance remains another gap. While the need for interoperable data architectures, V2X systems and digital platforms is widely acknowledged (UK; Sweden; 5GAA; Luxembourg), institutional responsibilities, interoperability enforcement and long-term maintenance models are rarely specified. Connectivity is recognised as essential, but governance frameworks remain underdeveloped.

Furthermore, although several documents highlight the potential of automation to improve low-demand or rural services (Germany; UK; PAVE Europe), economic sustainability and scaling models are not comprehensively detailed. The risk that deployment concentrates in profitable urban contexts rather than disadvantaged regions is acknowledged indirectly but not systematically addressed.

Most strategies remain at the level of strategic intent. The transition from accessibility as an aspiration to accessibility as a regulated, measurable and accountable outcome remains a key gap for future CCAM planning frameworks.

4.2 Affordability

4.2.1 Status quo analysis of planning documents at local and regional level

How is it currently addressed in planning documents?

Within the analysed documents affordability is addressed primarily through public transport policy, tariff structures, integrated ticketing, and pricing instruments linked to parking and traffic management, rather than through explicit social tariff frameworks. In most documents, affordability is rooted indirectly within broader goals of ensuring accessible and inclusive mobility systems.

Several SUMPs emphasise integrated ticketing and tariff coordination as mechanisms to reduce cost barriers across metropolitan areas (e.g. Łódź Metropolitan Area; Subregion Północny Śląsk; Bydgoszcz FUA). These measures aim to simplify fare systems and reduce cumulative travel costs when crossing administrative boundaries, thereby improving economic accessibility to employment and services.

In larger metropolitan strategies such as the Greater Dublin Area Transport Strategy, affordability is addressed through large-scale investment in public transport expansion and service improvement, including fleet upgrades and infrastructure enhancements.

Some documents refer to free or low-cost public transport schemes at national or regional level (e.g. Luxembourg's broader transport policy context), which significantly alter the affordability landscape of mobility. However, within the city mobility plans themselves, such measures are usually treated as contextual conditions rather than as locally designed social affordability policies.

Challenges and Gaps Evidenced in the planning documents

The analysed documents show that affordability is generally treated as an implicit outcome of system efficiency and modal shift rather than as a standalone social objective. Few plans provide detailed analysis of transport poverty, income-sensitive tariff structures, or targeted fare support mechanisms.

None of the analysed documents provides a structured assessment of mobility affordability for low-income or vulnerable groups (e.g. income-based tariff policies, mobility vouchers, or affordability thresholds). Since CCAM services, particularly automated on-demand or shared services may initially operate at higher cost levels than conventional public transport, the lack of established affordability governance mechanisms could result in unequal access to CCAM-enabled services.

Second, limited consideration of pricing models for new mobility services. The reviewed plans focus largely on conventional public transport fares and parking pricing. There is little discussion of dynamic pricing, platform-based fares, subscription models, or pay-per-use services – models that are highly relevant for CCAM deployment.

In summary, across the 20 plans, affordability is addressed mainly through integrated ticketing, public transport strengthening, and pricing instruments, but explicit treatment of transport poverty, differentiated tariff policies, or distributive affordability impacts is limited. The documents indicate recognition of cost-related barriers but do not consistently operationalise affordability as a distinct socio-economic governance dimension.

4.2.2 Status quo analysis of policy documents and roadmaps at national and international level

How is it currently addressed in policy documents?

Affordability is addressed primarily in indirect terms. Rather than focusing explicitly on user pricing or fare regulation, most strategies frame affordability through operational efficiency, cost reduction potential, and long-term economic sustainability of mobility systems.

Germany's national strategy presents automated mobility as a means to stabilise and strengthen public transport, particularly in contexts affected by driver shortages and rising operational costs (Germany – Die Zukunft fährt autonom). The underlying assumption is that automation can reduce labour-related expenditures and support financially viable services, especially in rural or low-demand areas. Similarly, the UK's CAM Roadmap 2035 links automated demand-responsive transport to the potential reduction of operating costs for rural services, suggesting that automation could improve financial sustainability while maintaining or expanding service coverage.

The PAVE Europe white paper frames affordability within a public transport reform context, arguing that automation may help reduce long-term operational costs and enable reinvestment into network expansion or service improvements (PAVE Europe White Paper). At EU level, the Status of progress on CCAM in Europe 2024 report and the World Economic Forum's Autonomous Vehicles 2025 roadmap emphasise scalability and cost-efficiency as necessary conditions for widespread adoption. Affordability is therefore seen as linked to technological maturity, economies of scale, and investment frameworks rather than direct fare control.

Challenges and Gaps Evidenced in the policy documents

The most significant gap is the limited explicit treatment of user-level affordability. Affordability is frequently assumed to follow from efficiency rather than governed through regulatory or financial instruments.

There is insufficient attention to affordability risks during early deployment phases. Automated mobility pilots and initial rollouts are often capital-intensive and technologically complex. Without targeted subsidy frameworks or fare integration mechanisms, early services may remain financially inaccessible to vulnerable users, reinforcing inequality rather than reducing it.

Affordability remains an implicit expectation rather than a structured policy objective. For CCAM deployment to support socially sustainable mobility transitions, future frameworks will need to connect operational efficiency gains with explicit fare integration, subsidy design and equitable pricing mechanisms.

4.3 Equity and inclusion

4.3.1 Status quo analysis of planning documents at local and regional level

How is it currently addressed in planning documents?

Equity and inclusion are primarily addressed through the lens of universal accessibility, reduction of mobility exclusion, and equal access to opportunities (employment, education, services). The main focus is spatial and infrastructural: ensuring that all user groups, including persons with disabilities, older people, children, and mobility-restricted users can physically access transport systems and urban space.

