SHared automation Operating models for Worldwide adoption

SHOW

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D17.1: First issue of best practices and decision-making mechanisms for different stakeholder groups

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Executive Summary

The deliverable provides a first overview about best practices and decision-making mechanisms represented by the application guidelines for the industry, Public Transportation/Public Transportation Operators (PT/PTOs) and cities for the deployment of shared automated mobility services (SAMS) considering different readiness level from research via first market entry to the large deployment. In this document, automated shared mobility services (SAMS) include all kind of mobility services transporting persons or freight with shared automated emission-free vehicles.

The main goal of the application guidelines is to give relevant actors, both within the business environment of SAMS or market introduction phases, reference and guidance on how to implement a SAMS, with advice applicable at almost any point or role in the realisation.

To summarize the results of the work, there were 140 industry application guidelines represented by the first two level of the decision tree covering the views of the political, legal, social, ecological, technical and economical view as well as 14 PTA/PTO and city application guidelines.

The next steps can be characterised via 2 main focus points:

- Focus 1: Deeper detailing of the existing industry application guidelines with the support of test sites and industry partners within the SHOW consortium as well as check of missing guidelines together with the different external stakeholders (twinning activities, business environments of the test sites).
- Focus 2: Development of methodology to split PTA/PTA from city/region application guidelines, divide them and then detailing them and update them with input of the SHOW consortium and external stakeholders like city of Bremen and other partners of the euro cities association.

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Abbreviation List

Abbreviation	Definition
AD	Automated Driving
ADS	Automated Driving System
AI	Artificial Intelligence
ALKS	Automated Lane Keeping System
ART	Automated Road Transport
BMI	Business Model Innovation
CARTRE	Coordination of Automated Road Transport Deployment of Europe
CapEx	Capitel Expenditure
CCAM	Connected and Cooperative Automated Mobility
CCAV	Connected and Cooperative Automated Vehicle
COM	Commission
CO_2	Carbon Dioxide
CPT	Cities & Public Transport (guideline)
DGPS	Differential Global Positioning System
DSSAD	Data Storage System for Automated Driving
DT	Department of Transport
EC	European Commission
ECI	Ecology & Impact
EI	Economy & Imapct
EPS	Environmental Perception System
EU	European Union
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GNSS	Global Navigation Satellite System
iRAP	International Road Assessment Programme
KDT	Key Digital Technologies
KFV	Kuratorium für Verkehrssicherheit
LI	Legal & Impact
MaaS	Mobility as a Service
OEM	Original Equipment Manufacturer
OpEx	Operational Expenditure
PESTEL-Analysis	Political, Economic, Social, Technological, Environmental, Legal - Analysis
PI	Politics & Impact
PT	Public transport
PTA	Public Transport Authority
PTO	Public Transport Operator
RDE	Research, Development, Engineering
RTE	Research, Technology, Engineering
SAE	Society of Automotive Engineers
SAMS	Shared automated mobility service
SI	Society & Impact
SME	Small Medium Enterprises
SUMP	Sustainable Urban Mobility Plan
TI	Technology & Impact
TV	Television
UN	United Nations

Abbreviation	Definition
UNECE	United Nations Economic Commission for Europe
USA	United States of America
V2X	Vehicle to Everything
VEC	Vulnerable to Exclusion
WiFi	Wireless Fidelity
WP	Work Package

1 Introduction

1.1 Purpose and structure of the document

Main target of this document is to present the first results of best practices and decision-making mechanisms in form of application guidelines for industry, PT/PTO as well as cities and regions.

The deliverable contains the following main chapters:

- Chapter 2: Providing the methodological approach for the application guidelines
- Chapter 3: Containing common basic information for all three application guidelines including the relevant results from D2.1 – Benchmarking of existing business/operating models & best practices, D16.2 First version of business and exploitation plans and D3.3 Recommendations for Adapting Regulatory and Operational Strategies for CCAV Deployment at Local and Regional Level
- Chapter 4: Describing the application guidelines for PT authorities and operators as well as for cities and regions
- Chapter 5: Containing the industry application guidelines based on the environment analysis and a monetarization as decision-making mechanism
- Chapter 6: Describing decision-making mechanisms and tools for cities & PTA/PTO
- Chapter 7: Giving a management summary about the results of the current D17.1 and the optimizations to be done in the next deliverable D17.2 – Best practices for implantation and application guidelines for Industry, Operators and Cities

1.2 Intended Audience

The deliverable addresses cities and regions, PTA/PTOs and industries working in the area of SAMS and the corresponding business environments and value chains as well as parties which are interested to implement and use the SAMS concept for their mobility services.

1.3 Interrelations

Analysing the internal interrelations to other WPs/Activities and the external interrelations the following could be identified:

- **Internal interrelations**
  - WP1 – Relevant Stakeholder defined in D1.1
  - WP2 – D2.1 for the environment and D2.2 and D2.3 for decision-making
  - WP3 – Legal issues: WP3 provides relevant information about legal regulations at European, national and regional level which influence the business environment for SAMS and market introduction
  - WP9 – KPIs for decision-making process
  - WP12 - Demo sites leaders provide relevant input for the application guidelines from the deployment perspective
  - WP16 – Economic impact assessment: WP16 provides the economic base for the market analyses (A16.1), impact assessment (A16.2) as well the partner-specific exploitation plans by benchmarking relevant, highly representative business and operating models enlarged by the relevant ecosystem and additional analyses. This means the results will be considered for industry

application guidelines in the field of decision-making and impact quantification of the singe guidelines.
    - WP17 – Feeding Decision-making mechanisms and guidelines for specific stakeholder groups as well as roadmaps: D17.2 – Best practices for implementation and application guidelines for Industry, Operators and Cities, D17.3 – Cities and Authorities decision-making mechanism, D17.4 – CCAV integration in SUMP and D17.5 – SHOW Roadmap towards CCAV implementation in cities and policy recommendations

- **External interrelations**
    - External stakeholders (especially the Industry, Cities and PT/PTOs) working on all kinds of mobility: Providing relevant additional input or best practices to the application guidelines and serving as multiplier for the results (together with WP15):
        - External stakeholders of industry like
            - Mobility service providers/operators
            - Telecommunication providers
            - Road operators
            - Infrastructure and vehicle providers
            - Maintenance operators
            - Billig system operators
            - IT providers
            - Marketing providers
            - Safety providers
        - External stakholders of PTA/PTO like
            - Regional PTAs/PTOs
            - National PTAs/PTOs
        - External stakeholder of cities & regions like
            - SHOW partner cities
            - Other cities
            - Rural regions
        - External stakeholders of authorities like
            - National authorities (e.g. ministries, local authorities)
            - International authorities (e.g. EU)
            - Standardization organisations (e.g. ISO, IEEE, UNECE)
        - External stakeholder from the twinning activities
            - Internal collaborations with SHOW in:
                - USA
                - Australia
                - Japan
                - China
                - Singapore
                - Korea

2 Methodological Approach

Best practices become more valuable the more they are applicable to different situations in the actual use case. However, this also means that they have to be balanced between a wide range of realisation scenarios and specific solutions. In addition, indicators must be provided for decision-making so that the right decisions can be made and implementation steps can be taken at the right time.

In order to take this basic condition into account, the relevant best practices are developed and presented in the form of application guidelines, which are supported by decision-making mechanisms, i.e. decision indicators of an economic nature.

For the development of such guidelines, the gained knowhow from the SHOW project will be used (representing the specific part) and enhanced by a PESTEL-based analysis [1] of the environment to broaden the perspective and boundary conditions.

The general approach of A17.1 – including relevant inputs and outputs - can be seen in the following Figure 1:

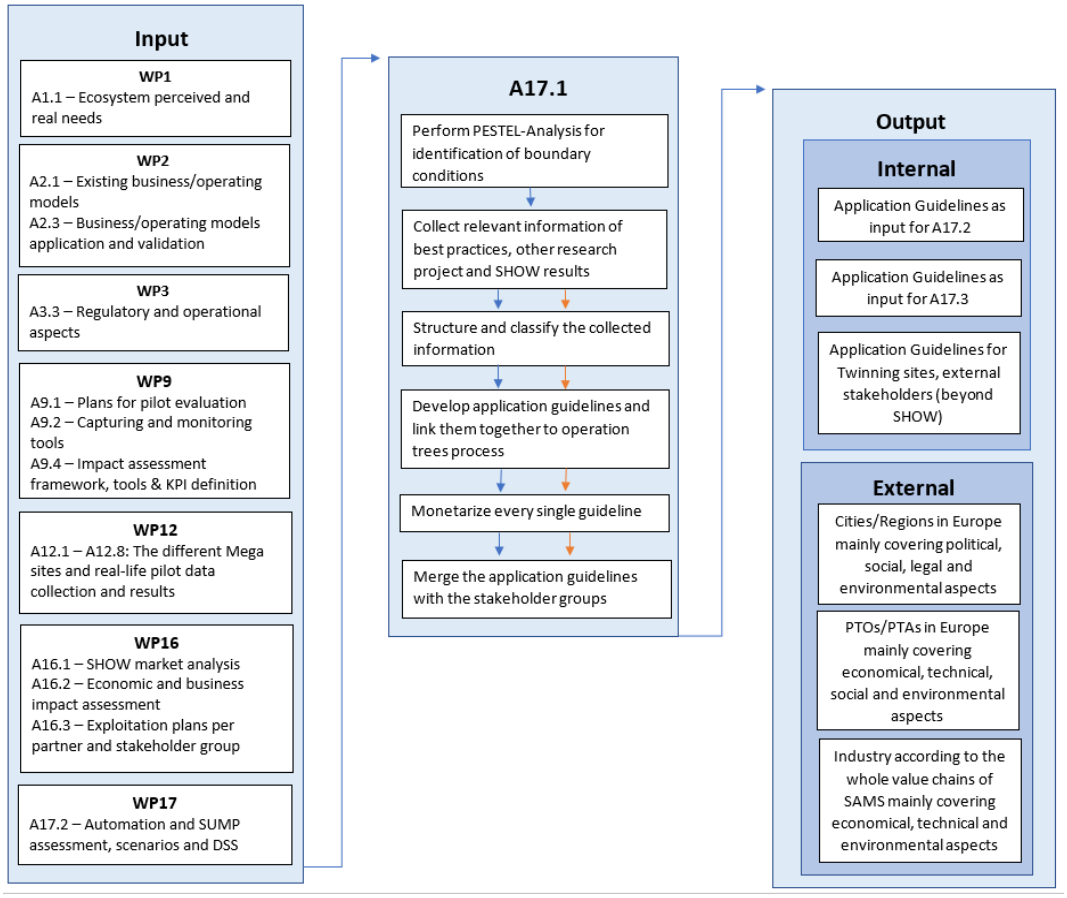

Figure 1 – Approach of Task A17.1

The middle column describes the approach and is divided in the following steps:

- **Step 1**: Perform a PESTEL-Analysis to identify relevant boundary conditions in the field of shared automated mobility services clustered in the main domains; politic, economy, technology, ecology, society and legal.

- **Step 2**: Collect relevant information of best practices, other research project results, SHOW results like D16.1 – Market analysis or D2.1 – Benchmarking of existing business/operating models & best practices; experiences of stakeholder groups PTA/PTO addressed by UITP, cities and regions addressed by EUROCITIES; experiences of single project partners; information from twinning activities and especially the results from the pre-demo phase of SHOW (WP11; D11.3).
- **Step 3**: Structure and classify the collected information (abstraction, granularity, dependencies).
- **Step 4**: Develop the application guidelines and link them together to operation trees.
- **Step 5**: Monetarize every single guideline to show the impact of them.
- **Step 6**: Mapping the application guidelines with the stakeholder groups.

To realize D17.1 and further on D17.2, which represents an update of the D17.1 with the knowledge gained from test phase of SHOW and the twinning activities, the following time plan was developed (see Figure 2):

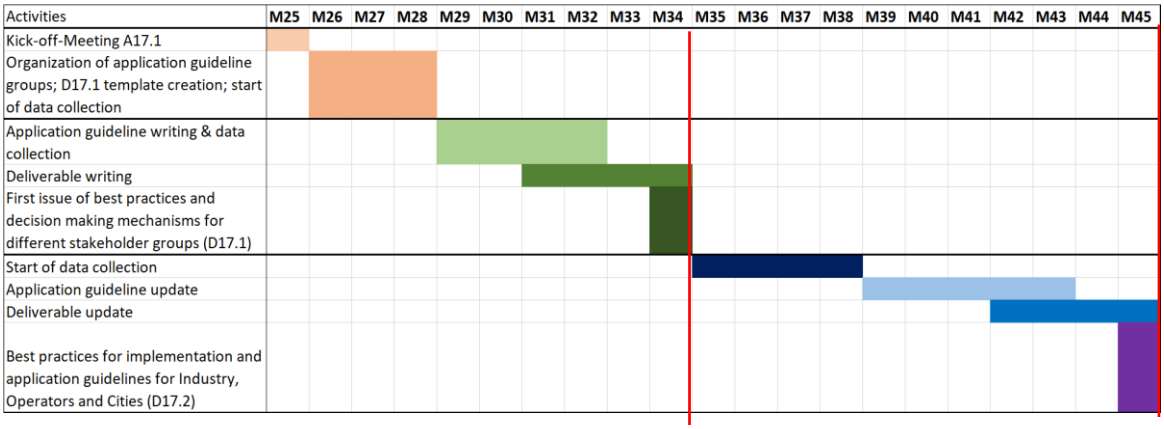

Figure 2 - Time plan A17.1

The work- and time plan in A17.1 is divided into 2 main loops creating the deliverables D17.1 - First issue of best practices and decision making mechanism for different stakeholder groups and D17.2 - Best practices for implementation and application guidelines for Industry, Operators and Cities. Every loops itself contains a data collection and research phase.

Additionally, to the approach and time plan the basic methodological interrelations which have to be considered (especially relevant for step 3 and step 4).

All three clusters of guidelines provide a specific view to the same objective, namely the deployment of SAMS, but have a different granularity and complexity for the realization to be done within their own domain. The following figure shows the dependencies of the three different views (Figure 3):

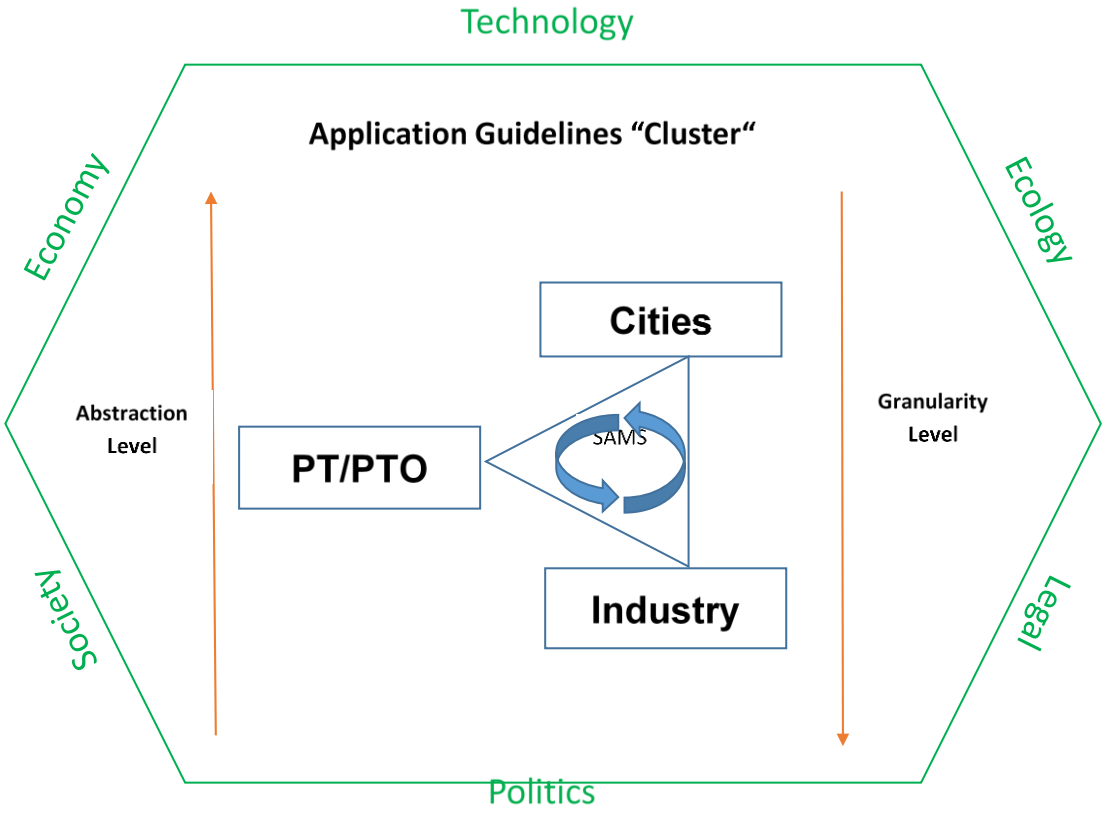

Figure 3 – Application Guidelines "Cluster" and (PESTEL-)Environment

Abstraction and granularity will have an impact on the guidelines, limiting the amount of guidelines in the domains of legal, politics, societal and ecological.

Decision-making mechanisms are different between the industry, PT/PTO and cities, because everyone of them follows their own regulations and have different needs, which will be described accordingly in the following two sub sections.

Industry

Industry companies are currently working on the different technologies for the deployment of SAMS, but are focused on economic/business success, mainly represented by the increase of revenues and the decrease of costs. So, the corresponding decision mechanisms are also oriented on optimization of income.

To sum up, this structure- and content-driven input of the application guidelines are documented in the following way:

Table 1 - Description of industry application guideline structure

Column Name	Description
Identifier	Unique identifier of the single application guideline; can used to build guidelines with sub-guidelines AG_1, AG_1.1…
Name of single application guideline	Title / Name of the single application guideline --> this could be a best practice or business model assumption, a guideline from SHOW or another research project, experiences…, a regulation, a business factor…
Description	Description of the single application guideline
Rationale	Description/Explanation why the guideline is necessary and should be considered
Key industry cluster concerned/involved	Shows the key industry cluster concerned or involved with the guideline
Source	Reference to source for the application guideline like SHOW, other EU or national RTD projects, studies, best practies from a market participant…
Realisation Phase	To be chosen from following options: Research, Development, Market Entry_small (small deployment), Market Entry_large (large deployment) or all phases
Dedicated to	To be chosen from following options: SAMS(P(erson)), SAMS(F(reight)) --> give an information about the influence of the application guidelines to the shared automated mobility service types
Linkage to PTO/City guidelines	Shows if and how the single industry application guideline is connected to the PTO/City guidelines
Stakeholder groups involved	Shows which stakeholder groups are involved or affected by the application guideline based on the definitions in D1.1
Possible Impact/Effect	Description of the impact or effect of the single application guideline
Occurancy (in %)	Please give the single application guideline an indication how relevant it is or how likely the guideline is to apply to your procedure
Severity (in €)	Please give an estimation (cost or revenues from 0 to xxx Mio. Euro) which is relevant for the single application guideline--> for cost use '-'; otherwise, it is a revenue ;-)
(Monitized) Impact (in €)	Is calculated by Occurany * Severity and acts as an indicator if the guideline should be realized or how important it is
Source/Rationale	Explanation where the numbers of the “Occurancy” and “Severity” categories comes from or how they are calculated

The blue marked rows represent the guideline and its identification, the green marked onesare sorting/filtering criteria (because the guidelines are not only covering one phase of lifetime or one kind of SAMS), the red marked area represents impact of the guideline.

Cities & regions and PTAs & PTOs

Based on the experience of all SHOW pilot sites in the preparation and implementation of Shared Automated Mobility Services, the **Application Guidelines for Cities, Regions, Public Transport Authorities and Operators** raise some considerations and provide advice and recommendations to local and regional authorities as well as

Public Transport organisations which have no or limited experience with the deployment of Shared Automated Mobility Services. Due to the permanently evolving technology and associated regulation, the guidelines are deliberately not directive, they rather present the challenges faced by SHOW pilot sites as well as the solutions implemented.

These guidelines mainly address decision makers, planners from the targeted authorities as well as their staff in charge of the coordination of the processes of preparation and implementation of shared CCAM services. Therefore, it places the focus on the necessary measures to facilitate the integration of Shared CCAM Services in the local mobility landscape and the practical steps to accompany the deployment of these services - not on the technology itself.

The Application Guidelines for Cities & Regions and PT organisations are built on the experience of SHOW pilot sites. Nonetheless, they also consider some issues from a perspective of long-term and/or larger scale implementation.