Several documents explicitly refer to universal accessibility principles. Barcelona's PMU highlights "accessibilitat universal" as a core planning principle, linking mobility with equality objectives. Kraków similarly references accessibility standards for persons with disabilities and older people. Le Havre institutionalises inclusion through a formal accessibility commission involving disability associations, embedding equity into governance structures. Luxembourg and Stuttgart emphasise barrier-free public transport infrastructure and improved stop accessibility, signalling an operational commitment to inclusive design.

In German masterplans such as Münster and Dresden, equity is linked to the removal of infrastructural "barrier effects" that disproportionately affect pedestrians, cyclists, and mobility-restricted users. Gelsenkirchen identifies spatial inequalities in infrastructure provision, including narrow sidewalks and structural barriers.

Several plans also recognise that exclusion can arise not only from physical barriers but from missing service connections or limited information (Łódź). This expands equity beyond infrastructure to include service-level and informational dimensions.

Challenges and Gaps Evidenced in the planning documents

Despite strong normative commitments, the documents reveal several limitations. First, equity is predominantly framed through physical accessibility and spatial connectivity, with less systematic treatment of socio-economic inequalities beyond disability or age-related mobility constraints. Broader distributive dimensions such as gender, income, migrant status, or digitally excluded populations are rarely operationalised in measurable terms.

Equity is typically considered within the existing transport paradigm. It is infrastructure-focused, not technology-focused. The plans rarely explore how emerging forms of mobility, particularly automated, on-demand, or digitalised systems could create new forms of exclusion if not proactively governed. The reviewed plans do not systematically address such risks.

Second, absence of defined equity benchmarks. Most plans do not define measurable thresholds for accessibility or service equity. Without such benchmarks, it becomes difficult to assess whether CCAM deployment improves or worsens distributive outcomes.

Third, limited integration of inclusion in service design. While barrier-free infrastructure is emphasised, there is little discussion of inclusive service design for new mobility modes—such as booking systems accessible to non-digital users, safeguards for vulnerable passengers in automated vehicles, or equitable geographic coverage of on-demand fleets.

Fourth, risk of spatial inequality amplification. CCAM systems, if deployed primarily in dense, economically attractive corridors, could reinforce existing spatial inequalities. Since many plans acknowledge peripheral service gaps but do not define mandatory service coverage standards, this gap could widen under market-driven automated mobility deployment.

4.3.2 Status quo analysis of policy documents and roadmaps at national and international level

How is it currently addressed in policy documents?

Equity and inclusion are consistently addressed through the strategic level. CCAM is presented as a way to reduce mobility exclusion, strengthen social participation, and address territorial inequalities.

Germany's Die Zukunft fährt autonom explicitly links automated mobility to improved participation in social life, particularly for people with reduced mobility and those living in rural areas. Automation is positioned as a means of strengthening equal access to public services and opportunities. The Czech Republic's Autonomous Mobility Plan similarly refers to increasing accessibility of services and reducing barriers as part of the societal benefits of automation.

The UK's CAM Roadmap 2035 provides one of the most explicit inclusion narratives, highlighting social exclusion caused by limited transport options and referencing accessible vehicle design, rural connectivity, and inclusive mobility for people at different life stages and abilities. Equity is framed not only geographically but also in terms of physical accessibility and independence.

At EU level, the Status of progress on CCAM in Europe 2024 recognises broader mobility options for non-drivers and underserved populations as expected societal outcomes. Luxembourg's Strategy for Automated Driving embeds inclusion within a broader ecosystem approach, linking technological development with societal acceptance, accessibility and integration into existing transport systems. Sweden's Trafikverket Digitalisation Roadmap connects inclusive mobility to combined mobility platforms, provided that digital and physical infrastructures are accessible.

Overall, equity and inclusion are addressed through narratives of rural inclusion, improved mobility for non-drivers and persons with reduced mobility, strengthening of public transport networks, and digital integration designed to broaden participation in mobility systems.

Challenges and Gaps Evidenced in the policy documents

Equity and inclusion are widely recognised as strategic objectives in CCAM policies, especially regarding rural access and mobility for non-drivers and persons with reduced mobility. However, these commitments are largely aspirational. Clear mechanisms to guarantee fair deployment, ensure affordability, track distributional impacts, and prevent new forms of digital or spatial exclusion are not yet fully defined. Strengthening these governance frameworks will be crucial to ensure that CCAM supports social cohesion rather than reinforcing existing inequalities.

4.4 Employment, skills & labour conditions

4.4.1 Status quo analysis of planning documents at local and regional level

How is it currently addressed in planning documents?

Employment is primarily addressed through the lens of access to jobs and economic competitiveness, rather than through labour market governance within the mobility sector itself. The dominant framing links transport planning to economic development by improving connectivity to employment centres and strengthening metropolitan labour market integration.

Several metropolitan-scale documents explicitly frame mobility as an enabler of access to employment opportunities. The Greater Dublin Area Transport Strategy positions transport investment as strengthening access to strategic employment locations and economic growth corridors. Similarly, the Luxembourg mobility plan highlights the city's concentration of national employment and the need for mobility solutions to accommodate commuting flows. Polish metropolitan SUMPs (e.g., Łódź, Bydgoszcz, Subregion Północny Śląsk) frame accessibility improvements as necessary to connect residents to workplaces across functional urban areas.

In this sense, employment is treated as a demand driver and outcome variable: improved connectivity is expected to enhance labour market participation and regional competitiveness.

With regard to skills and labour conditions within the transport system, explicit references are limited. Some plans include “soft measures” such as mobility management initiatives targeting companies and commuters (e.g., Luxembourg; Stuttgart), which imply organisational adaptation and behavioural change but do not elaborate on workforce transition.

There is little direct treatment of employment impacts within the transport sector itself (e.g., impacts on drivers, maintenance staff, dispatchers). Training, skills development, and labour conditions are generally not developed as structured components of the mobility strategies.

Challenges and Gaps Evidenced in the planning documents

The documents reveal a clear gap between employment as an economic outcome of mobility planning and employment as a structural component of the mobility system.

First, there is limited analysis of how changes in mobility systems affect jobs within the transport sector. None of the analysed documents systematically assess workforce implications of technological change, automation, or digitalisation.

Second, while commuting patterns and labour market access are well addressed, there is no detailed treatment of skills needs related to emerging mobility technologies (e.g., ITS management, digital systems, data governance). Even where intelligent transport systems are introduced, workforce transformation is not explicitly discussed.

Lack of structured skills development strategies presents a risk. CCAM systems require new technical and digital competencies within public authorities, operators, and service providers. Without proactive workforce planning, cities may face capacity constraints or rely heavily on private providers.

Public sector institutional capacity is not systematically linked to technological transformation. While many plans introduce ITS or data-driven management systems, they do not elaborate on organisational restructuring or training needed to manage automated fleets or AI-based systems.

While the analysed mobility plans strongly link mobility to economic competitiveness and access to employment, they provide limited guidance on how automation and digitalisation core elements of CCAM will affect labour markets, skills requirements, and working conditions. Addressing this governance gap will be essential for socially sustainable CCAM implementation.

4.4.2 Status quo analysis of policy documents and roadmaps at national and international level

How is it currently addressed in policy documents?

Across the eleven analysed national and strategic CCAM documents, employment and skills are recognised as structurally important aspects of automated mobility deployment. The documents highlight both opportunity and disruption: automation is presented as a driver of industrial competitiveness and new high-skilled jobs, while also having the potential to transform or reduce traditional driving-related occupations.

Germany’s Die Zukunft fährt autonom explicitly addresses the implications of automation for professional drivers and refers to the need to examine qualification requirements for new operational

roles such as technical supervision in driverless systems. Automation is also linked to addressing labour shortages in public transport and freight, positioning CCAM as a response to demographic and workforce pressures rather than solely as a cost-saving mechanism.

The Czech Republic's Autonomous Mobility Plan provides one of the clearest institutional approaches. It includes actions to analyse new skill requirements, integrate emerging competencies into the national qualifications framework, and coordinate across ministries, particularly in education and transport. Retraining and adaptation measures are explicitly recognised as necessary to mitigate negative labour market impacts.

The UK's CAM Roadmap 2035 similarly emphasises the need to identify and develop future skills, highlighting opportunities for high-value employment in engineering, software, cybersecurity and systems integration. It also notes labour shortages in existing sectors (e.g., bus and freight driving), suggesting that automation may alleviate workforce constraints while generating new technical roles.

At EU level, the Status of progress on CCAM in Europe 2024 situates skills development within broader industrial and research policy, while Luxembourg's Strategy for Automated Driving embeds talent development within its ecosystem model. The World Economic Forum's Autonomous Vehicles 2025 roadmap frames workforce transformation as part of the systemic transition required for scalable automation.

Overall, employment and skills are addressed through three principal lenses: mitigation of labour shortages, development of new high-skilled employment opportunities, and adaptation of education and qualification systems to emerging technological needs.

Challenges and Gaps Evidenced in the policy documents

Despite acknowledging workforce implications, several important gaps remain.

First, most strategies emphasise high-skilled job creation and innovation, while giving limited attention to workers at risk of displacement. Although professional drivers and other transport-related occupations are mentioned, comprehensive transition plans including retraining pathways, social protection measures, and clear labour market timelines are largely missing.

Labour conditions receive little detailed consideration. Emerging roles such as remote supervision or system monitoring are noted, but there is limited discussion of job quality, occupational safety, collective bargaining, or psychosocial risks linked to technology-mediated work.

The scale and timing of employment effects remain uncertain. Few documents provide quantitative forecasts or scenario analyses, making it difficult to assess whether automation will lead to overall job growth, sectoral shifts, or losses in specific areas.

Regional labour market effects are underexplored. While rural accessibility benefits are highlighted, potential employment disruptions in regions reliant on driving-related jobs are not systematically assessed.

4.5 Public health & safety

4.5.1 Status quo analysis of planning documents at local and regional level

How is it currently addressed in planning documents?

Across the 20 analysed mobility plans, public health and safety are some of the most consistently and clearly addressed socio-economic aspects. The main view connects mobility policy with better air quality, less noise, improved road safety, more active travel, and a higher overall quality of life.

Many plans explicitly associate mobility reform with reductions in emissions and pollutants. For example, Stuttgart's mobility action plan links transport transformation to reduced air pollution, lower noise levels, and less stress in the urban environment. Similarly, the Greater Dublin Area Transport Strategy sets out decarbonisation pathways for public transport fleets and links system reform to environmental sustainability objectives. Las Palmas, Barcelona, Gijón and Sintra integrate low-emission strategies and sustainable modal shift as central pillars of mobility planning.

Road safety is another major focus. German masterplans (e.g., Münster, Gelsenkirchen, Dresden) identify the need to reduce conflict points, improve pedestrian and cycling infrastructure, and rebalance street space to enhance safety. Polish SUMPs (Łódź, Szczecin–Świnoujście, Bydgoszcz, Subregion Północny Śląsk) frame safety as a core objective of network modernisation and traffic calming. The emphasis is often on protecting vulnerable road users and reducing accident risk through infrastructure redesign.

In addition, some documents refer to intelligent transport systems (ITS), traffic management systems, and real-time information as tools to improve traffic flow and potentially reduce accident risk. However, safety is predominantly addressed through traditional infrastructure and regulatory measures rather than advanced automation governance.

Challenges and Gaps Evidenced in the planning documents.

While the current plans strongly address environmental health and conventional road safety, it is primarily framed in terms of conventional traffic risk (accidents, conflicts, infrastructure deficiencies). The mobility plans do not systematically anticipate the new safety paradigms introduced by automated and connected mobility systems. CCAM deployment introduces risks related to software reliability, sensor accuracy, system redundancy, cybersecurity, and remote operations. These dimensions are largely absent from the reviewed documents.

Second, safety governance in the analysed plans focuses on infrastructure and human behaviour management. CCAM systems require additional layers of safety assurance, including validation frameworks, fail-safe protocols, liability allocation, and public communication strategies about system safety performance.