The guidelines are built on the experience of the SHOW pilot sites, and in particular on the experience shared during bilateral interviews conducted with representatives of the following SHOW pilot sites: **Carinthia** (Austria), **Brno** (Czech Republic), **Les Mureaux** (France), **Monheim** (Germany), **Madrid** (Spain) and **Linköping** (Sweden) as well as the follower test site of **Geneva** (Switzerland). The guidelines also build on the findings of other European projects, including CoEXist, AVENUE and Sohjoa.

Application guidelines to local & regional authorities and PT organisations all follow the same format, as indicated below:

Table 2 - Description of the structure of an application guideline for local & regional authorities and PT organisations

Code	Unique identifier of the single application guideline; the guidelines are numbered from CPT 1 to CPT 14
Name	Name of the single application guideline. This field describes very briefly the type of action which is advised.
Rationale	This field gives necessary information on the context. It explains which types of problems exist (or could arise) and why measures or actions are needed.
Guideline	This field describes the guideline per se. The guidelines clearly address the audience: local & regional authorities and PT organisations. Depending on the capacity to apply the guidelines in all contexts, the present guidelines use different degrees of imperativeness, which can vary from suggestions to very direct recommendations, to indication of necessary measures.
Good practices, example and sources	This field highlights good practices implemented by SHOW pilot sites. As much useful as good practices, this field also presents some examples of issues which occurred in pilot sites. When the examples relate to SHOW site, the name of the pilot site appears in **bold**. This section also makes reference to related documentations and sources.

3 Basic information for all guidelines

3.1 Business environment for Shared Automated Mobility Services (SAMS)

To describe the basic boundary condition, a PESTEL-Analysis [1] was performed, which includes the political, economic, social, technological, environmental and legal impacts of SAMS.

Analyzing the potential for existing business models it is very relevant to understand which conditions influence the value chain, the corresponding ecosystems and the business models for AD and AD-functionalities.

- Political impact factors/Political driven effects
  - Regional effects of the different countries (a lot of regions have their own measures and regulations)
    - Approval process on regional level in (see also D3.3 [2]):
      - Germany
      - Greece
      - Italy
  - National effects from the different European, American or Asian countries (which are not covered by UN regulations):
    - Based on the EU regulation (EU)2018/1999 implemented national plans on ministry-level and federal level:
      - All countries where a demo site is located have a so called "Integrated National Energy and Climate Plan"
    - Implemented national plans on ministry-level and federal level handling automated driving:
      - Austria:
        - Action plan: "Programme on Automated Mobility 2019 - 2022" supports relevant activities
      - Germany:
        - Action plan: "Strategy for Automated and Connected Driving"
        - Action plan: "Research for automated driving"
      - France:
        - Action Plan: "Development of Autonomous Vehicles Strategic Orientations for Public Action"
        - Strategy: "The French strategy for the development of automated road mobility 2020 – 2022"
      - Finland:
        - Roadmap: "A roadmap for developing automation and robotics in the transport sector 2017 – 2019"
        - Roadmap: "Road Transportation Automation Road Map and Action Plan 2016 – 2020"
      - Spain:
        - Action plan: "Spanish approach on Autonomous driving"
      - The Netherlands:
        - Roadmap: "HTSM Automotive Roadmap 2020 – 2030"
        - Strategy: "Paths to self-driving future"
        - Roadmap: "Truck Platooning Driving the Future of Transportation"
    - Force majeure, like COVID-19 can influence national political situation

    - Political Ambitions of Austria: Pioneer country as development, research and manufacturing location for automated driving can lead to more national funding in the future
    - Responsible for nationwide infrastructure expansion/upgrading for automated driving and creating legal boundary conditions
- European effects:
    - International political situation between different European countries can change and influences decision-making processes
    - Very-well established networks for RTE/RDE within the EU supports all kind of political activities
    - European negotiations and agreements: Since 2017 EC organizations and industrial organizations are meeting regularly for discussing the conditions for the introduction of automated driving (in a harmonized and standardized way)
    - EU Green Deal ((COM)2019 640 final)
    - The 2030 Climate target plan (COM(2020) 562 final)
    - New regulations regarding automated driving coming soon:
        - EC draft of EU regulation "laying down rules for the application of Regulation (EU) 2019/2144 of the European Parliament and of the Council as regards uniform procedures and technical specifications for the type-approval of the automated driving system (ADS) of fully automated motor vehicles"
- International effects:
    - United Nations work on a standardization of automated driving systems: data storage devices, registrations, cyber security measures and new classifications of vehicles providing a common base for AD (see L3 homologation approach of UNECE WG29)
    - Existing multi-national activities:
        - "Trilateral Working Group" (EU-USA-Japan) – working on standardizations
        - Trilateral agreement Austria-Hungary-Slovenia and corresponding activities
    - Twinning activities with different other nations (e.g. Australia, Japan, China, Singapore, South Korea, USA, Taiwan, etc.) to widening the project position, visibility, and scope
- Funding:
    - National Funding like Mobility of the Future-program
    - European Funding like Automated Road Transport (DT- ART), Coordination of Automated Road Transport Deployment for Europe (CARTRE) or Key Digital Technologies (KDT), EUREKA
    - Additional funding possibilities like Cooperative, Connected and Automated Mobility initiative (CCAM)
- <u>Economic impact factors/Economic driven effects</u>
    - Investments
        - Impact/Effect on company level
            - Investing in new and required vehicle technologies including research and development activities stimulates (more) testing of vehicles and other components (sensors, etc.) can/will generate a higher market share and income
            - Dialog events between the federal government, the states, municipalities and cities can create relationships which supports further business activities
        - Impact/Effect on national level

        - Invest time (in overall road and communication infrastructure) as well as funding through European activities influences national behaviour and will strengthening national competences and businesses
        - Invest time (in overall road and communication infrastructure) as well as funding through can fasten innovation cycle, market entry and create new business
    - Impact/Effect on European level
        - Invest time, know-how and money in automated driving technologies during international projects can strengthen/create international relationships
        - Missing legal framework and regulations for introducing automated driving vehicles complicates the market introduction and necessary pre-investments
        - Funding strengthening the EC position in global market and creates new or extended value chains
- Market Potential
    - Impact on company level: Increasing the image/marketing potential of the company in the automated driving sector regarding research, development and evaluation within Europe
    - Impact on European market shares
        - Increasing the visibility of the European region
        - Increasing attractivity of research and development of automated driving due to the fact that worldwide dominating car manufacturers are located in Europe. Therefore, the interest in the topic is going to stay and strengthening Europe as automated driving expert and attracts further OEM and their investments
        - The EU transport sector makes around 5% of the GDP in the EU which shows that this is an important economic sector [3] and therefore has increasing growth potential
        - The EU transport and storage services sector employed around 10.3 million people (5.3 % of the total workforce) [4]
            - 52% land transport (road, rail, pipelines) [4] shows the growth potential for automated vehicles
            - 3% water transport (sea and inland waterways) [4]
            - 4% air transport [4]
            - 27% in warehousing and supporting and transport activities [4] shows the growth potential for automated vehicles
            - 14% postal and courier activities [4] shows the growth potential for automated vehicles

- <u>Social impact factors/Social driven effects</u>
    - Occupancy impacts:
        - European Level: Around 11 million people work in the transport sector in the EU [5]. This is an area which saves crucial working places.
    - Society regulating and influencing:
        - Mobility needs and patterns: Around 11.58 million road vehicles were registered in the EU in 2021 [6]. Compared to 2020 (with 11.64 registered vehicles [7]) this is a slight decrease, which was due to the COVID-19 pandemic. Before COVID-19 the trend was that more vehicles were registered in total compared to the previous year. This

trend will most likely return and with that the interest in automated driving as base for new mobility solutions will increase.

- Societal problems:
  - Road safety: 18,800 people died from traffic accidents in Europe [8]. 90% of all accidents are due to human error [9]. Increasing road safety via technical and non-human solutions is necessary to increase safety.
  - Aging of Society: Rise in aging of the population will lead to more and more people which are unable to drive anymore/unsafe to drive. Therefore, the need for safe individual transportation will increase
- Environmental challenges: Around 307,000 people die from air pollution in Europe per year [10] (27 % of all emissions are produced in the transport sector [11]). Automated driving will support on long term the decrease of environmental pollution via optimized (shared, connected) mobility solutions.

- <u>Technological impact factors/ Technological driven effects</u>
  - Maturity of the technology:
    - Vehicle
      - Maturity level of vehicles: SAE Level 2, 2+ and 3 (partly) are available (Level 4 in innovative research projects)
      - Reliable EPS is needed to provide AD and AD-functionality for real-life applications
      - Precise and reliable localization e.g. DGPS, High-resolution digital maps
    - Digital Infrastructure (communication, road infrastructure)
      - Reliable, safe and scalable V2X and vice versa communication technology
    - Availability of digital infrastructure like in the current and future projects [12] that can be seen in Figure 4 below.
  - Duration of technological innovation cycle: Differ from country to country
  - Technical difficulties/challenges for automated driving regarding technical standards, testing experience, infrastructure equipment and local conditions
- <u>Ecological impact factors/Ecological driven effects</u>
  - European level: Fulfil emission goals until 2030 and 2050:
    - Goal for the transportation sector until 2050: min. 90 % greenhouse gas emissions reduction [13]
    - Goal of the EU until 2030: reduction of the greenhouse gas emissions by 55 % compared to 1990 [14]
    - Total Goal of the EU until 2050: Climate neutrality [14]
    - EU regulation (EU)2019/631: Fleet-wide CO_2 emissions are only allowed to be 59,4 g CO_2/km in the year 2030 (a 37.5 % reduction compared to 2021) [15]
  - Environment and Resources: New technology results influence existing resources and related processes
- <u>Legal impact factors (Regulations and procedures)</u>
  - Different approval processes in European countries. For details refer to D3.3 [2]
  - Availability on national level, European level and/or worldwide level
  - “In case of” – Effects of criminal law (responsibility, due diligence) and liability law (encumbrance liability, strict liability and product liability)
  - Interoperability
    - Difference between nations on approval processes (e.g. Austria is testing entire systems but Hungary is only testing functions for automated driving)

- No overall standardization for international automated driving available
- Twinning activities with different countries to identify legal differences and what needs to be done for international standardization and procedures

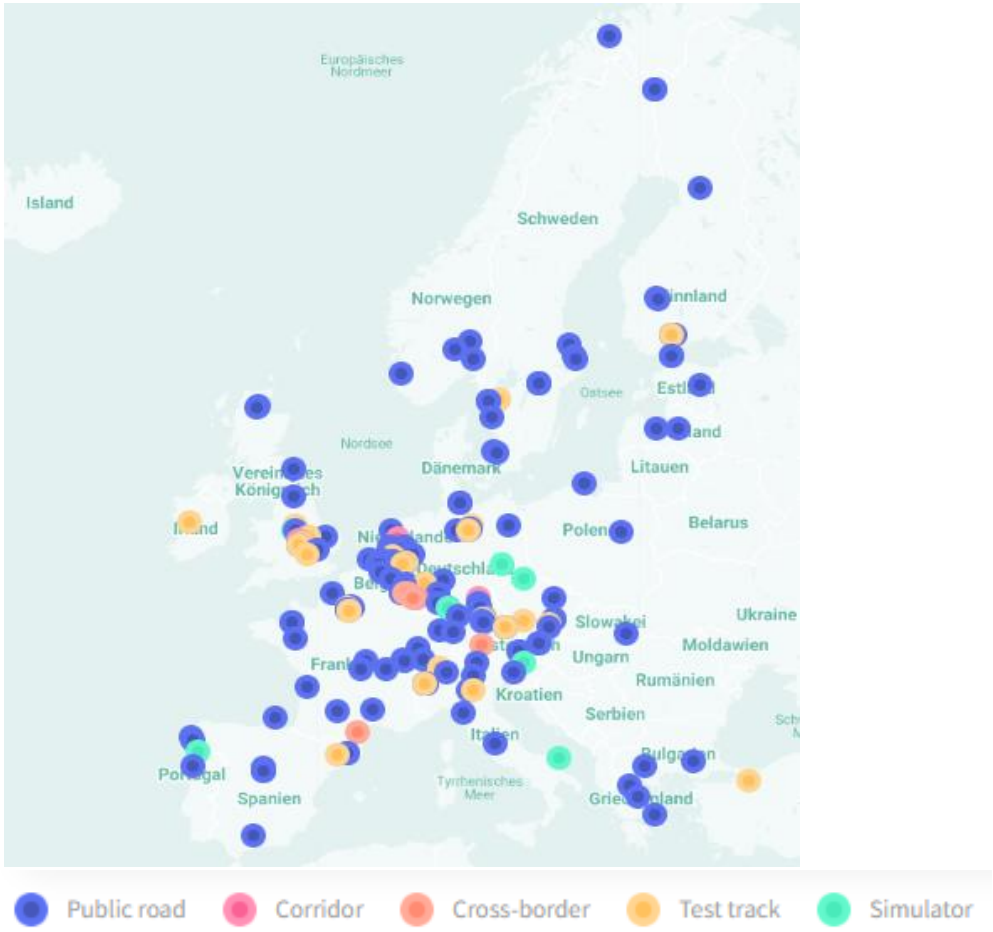

Figure 4 - Current CCAM test sites in Europe

3.2 Relevant stakeholder groups

Taken from D1.1 [16], the following table (Table 3) lists the relevant stakeholders for the linkage of application guidelines with the stakeholders.

Table 3 - Stakeholder groups

Stakeholders		Definition
OEM and transport/mobility operators	**OEM (Original Equipment Manufacturer)**	An industrial customer purchasing a product with the aim of integrating it into another product to be sold on another industrial market or to a final consumer. Example: Renault (OEM) buys tires from Michelin to be fitted on cars which it will then sell to an end user.
	Transport/Mobility operators	A mobility operator is a service provider to whom it is possible to subscribe. Following signature, a user who subscribes to a mobility operator will be able to access a mobility service. A user can also buy a ticket for occasional use of the service offered by operator.
Industry such as Tier 1 supplier	**Tier 1 Suppliers / Technology providers**	Tier 1 Supplier: Supplier who delivers directly to the company that produces, assembles or finishes the marketed product.

Stakeholders		Definition
		Technology provider: a company which for example provides 5G technology.
	Services companies	Company that carries out activities that add value to any product. It may also act as a service provider for a private individual or another company, in return for remuneration.
	Telecom operators	A telecommunications operator is an entity that offers remote communication services.
Research and academia		An establishment, laboratory or research and teaching organisation specialising in technological and human sciences. They may specialise in basic research or may be oriented towards applied research. They may be linked in partnership with universities, companies and ministries.
Passengers and other road users encompassing VEC		Passengers: A user of a vehicle who has no role in the operation of that vehicle. Other road users: All people who are not directly AV services' users, but participate in the surrounding traffic.
Umbrella associations/Non-profit organisations		An umbrella association is an association (often linked to a specific industry) of institutions that work together to coordinate activities or a set of resources. A non-profit organisation can be an association, a society or a club. The members of a non-profit organisation do not receive any financial benefit from it. Any profit made must be reinvested in the organisation
Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency and road operators	**Road operators**	Entity with the mission to operate and maintain the road domain, which is assigned to the needs of land traffic.
	Policy makers	Persons who have the power to influence or determine policy and practice at the national, regional, or local level.
	Ministries	Administration, public services under the leadership of a minister.
	Cities and Municipalities	A municipality is the territorial administration of a communal-type entity that may include a single city or several agglomerations (villages, hamlets, localities, etc.).
	Municipality agency	An agency elaborating different programs of development in a specific field including the different investment funds on the national and international levels and certifications.

3.3 Basic information from the SHOW project

3.3.1 Structured best practices from D2.1

Best practices covering success and failure factors can be looked at within D2.1 [17] chapter 9.4.2. For detailed information please refer to the mentioned document and chapter.

3.3.2 Structured information input from the business data collection in A16.2 and A2.3

The cost assessment results of D16.2 lay a solid base for the impact and therefore the decision-making mechanism by giving information about costs (CapEx, OpEx) and/or the possible revenues for the deployment of SAMS. This means for a single guideline it shows the potential of wins and losses, if you are ignoring the guideline or considering it. For details please refer to D16.2 [18].

3.3.3 Structured information input of WP3

The results of D3.3. [2] covering the different legal recommendations from a legal creator perspective as well as from legal non-creator perspectives were considered within the Cities/PTA/PTO application guidelines (see chapter 4) as well as for the industry application guidelines (for the legal aspects). So, this results build a relevant linking elements between the both guidelines providing the same requirements and boundary conditions for them. Since D3.3 is a living document it will also provide relevant input for the next deliverable D17.2 provifing.

4 Application guidelines for Cities & Regions, and PT Authorities & Operators

This first version of the Application Guidelines addresses both a) local and regional authorities and b) Public Transport Authorities (PTAs) and Operators (PTOs), referred to in this document as local & regional authorities and PT organisations. The document is designed for organisations with limited or no experience in deploying shared Cooperative, Connected and Automated Mobility (CCAM) services and targets primarily decision-makers, city planners and the staff coordinating the deployment of shared CCAM services in their respective organisations. The aim of the Application Guidelines is to provide advice and raise issues which require special attention, based on the experience of several SHOW pilot sites.

The reason for addressing local & regional authorities and PT organisations at the same time is the varying and sometimes unclear allocation of roles and responsibilities between local and regional authorities and PTAs and PTOs, when it comes to the development and deployment of shared CCAM services. This uncertainty is due to a) the similarities between these organisations which both belong to the public realm, and which address urban transport from a similar perspective; and b) the relative novelty of automation as a credible solution to provide shared CCAM services.

Although this version of the Application Guidelines already provides some stakeholder-specific advice and recommendations, the final version of the Application Guidelines (D17.2) will provide a more targeted set of recommendations. It will be based on refined research on the allocation of roles and responsibilities between both types of actors.

Yet, several trends emerge regarding the different roles of local & regional authorities and PTOs & PTAs. Generally speaking, and in most cases, local and regional authorities are mainly active at the beginning of the deployment process, especially when it comes to the definition of the vision, the objectives, and the service. Although they are often active since the first steps, PTAs and especially PTOs gradually increase their involvement as the preparation and implementation of the services get more concrete and technical, while local and regional authorities then generally tend to adopt a more “accompanying” role.

More specifically, local, and regional authorities have a dual role to play:

- On the one hand, local and regional authorities can facilitate the deployment of shared CCAM services thanks to their statutory position: they issue local and regional regulations, they own and manage regional and local roads, they are responsible for the urban infrastructure, they own and manage some transport-related data, etc.
- On the other hand, local and regional authorities have a strategic role to play in co-shaping the type of services that SAMS can offer and in defining how it integrates in the local mobility system, and more widely in the urban context.

Public Transport Authorities and Operators accompany the cities in fulfilling citizens’ mobility demands. Planning a shared CCAM service require PTA and PTO to act as strategic, tactical and operational levels.

Similarly, to bus network planning [19] strategic planning usually falls under the responsibility of the public transport authority or regulator and deals with the overall planning principles and ensuring the bus service – or shared CCAM service – meets citizens’ needs. Tactical and operational planning (e.g., defining the routes, scheduling

and safety provision) is usually within operators' domain, transposing the network planning requirements to vehicles and the operating crew (including the safety operator).

In these Application Guidelines, the deployment process of shared CCAM services has been divided in several steps which local & regional authorities and PT organisations usually take and are gathered into thematic areas. From the definition of a vision until the real-life deployment of the service, this includes:

- Definition of a vision, objectives, and main specificities of the service
- Cooperation framework
- Legal, regulatory, and administrative preparation
- Preparation, development, and management of the physical, digital and communication infrastructure
- Funding and procurement
- The role of safety operators and relation with users
- Testing, monitoring and maintenance
- Real-life deployment

Given the speed of development of the technology, the rapidly-evolving and fragmented regulatory framework and the expected evolution of the market, the Application Guidelines provide recommendations and advice both for a) a short-term experimentation of services, which will certainly remain limited in terms of types of services scale and duration; and b) a longer-term deployment which can be envisaged for a permanent, large-scale deployment of automated vehicles using a more mature technology.