While public health and safety are among the strongest dimensions in existing mobility plans, their focus remains predominantly on traditional environmental and traffic safety concerns. The transition to automated and connected mobility will require an expanded safety governance framework that addresses technological risks alongside established public health objectives.

4.5.2 Status quo analysis of policy documents and roadmaps at national and international level

How is it currently addressed in policy documents?

Public health and safety are presented as both the main justification for CCAM and the key condition for its deployment. Automated and connected mobility is expected to reduce road deaths and serious injuries, improve system reliability, and enable safer interactions between vehicles, vulnerable road users, and infrastructure. In most strategies, safety is not treated as a secondary benefit but as the central requirement that must be proven before moving from pilot projects to large-scale implementation.

Germany's Die Zukunft fährt autonom presents automation as a way to improve road safety, while stressing the need for robust validation methods and clear operational oversight for higher levels of automation. The Federal Ministry for Digital and Transport handbook on autonomous driving in public transport reinforces this perspective, linking safety to operational design, service concepts, and integration into regulated public transport systems.

In the United Kingdom, CAM Roadmap 2035 treats safety as a central societal benefit and connects CCAM to long-term ambitions such as Vision Zero, while acknowledging the challenges of mixed-traffic environments and complex user interactions. The Czech Republic's Autonomous Mobility Plan similarly emphasises that public trust depends on strong safety assurances and that societal acceptance is closely tied to perceived and actual safety performance.

The World Economic Forum's Autonomous Vehicles: Timeline and Roadmap Ahead (2025) similarly identifies safety as one of the main expected benefits of automation. At the same time, it stresses that safe large-scale integration will take time and that complex traffic environments will remain a challenge for many years.

The Chinese White Paper on ICV Roadmaps integrates safety within a staged technological development pathway. It links higher levels of automation to progressive improvements in sensing, connectivity, and system integration, positioning safety as an outcome of coordinated advances in intelligent vehicles and intelligent infrastructure.

All documents present public health and safety as central to CCAM. Safety is framed as a combination of crash reduction, reliable system performance, secure digital infrastructure, and controlled deployment.

Challenges and Gaps Evidenced in the policy documents

Many strategies remain stronger on the safety ambition than on specifying how safety will be evidenced in practice across the full lifecycle of automated systems.

public health considerations beyond collisions are not consistently developed. CCAM could generate indirect public health impacts through mode shift, changes in walking and cycling, congestion effects, and exposure to air pollution and noise. These broader health pathways appear less systematically integrated than crash reduction narratives. Where documents emphasise accessibility and convenience, they rarely connect those goals to potential behavioural or environmental health trade-offs, leaving a gap in overall public health assessment.

The current policy landscape shows strong agreement that CCAM must improve safety and protect public health. However, the gap lies in translating this commitment into detailed, long-term governance

frameworks that cover lifecycle safety management, transparency, accountability and broader public health impacts.

4.6 Public acceptance, trust & awareness

4.6.1 Status quo analysis of planning documents at local and regional level

How is it currently addressed in planning documents?

Public acceptance and awareness are primarily addressed through participatory processes, stakeholder engagement, information campaigns, and mobility management measures. The dominant approach frames public acceptance as a prerequisite for implementing structural mobility changes such as modal shift, traffic calming, low-emission zones, and reallocation of street space.

Several documents explicitly refer to consultation and participatory planning. French, Spanish, Polish and German SUMPs (e.g., Le Havre; Gijón; Kraków; Łódź; Münster) describe public consultation phases, stakeholder workshops, or formal advisory bodies as part of plan preparation. In Le Havre, for example, institutionalised accessibility commissions ensure stakeholder representation in decision-making processes. This reflects an understanding that legitimacy and acceptance are built through procedural inclusion.

Awareness-raising measures are also embedded in multiple plans. The Gijón SUMP includes a dedicated programme for awareness, sensitisation and citizen training. Luxembourg and Stuttgart refer to “soft measures,” including targeted information campaigns and mobility management initiatives aimed at commuters, companies, and residents. These measures are intended to influence behavioural change and foster understanding of sustainable mobility policies.

Real-time passenger information systems, digital platforms and ITS are also positioned as tools to improve system usability and transparency (e.g., Stuttgart; Szczecin–Świnoujście; Dublin). Although not always framed explicitly as trust-building measures, these systems enhance reliability and perceived service quality, which indirectly contributes to public confidence.

Challenges and Gaps Evidenced in the planning documents.

Despite structured participation and communication strategies, several gaps emerge.

Participation processes are often concentrated in the plan development phase, with less emphasis on long-term trust-building during implementation and monitoring. Continuous engagement frameworks are not consistently detailed.

CCAM technologies introduce a new layer of complexity that extends beyond conventional modal shift debates. Automated driving systems, AI-based routing, and connected infrastructure may generate uncertainty or scepticism among users. The reviewed plans do not establish dedicated communication strategies addressing technological trust.

There is limited evidence of structured technology transparency mechanisms. For CCAM deployment, acceptance will depend not only on consultation but also on clear communication about safety validation, operational limits, data use, and liability frameworks. These aspects are not explicitly covered in the analysed plans.

While the analysed mobility plans demonstrate strong commitment to participation and awareness-building for sustainable mobility transitions, they provide limited guidance on managing public trust in technologically complex systems such as CCAM. Expanding acceptance governance from behavioural change communication to technology transparency and accountability will be essential for successful CCAM integration.

4.6.2 Status quo analysis of policy documents and roadmaps at national and international level

How is it currently addressed in policy documents?

Across the eleven analysed documents, public acceptance is recognised as a key condition for scaling CCAM. However, it is usually addressed indirectly through measures such as safety validation, data protection, cybersecurity, and pilot projects, rather than through sustained public engagement strategies.