Table 4 – CPT_1: Integrating automation in sustainable urban mobility planning

Code	CPT_1
Name	Integrating automation in sustainable urban mobility planning
Rationale	Integrating shared automated mobility in Sustainable Urban Mobility Plans (SUMPs) will de facto prompt local and regional authorities to respect planning principles such as: the integration of modes, spatial integration at the functional area's level, institutional cooperation, public involvement, or monitoring & evaluation. The integration of automation in mobility planning will become even more essential as technology evolves and the technology can be used for permanent and full-scale services.
Guideline	The introduction of automation in a city or region should be planned and integrated in the general mobility planning framework of SUMPs. With a leading role in the SUMP development and implementation process, local and regional authorities have the capacity to integrate automation in the local mobility planning process. [20]
Good practices, example and sources	SHOW's pilot site **Tampere** (Finland) mentions automated services in its Sustainable Urban Mobility Plan (SUMP) as one of the feeder modes of public transport traffic. [21] For more information about the integration of automation in SUMP, a dedicated Practitioner Briefing is available on Eltis, the European Mobility Observatory. [20]

Table 5 – CPT_2: Integrating shared CCAM services with Public Transport and other modes

Code	CPT_2
Name	Integrating shared CCAM services with Public Transport and other modes
Rationale	In the SHOW project and in its pilot sites, shared CCAM services are mainly considered as on-demand first- and last-mile solutions to bridge the gap between the "conventional" public transport stations and hubs and the final trip origins or destinations. Despite this common understanding, many different types of integration (or not) are possible, making the choice of the type of adaptations important.
Guideline	Local & regional authorities and PT organisations should define the right level of integration between existing and shared CCAM mobility services: between a complete separation of services and a strong integration. The control, ownership and management of 'conventional' public transport by authorities and/or PT organisations is an opportunity to offer a complete, complementary and seamless mobility offer, following the MaaS (Mobility as a Service) principles. A strong integration would require to visually brand automated shuttles with the same 'look' as conventional vehicles. The digital (e.g. app, website) and physical information medium should provide information for both types of services. Likewise, offering the same transport fares and payment methods will further strengthen the integration of shared CCAM services with public transport. Other issues to consider include the time and spatial scale of shared CCAM services: should it serve specific neighbourhood(s) or the whole urban area with a systemic relation with public transport? Should shared CCAM services operate only as a complement to public transport or also as a replacement during night time? Finally, local & regional authorities and PT organisations should consider the integration of passenger and freight operations: should shuttles have a dual purpose? And if so, what times of the day and which share of the fleet should be dedicated to freight operation?
Good practices, example and sources	To favour the integration of shared CCAM services, SHOW pilot sites located their operation sites near public transport lines and hubs and in areas where public transportation service was missing: For instance, in **Linköping**, the test site is located in a suburban area where a university is located; in **Les Mureaux**, services are provided on a professional campus, and will be connected to the train station. In other cases, shared CCAM services are deployed where destinations are multiple and dispersed. In **Carinthia** for instance, the vehicles operate near a train station and serve a small village, as well as hotels and a lake.

Table 6 – CPT_3: Building knowledge and making good use of shared CCAM services

Code	CPT_3
Name	Building knowledge and making good use of shared CCAM services

Code	CPT_3
Rationale	The Operational Design Domain (ODD) defines the different physical and digital elements of the environment in which automated vehicles are able to operate. For instance, ODD can include e.g. the built environment, the communication infrastructure, the weather and visibility conditions. At the moment, the most common ODD is not yet comprehensive enough to allow operations in all types of environments and conditions. However, the technology, the market and the legal framework are evolving rapidly. Automated vehicles will progressively increase their capabilities with the objective of providing permanent mobility services in open urban areas.
Guideline	Before the deployment of services, local & regional authorities and PT organisations should build their knowledge on the current capabilities of automated vehicles. To do so interested local & regional authorities and PT organisations should organise demonstrations and pilot activities. It allows authorities to better understand the potential contribution of automation to urban mobility as well as the adaptations to the infrastructure it currently requires. [22] Until the technology allows operations in open environments, authorities must regulate their expectations regarding the service that automated vehicles can provide. When it comes to the preparation of activities, local & regional authorities and PT organisations should therefore select the site which allow the best use of the vehicle's capacities while still delivering a meaningful and useful mobility service. In this context, it is important that local & regional authorities and PT organisations clearly define why they deploy this type of services. In this early stage of planning, cities and regions often lead the process. Automation should not be considered as a technology for which authorities must find a use case. Automation should be implemented if it can improve the current mobility situation. In other words, local & regional authorities and PT organisations should not ask: Where could I implement a shared CCAM service in my city? or Where would a shared CCAM service make more sense in my city? On the contrary, authorities must start with the mobility needs of the city. The question they should ask themselves is: How could I improve the daily mobility of the inhabitants of my city (or a specific area)? Shared CCAM services can then come as a relevant solution as its characteristics responds to specific needs: e.g. first- and last-mile trips, door-to-door services, longer time range, slower speed, etc.
Good practices, example and sources	In the SHOW pilot site of **Brno**, the local pilot coordinator (CDV) decided on the location of the activities together with the municipality. CDV started the talks with the municipality about transportation needs and the most useful location for the pilot site. At the same time, CDV did its own investigations in relation with the vehicles' capabilities. They finally found the best compromise: a site where shared CCAM vehicles can bring a useful service and where vehicles are able to operate. Later in the process, the coordination team finetuned and decided on the exact streets.

Table 7 – CPT_4: Following the multi-step administrative and regulatory process

Code	CPT_4
Name	Setting-up a local partnership
Rationale	Local cooperation is key for ensuring the success of shared CCAM activities. The reasons for involving and engaging with local partners are multiple: - **Facilitate procedures**: Working from the early preparation stages with entities e.g. in charge of vehicle certification; which own roads and urban infrastructure; or manage mobility data makes preparation processes smoother and faster. - **Build confidence and trust:** The early involvement of partners which e.g. provide vehicles and technology or interact with vehicles creates good working relationships and avoids critical misunderstandings at later stages. - **Ensure the success of shared CCAM services:** The cooperation with the local population and organisations which represent and/or interact with them (e.g. employers and educational institutions, local and regional authorities and media) helps to raise awareness, to increase the interest and decrease concerns. This is also crucial to collect feedback from road users and the population.
Guideline	Local & regional authorities and PT organisations should set up local partnerships which correspond best to their needs and characteristics, both in terms of a) cooperation frameworks and b) types of partners involved. Involving partners on an ad-hoc and/or informal basis has the advantage of flexibility and offers the possibility to easily start new cooperations when needed. More formal partnership models which define who can make decisions, give a stronger sense of ownership and responsibility to partners while it may lack some flexibility. When it comes to the types of partners, a one-size fits all approach should be rejected as local characteristics must be considered. However, the partners below are usually part of local partnerships: - **City or regional authorities**. Local or regional authorities are often the initiators of the project. In other cases, they are invited to join the preparation process as they own and manage useful resources: e.g. mobility data, mobility planning, mobility regulations, road infrastructure, etc. A cross-department cooperation which covers e.g. transport planning, urban planning, environment and the economic affairs is definitely an asset. [25] - **Public Transport Authorities & Operators**. PTAs & PTOs have the relevant experience, know-how and skills for implementing public transport solutions on the ground. They can create synergies with conventional public transport. - **Emergency services**. The local police and fire brigade are often involved in the preparation of the shared CCAM services deployment. Training emergency staff is essential to ensure smooth interventions in case of incidents. - **OEMs and vehicle & technology providers**. Vehicle providers are more than 'simple' vehicle sellers. They are active

Code	CPT_4
	partners throughout the whole process for e.g. training of operators, software updates, repairs, etc. Other technology providers can be involved to provide e.g. on-demand mobility platform, MaaS integration services, etc. - **Regulatory and certification authorities**. Creating a trust relation with the authorities can make processes shorter and smoother. The relationship is often mutually beneficial. - **Land and/or infrastructure owners**. When shared CCAM services are deployed on non-public roads (e.g. airport, campus, etc.) involving the owners of the site is crucial. - **Mobility service providers.** The involvement of other mobility service providers (e.g. car-sharing, private buses, etc.) can be useful to find the best mobility synergies. - **Universities and research bodies.** Their participation is particularly important for the experimental implementation of shared CCAM services. They will guarantee the correct collection of data and will analyse the results of the experimentation. Inputs of students can bring fresh ideas. - **Population and specific groups.** The involvement of residents, passengers and other road users is key for the success of shared CCAM services. Involving certain groups (or their representative organisations), e.g. people with disabilities and special needs, children, older people, etc. is necessary to design accessible, comfortable and attractive services for them.
Good practices, example and sources	**All SHOW pilot sites** who were interviewed confirmed the importance of setting up a local partnership for preparing and running shared CCAM activities. They insisted on the importance of gathering all relevant partners as early as possible in the preparation process. Most SHOW pilot sites involved partners in an informal framework. On the contrary, the pilot site of **Linköping** (Sweden) worked with a more formal partnership model, called a “demonstration board” which gathered all partners who could make decision regarding the pilot. The pilot site of **Carinthia** raised the question of the level of participants. In this case, withing the municipality, the participation of the Mayor was beneficial.

Table 8 – CPT_5: Following the multi-step administrative and regulatory process

Code	CPT_5
Name	Following the multi-step administrative and regulatory process
Rationale	Implementing a shared CCAM service experimentation requires a several-step administrative process which can prove lengthy. This is because automation is still perceived as a new field of operation. Therefore, authorities – at various levels - try to limit down risks and generally impose a rather ‘heavy’ framework. Additionally, in a context of fragmentation of administrative processes and legislations across European countries, the regulatory and administrative framework evolves, as the technology and the usage change.

	On the longer-term, processes are expected to become shorter in time and lighter, and to attain a higher level of harmonisation across Europe.
Guideline	Local & regional authorities and PT organisations are advised to make sufficient time for taking the necessary administrative steps which vary across countries. The ones below apply in most cases: - **Assessment of the regulatory framework:** Local & regional authorities and PT organisations need to understand which laws and regulations apply to the vehicles and the services. Since the regulations can be issued at the national, regional and/or local levels, it is advised to identify and create trust relations with the relevant authority(ies), as early as possible. Beyond the regulation on vehicles, various fields of legislation might apply to shared CCAM services, such as the type of driving licenses for operators, transport of passengers, data protection, etc. - **Authorisation, licensing, registration of vehicles:** Generally, automated vehicles need to be authorised, especially if operations take place on public roads. This process is often managed by national bodies, but several countries share this role with regional administrations (i.e. Germany, Greece and Italy). The process can be lengthy and usually takes from a couple of months, to up to nine months. - **Technical validation:** Before the actual implementation of services, a technical validation is performed to ensure the overall good functioning of the vehicle in a given ODD. The technical validation is usually performed by the OEM, or by a national/local certification authority (in some cases in collaboration with the Ministry of Transport) and typically requires one day. - **Data protection and management (GDPR):** Local & regional authorities and PT organisations need to pay attention to the rules which apply to data protection, namely the EU regulation: General Data Protection Regulation (GDPR). A core principle of the GDPR is the consent of the data subject which can only be substituted with the necessity of processing for “reasons of public interest”. The issues to carefully consider include: the management of personal data captured by cameras (e.g. faces); the clear definition of the owner and/or manager of data. A good understanding of GDPR is crucial to avoid atony. An over-precautionary attitude would decrease the level of ambitions and the speed of the deployment of shared CCAM services.
Good practices, example and sources	In 2022, the experience gained in SHOW clearly confirms the fragmentation of administrative processes and legislations across European countries. [23] However, in this context, **all SHOW pilot sites** faced a similar situation: since no EU or national regulatory framework for commercial deployment of fully automated vehicles exist yet, they must comply with procedures which apply for experimentations only. The EU delegated act on type-approval a milestone in the efforts to attain a higher level of harmonisation across European countries. [24] Regarding the respect of GDPR, the Sohjoa project noted that “in the context of automated driving, the use of cameras for safe motion of the

	vehicle may pose major challenges for test operations." [25] The follower site leader in **Geneva** notes that a misunderstanding of the GDPR leads to high levels of cautiousness and slows down processes and reduces the ambitions of activities.

Table 9 – CPT_6: Setting-up and managing physical infrastructure

Code	CPT_6
Name	Setting-up and managing physical infrastructure
Rationale	The current state of technology does not allow automated vehicles to drive 'autonomously' in any type of road infrastructure. On the contrary, automated vehicles can operate only in environments which have been made 'drivable': through a) mapping the route and the environment and/or b) the adaptation of physical infrastructure. Therefore, the adaptation of the physical infrastructure is often required for safety and/or technical reasons. The development of non-road infrastructure such as a depot and charging points is also crucial to maintain, store, and charge automated vehicles.
Guideline	Local & regional authorities and PT organisations are advised to adapt their road infrastructure to shared CCAM services. On the longer-term though, they may raise the issue of the adaptation of the vehicles to the environment, and not the contrary. It may be part of their responsibility to push technology and vehicle manufacturers to provide vehicles able to drive safely on all roads, without major adaptations. Yet, for the moment, adaptations should include: - **Usage and width of the road:** When vehicles pass too close to the automated shuttle, they will be detected as moving obstacles and the shuttle will decrease its speed and even stop on the road – sometimes after performing an emergency break. To avoid this, local & regional authorities and PT organisations can enlarge the road or change the regulations on the usage of the road (e.g. bidirectional to one-way roads) - **Surface of the road:** Local & regional authorities and PT organisations should make the surface of the road as uniform and clean as possible to avoid that vehicles detect "fake obstacles". Likewise, speedbumps may need to be flattened. - **Immediate environment:** A multitude of objects located on (the side of) roads can be detected as obstacles e.g. side-parked cars, bicycles & scooters, road signs, grass, branches, snowbanks, recycling bins, birds, plastic bags, etc. Local & regional authorities and PT organisations should keep the environment of the roads as tidy as possible. Solutions include removing or reorganising parking slots, regular grass mowing, trimming trees and hedges, snow removal, etc. - **Road markings & signs:** Certain vehicles use road markings and signs as extra guidance. Local & regional authorities and PT organisations can adapt their road markings and install new signs (with no other usage than providing visual guidance to vehicles).

	The involvement of local authorities in the deployment of shared CCAM services is particularly useful here as the departments in charge of road maintenance, urban cleaning, and traffic management can provide useful services. In addition, local & regional authorities and PT organisations are advised to get equipped with depots and charging infrastructure. - **Depots:** The depot should be located as close as possible to the operation site to decrease the 'useless' travel distance and time to the site. This is particularly true if vehicles do not have a depot function and must be 'driven' manually by an on-board operator (with a gamepad). To allow overnight charging, the depot must include an electric recharging point, or local & regional authorities and PT organisations will have to install one. Depending on the countries, depots need to be heated in winter and/or cooled down in summer, in order to keep the batteries in an acceptable temperature range. On the longer term, Local & regional authorities and PT organisations should decide on the location of depots. Should they favour a distributed or centralised storage in the city? While a distributed storage allows vehicles to remain close to their operation fields, it is a more expensive solution than a limited number of storage depot(s). - **Additional charging points:** In certain configurations, additional charging points may be needed, to allow charging of vehicles during the day. The location of charging points should be considered carefully. The possibility to share charging points with other road users should be decided. On the longer term, local & regional authorities and PT organisations must decide on the type of charging method. Inductive charging allows a fully automated solution but has a lower charging efficiency. On the contrary, wire charging gives better performances, but it requires the intervention of employees.
Good practices, example and sources	In **Monheim**, pilot coordinators noticed an issue with waste collection during the pre-demonstration phase. One day per week, trash bins are put on the side of the pilot roads and block the operation of shuttles. For the short term, trash bins are pushed away before they are collected. To solve this type of issues and avoid incidents the SHOW pilot sites have implemented a variety of measures, including: campaign and signs on the rear of vehicles to inform other drivers, speed reduction (signs must be installed every day, when operation starts) in **Carinthia** ban on overtaking, two-way streets transformed to one-way streets in **Monheim**, etc. [26] On the contrary the SHOW pilot site of **Les Mureaux**, in France explicitly required to implement the shared CCAM services without making changes to the current traffic context in order to test the current capacities of vehicles. Regarding depots**,** the SHOW pilot site of **Monheim** opted for a depot made of glass. This can be considered as a good practice: the activities around automation are transparent and the public can come and ask information. The depot is close to the test site and is heated in winter and cooled down in summer.

	Finally, regarding charging infrastructure, the SHOW pilot site of **Linköping** decided to test several technologies and vehicles – which have different charging standards. Therefore, two types of charging points had to be installed.

Table 10 – CPT_7: Setting-up and managing the digital and communication infrastructure

Code	CPT_7
Name	Setting-up and managing the digital and communication infrastructure
Rationale	To drive safely and smoothly in open streets, automated vehicles use a variety of technologies which rely on a complete set of digital and communication infrastructure which can include: - Global Navigation Satellite System (GNSS) technology: vehicles' GNSS receiver with access to a GNSS antenna / station. Such stationary antennas already exist in many European locations. - Connection to the internet through WiFi, 4G and/or 5G. - Connection with digitalised traffic management systems (e.g. traffic light controllers). It must be noted that while remote control of the vehicles will become more and more widespread - either to monitor the operations or to possibly take the remote control of the vehicles - the communication between the vehicle and the remote-control centre will take an even larger importance.
Guideline	Local & regional authorities and PT organisations need to make sure the necessary infrastructure is either existing and available or to provide for it. In particular, local & regional authorities and PT organisations are advised to verify that the GNSS antenna provide a reliable signal on a permanent basis, 24 hours a day and 7 days a week. They must require the adaptation of the internet networks and infrastructure to ensure a full coverage of the activities. The autonomy of vehicles without access to the internet is indeed limited both in terms of distance / time of operation and capacities. Additionally, local & regional authorities and PT organisations need to assess the availability of digital data and the state of digitalisation of traffic management systems (e.g. traffic light controllers) to feed the "intelligence" of the vehicles or interact with it. For this, the cooperation with relevant partners and from the early stages of the preparation proves to be crucial.
Good practices, example and sources	In follower site of **Geneva**, despite asking the owner of the station, a confirmation of the reliability of the antenna could not be obtained. Consequently, they installed their own GNSS antenna to ensure the good transmission of information, on a permanent basis (24/7). In **Madrid** for instance, the pilot site faced issues about the communication with the traffic digital infrastructure. Issues were due to inappropriate technology or simply the reluctancy to give access to systems, for competition or ownership reasons.

Table 11 – CPT_8: Establishing a cost-efficient business model

Code	CPT_8
Name	Establishing a cost-efficient business model
Rationale	The comparison with the costs of conventional services must go beyond the comparison of prices between vehicles as the deployment of shared CCAM services implies a systemic change. A series of "hidden costs" increases the actual costs of deploying shared CCAM services including: - The installation of ramps, locks for wheelchairs and seatbelts in vehicles (not always available by design). - Licence, maintenance and supervision fees, homologation process fees, technical consulting fees, the cost of training of safety operators; all usually due to the vehicle providers or other connected third parties. - Some pieces of infrastructure such as the installation of new signs, the adaptation of the road and the construction and/or acquisition of a depot and/or workshops, and, certainly, quite often, the complementary PDI that is required. - Salary costs of staff members for safety operation, maintenance and cleaning of the vehicles. These costs must be added to the costs of drivers (or rather operators) In the short term, the savings implied by the absence of drivers do not exist. Indeed, the legislation in place in European countries forces operators to place a "safety operator" in the vehicle. While remote control becomes allowed, it is expected that safety operators will be able to supervise several vehicles and therefore divide the salary costs, until vehicles can operate fully autonomously on the longer term. In this context, cost-efficient business models for running shared CCAM services in cities and regions remain to be found.
Guideline	In the first instance, local & regional authorities and PT organisations should build their knowledge regarding the costs of running shared CCAM services and balance the expectations. In a second step, local & regional authorities and PT organisations should look at possible revenues to make the business model cost-efficient. For the shorter term, and most probably in the longer term – until the costs of drivers and/or safety operators can be completely cut, local & regional authorities and PT organisations are advised to consider providing and/or looking for public (or private) subsidies, to cover a major part of the costs.
Good practices, example and sources	**All SHOW pilot sites** insisted on the necessity to consider all costs related to the deployment of shared CCAM services. The staff costs might even be higher than the costs of conventional bus drivers: in **Monheim**, the project partners noticed that – according to the national law - safety operators must take a 15-minute break after each period of operations of 45-minute.

Table 12 -: CPT_9: Preparing CCAM vehicles procurement

Code	CPT_9
Name	Preparing CCAM vehicles procurement

Code	CPT_9
Rationale	The size of the market of automated vehicles market which could be used for collective transportation is currently very limited in Europe. Only a few OEMs provide commercial vehicles on the market. Additionally, compared to conventional vehicles on the market, the current generation of automated vehicles has a short life span. This is due to a) the rapid wear of some parts as well as b) the technology which rapidly becomes outdated. Furthermore, the procurement of vehicles is even more crucial on this market since the selected company will not only deliver a vehicle, but will also usually have an active role throughout the entire project development. OEMs can possibly fullfil the following tasks: e.g. preparation of the site (commissioning/ risk assessment), delivery of vehicles, technical validation (in collaboration with the designated local entities/authorities), direct communication for maintenance of vehicles, repair of vehicles, software updates, training of safety operators, intervention during operation via specific teams engaged for that, fleet management often in collaboration with another entity through proprietary solutions and APIs, etc.
Guideline	Although local & regional authorities and PT organisations should keep high levels of ambitions for the deployment of shared CCAM services on the longer term, they must temper their enthusiasm and have a more realistic approach on the shorter term. Local & regional authorities and PT organisations should set tender specifications which do not diverge too much from the existing state of play of shared CCAM services already deployed in Europe. When it comes to the evaluation of the offers, beyond the quality and capabilities of the vehicles themselves, local & regional authorities and PT organisations are advised to consider the quality of the overall services provided by the company. Local & regional authorities and PT organisations could consider developing a vehicle and/or retrofitting a conventional collective transport vehicle. This offers advantages in terms of control over the vehicle and the technology. However, it requires the presence of local (in-house) skilful and competent staff. Options such as leasing, or renting are preferable to purchasing since local & regional authorities and PT organisations will avoid making large investments and being “locked” with an outdated vehicle. This issue will become particularly critical when local & regional authorities and PT organisations will consider long-term and full-scale deployment of shared CCAM services as entire fleets of vehicles will be required. Therefore, flexible acquisition solutions (i.e. conditional agreements with the OEMs that will encompass replacement of outdated vehicles after a given timeframe, etc.) will be needed to allow them to make large investments – for several year, or even decades – while using vehicles which are technologically up to date. This is not yet the business status quo in Europe.
Good practices, example and sources	The pilot site of **Brno** makes use of its own fleet of vehicles, developed locally: regular electric shuttles which have been retrofitted with automated features system. The pilot site has a full control upon the vehicles and do not rely on external parties for tasks such as e.g. training of operators.

Table 13 – CPT_10: Allowing for the efficient, safe and comfortable action of on-board operators

Code	CPT_10
Name	Allowing for the efficient, safe and comfortable action of on-board operators
Rationale	As odd as it may sound, automated vehicles still need human drivers. Indeed, international, and most national laws make obligatory the presence of a human person who can monitor the operation and even drive or better handle the vehicle under specific circumstances. This person must be located either on board of the vehicle, or in an increasing number of countries, in a remote-control centre. The primary role of the operator is to ensure the safe operations of the vehicle. It includes emergency braking, taking over in case of inextricable situations (e.g. other vehicles or obstacles blocking the way, unnecessary stops, 'fake' obstacles, etc.), ensuring the safety of passengers during potential incidents and accidents, and liaising with the emergency services in case of necessary interventions. To do so, on-board operators make use of a gamepad and a Drive User Interface (DUI) which allow to control the vehicle and "communicate" with the system. Beyond his/her safety role, the interpersonal role of the onboard operators is often underestimated. Operators welcome passengers onboard, he/she can provide information about and promote the technology and the vehicle; provide practical information about the service (e.g. location of next stops, travel times, etc.); ensure the comfort of travellers, including older people, children or people with disabilities; and keep the vehicle clean and quiet; all of which seem quite important especially in the current transition period of CCAM.
Guideline	For local & regional authorities and PT organisations, the necessity to have safety operators opens a series of issues to consider before deploying shared CCAM services: - **The recruitment of drivers/operators:** In a context of drivers' shortage, local & regional authorities and PT organisations need to plan carefully the recruitment of operators. Despite the difficulties, local & regional authorities and PT organisations should avoid re-allocating drivers from conventional lines to shared CCAM operation – both for quantitative and qualitative reasons. Indeed, operators must have the skills of a 'conventional' driver AND should also have some IT skills, good interpersonal relations as well as an ability to adapt to new situations. Nevertheless, in the longer term, the expected need of a single remote operator for an increasing number of vehicles will decrease the need of staff, until shared CCAM vehicles are fully autonomous. - **Training of operators:** Sufficient time and budget must be allocated for this step which can be time-consuming as the training of an operator requires several days of education. Usually, local & regional authorities and PT organisations can either have all their staff trained directly by the vehicle provider,

Code	CPT_10
	or have a single (or a few) person(s) has (have) been trained to later train colleagues. While the first option allows all operators to hear the instructions from the OEM, the second option allows to train more smoothly new staff. In addition, local & regional authorities and PT organisations should carefully check which type of driving licence on-board operators must hold and the regulation which applies to them. For the longer term, training remote operators is also very important and must be done in a coordinated manner with the training of on-board operators – so the allocation of roles is made clear as long as on-board and remote operators co-exist. When only remote operators will be necessary, their role will certainly include in situ tasks as well, such as e.g. on-site assistance in case of incidents or accidents, - **Safety and comfort of operators:** Local & regional authorities and PT organisations should ensure a minimum level of comfort and safety for on-board operators. This will reduce risks and the physical pain due to (still) repeated emergency braking and to allow operators to carry out their tasks correctly while interacting with passengers. Despite their important role on board, their place in the vehicle is not fully established yet. To have a good view on the DUI, the operator must stand in one area of the vehicle without a seat. During emergency braking, the operator is likely to fall or at least to be propelled forward. To avoid this, local & regional authorities and PT organisations the SHOW pilot sites are advised to request or to make changes to vehicles and install e.g. a safety arm and/or a safety cordon, or even a proper seat for on-board operators.
Good practices, example and sources	SHOW pilot sites have adopted different strategies when it comes to training: while in some SHOW sites like e.g. **Linköping**, drivers have all been trained by the vehicle providers, in other sites, a single (or a few) person(s) has (have) been trained to later train colleagues, like in e.g. **Les Mureaux**. Finally, a SHOW pilot site (**Brno**, see CPT 9) developed its own training method. The time and costs needed for training the operators must be considered. Regarding the conditions of work of operators, in **Linköping**, a foldable safety arm has been installed in the vehicle. The installation of a proper seat and equipment (i.e. safety belt) could further improve the comfort and safety. [26]

Table 14 -: CPT_11: Promoting the use of shared CCAM services

Code	CPT_11
Name	Promoting the use of shared CCAM services
Rationale	The success of shared CCAM services relies on a simple factor: the usage of this new service by people. Therefore, before welcoming passengers, the first step is to make them feel like trying and using automated shuttles. On the longer-term, the consultation of public will be necessary before the deployment of permanent shared CCAM services. One of the SHOW pilot sites is already working on this type of public consultation

Code	CPT_11
	to design a service which responds best to the needs of the local population, both in terms of vehicles' design and service.
Guideline	To convince people to use shared CCAM services, local & regional authorities and PT organisations must communicate and promote their services using marketing techniques. They should also make visible the operations of vehicles. The everyday smooth operation of vehicles, in a public area, close to the public is certainly the best argument to attract more passengers. Finally, local & regional authorities and PT organisations should make use of the on-board operators and must not underestimate their role. Being the physical person who welcome people on board, this person is key to raise the level of confidence and provide technical information en route.
Good practices, example and sources	Several of the SHOW pilot sites implemented promotion actions which can be regarded as good practices. These include: - the recruitment of 'ambassadors' who travel regularly onboard, provide their feedback and attract their acquaintances (**Linköping**); - rides with VIP passengers including EU Commissioners, Ministers, Mayors, and other high-level representatives (**Carinthia**); - information sessions at schools, senior homes and with event organisers, tourist offices, etc. (**Linköping, Carinthia**); - communication on local newspapers, TV and radio channels, social media, leaflets, etc (**Brno**).

Table 15 – CPT_12: Making shared CCAM services inclusive

Code	CPT_12
Name	Making shared CCAM services inclusive
Rationale	As much as any collective transportation option, shared CCAM services should be accessible to all passengers, including people with disabilities, visually impaired people, older people, children and families.
Guideline	As the current generation of shuttles on the market is rapidly evolving, local & regional authorities and PT organisations should seize the occasion to make them as inclusive as possible and add their own requirements on this end towards the vehicle makers. Involving the above-mentioned groups and following the principles of the "*design for all"* approach will make the vehicles and services more accessible, not only for representatives of these groups, but for all passengers. The "design for all" concept is a participatory and inclusive approach used from the early stages of product design. It considers the characteristics of the different public who will possibly use the services with the aim of responding to the various incapacities due to age or disability. Once more, local & regional authorities and PT organisations should make use of the on-board operators and must not underestimate their role. As the only human presence on-board, they will increase the

Code	CPT_12
	confidence of passengers and they will be able to provide the relevance guidance and support to public who might need it.
Good practices, example and sources	In the framework of SHOW, several pilot sites (e.g. **Carinthia, Geneva**) have installed a ramp for a better access of people in wheelchair as well as a safety hook to secure the position of the wheelchair in the shuttle. Nevertheless, their experience shows that the presence of a wheelchair in the vehicle severely reduces the possibility to transport (many) other passengers. Other changes in the interior of the vehicles such as the installation of cushions and safety belt on the passenger seats make the transport of all passengers more comfortable and safer, especially vulnerable users. In this context, the presence of safety operators is also very much appreciated by this type of public groups. With the gradual transition towards remote operators, the possibility for passengers to talk to a human being will remain a necessity, especially for people that are visually impaired. [28]

Table 16 – CPT_13: Testing vehicles and the system

Code	CPT_13
Name	Testing vehicles and the system
Rationale	The testing/validation phase may sound like a simple transition phase between the preparation phase and the actual deployment phase. However, this phase is crucial as it allows to ensure that all aspects of the project are correctly set - without the pressure of passengers. The testing phase is particularly important for safety operators to get familiar with the vehicles, the technology, the environment, and the different tasks they will have to perform on a daily basis. A successful testing phase will allow to identify potential issues, fix the problems which can be easily fixed and adapt/avoid those which will require more time.
Guideline	Local & regional authorities and PT organisations are advised to test vehicles in a diversity of traffic situations to test the behaviour of vehicles e.g. at different times of the day with different level of visibility, with different weather conditions, with different level of 'business' and traffic occupancy in the direct environment, etc. They should perform test with the on-board operators who will be present during the actual implementation phase. It is therefore important to organise operator's training before the testing phase. Local & regional authorities and PT organisations should keep the main learnings and conclusions of the testing phase in a concrete manual which can serve as a guide for the deployment phase.
Good practices, example and sources	**SHOW pilot sites** all stress the importance of this step and this is the reason that in the workplan of SHOW there is a specific validation process protocoled and applied respectively (WP11). In **Monheim** for instance, the testing phase helped partners e.g. to identify the maximum intensity of rain possible for automated vehicles operation, or to decide on how to deal with garbage left on the side of the road, once a week.

Table 17 – CPT_14: Keeping vehicles operational

Code	CPT_14
Name	Keeping vehicles operational
Rationale	Monitoring and maintenance begin as soon as vehicles start their operations – during the testing phase as well as the actual deployment phase. Automated vehicles require a special attention as they contain specific technological equipment which differs from the equipment of conventional vehicles, including radar and/or lidar sensors, GNSS receiver, DUI, and other controlling devices, as well as the electrical equipment (batteries, charging interface, etc.). Additionally, updates of the navigation system should be implemented on a regular basis in order to allow automated vehicles to operate with up-to-date technological developments. On the longer-term, self-monitoring tools could be expected to check e.g. the cleanliness of sensors, the pressure of tyres, the state of batteries, etc. and indicate when a human intervention is needed. In addition, when vehicles will be expected to drive without an operator on board, further attention to the interior of the vehicles will be required (currently performed by the onboard operators) to avoid e.g. graffiti and other permanent deterioration. Despite the absence of human operators, passengers will certainly expect the same level of comfort and cleanliness as in conventional vehicles.
Guideline	If a monitoring procedure already exists for conventional vehicles, it is advised to integrate the monitoring of automated vehicles within this procedure. However, since automated vehicles differ greatly from conventional vehicles, local & regional authorities and PT organisations should ensure that their monitoring is completed by trained staff. The staff should be able to manage regular system updates. These updates are usually launched by the vehicle manufacturer – either onsite or remotely - and only require some 'invisible' changes. However, it can have a physical impact on the road and can thus be seen as a 'sub-project'. Therefore, the person in charge of the monitoring must be able to make decisions about e.g. people to inform, changes to make in the infrastructure, information to make public, etc.
Good practices, example and sources	For instance, in **Monheim**, an update addressed the behaviour of vehicles after stopping at a "STOP" sign. The vehicle activated a flashing light when re-starting. This was regarded as confusing and potentially dangerous in this context. Therefore, the pilot site management team decided to remove the "STOP" signs from the pilot area. In other cases, informing the authorisation authorities might also be required. In **Madrid,** the PT operator EMT which monitor daily a high number of conventional vehicles, has integrated CCAM vehicles in its monitoring procedure. Like in **most SHOW pilot sites**, a part of the maintenance staff has been trained on the automated vehicles and can fix small issues. However, bigger issues are fixed by shuttle providers. Due to the current small size of the market, **several SHOW pilot sites** have experienced rather long delays for the replacement of certain parts, e.g. up to three weeks for a door. This type of issues is expected to become less frequent as the market gets more mature.

Real-life deployment is the end of the preparation process and also the beginning of a longer implementation process. The current status of the technology, the market and the legislation doesn't allow for large-scale, permanent deployment of shared CCAM services in cities and regions. Nevertheless, this technological, economic, and regulatory framework is expected to evolve rapidly and to make the implementation of permanent and full-scale shared CCAM services gradually possible. This will certainly trigger new questions for local & regional authorities and PT organisations such as:

- The level of human presence sought/necessary to run shared CCAM services;
- Scale and pace of investments and replacement of current conventional fleets;
- Societal acceptance;
- The role of public and private entities in running shared CCAM services;

D17.2: Further research

For the second version of the guidelines in the context of D17.2, further research will be conducted in the following fields:

- Specific allocation of roles between cities & regions and PTAs & PTOs;
- Collection of results from more SHOW pilot sites and from SHOW pilot sites which are currently in the early stages of deployment of shared CCAM services.

5 Application guidelines for industries

This chapter contains the developed industry application guidelines using the methodlogy, knowledge of the demo sites and WP17 partners.

5.1 Industry application guidelines

The following sub chapters describes/presents the developed industry application guidelines divided into the 6 main focus areas of the PESTEL-Analysis [1]. At the end of tables a short summary gives an overview about the relevance for the deployment phases, the kind of SAMS it can be applied, the beneficiaries of the guideline and the relevant impact for decion-making.

5.1.1 Political application guidelines and decision-making mechanism

The following tables (Table 18 to Table 40) shows the best practices and decision-making mechanism in form of application guidelines for political view of SAMS:

Table 18 - PI_1: Support local authorities

Identifier & Name	PI_1: Support local authorities
Description	Support local authorities for the creation of a political goals or motivation to lay the base for SAMS.
Rationale	Supporting the local defined political goals (by delivering solutions targeting to reduce emissions and traffic) offers a great chance to get funding which helps to minimize the risk of high CapEx and OpEx.
Key industry cluster concerned/involved	Transport/Mobility service operators, OEM, Tier I supplier
Source	SHOW D2.1

Identifier & Name	PI_1: Support local authorities
Linkage to PTO/City guidelines	CPT_4
Link to sub-guidelines	PI_1.1 to PI_1.4

Summary of PI_1

This industry application guideline should be considered in all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency

The possible impact/effect includes the increase of knowledge about political impact and motivations and allows a better planning of deployment or adaption of SAMS. The occurancy is about 75 %, the severity 150,000 € (profit) and the (monetized) impact 112,500 € (profit). This value contains the revenues for the services (fleet sizes, number of services) minus the consulting costs (about 3 PM) for supporting the relevant political organisations.

The decision-making of PI_1 can be detailed in the following way:

Table 19 - PI_1.1: Finding and contacting the correct contact person for automated mobility topics

Identifier & Name	PI_1.1: Finding and contacting the correct contact person for automated mobility topics
Description	The correct contact person - responsible for the topic - needs to be identified and contacted.
Rationale	This is needed to discuss the needs of the city/area, approach, regulations, challenges, goals, concepts of the planned mobility service concepts.

Source	SHOW pilot experience

Table 20 - PI_1.2: Supporting the (organizations and) authorities with needed information about shared automated mobility service concepts

Identifier & Name	PI_1.2: Supporting the (organizations and) authorities with needed information about shared automated mobility service concepts
Description	Identify, agree and update recommendations for innovation management, an elaboration of governmental influence, gap analysis of organizations' and maturity.
Source	Smart Mobility – Connecting Everyone: Trends, Concepts and Best Practices (2017)
Linkage to PTO/City guidelines	CPT_1

Table 21 - PI_1.3: Supporting the authorities with other aspects regarding shared automated mobility services (Consultation services)

Identifier & Name	PI_1.3: Supporting the authorities with other aspects regarding shared automated mobility services (Consultation services)
Description	Beside the planned mobility service concept, provide support for authorities regarding topics handled when implementing such a service.
Source	Key expert
Linkage to PTO/City guidelines	CPT_2

This should be considered in all phases.

Table 22 - PI_1.4: Provide decision support system for city logistics and person transport

Identifier & Name	PI_1.4: Provide decision support system for city logistics and person transport
Description	The provided supporting services via a decision support system to identify, in advance, possible sustainable interventions/policies for the improvement of city logistics and person transport, in compliance with environmental constraints (min. externalities), economic constrains (maximum investment expected by decision-maker), and guaranteeing goods supply to retailers, and end-users
Source	Elsevier (Andrea Conca et al., 2014)

Table 23 - PI_2: Asking local authorities for supporting them regarding necessary documents, permits (matters of bureaucracy)

Identifier & Name	PI_2: Asking local authorities for supporting them regarding necessary documents, permits (matters of bureaucracy)
Description	Support local authorities for the creation of a the relevant documentation or paperwork to lay the base for SAMS.
Rationale	Implementing an automated mobility service requires a lot of approvals and other bureaucracy matters. Therefore, cooperation with the authorities, that are inevitably involved in such processes, is crucial for a smooth implementation.
Key industry cluster concerned/involved	Transport/Mobility service operators, Tier I supplier

Identifier & Name	PI_2: Asking local authorities for supporting them regarding necessary documents, permits (matters of bureaucracy)
Source	SHOW pilot experience, Key experts
Linkage to PTO/City guidelines	CPT_4
Link to sub-guidelines	PI_2.1 to PI_2.2

Summary of PI_2

This industry application guideline should be considered in all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency

The possible impact/effect includes the increase of knowledge about political impact and motivations and allows a better planning of deployment or adaption of SAMS. The occurancy is about 75 %, the severity 150,000 € (loss) and the (monetized) impact 112,500 € (loss). This value contains the revenues for the services (fleet sizes, number of services) minus the consulting costs (about 3 PM) for supporting the relevant political organisations.

The decision-making of PI_2 can be detailed in the following way:

Table 24 - PI_2.1: Recherching of what documents, approvals, etc. are needed to implement an automated mobility service

Identifier & Name	PI_2.1: Recherching of what documents, approvals, etc. are needed to implement an automated mobility service
Description	To operate an automated mobility service certain bureaucracy procedures need to be done beforehand.

Identifier & Name	PI_2.1: Recherching of what documents, approvals, etc. are needed to implement an automated mobility service
Rationale	This should be researched to create a common perspectives, impacts and to avoid getting in trouble with the authorities.
Source	SHOW pilot experience

Table 25 - PI_2.2: Asking local authorities for feedback regarding necessary documentation, permits

Identifier & Name	PI_2.2: Asking local authorities for feedback regarding necessary documentation, permits
Description	When necessary the contact person and other people working at authorities can be asked for help if needed for bureaucracy processes.
Source	SHOW pilot experience

Table 26 - PI_3: Active stakeholder involement

Identifier & Name	PI_3: Active stakeholder involement
Description	Involve stakeholder actively via workshops, interviews, continous communication and information exchange for optimisation feedback.
Rationale	Involving the stakeholders actively in the test phase of the mobility service and beyond is very important to get continuously feedback, rise their curiosity and leads finally to a first fixed pool of customers covering possible technology gaps at the beginning.

Identifier & Name	PI_3: Active stakeholder involement
Key industry cluster concerned/involved	Transport/Mobility service operators, Industry
Source	SHOW pilot experience
Linkage to PTO/City guidelines	CPT_4, CPT_11
Link to sub-guidelines	PI_3.1 to PI_3.4

Summary of PI_3

This industry application guideline should be considered in all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Passengers and other road users encompassing VEC, Umbrella associations; research & academia, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Transport/Mobility operators, Industry

The possible impact/effect is that it increases the maturity and awareness level of the provided SAMS. The occurancy is about 100 %, the severity 40,000 € (loss) and the (monetized) impact 40,000 € (loss). This value is depending on fleet size, services provided and market, the number of customers will be increased about 20% which will increase the revenue.

The decision-making of PI_3 can be detailed in the following way:

Table 27 - PI_3.1: Identifying relevant political stakeholders to be involved in the deployment value chain

Identifier & Name	PI_3.1: Identifying relevant political stakeholders to be involved in the deployment value chain

Description	Identifying the relevant stakeholders for the crucial for the development and operation of the automated mobility service.