Several documents acknowledge that acceptance cannot be taken for granted and that perceptions of risk, data use, and system reliability will strongly influence uptake. The Czech Republic's Autonomous Mobility Plan states that public confidence depends on limited and justified data collection, strong data protection, and broader societal debate and awareness-raising around automated mobility. Similarly, Luxembourg's Strategy for Automated Driving identifies trust, security and acceptance as a strategic pillar, linking societal acceptance to systematic ecosystem development and visible safeguards accompanying technology deployment.

The UK's CAM Roadmap 2035 positions trust as an adoption condition linked to safety and system reliability and connects awareness to the wider societal understanding of CAM's role in addressing mobility access and service challenges. Sweden's Trafikverket Digitalisation Roadmap addresses trust and awareness mainly through the lens of usability and transparency of digital mobility systems, where integrated services, common access points, and user-facing digital platforms can increase confidence by improving predictability and ease of use.

Overall, across the full set of documents, public acceptance and awareness are addressed mainly through safety and security arguments, system-readiness measures, and pilot projects that familiarise users with the technology. Far fewer documents set out clear long-term strategies for public engagement, digital literacy, transparency, and accountability.

Challenges and Gaps Evidenced in the policy documents

The main gap across the documents is that acceptance is frequently acknowledged but not operationalised as a continuous governance and engagement programme. Many strategies rely on the assumption that if systems are safe, secure and compliant, acceptance will follow. Even where awareness is mentioned, detailed long-term approaches targeted engagement with specific user groups, continuous feedback loops during operations, and mechanisms to address concerns over time are rarely defined.

The documents tend to emphasise cybersecurity, data protection and technical assurance, but they less often define how the public will understand operational limits, decision-making logic, safety performance over time, and responsibility allocation when incidents occur.

What remains missing is a more developed governance approach to public acceptance of CCAM: ongoing engagement beyond pilot phases, clear transparency and accountability practices for citizens, tailored approaches for different affected groups, and a stronger link between public confidence and fair, socially beneficial deployment outcomes.

4.7 Data governance, privacy & cybersecurity

4.7.1 Status quo analysis of planning documents at local and regional level

How is it currently addressed in planning documents?

Within the analysed documents, data-related topics are mainly discussed in relation to the digitalisation of transport operations rather than as separate governance areas. The main focus is on using data and digital tools to improve network management, service quality, passenger information, and overall system efficiency. Typical measures include traffic management systems, intelligent transport systems (ITS), and real-time passenger information, all of which rely on collecting, processing, and sharing data.

However, across the reviewed plans, “data” is treated mainly as a practical tool, something that helps improve operations and user information, rather than as a governance issue. Questions of privacy, cybersecurity, and data rights (such as ownership, access, and retention) are not consistently developed into clear policy sections or binding governance frameworks. When digital systems are mentioned, they are usually presented as solutions, with little discussion of governance requirements, institutional responsibilities, or the management of data and cyber risks.

Challenges and Gaps Evidenced in the planning documents.

A clear cross-document gap is that data governance is not consistently treated as a core policy field, even where digitalisation is central to the mobility strategy. The plans frequently propose or rely on digital tools, but they rarely specify how data will be governed in terms of accountability, security, privacy compliance, or cross-organisational sharing rules.

The second gap is the lack of systematic treatment of privacy and cybersecurity risks associated with increasingly data-driven mobility systems. The documents tend to focus on the benefits of ITS and digital management, while offering limited explicit discussion of cyber resilience, incident response, data breach handling, or security-by-design requirements for service providers.

The 20 mobility plans demonstrate growing reliance on digital and data-enabled mobility management, but they generally do not yet provide robust policy frameworks for data governance, privacy protection, and cybersecurity. For CCAM deployment, this represents a major planning and regulatory gap: cities will need to complement operational digitalisation measures with explicit governance, accountability, and cyber resilience structures that match the safety-critical, data-intensive nature of automated and connected mobility.

4.7.2 Status quo analysis of policy documents and roadmaps at national and international level

How is it currently addressed in policy documents?

The analysis of CCAM policy documents has shown that data governance, privacy, and cybersecurity are treated as core conditions for deployment and scaling. Strong data protection and cybersecurity are

widely presented as prerequisites for safety, system reliability, and public confidence. Compared with several other socio-economic dimensions, this area is addressed relatively explicitly, with clearer recognition of institutional roles and cross-sector coordination needs.

Germany's Die Zukunft fährt autonom is particularly clear in identifying cybersecurity and privacy as strategic priorities, emphasising cooperation between industry, research, and public authorities, as well as shared standards and privacy-by-design approaches. The Czech Republic links justified data collection and strong data protection directly to public acceptance. Luxembourg embeds data governance in a broader ecosystem model, stressing clear responsibilities and secure data use. Sweden's Trafikverket Digitalisation Roadmap highlights integrated mobility services and common data access points, raising issues of interoperability and data stewardship.

Industry-oriented documents reinforce these themes. The 5G Automotive Association's Roadmap III focuses on secure V2X interfaces and trusted communication channels, while the World Economic Forum's Autonomous Vehicles 2025 roadmap identifies cybersecurity and data governance as systemic scaling barriers requiring coordinated action. Technology-focused perspectives such as the China ICV Roadmaps also emphasise data and connectivity maturity as fundamental to automation capability.

Overall, the documents share a clear understanding that CCAM depends on continuous data exchange between vehicles, infrastructure, and platforms, and that this requires privacy-by-design, secure communications, interoperable systems, and coordinated governance across actors.

Challenges and Gaps Evidenced in the policy documents

While analysed CCAM policies clearly treat data governance, privacy and cybersecurity as essential deployment conditions, and several documents provide strong directional guidance toward ecosystem coordination and interoperable architectures. However, the policy landscape still lacks mature, operational governance frameworks for lifecycle cybersecurity management, cross-actor accountability, and citizen-facing transparency mechanisms. Addressing these gaps will be essential for scaling CCAM in a way that is not only technically secure but socially legitimate and institutionally robust.