Table 28 - PI_3.2: Contacting identified political stakeholder

Identifier & Name	PI_3.2: Contacting identified political stakeholder
Description	After identifying all relevant stakeholders they should be contacting them by different (applicable to each) means.

Table 29 - PI_3.3: Including the stakeholders in the development and integration of the automated mobility service (co-creation concept).

Identifier & Name	PI_3.3: Including the stakeholders in the development and integration of the automated mobility service (co-creation concept).
Description	The stakeholders should be involved in the development and integration process by giving their opinions and feedback.
Rationale	The (contiuous) involvement of the stakeholders should guarantee that their needs and demands are considered which would lead to more customers after the service starts operation.

Table 30 - PI_3.4: Keeping the stakeholders informed

Identifier & Name	PI_3.4: Keeping the stakeholders informed
Description	During the whole development and implementation process the stakeholders should be informed about the process as well as changes and asked for feedback.

Identifier & Name	PI_4: Marketing for a high tech city
Description	Promote the city as a modern smart and green city with the latest smart mobility systems and AVs
Rationale	It is important to create a common awareness among citizens and representatives of the municipality in order to create a positive atmosphere for the implementation of SAMS and to be assured of the encouragement and support in order to jointly facilitate the challenges for the implementation.
Key industry cluster concerned/involved	Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Umbrella associations; research & academia, Transport/Mobility service operators
Source	SHOW D8.3; European Green Deal
Linkage to PTO/City guidelines	CPT_11
Link to sub-guidelines	PI_4.1 to PI_4.3

Table 31 - PI_4: Marketing for a high tech city

Summary of PI_4

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC, Transport/Mobility service operators

The possible impact/effect is that with marketing within a city which wants to present itself as a high tech city, offers the possibility to get into new markets. This steps includes the marketing costs & OPEX increase as well as increased revenues considering number of services, fleet size and market potential (number of possible customers) The occurancy is about 50 %, the severity 150,000 € (profit) and the (monetized) impact 75,000 € (profit). Includes the possible revenues of an new or extended market minus the marketing costs.

The decision-making of PI_4 can be detailed in the following way:

Table 32 - PI_4.1: Local Marketing

Identifier & Name	PI_4.1: Local Marketing
Description	Focus here is on the city/area the service is operating.

Table 33 - PI_4.2: National Marketing

Identifier & Name	PI_4.2: National Marketing
Description	Focus here is on marketing activities reaching the whole country the service is operating to inform and activate potential customers.

Table 34 - PI_4.3: International Marketing

Identifier & Name	PI_4.3: International Marketing
Description	Focus here is on marketing activities reaching the international area presenting innovation.

Table 35 - PI_5: New insurance policies

Identifier & Name	PI_5: New insurance policies
Description	Clear legal framework and updates regarding the impact on insurance policies, strategies and implmenetation to be able to determine responsibilities regarding safety issues and operation of SAMS.
Rationale	Insurance policies influences ecenomic aspects as well as legal aspects for the deployment of SAMS . Particularly in the case of shared responsibilities for safety, the environment and economic efficiency, and protection against incidents, a continuous change management process is required in order to be able to optimally manage risks as they arise.
Key industry cluster concerned/involved	Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Industry (Insurance provider)
Source	SAFE-UP D7.3
Linkage to PTO/City guidelines	CPT_1, CPT_3, CPT_5
Link to sub-guidelines	PI_5.1 to PI_5.2

Summary of PI_5

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility service operators, Industry

The possible impact/effect is that for cities there are no direct costs, but indirect effects (e.g. if they have to provide new or updated infrastructure); for the SAMS provider or PTO the costs of training and new licenses are in the focues, which influences the price of the SAMS. The occurancy is about 15 %, the severity 50,000 € (loss) and the (monetized) impact 7,500 € (loss). This value are test site and key experts estimations.

The decision-making of PI_5 can be detailed in the following way:

Table 36 - PI_5.1: Identifying current problems/gaps in legal framework regarding responsiblities regarding AD

Identifier & Name	PI_5.1: Identifying current problems/gaps in legal framework regarding responsiblities regarding AD
Description	To establish clear legal frameworks, first the problems have to be identified and analysed.

Table 37 - PI_5.2: Creating recommendations for the identified problems/gaps

Identifier & Name	PI_5.2: Creating recommendations for the identified problems/gaps
Description	After the problems/gaps in the legal frameworks are analysed, recommendations should be created for the international and national policy makers.

Table 38 - PI_6: New driver permits

Identifier & Name	PI_6: New driver permits
Description	Include changes for new driver permits as soon as possible to avoid delays and interruptions in the introduction and operation of SAMS.
Rationale	It is important for the deployment and operation of SAMS to have the current legal-conform driver permits. Especially for automated driving and the observer-function of the driver means changes within the permit and the driver training which have to be implement as soon as possible to get things running. Additionally, a

Identifier & Name	PI_6: New driver permits
	continuously monitoring of changes triggered by technology and legal regulations (national and European level) hekps to minimise possible impact on the operation of SAMS.
Key industry cluster concerned/involved	Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency
Source	SHOW test sites and project experiences
Linkage to PTO/City guidelines	CPT_1, CPT_3, CPT_5, CPT_10
Link to sub-guidelines	PI_6.1 to PI_6.2

Summary of PI_6

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility service operators, Industry

The possible impact/effect is that it causes costs of updating trainings and drivers for the SAMS provider or PTO. The occurancy is about 15 %, the severity 20,000 € (loss) and the (monetized) impact 2,500 € (loss). This value are test site and key experts estimations.

The decision-making of PI_6 can be detailed in the following way:

Table 39 - PI_6.1: Identifying and analysing relevant legal framework

Identifier & Name	PI_6.1: Identifying and analysing relevant legal framework
Description	The tasks and permits of an AV driver are specified in legal frameworks. Identifying and analysing them is crucial for the operation of the automated mobility service.

Table 40 - PI_6.2: Creating recommendations for authorities regarding identified gaps

Identifier & Name	PI_6.2: Creating recommendations for authorities regarding identified gaps
Description	After the problems/gabs in the legal frameworks are analysed, recommendations should be created for the international and national policy makers.

5.1.2 Economic application guidelines and decision-making mechanism

The following tables (Table 41 to Table 92) show the best practices and decision-making mechanism in form of application guidelines for economic view of SAMS.

Table 41 - EI_1: Active customer involvement from the business environment and linked value chains

Identifier & Name	EI_1: Active customer involvement from the business environment and linked value chains
Description	Actively involve customer via different feedback loops and methods (interviews, events, Satisfaction surveys) for the optimisation of provided SAMS or deployment of new SAMS.
Rationale	Involving the stakeholders actively in the test phase of the mobility service and beyond is very important to get continuously feedback, rise their curiosity and leads finally to a first fixed pool of customers covering possible technology gaps at the beginning and shows their demands and needs.

Identifier & Name	EI_1: Active customer involvement from the business environment and linked value chains
Key industry cluster concerned/involved	Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Transport/Mobility operators, Industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_1, CPT_4, CPT_11
Link to sub-guidelines	EI_1.1 to EI_1.4

Summary of EI_1

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Passengers and other road users encompassing VEC, Umbrella associations; research & academia, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Transport/Mobility operators, Industry

The possible impact/effect is that it increases the maturity and awareness level of the SAMS provided. The occurancy is about 100 %, the severity 40,000 € (loss) and the (monetized) impact 40,000 € (loss). The value is depending on fleet size, services provided and market, the number of customers will be increased about 20% which will increase the revenue.

The decision-making of EI_1 can be detailed in the following way:

Table 42 - EI_1.1: Identifying relevant stakeholder from the business environment and relevant economic value chains

Identifier & Name	EI_1.1: Identifying relevant stakeholder from the business environment and relevant economic value chains

Description	Identifying the relevant stakeholders for the crucial for the development and operation of the automated mobility service.

Table 43 - EI_1.2: Contacting identified stakeholder from the business environment and relevant economic value chains

Identifier & Name	EI_1.2: Contacting identified stakeholder from the business environment and relevant economic value chains
Description	After identifying all relevant stakeholder they should be contacting them by different means.

Table 44 - EI_1.3: Including the stakeholders in the development and integration of the automated mobility service

Identifier & Name	EI_1.3: Including the stakeholders in the development and integration of the automated mobility service
Description	The stakeholders should be involved in the development and integration process by giving their opinions and feedback. This should guarantee that their needs and demands are considered which would lead to more customers after the service starts operation.

Table 45 - EI_1.4: Keeping the stakeholders informed

Identifier & Name	EI_1.4: Keeping the stakeholders informed
Description	During the whole development and implementation process the stakeholders should be informed about the process as well as changes and asked for feedback.

Table 46 - EI_2: Time related cost & revenue optimization

Identifier & Name	EI_2: Time related cost & revenue optimization
Description	For optimizing costs and revenues in a timely manner it is necessary to analyse the value chain and the corresponding business environment continuously and just-in-time.
Rationale	Although, value chains look stable, there are many factors which have to be considered for the optimisation of SAMS. Especially, SAMS are acting in a business environment were disruptive technologies, processes or boundary conditions influences the operation in a measureable way, so the potential of the possible changes, e.g. introduction of new SME or new communication technologies, must be carefully monitored, analysed and optimised (just in-time).
Key industry cluster concerned/involved	Transport/Mobility operators, Industry (ITS supplier)
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_8
Link to sub-guidelines	EI_2.1 to EI_2.3

Summary of EI_2

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, Industry (ITS supplier), Passengers and other road users encompassing VEC

The possible impact/effect is that it decreases the costs for the SAMS and increases the number of services to be delivered. The occurancy is about 50 %, the severity 100,000 € (loss) and the (monetized) impact 50,000 € (profit). This value is test sites and key experts estimation.

The decision-making of EI_2 can be detailed in the following way:

Table 47 - EI_2.1: Identifying and analysing the service owned needs

Identifier & Name	EI_2.1: Identifying and analysing the service owned needs
Description	Each service has its own special needs, which needs to be identified and analysed to know which businesses are part of the value chain and to create the correct business environment

Table 48 - EI_2.2: Finding and Involving value chain participants needed to cover needs

Identifier & Name	EI_2.2: Finding and Involving value chain participants needed to cover needs
Description	To cover the identified needs of the service it is necessary to find, contact and involve value chain participants, who can cover this needs

Table 49 - EI_2.3: Creating and updating business environment for cost and revenue optimization

Identifier & Name	EI_2.3: Creating and updating business environment for cost and revenue optimization
Description	Based on the value chain the corresponsing business environment is created. It will change continuously based on the changing needs and value chain participants identified

Table 50 - EI_3: Marketing revenues

Identifier & Name	EI_3: Marketing revenues
Description	Using marketing by selling spaces on vehicles or stations (not only for self-advertising) can be an important revenue stream when properly exploited and help to make the service more profitable.
Rationale	Do not miss any potential income especally for the deployment because costs at the beginning are an important challenge.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_11
Link to sub-guidelines	EI_3.1 to EI_3.3

Summary of EI_3

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry

The possible impact/effect is that it increases the revenues by activating new customers and binds the existing customer to the service. It also generates income from marketing space leased to other companies. With that it can help to minimize OpEx. The occurancy is about 60 %, the severity 20,000 € and the (monetized) impact 12,000 € (profit). This value is test sites and key experts estimation.

The decision-making of EI_3 can be detailed in the following way:

Table 51 - EI_3.1: Local Marketing

Identifier & Name	EI_3.1: Local Marketing
Description	Focus here is on the city/area the service is operating

Table 52 - EI_3.2: National Marketing

Identifier & Name	EI_3.2: National Marketing
Description	Focus here is on marketing means reaching the whole country the service is operating

Table 53 - EI_3.3: International Marketing

Identifier & Name	EI_3.3: International Marketing
Description	Focus here is on marketing means reaching the international area

Table 54 - EI_4: SME potential for the business environment and relevant economic value chains

Identifier & Name	EI_4: SME potential for the business environment and relevant economic value chains
Description	Using the potentials (like adaptability, creativity, flexibility …) of the SMEs is a great chance to optimize the business as well as the services themselves.
Rationale	Strongly connected to EI_2 and EI_5, SME offers the potential to optimise the value chains with new products and services and to change the business environment for the SAMS. This can/will support the risk management for the deployment and operation of SAMS and offers new chances
Key industry cluster concerned/involved	Transport/Mobility operators, industry (SMEs of the whole value chain)
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_4
Link to sub-guidelines	EI_4.1 to EI_4.2

Summary of EI_4

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry (SMEs of the whole value chain)

The possible impact/effect is that SME can help to cover technology gaps as well as operative gaps during service operation. So, they will minimize costs and can increase the customer trust, which influence the number of customers and frequency of service usage. With that it can

help to minimize OpEx. The occurancy is about 50 %, the severity 50,000 € and the (monetized) impact 25,000 € (profit). The value depends on SAMS desgin, number of SME to be intrated and market potential.

The decision-making of EI_4 can be detailed in the following way:

Table 55 - EI_4.1: Identifiying relevant SMEs and their potentials and contacting them

Identifier & Name	EI_4.1: Identifiying relevant SMEs and their potentials and contacting them
Description	The identification of SME covering possible gaps within the own value chain or offering new or additional economic potential, and itroducde and integrate them will strengthen the SAMS by either minimzing cost (CapEx, OpEx) or maximising income.

Table 56 - EI_4.2: Introducing and integrating the different SMEs and their potentials into the SAMS

Identifier & Name	EI_4.2: Introducing and integrating the different SMEs and their potentials into the SAMS
Description	The introduction and integration of an SME finding a common economic perspective, relevant interfaces as well as legal and personal communication will strengthen the own SAMS and the overall economic potential.

Table 57 - EI_5: Business environment analysis

Identifier & Name	EI_5: Business environment analysis
Description	A good business environmental analysis should be the basis for all businesses – do not forget to update on regular base.
Rationale	SAMS are acting in a business environment were disruptive technologies, processes or boundary conditions influences the operation in a measureable way.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_1

Summary of EI_5

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry

The possible impact/effect is that by knowing your market helps to provide the best SAMS and maximize the revenues by activating all customer potentials. With that it can help to minimize OpEx. The occurancy is about 50%, the severity 100,000 € and the (monetized) impact 50,000 € (profit). This value is test sites and key experts estimation.

The decision-making of EI_5 can be detailed in the following way:

Table 58 - EI_6: Usage time optimization

Identifier & Name	EI_6: Usage time optimization
Description	By optimizing the non-usage times of vehicles (considering the limits of the used technology) the service is running more efficiently, creating (more or more constant) revenues optimizing also the costs side.
Rationale	Time optimisation has to be done not only from a technology perspective, but also from the economic view to balance what can be done and what should be done to maximise the revenues.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	none
Link to sub-guidelines	EI_6.1 to EI_6.3

Summary of EI_6

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry, Passengers and other road users encompassing VEC

The possible impact/effect is that vehicles not on the road cannot earn money, so balancing working time and maintenance time is very important to increase the revenues. The occurancy is about 50 %, the severity 50,000 € and the (monetized) impact 25,000 € (profit). The value depends on the market size, fleet size and number of SAMS realized.

The decision-making of EI_6 can be detailed in the following way:

Table 59 - EI_6.1: Identifying non-usage times of the vehicle

Identifier & Name	EI_6.1: Identifying non-usage times of the vehicle
Description	The time-slots (and their duration) the vehicles are not used needs to be identified (e.g. nights, certain hours during the day, etc.)

Table 60 - EI_6.2: Create a concept for how to optimize the non-usage times

Identifier & Name	EI_6.2: Create a concept for how to optimize the non-usage times
Description	After identifying the non-usage times a suitable concept needs to be developed on how to use them in the most efficient and optimized way.

Table 61 - EI_6.3: Implement concept of non-usage times

Identifier & Name	EI_6.3: Implement concept of non-usage times
Description	After creating the concept, it should be implemented and used.

Table 62 - EI_7: Technology usage & update

Identifier & Name	EI_7: Technology usage & update

Description	Do not use the existing technology in a correct way and especially updating it accordingly can cause loss of revenues.
Rationale	A customer require an amount of comfort in the field of vehicle, available technologies, communication (booking platform, interfaces), so the progress has to be considered and implemented in the existing or new SAMS.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_6, CPT_7, CPT_13
Link to sub-guidelines	EI_7.1 to EI_7.5

Summary of EI_7

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry, Passengers and other road users encompassing VEC

The possible impact/effect is that it can cause the loss of customers and therefore the as well revenues due to the decrease of customer acceptance for the service if the technology is not accordingly used and updated. The occurancy is about 75 %, the severity 100,000 € and the (monetized) impact 75,000 € (loss). The value depends on the market size, fleet size and number of SAMS realized.

The decision-making of EI_7 can be detailed in the following way:

Table 63 - EI_7.1: Getting informed about different technologies available on the market

Identifier & Name	EI_7.1: Getting informed about different technologies available on the market
Description	Before implementing a certain technology, it should be known what is available on the market to select the best suitable for the service needs

Table 64 - EI_7.2: Selecting the most suitable technologies

Identifier & Name	EI_7.2: Selecting the most suitable technologies
Description	Selecting the technologies according to service needs

Table 65 - EI_7.3: Intensifying knowledge about used technologies

Identifier & Name	EI_7.3: Intensifying knowledge about used technologies
Description	To really understand how the technology of the service works, the knowledge should be itensified as well as regularly updated if new versions are published.

Table 66 - EI_7.4: Hiring personnel familiar with the used technologies or targeted training of already existing personnel

Identifier & Name	EI_7.4: Hiring personnel familiar with the used technologies or targeted training of already existing personnel
Description	To be able to handling the technologies accordingly skilled personnel is needed.

Table 67 - EI_7.5: Creating concept on how to maintain and update the used technology

Identifier & Name	EI_7.5: Creating concept on how to maintain and update the used technology
Description	Concepts for maintenance and updating should be created to have a clear understanding what is when to do. Same for unplanned occurances such as break downs of vehicles to ensure the safety of the customers and to get back to operating as fast as possible.

Table 68 - EI_8: Customer knowledge

Identifier & Name	EI_8: Customer knowledge
Description	To know the own customers and his needs (city vs. rural, and react with a standard approach) is elementary to design and update the SAMS.
Rationale	The elementary rule of every business: Know your market and your customer otherwise revenues could not be achieved.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_4, CPT_11

Link to sub-guidelines	EI_8.1 to EI_8.5

Summary of EI_8

This industry application guideline should be considered during the all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry

The possible impact/effect is that by knowing your customers helps to provide the best SAMS and maximizing the revenues by activating the full customer potential. The occurancy is about 50%, the severity 100,000 € and the (monetized) impact 50,000 € (profit). The value depends on market size, fleet size and number of SAMS realized.

The decision-making of EI_8 can be detailed in the following way:

Table 69 - EI_8.1: Involving customers (in the economic view) from the beginning / as soon as possible

Identifier & Name	EI_8.1: Involving customers (in the economic view) from the beginning / as soon as possible
Description	To know the service' customers they should be involved from the beginning when implementing the service.

Table 70 - EI_8.2: Having a reliable and good customer service

Identifier & Name	EI_8.2: Having a reliable and good customer service
Description	To get customer feedback and to know where problems are, a good customer service is crucial and needed.

Table 71 - EI_8.3: Updating and informing the customers of changes

Identifier & Name	EI_8.3: Updating and informing the customers of changes

Description	If bigger changes within the service is needed, customers should be informed.

Table 72 - EI_8.4: Doing different things to get the customers needs and demands

Identifier & Name	EI_8.4: Doing different things to get the customers needs and demands
Description	After bigger changes the customers should be asked what they think about them.

Table 73 - EI_8.5: Reacting to customer demands and needs

Identifier & Name	EI_8.5: Reacting to customer demands and needs
Description	After customers expressed their needs, the service should react accordingly to them.

Table 74 - EI_9: Be awere of the complexity of business value chain and the necessary members

Identifier & Name	EI_9: Be awere of the complexity of business value chain and the necessary members
Description	Over- or underestimate the complexity of the value chain will endanger the economic success.
Rationale	Considering EI_2, EI_4 and EI_5 as well as SAMS are complex constructions including many participants, technologies, interfaces and dependencies, so managing that complicated and complex construction is a difficult activity, becases a change in one part/factor influences many other factors and therefore egalises the postive impact of the initiated change.

Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_4

Summary of EI_9

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry

The possible impact/effect is that too simple or too complex SAMS design can increase CapEx and OpEx and danger the economic success by decreasing reveneues and increasing costs. The occurancy is about 35%, the severity 100,00 € and the (monetized) impact 35,000 € (loss). The value depends on market size, fleet size and number of SAMS realized.