4.8 Digital coverage and connectivity

4.8.1 Status quo analysis of planning documents at local and regional level

How is it currently addressed in planning documents?

Digital coverage and connectivity are mostly treated as an enabling condition for digital public transport services, integrated information/ticketing, and (in a few cases) connected-vehicle / C-ITS functionality, rather than as a standalone telecoms deployment strategy. Several documents explicitly link mobility performance to mobile network availability, onboard connectivity (e.g., Wi-Fi), and communications infrastructure upgrades. Stuttgart, for example, identifies the need to improve mobile availability in tunnels and to expand customer communication options via mobile devices including free Wi-Fi onboard Münster goes further into "connected mobility" by defining targets for digital stops with real-time information and Wi-Fi and by explicitly referencing integration with C-ITS and V2X concepts and standards. Gelsenkirchen similarly ties traffic-signal infrastructure modernisation to fibre-optic / wireless mesh networks and discusses multifunctional "smart poles" as part of digital infrastructure.

Many cities present connectivity as a foundation for Mobility-as-a-Service (MaaS), integrated platforms, and single-channel access to multiple transport services. In these plans, MaaS is framed as a way to

centralise information, booking, and payment through one platform or app, often supported by data portals, intelligent transport systems (ITS), and digital passenger information tools.

Additionally, particularly in several Polish and German plans, digital connectivity is approached through the expansion and standardisation of ITS and integrated information systems. Here, the emphasis is on upgrading and integrating transport systems such as unified passenger information, common timetable databases, telematics, and system-wide digital tools rather than on telecommunications infrastructure itself. Connectivity is framed as a system-level enhancement that improves coordination, trip planning, and multimodal integration.

Challenges and Gaps Evidenced in the planning documents.

CCAM depends on robust connectivity (vehicle-to-network, vehicle-to-infrastructure, fleet operations, digital user interfaces). The reviewed plans show that cities are building blocks (ITS, MaaS, real-time information), but CCAM-relevant gaps remain.

Explicit connectivity performance requirements are rarely defined, even where connected mobility is a strategic goal. While some cities acknowledge issues such as mobile coverage in tunnels or the need for C-ITS/V2X strategies, these remain partial or still under development. References to connected vehicles and 5G are often sector-specific and do not amount to a comprehensive, citywide connectivity governance model for CCAM.

Second, there is a gap in integration maturity and operational readiness. In several cases, cities are still implementing or expanding classical ITS layers and working toward unified data platforms and applications. Because CCAM systems would build on and interact with these foundations, unresolved ITS fragmentation and incomplete integration pose risks for future deployment.

4.8.2 Status quo analysis of policy documents and roadmaps at national and international level

How is it currently addressed in policy documents?

Similar to the planning documents, policy documents also treat digital coverage and connectivity as foundational infrastructure for automated and connected mobility. Unlike broader accessibility goals, digital connectivity is framed less as a social objective in itself and more as a technical and systemic prerequisite without which CCAM cannot function safely or scale.

Germany's Die Zukunft fährt autonom situates connected mobility within a broader digital transformation agenda, recognising that reliable communication networks and secure data exchange are essential for automated operations. The UK's CAM Roadmap 2035 is particularly explicit in identifying enabling layers such as vehicle-to-everything (V2X) connectivity, high-quality data availability, federated data architectures and seamless passenger connectivity as structural requirements for future deployment. Connectivity is therefore framed as both a safety enabler and a market-scaling condition.

Luxembourg's Strategy for Automated Driving positions next-generation communications infrastructure as a cornerstone of its ecosystem approach, emphasising the need for seamless integration of automated vehicles into existing transport networks through advanced digital capabilities. Sweden's Trafikverket Digitalisation Roadmap connects digital coverage to combined mobility services, highlighting that digital infrastructure and a common access point for mobility data are prerequisites for integrated service platforms. The Czech Republic's Autonomous Mobility Plan also recognises the need

for communication networks and spatial data infrastructure as enabling conditions for automated mobility.

Overall, digital coverage and connectivity are addressed primarily as enabling infrastructure layers: communication networks (including 5G and V2X), interoperable data systems, positioning services and cross-border digital readiness. The emphasis is on system performance, reliability and scalability rather than on digital access as a socio-economic distribution issue.

Challenges and Gaps Evidenced in the policy documents

Most strategies focus on availability and performance of connectivity without explicitly addressing territorial disparities in digital infrastructure. Rural inclusion is frequently mentioned in accessibility narratives, yet the digital coverage needed to support automated services in rural or low-density areas is not always examined in equal detail. Without explicit commitments to ensure high-quality connectivity in underserved regions, CCAM deployment risks being constrained to digitally advanced urban environments.

Digital inclusion considerations are not systematically integrated into digital coverage planning. While data infrastructure and V2X systems are discussed extensively, there is limited reflection on user-level access to digital services, device compatibility, or alternatives for individuals who may be digitally excluded. As mobility services increasingly rely on digital interfaces, gaps in digital access may translate directly into mobility exclusion.

4.9 Funding, financing & procurement

4.9.1 Status quo analysis of planning documents at local and regional level

How is it currently addressed in planning documents?

Within the mobility plans, financing is mainly treated as a prerequisite for implementation. Most documents either identify funding sources, provide cost estimates, or refer to potential revenue instruments such as tolls. Several emphasise that sustainable mobility requires long-term investment and reallocation of financial resources, not just technical planning.

A smaller group sets out more explicit financing structures. These include dedicated financing chapters, stated municipal budgets, co-financing arrangements (e.g. EU programmes), and clear references to multiple funding sources. In some cases, financing is embedded at the level of individual measures, with cost estimates and identified (or potential) funding streams attached to specific actions.

Only a few plans discuss financing principles in more structural terms, such as “user pays” approaches or broader multi-level funding frameworks.

Procurement, by contrast, is much less developed. Where mentioned, it tends to appear indirectly – through references to contracts or implementation responsibilities, rather than as a clearly defined procurement strategy. Some plans focus on economic benefits or financial support at project level but do not translate this into a structured, system-wide financing and procurement framework for mobility policy.

Challenges and Gaps Evidenced in the planning documents.

The plans show that cities already use mixed financing models, combining municipal budgets, external funds, programme co-financing, costed measures, and occasionally user-pays instruments. However, CCAM deployment is likely to expose gaps in three key areas: operational financing, procurement capacity, and long-term funding stability.

First, several plans indicate that implementation can be delayed or constrained by limited budgets. Since CCAM involves high upfront investment as well as ongoing operational and maintenance costs, the limited attention to lifecycle and OPEX planning suggests a potential readiness gap for sustained deployment.

Second, although many plans emphasise the need for stable and diversified funding, financing structures are often described only in general terms. CCAM will require more complex and clearly defined funding packages, covering digital infrastructure, safety, connectivity, and data governance. Without this, deployment risks remaining at pilot scale.

Third, procurement is generally underdeveloped. Even where cost estimates and funding sources are identified, they are rarely translated into robust procurement strategies suited to technology-intensive services. For CCAM, unclear contracting models, risk allocation, and responsibility for safety and cybersecurity could create significant delivery risks.

4.9.2 Status quo analysis of policy documents and roadmaps at national and international level

How is it currently addressed in policy documents?

Among the CCAM national and strategic documents, funding and financing are treated as enabling conditions for research, testing, infrastructure deployment and ecosystem development. However, compared to safety or connectivity, financing is more often addressed at a strategic or investment-readiness level rather than through detailed financial instruments or procurement reform.

At EU level, the Status of progress on CCAM in Europe 2024 reflects a multi-level funding architecture, referencing EU programmes, cross-border cooperation and coordinated investment to support research, infrastructure and harmonisation.

Germany’s Die Zukunft fährt autonom situates automated mobility within broader federal innovation and industrial policy frameworks, linking deployment to research funding, pilot programmes and coordinated investment support. The German BMDV Handbook on Autonomous Driving in Public Transport implicitly connects funding to operational pilots in regulated public transport environments, where public authorities play a key role in commissioning and co-financing demonstration services. The Czech Republic’s Autonomous Mobility Plan explicitly refers to state budget allocations and coordinated public funding to support implementation measures, including infrastructure and skills development, demonstrating a more direct acknowledgement of public financial responsibility. Luxembourg’s Strategy for Automated Driving embeds financing within its ecosystem model, highlighting the mobilisation of public and private investment to support infrastructure, testing and digital systems.

It is however noted CCAM deployment requires blended financing approaches. The Czech Republic’s explicit allocation of state funding responsibilities and Germany’s structured pilot funding demonstrate a clear public role in early-stage deployment. This reduces reliance on purely market-driven roll-out and allows authorities to shape deployment objectives. Another point is the linking of financing with industrial

and innovation policy, as seen in the UK and WEF framings. By positioning CAM as part of broader economic competitiveness and digital transformation strategies, these documents help secure long-term political and investment commitment.

Overall, funding and financing are addressed through public R&D support, pilot funding, infrastructure investment strategies, ecosystem financing mobilisation and regulatory measures designed to reduce uncertainty and attract private capital. Procurement, however, is less frequently discussed as a transformative policy lever.

Challenges and Gaps Evidenced in the policy documents

There is limited discussion of long-term operational financing models for automated services, particularly in public transport contexts. While pilot funding and innovation grants are common, few documents specify how services will transition from subsidised demonstration phases to financially sustainable, scaled operations.

The distribution of financial risk between public authorities and private operators is rarely clarified. Automated mobility involves high upfront infrastructure costs, uncertain demand patterns and evolving liability frameworks. The documents generally acknowledge the need for investment but do not systematically address risk-sharing models, insurance evolution or contingency funding mechanisms.

Territorial equity in financing is insufficiently explored. Although rural inclusion and underserved areas are frequently highlighted as objectives, funding strategies do not consistently prioritise these areas or define mechanisms to prevent investment concentration in high-demand urban markets.

Finally, coordination between transport funding and digital infrastructure investment is not always clearly articulated. Given that CCAM depends heavily on communications networks and digital platforms, fragmented budgeting across ministries or governance levels could undermine deployment coherence.

Funding and financing are clearly recognised as critical enablers of CCAM deployment, particularly in research, pilots and infrastructure development. However, current policy frameworks remain stronger on investment mobilisation and innovation support than on long-term service financing, equitable distribution of funds, and procurement-driven governance.

4.10 Cross-cutting synthesis of current status and gaps

The analysis across the nine socio-economic factors reveals a consistent pattern in how CCAM is currently addressed in policy and planning documents.

At the strategic level, policy documents generally recognise a broad range of socio-economic implications associated with CCAM. Accessibility, safety, and innovation are frequently highlighted as key objectives, and there is a clear emphasis on the potential of CCAM to improve transport system performance and support sustainability goals. However, other aspects such as affordability, equity and inclusion, labour conditions, digital inclusion, and public trust are typically addressed at a more general level. They are often framed as expected benefits rather than as areas requiring targeted policy instruments, governance structures, or monitoring frameworks.

At the planning level, this pattern becomes more pronounced. SUMPs and mobility strategies tend to reflect socio-economic considerations where these align with established planning priorities, particularly in relation to accessibility, safety, and environmental performance. In contrast, aspects that are more

directly linked to the systemic transformation introduced by CCAM, such as employment impacts, data governance, or digital infrastructure, are addressed less consistently or remain largely absent.

Across both policy and planning documents, three cross-cutting gaps can be identified. First, there is a lack of operationalisation. Many socio-economic aspects are acknowledged, but only rarely translated into concrete objectives, measures, indicators, or evaluation criteria. Second, there is limited integration across domains. Socio-economic factors are often considered in isolation rather than as interrelated elements of a broader transition. Third, there is an insufficient link between strategic ambition and implementation, with limited guidance on how high-level goals should be translated into planning practice.