Table 75 - EI_10: OPEX/CAPEX

Identifier & Name	EI_10: OPEX/CAPEX
Description	Do not underestimate OpEx costs in relation to the CapEx

Rationale	Deploying SAMS, the CapEx seems to have a very heavy part on the costs, especially in the public environment. Analysing different SAMS as well as other mobility services.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_8, CPT_9
Link to sub-guidelines	EI_10.1 to EI_10.2

Summary of EI_10

This industry application guideline should be considered during the all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency

The possible impact/effect is that OpEx costs can change the profitability of a SAMS, be providing a higher cost potential in relation to the calculated revenues. The occurancy is about 35%, the severity 250,000€ and the (monetized) impact 87,500€ (loss). The value depends on market size, fleet size and number of SAMS realized.

The decision-making of EI_10 can be detailed in the following way:

Table 76 - EI_10.1: Systematic recording of all OPEX and CAPEX costs

Identifier & Name	EI_10.1: Systematic recording of all OPEX and CAPEX costs

Description	All upcoming OpEx and CapEx costs should be recorded for the analysis

Table 77 - EI_10.2: Analysing and comparing the OpEx and CapEx costs to see which impact they finally have in the total cost structure of the service

Identifier & Name	EI_10.2: Analysing and comparing the OpEx and CapEx costs to see which impact they finally have in the total cost structure of the service
Description	When everything is recorded, the total OpEx and CapEx costs should be summed up and looked at to see which impact they have on the final cost structure of the service. (Often it is assumed that the CapEx is higher as the OpEx. But is it still true when looking at a holding period of e.g. 8 years?) It is also good to compare them with the revenues made in the same holding period.

Table 78 - EI_11: Basic SAMS Definition

Identifier & Name	EI_11: Basic SAMS Definition
Description	Offered services do not need to be too specialised (concentrated on a too small market niche)
Rationale	To maximise the revenues of the deployed SAMS, the provided services must cover the main requirements of the market/customers, not only a niche, although niche means lower CapEx
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1

Identifier & Name	EI_11: Basic SAMS Definition
Linkage to PTO/City guidelines	CPT_1
Link to sub-guidelines	EI_11.1 to EI_11.2

Summary of EI_11

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry

The possible impact/effect is reduced customer potential because it is niche service. The occurancy is about 80 %, the severity 60,000€ and the (monetized) impact 30,500€ (loss). The value depends on fleet size and current number of customer potential but can de-activate up to 1/3 of the current customers.

The decision-making of EI_11 can be detailed in the following way:

Table 79 - EI_11.1: Analysing if the current service meets the needed demand

Identifier & Name	EI_11.1: Analysing if the current service meets the needed demand
Description	Often services are not successful because they cover a too small market niche with only a few customers. Therefore, the market should be analysed.

Table 80 - EI_11.2: Adapting to the demands by widen the services offered to cover more market niches

Identifier & Name	EI_11.2: Adapting to the demands by widen the services offered to cover more market niches
Description	After analysing the market und seeing where potentials are more services should be implemented and offered.

Table 81 - EI_12: Customer & Trust

Identifier & Name	EI_12: Customer & Trust
Description	Monitor und integrate trust issues of the customers regarding the service and/or the technology to avoid revenue losses.
Rationale	Increased customer trust means continuous usage and new customers for the service.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_4, CPT_11
Link to sub-guidelines	EI_12.1

Summary of EI_12

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry, Passengers and other road users encompassing VEC

The possible impact/effect is that customer's trust in the automated vehicles influence the number of people using a SAMS and the frequency, which directly influences the revenues in both directions. The occurancy is about 100 %, the severity 150,000 € and the (monetized) impact 150,000 € (profit/loss depending on what is done). The value depends on the market size, fleet size and number of SAMS realized.

The decision-making of EI_12 can be detailed in the following way:

Table 82 - EI_12.1: Receiving order via software (digital purchasing, e-mail or phone call)

Identifier & Name	EI_12.1: Receiving order via software (digital purchasing, e-mail or phone call)
Description	It is a first step to have an online purchase procedure for digital order process. It aims to have a "no human intervention" when a company would create orders. An automated purchase order technique digitalizes the purchasing process to save time and resources. To implement it, several steps are needed to follow as: Digital Request, Approval, Send purchase to vendor, Track purchase order, and Create digital receipt.
Source	SHOW WP17

Realization phase is phase 1 (Digitalized Ordering Process).

Table 83 - EI_13: Optimisation of travel time: Traffic light signaling phase optimization for PT

Identifier & Name	EI_13: Optimisation of travel time: Traffic light signaling phase optimization for PT

Description	By optimizing the travel time of the PT thanks to the traffic light priority, it is possible to save time for travellers and increase the efficiency on PT
Rationale	Together with the technology and ecology aspects, the travel time is one of the most influencing factor for SAMS, so the optimisation increases the customer trust and therefore the revenues
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D8.3
Linkage to PTO/City guidelines	CPT_1
Link to sub-guidelines	EI_13.1 to EI_13.3

Summary of EI_13

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry, Passengers and other road users encompassing VEC

The possible impact/effect is a fuel reduction for a fleet of 1,007,345 million vehicle-km annual in one day of service. The occurancy is about 85 %, the severity 2,014,690,000 € and the (monetized) impact 1,712,486,500 € (profit). This value depends on the market size, fleet size and number of realized SAMS.

The decision-making of EI_13 can be detailed in the following way:

Table 84 - EI_13.1: Developing concept

Identifier & Name	EI_13.1: Developing concept
Description	Before anything can be done, an implementation concept needs to be developed.

Table 85 - EI_13.2: Permission of local authorities

Identifier & Name	EI_13.2: Permission of local authorities
Description	Due to the fact that it is public ground the needed infrastructure needs to be implemented, the local authorities have to be asked for permission according to the foreseen in each case processes.

Table 86 - EI_13.3: Implementing intelligent traffic infrastructure

Identifier & Name	EI_13.3: Implementing intelligent traffic infrastructure
Description	For AD that implements cooperative solutions, an intelligent traffic infrastructure has to be implemented.
Rationale	Due to the use of intelligent traffic infrastructure, traffic flow is overall optimized. This results in smoother rides, less collisions and therefore less maintenance of the road infrastructure in the long term. implementation of ITS solutions in general allows more efficient use of the existing road infrastructure, therefore reduces the need for new infrastructure and thus costs.

Table 87 - EI_14: New insurance policies

Identifier & Name	EI_14: New insurance policies
Description	Check if new forms of insurance are available due to changes in responsibility & liability
Rationale	New insurance policies means an increased or decreased financlial risk for the operation of SAMS
Key industry cluster concerned/involved	Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, industry (insurance provider)
Source	SAFE-UP D7.3
Linkage to PTO/City guidelines	CPT_1, CPT_5
Link to sub-guidelines	EI_14.1 to EI_14.2

Summary of EI_14

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry

The possible impact/effect is that it increases the OpEx of SAMS. The occurancy is about 15 %, the severity 50,000 € and the (monetized) impact 7,500 € (loss). This value depends on the market size, fleet size and number of realized SAMS.

The decision-making of EI_14 can be detailed in the following way:

Table 88 - EI_14.1: Identifying current problems/gaps in legal framework covering the economic perspective

Identifier & Name	EI_14.1: Identifying current problems/gaps in legal framework covering the economic perspective
Description	To establish clear legal frameworks, first the problems have to be identified and analysed.

Table 89 - EI_14.2: Creating business & economic recommendations for the identified problems/gaps

Identifier & Name	EI_14.2: Creating business & economic recommendations for the identified problems/gaps
Description	After the problems/gaps in the legal frameworks are analysed, recommendations should be created for the international and national policy makers.

Table 90 - EI_15: Test tracks affordability

Identifier & Name	EI_15: Test tracks affordability
Description	Ensure that test tracks are affordable, so that they don't become an entry barrier for SMEs.
Rationale	Espicially for the development of SAMS, a test center and certification is very important to ensure the quality of technology. The cost of the certification strongly influences market maturity, the content of a service and cost structure, so if a testing and certification in test tracks is more affordable, the more reliable and more customer specific services can be deployed.
Key industry cluster concerned/involved	Transport/Mobility operators, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency

Source	Brad Templeton roadmap
Linkage to PTO/City guidelines	CPT_8, CPT_13
Link to sub-guidelines	EI_15.1 to EI_15.2

Summary of EI_15

This industry application guideline should be considered during research, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, industry (SMEs), Umbrella associations, research & academia

The possible impact/effect is that if the test track costs are too expensive the tests and evaluation of vehicles will be more expensive or not so detailed, which influences the quality and kind of SAMS or the point of market entry. The occurancy is about 60%, the severity 50,000 € and the (monetized) impact 30,000 € (profit). This value depends on the market size, fleet size and number of realized SAMS.

The decision-making of EI_15 can be detailed in the following way:

Table 91 - EI_15.1: Recherching which test tracks are available and their prices

Identifier & Name	EI_15.1: Recherching which test tracks are available and their prices
Description	Getting a list of test tracks and what they offer is the first step to find the right test track for the service and SMEs needs

Table 92 - EI_15.2: Contacting test tracks and explain them the service and what exactly is needed

Identifier & Name	EI_15.2: Contacting test tracks and explain them the service and what exactly is needed
Description	To discuss what and how exactly is needed to be tested, meetings should be organized

5.1.3 Technological application guidelines and decision-making mechanism

The following tables (Table 93 to Table 124) show the best practices and decision-making mechanism in form of application guidelines for technological view of SAMS:

Table 93 - TI_1: Maintenance influence for service operation

Identifier & Name	TI_1: Maintenance influence for service operation
Description	Proper operation of the service is only possible by keeping the service's assets in good shape. Therefore, a good maintenance team is needed.
Rationale	A good maintenance increases the revenues and the satisfaction of custoerms as well as the operation time of the used technologies
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_14

Summary of TI_1

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry

The possible impact/effect is the profit loss due to less sold single tickets. The occurancy is about 50 %, the severity 1,000,000 € and the (monetized) impact 500,000 € (loss).

Table 94 - TI_2: Contiously monitor, identify and implement technologies provided by new or existing value chain SME

Identifier & Name	TI_2: Continuously monitor, identify and implement technologies provided by new or existing value chain SME
Description	Using the potentials (like adaptability, creativity, flexibility …) of the SMEs is a great chance to optimize the business as well as the services themselves.
Rationale	SME Technology Solution Provider offering HW, SW and interfaces in the areas of vehicles, SAMS services, infrastructure, fleet management, communication, network services, banking which can/will increase the efficiency of the used technology or the operation of a SAMS
Key industry cluster concerned/involved	Transport/Mobility operators, all kind of industry along the involved value chains
Source	SHOW D2.1

Linkage to PTO/City guidelines	CPT_14

Summary of TI_2

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Contibutors and Beneficiaries: Transport/Mobility operators, industry

The possible impact/effect is that the SME can help to cover technology gaps as well as operative gaps during service operation. So, they will minimize costs and can increase the customer trust, which influence the number of customers and frequency of service usage. The occurancy is about 50 %, the severity 500,000 € and the (monetized) impact 250,000 € (profit). The value are test sites and key experts estimations.

Table 95 - TI_3: Technology usage & update

Identifier & Name	TI_3: Technology usage & update
Description	Not using the existing technology in a correct way and especially updating it accordingly, can cause the loss of customers (customer acceptance for the service is decreasing).
Rationale	1) Customers are used to common standard of available technologies (e.g. smartphones) 2) The operation of technologies needs a continously monitoring and updating to ensure a proper operation Together the correct usage can/will increase the revenues and trust into the technologies and SAMS
Key industry cluster concerned/involved	Transport/Mobility operators, industry

Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_3, CPT_8
Link to sub-guidelines	TI_3.1

Summary of TI_3

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry, Passengers and other road users encompassing VEC

The possible impact/effect is that the selection of the right technology (vehicles, interfaces, infrastructure, customer integration, trust) can increase the number of customers, the frequency of using the SAMS as well as their trust. Additionally it influences the CapEx and OpEx and therefore the breakeven point. The occurancy is about 75%, the severity 3,100,000€ and the (monetized) impact 2,325,000€ (profit when used accordingly). The value are test sites and key experts estimations.

The decision-making of TI_3 can be detailed in the following way:

Table 96 - TI_3.1: Digital customer services

Identifier & Name	TI_3.1: Digital customer services
Description	To prevent customer loss and highen the interest in the service for customers a efficient and informative customer service needs to be developed. This includes providing passive customer service such as real-time information and intelligent confirmation as well as active customer services such as hotlines and chats with employees

Linkage to PTO/City guidelines	CPT_10

This should be considered at market entry.

Table 97 - TI_4: Complexity of technology and solutions

Identifier & Name	TI_4: Complexity of technology and solutions
Description	Make a realistic estimation regarding implementation and complexity and the technic products to be used for a SAMS
Rationale	The selection and implementation of the technology solutions for SAMS can lead to complex solution with many interfaces, reliabilities and partners to keep the service running. This leads to an increase of technology and operation management as well as increased costs, training for technicians and operators.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_6, CPT_7, CPT_8, CPT_9

Summary of TI_4

This industry application guideline should be considered during the all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry

The possible impact/effect is that the available technology and market solutions influences the relevant decisions for the realization and operation of SAMS as well as maintenance belongings or trainings. It also balances CapEx and OpEx to maximize revenues and to minimize costs. The occurancy is about 50%, the severity 2,067,125€ and the (monetized) impact 1,033,563€ (profit). The value are test sites and key experts estimations.

Table 98 - TI_5: Increase customer trust in technology

Identifier & Name	TI_5: Increase customer trust in technology
Description	Avoid trust losses of customers regarding relevant interfaces, used technologies and comfort functionalities
Rationale	Trust issues of the customers regarding the service and/or the technology used can lead to revenue losses
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_8
Link to sub-guidelines	TI_5.1

Summary of TI_5

This industry application guideline should be considered during the all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry, Passengers and other road users encompassing VEC

The possible impact/effect is that the customer trust in automated vehicles influences the number of people using a SAMS and the frequency, which – as well – influences the revenues in both directions. The occurancy is about 100%, the severity 150,000 € and the (monetized) impact 150,000€ (profit/loss depending on which direction is taken). The value are test sites and key experts estimations.

The decision-making of TI_5 can be detailed in the following way:

Table 99 - TI_5.1: Management of vehicles' usage-time

Identifier & Name	TI_5.1: Management of vehicles' usage-time
Description	Optimise of vehicle usage times using current market technology
Source	SHOW D2.1

Table 100 - TI_6: Technology Management - Smart and Sustainable Supply Chain Management

Identifier & Name	TI_6: Technology Management - Smart and Sustainable Supply Chain Management
Description	Implement an active technology management to handle the technological issues of smart contracts and the IT system landscape (e.g. scalability, energy consumption, and performance restrictions).

Rationale	Technology management for technology in use or new to be deployed, especially for supply chain management is important to minimise costs within SAMS(F) and increase reliability, abilities and transport capacity.
Source	Springer (Kosacka-Olejnik et al., 2020)
Linkage to PTO/City guidelines	none
Link to sub-guidelines	TI_6.1 to TI_6.2

Summary of TI_6

This industry application guideline should be considered during the all phases, is dedicated to SAMS(F).

The decision-making of TI_6 can be detailed in the following way:

Table 101 - TI_6.1: Implementation of Automated Traceability Technology - Best Practices for Automated Traceability

Identifier & Name	TI_6.1: Implementation of Automated Traceability Technology - Best Practices for Automated Traceability
Description	Implement and use Automated traceability applying information-retrieval techniques to generate candidate links, sharply reducing the effort of manual approaches to build and maintain a requirements trace matrix as well as providing after-the-fact traceability in legacy documents.
Source	IEEE (Cleland-Huang et al., 2007)

Table 102 - TI_6.2: Software Quality and Framework in a logistic SAMS application - Best Practices for Automated Traceability

Identifier & Name	TI_6.2: Software Quality and Framework in a logistic SAMS application - Best Practices for Automated Traceability
Description	Provide a fully automated logistics service and comprehensive definition of software quality and framework to optimze efforts and revenues.
Source	Dr. Markopoulos Evangelos, 17th International Logistics Congress, October 16-18 2001

Table 103 - TI_7: Monitor the Infrastructure status & update it

Identifier & Name	TI_7: Monitor the Infrastructure status & update it
Description	The infrastructure should be monitored by the SAMS provider/ road operators part of the SAMS value chain and updates should be initiated to ensure high quality of the provided SAMS.
Rationale	Updated infrastructure will increase the safety of SAMS and therefore the customer trust as well as positively stimulates the value chains of infrastructure provider and operator, which will influence the cost structure of the services.
Key industry cluster concerned/involved	Transport/Mobility operators, industry (along the entire value chain), Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency
Source	SHOW D8.3; Key Experts

Linkage to PTO/City guidelines	CPT_3, CPT_6, CPT_7, CPT_8, CPT_14
Link to sub-guidelines	TI_7.1 to TI_7.4

Summary of TI_7

This industry application guideline should be considered during the all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry (along the entire value chain), Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency

The possible impact/effect is that the actual and updated infrastructure can ensure a proper function of the SAMS and increase the trust of customers, which leads to more customers or increased usage of the SAMS, which leads to an increase in the revenues. The occurancy is about 50%, the severity 2,067,125 € and the (monetized) impact 1,033,562€ (profit). The value are test sites and key experts estimations.

The decision-making of TI_7 can be detailed in the following way:

Table 104 - TI_7.1: Infrastructure design and maintenance

Identifier & Name	TI_7.1: Infrastructure design and maintenance
Description	Consistent infrastructure layout and signaling visibility and recognisability are key for on-board sensors to make sense of their surroundings (this includes drainage conditions)
Source	SAFE-UP D7.3

Table 105 - TI_7.2: Infrastructure standardisation

Identifier & Name	TI_7.2: Infrastructure standardisation
Description	Road signs could be far better standardised to ensure interoperability accross countries and proper interpretation of the road laws
Source	Key expert

Table 106 - TI_7.3: Digital infrastructure

Identifier & Name	TI_7.3: Digital infrastructure
Description	Digital retrofitting of standard infrastructure is needed to support CAVs (releasing pressure from sensing capabilities). Signaled beacons specially at junctions (where the amount of information is larger).
Source	SAFE-UP D7.3

Table 107 - TI_7.4: Enhanced communication technology

Identifier & Name	TI_7.4: Enhanced communication technology
Description	Development of DSRC or ITS-G5 to ensure proper V2X communication, specially with infrastructure. Combine hybrid structure with 5G to ensure enough geographical coverage.
Source	SAFE-UP D7.3

Table 108 - TI_8: CCAVs Cooperative vs individualistic decision-making

Identifier & Name	TI_8: CCAVs Cooperative vs individualistic decision-making
Description	Balance cooperative & individualistic decision-making for the deployment and operation of SAMS to minimise conflict potential with the other impact areas.
Rationale	Whether CCAVs are set up to cooperate to achieve social optimum allocation of infrastructure space (i.e. prioritising PT), might require different levels of infrastructure prioritisation
Key industry cluster concerned/involved	Transport/Mobility operators, industry (along the entire value chain), Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency
Source	Key Experts
Linkage to PTO/City guidelines	CPT_1, CPT_6

Summary of TI_8

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry (along the entire value chain), Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC

The possible impact/effect is that the quality of data of infrastructure influences the “value” of SAMS, therefore is revenues. The occurancy is about 50%, the severity 80,000€ and the (monetized) impact 40,000 € (profit). The value are test sites and key experts estimations.

Table 109 - TI_9: Sensor configuration

Identifier & Name	TI_9: Sensor configuration
Description	Ensure proper sensor configuration to optimise information flow for safety aspects and customer trust.
Rationale	Proper perception of the environment needs to be ensured via redundancy in the sensor-fusion (camera, radar, lidar) and account for all kinds of situations, including low visibility conditions (e.g. adverse weather, confusing background, low contrast image) will increase the efficiency of the service and the customer trust into the service.
Key industry cluster concerned/involved	Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency
Source	SAFE-UP D7.3
Linkage to PTO/City guidelines	CPT_6

Summary of TI_9

This industry application guideline should be considered during the development phase, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry (along the entire value chain), Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC

The possible impact/effect is that the quality of sensor-based data influences the “value” of SAMS (trust, applicability, usability), therefore is revenues. The occurancy is about 25 %, the severity 30,000 € and the (monetized) impact 7,500 € (profit). The value are test sites and key experts estimations.

Table 110 - TI_10: Vehicle maintenance

Identifier & Name	TI_10: Vehicle maintenance
Description	AVs can get faster outdated than current vehicles and current costs are also higher.
Rationale	A maintenance plan needs to be considered before launching the solution to ensure continuous service and financial control to avoid unexpected interruptions.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	AVENUE
Linkage to PTO/City guidelines	CPT_14

Summary of TI_10

This industry application guideline should be considered during the all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry (along the entire value chain)

Maintenance of the vehicle includes the ones to keep the vehicle running as well as customer-related maintenance like cleaness of vehicle or re-parking of the vehicles. All maintenance activities increase customer satisfaction and thus the number of users of the services offered. In addition, word-of-mouth is stimulated, which positively influences the number of new customers. The occurancy is about 80%, the severity 100,000€ and the (monetized) impact 80,000€ (loss). The value are test sites and key experts estimations.