In addition, differences between governance levels highlight a structural disconnect. While policy documents provide direction and set expectations, planning documents often lack the tools, data, or institutional frameworks needed to address more complex socio-economic dimensions of CCAM. This results in a gap between what is envisioned at the strategic level and what is realised in practice.

Overall, the findings suggest that socio-economic aspects of CCAM are present in current policy and planning but are not yet systematically integrated into decision-making processes. Strengthening this integration requires a shift from general recognition towards more explicit, measurable, and coordinated approaches that link policy objectives with planning and implementation mechanisms.

5 Conclusions

5.1 Key insights emerging from the document analysis

This deliverable set out to analyse how socio-economic aspects are currently addressed in CCAM-related planning and policy frameworks, and to identify gaps and requirements for a more inclusive and balanced transition. By combining a SUMP-based process analysis with a factor-based review of policy and planning documents, the analysis provides both a methodological and an empirical perspective on how socio-economic considerations can be strengthened in CCAM deployment.

A first key insight is that existing planning frameworks already provide a solid structural foundation for integrating socio-economic aspects. The SUMP cycle offers a comprehensive and well-established approach to guide mobility planning across all phases, from analysis to implementation and monitoring. However, while this structure is robust, it is not yet fully utilised to address the specific challenges associated with CCAM. In particular, socio-economic dimensions are not consistently integrated across all phases of the planning process, and important aspects related to digitalisation and automation remain outside the core planning logic.

The analysis of eleven CCAM policy documents and twenty local and regional mobility plans confirms that socio-economic aspects are widely recognised but not systematically operationalised. Accessibility and public safety are relatively well addressed, reflecting their long-standing role in mobility policy. In contrast, affordability, equity, employment impacts, digital inclusion, data governance, and public trust are less consistently translated into concrete planning requirements. They are often treated as expected outcomes rather than as elements that require explicit governance, measurable targets, and dedicated policy instruments.

Across the SUMP cycle, several structural gaps can be identified. In the preparation and analysis phase, socio-economic diagnostics remain limited, with insufficient attention to labour market dynamics,

affordability, digital access, and institutional readiness. In the strategy development phase, CCAM is not yet fully reflected in visions, scenarios, and targets, and socio-economic objectives are not systematically translated into measurable indicators. In the measure planning phase, there is a clear absence of integrated CCAM measure packages, particularly those addressing workforce transition, affordability, and digital inclusion. In the implementation and monitoring phase, existing systems focus mainly on transport and environmental performance, while socio-economic and technological impacts are only partially captured.

A second key finding is the disconnect between policy ambition and planning practice. Policy documents articulate broad societal objectives and recognise the transformative potential of CCAM, but they often lack detailed guidance on how these objectives should be implemented, monitored, and enforced. At the same time, planning documents demonstrate strong capabilities in structuring and implementing mobility strategies, but they do not yet incorporate the full range of socio-economic implications associated with automation and digitalisation. This creates a gap between strategic intent and practical application.

A third important insight relates to governance and institutional capacity. CCAM introduces new actors, new forms of coordination, and new regulatory challenges that go beyond traditional transport planning. Addressing socio-economic aspects requires the involvement of labour market institutions, social policy actors, digital and data authorities, and economic development bodies. However, current governance structures remain largely centred on transport and infrastructure actors, limiting the ability to address cross-sectoral impacts in a coordinated way.

5.2 Recommendations

Based on these findings, several implications for future planning and policy can be identified.

- First, socio-economic aspects need to be systematically integrated across all phases of the SUMP cycle and CCAM policy development. This requires expanding the scope of analysis beyond traditional transport indicators to include employment impacts, skills needs, affordability, equity, digital inclusion, and public trust. These aspects should be clearly defined within planning frameworks and translated into measurable objectives, targets, and indicators that allow for continuous monitoring and evaluation.
- Second, governance structures need to become more interdisciplinary and inclusive. Effective CCAM planning requires the involvement of actors beyond the traditional transport domain, including labour market institutions, education and training providers, social policy departments, digital infrastructure and data governance authorities, economic development agencies, and civil society organisations. Integrating these actors into planning processes from the outset is essential to anticipate and manage the broader socio-economic impacts of automation and digitalisation.
- Third, there is a need to develop new analytical tools, methodologies, and data frameworks that enable cities and policymakers to assess both technological and socio-economic impacts of CCAM. This includes the development of indicators for workforce transitions, affordability of services, digital access, and public acceptance.
- Fourth, there is a need to move from general objectives towards operational requirements. This includes defining measurable targets for socio-economic outcomes, embedding these targets into planning and procurement processes, and ensuring that monitoring systems capture

distributional impacts and user experiences. Financing and procurement mechanisms should also be aligned with socio-economic objectives, supporting equitable access, workforce transition, and long-term system sustainability.

- Fifth, it is essential to strengthen institutional capacity, knowledge management, and continuous learning processes. Public authorities need the skills, organisational structures, and resources to manage complex, data-driven mobility systems and to respond to rapid technological change. This includes investing in training, fostering collaboration with research and innovation actors, and establishing mechanisms for sharing knowledge and lessons learned across cities and regions.

Finally, the combined methodological approach applied in this deliverable demonstrates the value of linking process-oriented planning frameworks with thematic policy analysis. The SUMP cycle provides a clear structure for identifying where socio-economic aspects should be addressed, while the factor-based review highlights what is currently being addressed and where gaps remain. Together, these approaches offer a robust basis for developing more targeted recommendations and for informing the roadmap for socio-economic transition in CCAM in Deliverable 6.2.

In conclusion, CCAM has the potential to contribute to more efficient, accessible, and sustainable mobility systems. However, realising this potential depends on the extent to which socio-economic considerations are systematically integrated into planning and policy frameworks. Strengthening this integration will be essential to ensure that the transition to automated and connected mobility is not only technologically advanced, but also socially equitable and economically balanced.

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