Table 111 - TI_11: Update and track data relevant for SAMS

Identifier & Name	TI_11: Update and track data relevant for SAMS
Description	Quality of the SAMS is focus of the operation, so relevant data and data sourced should be monitored, and if possible be increased.
Source	SHOW and Key Experts
Linkage to PTO/City guidelines	CPT_5
Link to sub-guidelines	TI_11.1 to TI_11.3

Summary of TI_11

This industry application guideline should be considered during the all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Contributors and Beneficiaries: Operators, mobility service provider, industry, delivery service providers

The possible impact/effect is that the better the data quality the better the SAMS, which increases the revenues (number of customers and their trust, higher frequency of usage, ect). The occurancy is about 80 %, the severity 150,000 € and the (monetized) impact 120,000 € (profit). The value are test sites and key experts estimations.

The decision-making of TI_11 can be detailed in the following way:

Table 112 - TI_11.1: Environment mapping

Identifier & Name	TI_11.1: Environment mapping
Description	To ensure a proper function of the AV a point cloud might need to be done to understand and learn the environment where it is going to drive (e.g. Graz pilot).
Source	SHOW pilots, especially Graz pilot

Table 113 - TI_11.2: Safety data

Identifier & Name	TI_11.2: Safety data
Description	Define mandatory datasets regarding safety of operation
Source	SHOW A3.3

Table 114 - TI_11.3: Virtual road availability

Identifier & Name	TI_11.3: Virtual road availability
Description	Ensure that AV maps are properly updated and that events (e.g. roadworks) correctly appear on them
Source	Key expert

Table 115 - TI_12: Technology update for all relevant components, sub-systems and systems for the operation of SAMS

Identifier & Name	TI_12: Technology update for all relevant components, sub-systems and systems for the operation of SAMS
Description	Quality of the SAMS is focus of the operation, so relevant data and data sourced should be monitored, and, if possible, be increased.
Rationale	Interfaces are the "face" of the SAMS and the usability of them have an impact on the customer, especially to the different types of customer (young vs. older) or for the SAMS provider itself to react in real-time on challenges for the transport, optimize the budget for personnel and their trainings.
Key industry cluster concerned/involved	Transport/Mobility operators, industry (along the entire value chain)
Source	SHOW A3.3
Linkage to PTO/City guidelines	CPT_6, CPT_7, CPT_8
Link to sub-guidelines	TI_12.1 to TI_12.2

Summary of TI_12

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Contributors and Beneficiaries: Transport/Mobility operators, industry (along the entire value chain)

The possible impact/effect is that updating the interfaces increases the quality of the SAMS, which increases the revenues (Frequency of used service(s), more services used, more customers activated). The occurancy is about 90%, the severity 150,000€ and the (monetized) impact 135,000 € (profit). The value are test sites and key experts estimations.

The decision-making of TI_12 can be detailed in the following way:

Table 116 - TI_12.1: Standard data interface

Identifier & Name	TI_12.1: Standard data interface
Description	Define standardized data interface to be used by the operator and authorities
Source	SHOW A3.3

Table 117 - TI_12.2: Public information interface

Identifier & Name	TI_12.2: Public information interface
Description	Create interface to public (information system)
Source	SHOW A3.3

This only applies to SAMS(P).

Table 118 - TI_13: Integration into the Transport system

Identifier & Name	TI_13: Integration into the Transport system

Description	The degree of success of a new deployment/operation is largely dependent on its level of integration and cooperation into the overall transport system.
Rationale	SAMS are normally an extension of the existing mobility system/public transport so the integration/cooperation highly influences the success of the SAMS.
Key industry cluster concerned/involved	Transport/Mobility operators, industry (along the entire value chain), Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency (permits and ecological requirements.
Source	Test sites and SHOW experts knowhow
Linkage to PTO/City guidelines	CPT_2
Link to sub-guidelines	TI_13.1 to TI_13.6

Summary of TI_13

This industry application guideline should be considered during the market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry (along the entire value chain), Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency (permits and ecological requirements), Passengers and other road users encompassing VEC

The possible impact/effect is that the integration into the existing transport infrastructure and interfaces increases the quality of the SAMS, which increases the revenues (Frequency of used service(s), more services used, more customers activated). The occurancy is about 75%, the severity 150,000€ and the (monetized) impact 112,500 € (profit). The value are test sites and key experts estimations.

The decision-making of TI_13 can be detailed in the following way:

Table 119 - TI_13.1: Design interaction models for interaction with traffic participants

Identifier & Name	TI_13.1: Design interaction models for interaction with traffic participants
Description	Define standardized data interface to be used by the operator and authorities.
Source	Test sites and SHOW experts knowhow

Table 120 - TI_13.2: Design interaction models for interaction with VRU

Identifier & Name	TI_13.2: Design interaction models for interaction with VRU
Description	A new transport solution will only succeed if VRUs taking part in traffic in close proximity of the solution feel sufficiently safe.
Source	Test sites and SHOW experts knowhow

Table 121 - TI_13.3: Design methods for assessment of acceptance of other traffic participants

Identifier & Name	TI_13.3: Design methods for assessment of acceptance of other traffic participants
Description	Assessment of developed interaction models is crucial on the road to successful deployment.
Source	Test sites and SHOW experts knowhow

This should be realized during the research phase.

Table 122 - TI_13.4: Sustainable vehicle trajectory planning

Identifier & Name	TI_13.4: Sustainable vehicle trajectory planning
Description	Taking into account not just progress and a fixed route, but also wear and tear of components as well as energy efficient trajectories has a positive impact on the environment.
Source	Test sites and SHOW experts knowhow

This should be realized during the research and development phase.

Table 123 - TI_13.5: Design methods for Smart Routing

Identifier & Name	TI_13.5: Design methods for Smart Routing
Description	Implement a route planning setting a primar focus on route through environment/stops that have passengers waiting to be picked up (to maximize revenues).
Source	Test sites and SHOW experts knowhow

This should be realized during the research and development phase.

Table 124 - TI_13.6: City mobility planning

Identifier & Name	TI_13.6: City mobility planning
Description	More one-way streets and divided roads allow a better route planning.

Rationale	Changing street directions to make the most out of them one-way will help AVs avoid even more accidents. At certain speeds, head-on collisions are not avoidable, even for an AV. If this is road separation is achieved 100%, the AV would only need to care about junctions.
Source	Brad Templeton, Roadmap to Robocars

This should be realized during the market entry phase.

Table 125 - TI_14: High level of interoperability

Identifier & Name	TI_14: High level of interoperability
Description	Ensure a high level of interoperability, especially for (data) communication, traffic management and all relevant HW and SW interfaces.
Rationale	Have interoperable technologies between different states to increase the efficiency of services.
Key industry cluster concerned/involved	Transport/Mobility operators, industry (along the entire value chain)
Source	SHOW D8.3 / ICT4CART
Linkage to PTO/City guidelines	CPT_6

Summary of TI_14

This industry application guideline should be considered during the all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficiaries: Transport/Mobility operators, industry (along the entire value chain)

The possible impact/effect is that a high level of interoperability makes the integration of new functionalities or new services easier and decreases CapEx for the introduction and OpEx for the operation. The occurancy is about 50%, the severity 4,134,250 € and the (monetized) impact 2,067,125€ (profit). The value are test sites and key experts estimations.

5.1.4 Social application guidelines and decision-making mechanism

The following tables (Table 126 to Table 139) show the best practices and decision-making mechanism in form of application guidelines for social view of SAMS:

Table 126 - SI_1: Customer Management

Identifier & Name	SI_1: Customer Management
Description	That means services such as short waiting times when questions are asked over the service hotline or per e-mail as well as the possibility for the customer to have some kind of personal contact to take care of problems (especially important for elderly).
Rationale	For a running and efficient service good customer service is important.
Key industry cluster concerned/involved	Transport/Mobility service operators
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_4, CPT_11

Summary of SI_1

This industry application guideline should be considered during market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Passengers and other road users encompassing VEC

The possible impact/effect is that this will increase the customer satisfaction and therefore the number of services used from the existing customers can activate new customer. The occurancy is about 50%, the severity 60,000 € and the (monetized) impact 30,000 € (profit). The value is depending on fleet size and customer potential can activate up to 1/3 of the current customers (calculations in D16.2).

Table 127 - SI_2: Actual company strategies considering social aspects

Identifier & Name	SI_2: Actual company strategies considering social aspects
Description	Update own company stratetgy to increase attractiveness of SAMS
Rationale	Offered services do not need to be too specialised (concentrated on a too small market niche)
Key industry cluster concerned/involved	Transport/Mobility service operators
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_3, CPT_11
Link to sub-guidelines	SI_2.1 to SI_2.2

Summary of SI_2

This industry application guideline should be considered during market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility service operators, industry

The possible impact/effect is that this will increase the customer satisfaction and therefore the number of services used from the existing customers can activate new customer. The occurancy is about 50%, the severity 60,000€ and the (monetized) impact 30,000€ (profit). The value

is depending on fleet size, number and kind of provided services and customer potential can activate up to 1/3 of the current customers (calculations in D16.2).

The decision-making of SI_2 can be detailed in the following way:

Table 128 - SI_2.1: Transferability of strategy

Identifier & Name	SI_2.1: Transferability of strategy
Description	Consider the current relevant national and European strategies for the update of the company strategy.
Rationale	The purpose of this paper is to consider the state of research and practice in the context of transferability from the interesting and innovative strategies that are being developed in Europe and other parts of the world.
Source	Transportation Research Record, Dablanc et al., 2013

Table 129 - SI_2.2: SAMS & Stakeholders' view

Identifier & Name	SI_2.2: SAMS & Stakeholders' view
Description	To implement sucessful SAMS consider relevant stakeholder input and views.
Rationale	Smart mobility can make a difference for SAMS deployment and operation: usage scenarios are being more elaborated considering distinct stakeholders' points of view.
Source	Smart Mobility – Connecting Everyone: Trends, Concepts and Best Practices (2017)

Table 130 - SI_3: Increase trust of customer considering societal aspects

Identifier & Name	SI_3: Increase trust of customer considering societal aspects
Description	Trust issues of the customers taking into account social aspects (age, culture, knowledge level) regarding the service and/or the technology used can lead to revenue losses.
Key industry cluster concerned/involved	Transport/Mobility service operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_4, CPT_11
Link to sub-guidelines	SI_3.1 to SI_3.3

Summary of SI_3

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility service operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC

The possible impact/effect is that this will increase the customer satisfaction and therefore the number of services used from the existing customers can activate new customer. The occurancy is about 50%, the severity 60,000€ and the (monetized) impact 30,000€ (profit). The value is depending on fleet size and customer potential can activate up to 1/3 of the current customers (calculations in D16.2).

The decision-making of SI_3 can be detailed in the following way:

Table 131 - SI_3.1: Ensured accessibility and safety

Identifier & Name	SI_3.1: Ensured accessibility and safety
Description	Ensure that implemented interfacescovers the requirements.
Rationale	New solutions have to be accessible for all (or as many) individuals. Apart from physical accessibility, targeting solutions for digital natives only is not inclusive for example. Also, solutions must cope with the safety issues, aspect that can be left out when moving into automated vehicles as individuals can find themselves alone in the vehicle - this is crucial for customer attraction and user friendliness.
Source	Key expert
Linkage to PTO/City guidelines	CPT_10

Table 132 - SI_3.2: Keep passengers informed

Identifier & Name	SI_3.2: Keep passengers informed
Description	Similar to airplanes, ensure that passengers are informed about what to do in case of an emergency in a convenient and simple way before the trip.
Source	SHOW A3.3

Table 133 - SI_3.3: Monitor passenger acceptance

Identifier & Name	SI_3.3: Monitor passenger acceptance

Description	During pilots and deployment, keep continuous track of feedback from passengers to improve service.
Source	SHOW A9.3

Table 134 - SI_4: SAMS update cycle covering social aspects

Identifier & Name	SI_4: SAMS update cycle covering social aspects
Description	Improve regurlarly your SAMS to increase reliability for customer.
Rationale	Improved SAMS increases the trust and the revenues
Key industry cluster concerned/involved	Transport/Mobility service operators
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_8, CPT_11
Link to sub-guidelines	SI_4.1 to SI_4.3

Summary of SI_4

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC

The possible impact/effect are defined in SI_4.1 and SI_4.2. The same applies for the occurance, severity and (monetized) impact.

The decision-making of SI_4 can be detailed in the following way:

Table 135 - SI_4.1: Congestion reduction

Identifier & Name	SI_4.1: Congestion reduction
Description	Use available and update traffic management servicesto increase the quality and reliability of your SAMS via decreasing the travel time and provide reliable information.
Rationale	thanks to the use of Traffic management services, the levels of congestion is lower so people use less time in the vehicles and can invest this gained time in other activities.
Source	SHOW D8.3

The possible impact is, that avoiding congestions saves fuel. Gas/Diesel Oil consumption 5.645,84 kt (20% less in a trip of 40-50 km). The occurance is 80%, the severity 2.258,34 € and the (monetized) impact 1.806,67 € (profit). The numbers represent the overall European view from which the company may profit.

Table 136 - SI_4.2: Travel time reduction

Identifier & Name	SI_4.2: Travel time reduction
Description	Use available and update traffic management services to increase the quality and reliability of your SAMS via decreasing the losses through congestions and provide reliable information.
Rationale	Thanks to the use of Traffic management services, the levels of congestion is lower so people use less time in the vehicles and can invest this gained time in other activities.

Identifier & Name	SI_4.2: Travel time reduction
Source	SHOW D8.3/ICT4CART

The possible impact is calculated the following way per person: Savings 10 minutes in a 1h trip being monetizing these 10 minutes on European level (take an average of salary in EU and take the cost x hour of 746,4 mio people in EU). The occurance is 70%, the severity 46.836,60 € and the (monetized) impact 37,469.28 € (profit). The numbers represent the overall European view from which the company may profit.

Table 137 - SI_4.3: Human Machine Interface (HMI)

Identifier & Name	SI_4.3: Human Machine Interface (HMI)
Description	Update the HMI interface and communication channels to integrate new customers and ti increase reliability of the service itself, e.g. design interaction models for interaction with traffic participants.
Rationale	Good and clear communication channels between the vehicle and the human (either safety driver or passenger) is important to ensure trust and maintain safety as well as reliability on the service itself.
Source	Bellet et al. (2019)

Table 138 - SI_5: Check and improve the integration in existing transport systems

Identifier & Name	SI_5: Check and improve the integration in existing transport systems
Description	Check the integration into the transport system and adapted according to the existing conditions covering societal aspects (age, culture, vulnerability).

Rationale	The degree of success of a new deployment is largely dependent on its integration into the overall transport system.
Key industry cluster concerned/involved	Transport/Mobility service operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency
Source	Key Expert
Linkage to PTO/City guidelines	CPT_2, CPT_5

Summary of SI_5

This industry application guideline should be considered during market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility service operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC

The possible impact/effect is that this will increase the customer satisfaction and therefore the number of services used from the existing customers can activate new customer. The occurancy is about 50%, the severity 60,000€ and the (monetized) impact 30,000€ (profit). The value is depending on fleet size and customer potential can activate up to 1/3 of the current customers (calculations in D16.2).

The decision-making of SI_5 can be detailed in the following way:

Table 139 - SI_6: Communicate and integrate unions (employment repercussions)

Identifier & Name	SI_6: Communicate and integrate unions (employment repercussions)
Description	Integrate unios in to the research, development and deployment activities of SAMS to minimize the opposition.

Rationale	AV are seen as one job killer with the mobility sector, unions are a natural oppponent to such services, technologies and updates. So, the integration of them into the deployment and development/innovation process offers the change to decrease resistance and to create new perspectives, jobs and opportunities.
Key industry cluster concerned/involved	Transport/Mobility service operators
Source	SHOW A13.3
Linkage to PTO/City guidelines	CPT_10

Summary of SI_6

This industry application guideline should be considered during market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility service operators

The possible impact/effect is that this reduces the resources for deployment and operation of SAMS. The occurancy is about 15%, the severity 40,000€ and the (monetized) impact 4,500€ (loss). The minimization of the resistence can be heavily monetised, but unions supporting a company helps to increase OPEX costs in the field of salaries, human resources. So, the amount of time for an SME in person month with an average salary will be considered here (2 persons working 3 months to compensate negative effects).

5.1.5 Ecologic application guidelines and decision-making mechanism

The following tables (Table 140 to Table 147) show the best practices and decision-making mechanism in form of application guidelines for ecological view of SAMS:

Table 140 - ECI_1: Environment & Marketing

Identifier & Name	ECI_1: Environment & Marketing
Description	Increase ecology image by the selction of environmental friendly and sustainable companies.
Rationale	Using the environmental friendly image for customer attraction.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_11
Link to sub-guidelines	ECI_1.1

Summary of ECI_1

This industry application guideline should be considered during market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency

The possible impact/effect is that this increases the market value and market share of the related companies, therefore possibly more customers will use the service. The occurancy is about 50%, the severity 60,000 € and the (monetized) impact 30,000€ (profit). The value depends on the fleet size and customer potential but can activate up to 1/3 of the current customers.

Identifier & Name	ECI_1.1: Trackable green energy sources
Description	Use trackable green energy (resources).
Rationale	Contracting sustainable energy providers as charge providers for BEV has a positive effect on the environment.
Source	Key Expert

The decision-making of ECI_1 can be detailed in the following way:

Table 141 - ECI_1.1: Trackable green energy sources

The effect here is that it decreases the (negative) environmental image of a company/PTO/city and should be realized in all phases.

Table 142 - ECI_2: Coverage of SAMS & Environmental effects

Identifier & Name	ECI_2: Coverage of SAMS & Environmental effects
Description	Offered services do not need to be too specialised (concentrated on a too small market niche) from the ecologoy point of view.
Rationale	To increase the positive impact of SAMS, the services should cover a high number market/customer requirements for mobility to increase the ecological effect of the SAMS (combining person and freight transport

	can dcrease the number of travels/vehicles for the transport --> a shuttle can transport more people and freight than a single car or LDV).
Key industry cluster concerned/involved	Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency
Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_11

Summary of ECI_2

This industry application guideline should be considered during market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency

The possible impact/effect is that this reduces the customer potential because it is niche service. The occurancy is about 80%, the severity 60,000 € and the (monetized) impact 48,000€ (loss). The value depends on the fleet size and current number of customer potential but can de-activate up to 1/3 of the current customers.

Table 143 - ECI_3: Air pollution reduction

Identifier & Name	ECI_3: Air pollution reduction
Description	Be aware of traffic management systems and integrate their services to lower pollutants and to increase the ecological image to positively stimulate the revenues.

Rationale	Shorter stop times optimised by traffic management systems means short travel times causing a more efficient usage of the power and material degree (aging of the battery), which means an increased number of electric vehicles substituting existing ICT vehicles.
Key industry cluster concerned/involved	Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency
Source	SHOW D8.3
Linkage to PTO/City guidelines	none

Summary of ECI_3

This industry application guideline should be considered during market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC

The possible impact/effect is that this saves the cost of health due to air pollution. The occurancy is about 50 %, the severity 5.020.357.000€ and the (monetized) impact 2.510.178.500€ (profit). The value is calculated from the following numbers: 22.6 million tons of CO_2/year. Passenger Car Traffic 99,399,79 million Vehicle-Km Annual; Bus and Motor Coach Traffic 1,007.35 Mio Vehicle-Km Annual. Now 0.10€/km; in the future 50% less [29].

Table 144 - ECI_4: Land consumption reduction

Identifier & Name	ECI_4: Land consumption reduction
Description	Consider SAMS to decrease land consumption.

Identifier & Name	ECI_4: Land consumption reduction
Rationale	ITS solutions optimize the use of existing road infrastructure which supports reducing land consumption due to increasing demand in the long term.
Key industry cluster concerned/involved	Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency
Source	SHOW D8.4
Linkage to PTO/City guidelines	none

Summary of ECI_4

This industry application guideline should be considered during market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC

The possible impact/effect is that the regional and local government construction expenditure is reduced by 1% (from 605.56 million USD). The occurancy is about 50%, the severity 6,055,600€ and the (monetized) impact 3,027,800€ (profit).

Table 145 - ECI_5: Optimizing SAMS routing

Identifier & Name	ECI_5: Optimizing SAMS routing
Description	(Continuously) Optimize the routing of the service regarding energy consumtion (low distance, less hills) in combination with number of customer targets and pick-ups on the route.

Rationale	For the environment the energy not consumed (produced) is the most valuable one. So, every optimisation decreasing the driven km, especially empty km, is very important.
Key industry cluster concerned/involved	Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency
Source	Key Expert
Linkage to PTO/City guidelines	CPT_2
Link to sub-guidelines	ECI_5.1 to ECI_5.2

Summary of ECI_5

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry, Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Passengers and other road users encompassing VEC

The possible impact/effect is saving 10 minutes in a 1 hour trip is monetized. The occurancy is about 70%, the severity 46,836.60€ and the (monetized) impact 32,786€ (profit). The value is taken from the average salary in the EU and take the costs x hour of 746.4 million people in the EU.

The decision-making of ECI_5 can be detailed in the following way:

Table 146 - ECI_5.1: Sustainable vehicle trajectory planning

Identifier & Name	**ECI_5.1: Sustainable vehicle trajectory planning**

Description	Balance the routing not only on the progress based on a fixed route, but also wear and tear of components as well as energy efficient trajectories.

Table 147 - ECl_5.2: Design methods for Smart Routing

Identifier & Name	**ECl_5.2: Design methods for Smart Routing**
Description	Avoid "empty kilometers" by (mainly) route through environment/stops that have passengers waiting to be picked up.

5.1.6 Legal application guidelines and decision-making mechanism

The following tables (Table 148 to Table 155) show the best practices and decision-making mechanism in form of application guidelines for legal view of SAMS:

Table 148 - LI_1: Consider European and national legal framework

Identifier & Name	LI_1: Consider European and national legal framework
Description	Consider the relevant actual legal frameworks, regulations by analysing them and identify relevant parts for the planned SAMS.
Rationale	Legal framework tremendously influences the mobility service, especially on European and international level. By miscalculating this influence the service can face several legal challenges. Political environment is not supporting.
Key industry cluster concerned/involved	Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Umbrella associations, research & academia

Source	SHOW D2.1
Linkage to PTO/City guidelines	CPT_1, CPT_5, CPT_10, CPT_13
Link to sub-guidelines	LI_1.1 to LI_1.2

Summary of LI_1

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry, Umbrella associations, research & academia

The possible impact/effect is that this interrupts revenues for running SAMS services, delays the introduction/deployment of a new SAMS and causes extra costs to update HW, SW and trainings. The occurancy is about 75%, the severity 150,000€ and the (monetized) impact 112,500€ (loss). The delay for deployment between 3-6 month per SAMS (2 SAMS(P) + 1 SAMS(F)) decreases the revenues between 5,000 and 50,000 per service.

The decision-making of LI_1 can be detailed in the following way:

Table 149 - LI_1.1: Consideration of European policy and legal studies

Identifier & Name	**LI_1.1: Consideration of European policy and legal studies**
Description	Identify and analyse EU regulations and legal studies effecting the planned SAMS and their deployment as well as national regulation or laws.
Rationale	Strategic Transport Research and Innovation Agenda roadmap document addresses the Research and Innovation activities and other policy support measures required so that the concepts of connected and

	automated transport, for all transport modes, may contribute to the Energy Union 2050 goals in the domains of decarbonisation, greater efficiency and competitiveness.
Source	European Commission (2017), Connected and Automated Transport: Studies and reports, SRIA CCAM in the current valid version

Table 150 - LI_1.2: Consideration of relevant national regulation of the identified markets/countries

Identifier & Name	**LI_1.2: Consideration of relevant national regulation of the identified markets/countries**
Description	Identify and analyse national regulations and legal studies effecting the planned SAMS and their deployment including a countercheck against European and UN regulations

Table 151 - LI_2: Defining and updating legal regulations on national and regional level (Legislator and executioner view)

Identifier & Name	LI_2: Defining and updating legal regulations on national and regional level (Legislator and executioner view)
Description	Defining and updating national regulations and legal studies effecting the planned SAMS and their deployment.
Rationale	Legal framework tremendously influences the mobility service, especially on European and international level. The adaption and updating of the legal requirements by the competent national and regional authorities via laws and ordinances within the framework of the defined legal processes must be coordinated with the different framework conditions in the areas of technology, economy and environment.
Key industry cluster concerned/involved	Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency, Umbrella associations, research & academia

Linkage to PTO/City guidelines	CPT_5
Link to sub-guidelines	LI_2.1 to LI_2.2

Summary of LI_2

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry

The possible impact/effect is that this interrupts revenues for running SAMS services, delays the introduction/deployment of a new SAMS and causes extra costs to update HW, SW and trainings. The occurancy is about 50%, the severity 150,000€ and the (monetized) impact 75,000€ (loss). The delay for deployment between 3-6 month per SAMS (2 SAMS(P) + 1 SAMS(F)) decreases the revenues between 5,000 and 50,000 per service.

The decision-making of LI_2 can be detailed in the following way:

Table 152 - LI_2.1: Check and work on clear definition of the vehicle's ODD

Identifier & Name	**LI_2.1: Check and work on clear definition of the vehicle's ODD**
Description	When designing ODD for legal regualtions have an eye on a clear definition of the scenarion, boundary conditions and safety issues.
Rationale	A clear definition of the vehicle's capabilities on the route which has been designed to operate and under which conditions and supported by a "fail operational" system when the limit of the ODD is reached, will increase the applicability of legal regulations.
Source	SAFE-UP D7.3

Linkage to PTO/City guidelines	CPT_1, CPT_3

This should be realized at the market entry.

Table 153 - LI_2.2: Go for legal flexibility and adaptation

Identifier & Name	**LI_2.2: Go for legal flexibility and adaptation**
Description	Support the creation of "relatively" open regulatory environment and support a team of legal experts able to quickly adapt the laws and regulations as the deployment of CCAVs advances and new lessons are learned.
Source	Brad Templeton, Roadmap to robocars

This should be realized during all phases.

Table 154 - LI_3: Regurlarly check and consider european and national regulations and procedures in obtaining a driving permit from the legal point of view

Identifier & Name	LI_3: Regurlarly check and consider european and national regulations and procedures in obtaining a driving permit from the legal point of view
Description	Timeline towards deployment and accompanied cost and time investments are highly dependent on regional procedures for road permits.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SHOW A3.3

Linkage to PTO/City guidelines	CPT_5

Summary of LI_3

This industry application guideline should be considered during all phases, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry

The possible impact/effect is that this interrupts revenues for running SAMS services, delays the introduction/deployment of a new SAMS and causes extra costs to update HW, SW and trainings. The occurancy is about 15%, the severity 150,000€ and the (monetized) impact 22,500€ (loss). The delay for deployment between 3-6 month per SAMS (2 SAMS(P) + 1 SAMS(F)) decreases the revenues between 5,000 and 50,000 per service.

Table 155 - LI_4: Regularly check on new insurance policies

Identifier & Name	LI_4: Regularly check on new insurance policies
Description	Clear legal framework established (including the ODD, fault analysis, and infrastructure & human interaction) to be able to determine responsibility in case of incidents and accidents.
Key industry cluster concerned/involved	Transport/Mobility operators, industry
Source	SAFE-UP D7.3

Linkage to PTO/City guidelines	CPT_5, CPT_13

Summary of LI_4

This industry application guideline should be considered during market entry, is dedicated to SAMS(P) and SAMS(F), and involves the following stakeholders as

- Beneficaries: Transport/Mobility operators, industry

The possible impact/effect is that this increases the OpEx of SAMS. The occurancy is about 15%, the severity 50,000€ and the (monetized) impact 7,500€ (loss). The value depends on the fleet size and will be about 5 – 15% of the insurance premimum. The value is calculated for a fleet of 100 vehicles.

5.2 Application guidelines for stakeholder groups

5.2.1 Stakeholder groups connected to the Cities and PT/PTO application guidelines

Table 156 – Cities and PT/PTO application guideline and decision mechanism for the stakeholder groups

Stakeholder groups	Application Guideline Identifier	Focus on
Local and regional decision-makers	CPT 1; CPT 2; CPT 3; CPT 4; CPT 8	**Politic**: Focus on making general policy decisions regarding the use of shared CCAM services **Economy**: Focus on cost-efficiency of shared CCAM services; Decision on providing subsidies **Technology**: General understanding and impacts of the technology

		Society: Focus on the impact of shared CCAM services on transport efficiency, accessibility, safety, etc. **Ecology**: Focus on the overall impact of shared CCAM services on local environmental indicators **Legal**: Focus on adapting local regulations
Local and regional administrations	CPT 1; CPT 2; CPT 3; CPT 4; CPT 5; CPT 6; CPT 7; CPT 8; CPT 9; CPT 12	**Politic**: Focus on implementing policies and political decisions **Economy**: Focus on identifying costs and revenues **Technology**: Focus on facilitating the introduction of technology **Society**: Focus on the impact of shared CCAM services on transport efficiency, accessibility, safety, etc. **Ecology**: Focus on the overall impact of shared CCAM services on local environmental indicators **Legal**: Focus on checking existing legal frameworks; ensuring their respect; and implementing local regulations
Public Transport Authorities	CPT 1; CPT 2; CPT 3; CPT 4; CPT 5; CPT 6; CPT 7; CPT 8; CPT 9; CPT 11 CPT 12	**Politic**: Focus on co-shaping urban mobility decisions and implementing them; focus on integration of shared CCAM services with existing PT **Economy**: Focus on finding a balanced business model and managing costs and revenues **Technology**: Focus on facilitating the integration of the technology in mobility services **Society**: Focus on the contribution of shared CCAM services on the impact of PT on transport efficiency, accessibility, safety, etc.

		Ecology: Focus on the contribution of shared CCAM services on the impact of PT on the local environment **Legal**: Focus on checking national and European legal frameworks, new policies and permits
Public Transport Operators	CPT 1; CPT 2; CPT 3; CPT 4; CPT 5; CPT 6; CPT 7; CPT 8; CPT 9; CPT 10; CPT 11; CPT 12; CPT 13; CPT 14	**Politic**: Focus on implementing local policies and decisions. Decision power at the operational level. **Economy**: Focus on running operations cost-effectively **Technology**: Focus on facilitating the integration of technology; focus on managing operational configuration, usage and updates **Society**: Focus on running operations to provide efficient, accessible, safe, comfortable and useful services **Ecology**: Focus on running operations as clean as possible **Legal**: Focus on applying European, national and local regulations and making the necessary adaptations
Public and users	CPT 1; CPT 4; CPT 11; CPT 12	**Economy**: Interest in using cost-efficient transport modes **Technology**: Interest and/or anxiety towards new technology **Society**: Impacts of transport modes contributes partly to the choice of using a specific mode **Ecology**: Impacts of transport modes contributes partly to the choice of using a specific mode **Legal**: Legal frameworks protect users

Providers of materials, services, regulations, etc.	CPT 1; CPT 4; CPT 5; CPT 6; CPT 7; CPT 9; CPT 14	**Economy**: Focus in making their operations profitable. **Technology**: Focus in providing technology or in providing necessary elements to deploy the technology **Society**: Focus on sectoral impacts e.g. safety, efficiency, etc. **Ecology**: Focus on minimising the environmental footprint **Legal**: Focus on understanding and respecting legal framework

Table 156 lists the different stakeholders from the view of an city and a PTA/PTO and shows which single application guideline from chapter 4 applies to which stakeholder. It also gives a short description of the stakeholder focuses in each application guideline category.

5.2.2 Stakeholder groups connected to the Industry application guidelines

The following matrix (Table 157) shows the linkage between the developed application guidelines and the stakeholder groups identified in SHOW (D1.1 [16]).:

Table 157 - Industry application guideline and decision mechanism for the stakeholder groups

Stakeholder groups	Application Guideline Identifier	Focus on
OEM and transport/mobility operators	PI_1, PI_2, PI_3, PI_4, PI_5, PI_6 EI_1, EI_2, EI_3, EI_4, EI_5, EI_6, EI_7, EI_8, EI_9, EI_10, EI_11, EI_12, EI_13, EI_14, EI_15 TI_1, TI_2, TI_3, TI_4, TI_5, TI_6, TI_7, TI_8, TI_9, TI_10, TI_11, TI_12, TI_13, TI_14	**Politic**: Focus on legal frameworks and policies, communication with legal authorities and stakeholder **Economy**: Focus on cost and revenue optimisation on different levels, different detailed analyses and using potentials of SMEs, customers and concepts **Technology**: Focus on technology integration, monitoring, optimisation, configuration, usage and updates

Stakeholder groups	Application Guideline Identifier	Focus on
	SI_1, SI_2, SI_3, SI_4, SI_5 ECI_1, ECI_2, ECI_3, ECI_4, ECI_5 LI_1, LI_2, LI_3, LI_4	**Society**: Focus on customer managment and trust increase, service and Service attractiveness improvement **Ecology**: Focus on air pollution and land consumption reduction, marketing and route optimization **Legal**: Focus on checking national and european legal frameworks, new policies and permits
Passengers and other road users encompassing VEC	PI_3, PI_4 EI_1, EI_2, EI_6, EI_7, EI_12, EI_13 TI_5, TI_8, TI_9, TI_13 SI_1, SI_3, SI_4, SI_5 ECI_3, ECI_4, ECI_5	**Politic**: Focus on stakeholder engagement and marketing **Economy**: Focus on stakeholder engagement, time optimisations on different levels and correct technology usage **Technology**: Focus on trust in technology and transport system integration **Society**: Focus on customer management, customer trust, and service improvement **Ecology**: Focus on air pollution and land consumption reduction and optimisation of service routing
Umbrella associations/Non-profit organisations	PI_3, PI_4 EI_1, EI_15 LI_1, LI_2	**Politic**: Focus on stakeholder engagement and marketing **Economy**: Focus on stakeholder involvement and test track affordability **Lega**l: Focus on considering and updating legal regulations and frameworks

Stakeholder groups	Application Guideline Identifier	Focus on
Research and academy	PI_3, PI_4 EI_1, EI_15 LI_1, LI_2	**Politic**: Fokus on stakeholder engagement and marketing **Economy**: Focus on stakeholder involvement and test track affordability **Legal**: Focus on considering and updating legal regulations and frameworks
Authorities (Cities, Municipalities, Ministries), policy makers, municipality agency and road operators	PI_1, PI_2, PI_3, PI_4, PI_5, PI_6, EI_1, EI_10, EI_14, EI_15 TI_7, TI_8, TI_13 SI_3, SI_4, SI_5 ECI_1, ECI_2, ECI_3, ECI_4, ECI_5 LI_1, LI_2	**Politic**: Focus on legal frameworks and policies, communication with legal authorities and stakeholder **Economy**: Focus on policies, test tracks affordability, customer involvement and OPEX/CAPEX considerations **Technology**: Focus on monitoring, updating and prioritising infrastructure, integration in existing transport systems and vehicle testing **Society**: Focus on integration and improvement of the service and increasing customer trust **Ecology**: Focus on air pollution and land consumption reduction, marketing and route optimization **Legal:** Focus on considering and updating legal regulations and frameworks and creating new driver permits
Industry such as Tier 1 suppliers, telecom operators, technology providers and services company	PI_1, PI_2, PI_3, PI_5, PI_6, EI_1, EI_2, EI_3, EI_4, EI_5, EI_6, EI_7, EI_8, EI_9, EI_10, EI_11, EI_12, EI_13, EI_14, EI_15	**Politic:** Focus on new policies and permits, stakeholder engagement and supporting the local authorities

Stakeholder groups	Application Guideline Identifier	Focus on
	TI_1, TI_2, TI_3, TI_4, TI_5, TI_7, TI_8, TI_9, TI_10, TI_11, TI_12, TI_13, TI_14 SI_2, SI_3, SI_5 ECI_1, ECI_2, ECI_3, ECI_4, ECI_5 LI_1, LI_2, LI_3, LI_4	**Economy**: Focus on cost and revenue optimisation on different levels, different detailed analyses and using potentials of SMEs, customers and concepts **Technology**: Focus on technology integration, monitoring, optimisation, configuration, usage and updates **Society**: Focus on increasing customer trust in service and rise attractiveness of the service as well as checking the integration of the service into the existing transport service **Ecology**: Focus on air pollution and land consumption reduction, marketing and route optimization **Legal**: Focus on checking national and european legal frameworks, new policies and permits

Table 157 lists the different stakeholders identified in D1.1 and shows which single application guideline from chapter 5.1 applies to which stakeholder. It also gives a short description of the stakeholder focuses in each application guideline category.

6 Towards decision-making mechanisms for Cities/Authorities (and PTOs)

The present version of the technical guidelines for Cities & Regions and PT Authorities & Operators provides indications to follow for a successful deployment of shared CCAM services. Nonetheless, these guidelines – which are based on the experience of SHOW pilot sites – remains general and cannot address the multitude of city typologies, transport systems, states of public transport development, etc. In this context, the development of a decision support tool (DST) for Cities & Regions and PT Authorities & Operators would have the capacity to provide more tailored assistance to decision-makers. SHOW will aim at creating a tool which helps decision makers to make rational and informed decision on the different aspects mentioned in the guidelines while ensuring a necessary level of specification.

The following existing online DSTs, which have been developed in recent EU-funded projects are considered to serve as a basis for the development of a SHOW DST for Cities & Regions and Public Transport Authorities & Operators:

- The **LEVITATE Policy Support Tool** [30]
- The **MOMENTUM Decision Support Tool** [31]

These two tools have been selected because they already contain some key features:

- Both of them have been designed to support the same/similar target group: decision-makers of cities & regions and PT authorities and operators.
- The tools have been specifically developed in the field of urban mobility, in particular new and innovative forms of mobility.
- These DSTs are accessible freely online and can be used by decision-makers and/or any organisations interested in the topic.
- The tools include several degrees of complexity and personalisation which allows to obtain results with a variable level of precisions, depending on the quality and amount of the input data.
- The DSTs have been designed to be usable in any several European cities.
- Both tools have been developed by SHOW partners in the framework of other EU-funded projects, namely CERTH (MOMENTUM) and NTUA (LEVITATE).

LEVITATE Policy Support Tool

The LEVITATE Policy Support Tool [30] is an online-based tool which aims at estimating the short-term, mid-term and long-term impacts of CCAM-related interventions on local mobility systems and more generally on the city. Three separate components form the LEVITATE Policy Support Tool:

- The forecasting module. This dynamic tool “provides quantifies and/or monetized output on the expected impacts of automation- and CCAM-related policies.”
- The back-casting module. This dynamic tool complements the backcasting module “enables users to identify the sequences of CCAM measures that are expected to result in their desired policy objectives” by a selected date.
- The knowledge module. This static module is a repository of knowledge, tools and recommendations produced by the LEVITATE project.

The forecasting and back-casting modules rely on the same set of data and give the impacts of some predefined policy measures in the areas of a) automated freight

transport, b) automated passenger cars and c) automated urban (public) transport on a series of indicators such as e.g. travel time, freight transport cost, modal split, vehicle occupancy, emissions, congestion, accessibility, etc. The type of policy measures which can be tested include e.g. the introduction of an on-demand bus shuttle service, the creation of dedicated lanes for CCAM (private) vehicles or the implementation of automated delivery systems.

Since it focuses on CCAM policies in urban areas, the LEVITATE Policy Support Tool appears as a good basis and source of inspiration for further development of a SHOW DST. Although not all aspects of the application guidelines are – and can possibly be – integrated in such a tool, it provides a solid basis to develop a system able to guide policy makers on the relevance of their CCAM-related policy measures.

However, in the LEVITATE Policy Support Tool, the penetration rate of CCAM vehicles in the traffic is exogenous. Several scenarii (from zero CCAM to a high penetration rate) can be tested but ultimately, a policy which favours – or on the contrary which restricts – the introduction of CCAM in a city or PT fleet can not be tested, per se.

Similarly, it is not possible to compare the impact of a CCAM-related measure with its non-CCAM-related measure. For instance, by default, the on-demand shuttle service option will evaluate the impact of automated shuttles. The introduction of a 'regular' on-demand shuttle service cannot be evaluated and compared.

MOMENTUM Decision Support Tool

The MOMENTUM Decision Support Tool [31] is an online-based tool which aim is to assess "the impacts of new mobility options by collecting and analysing heterogeneous data sources". The tool is designed especially for public authorities and give them the possibility to test and assess the performance of mobility measures. The measures include e.g. bicycle sharing, scooter-sharing systems and on-demand transport solutions (personal and collective). The DST includes 3 levels, which can be used successively for a more detailed assessment. The level of details which the local authority must input increases from one level to the next one.

- Level 1 (online): this level is designed for all cities, including municipalities which do not have detailed mobility data and/or a transportation model. The user can 'simply' fill the online tool with aggregated data and will receive "dashboards, charts and values of the parameters (such as number of stations, docks, number of bicycles and scooters)" which will help to evaluate the impact of the measures.
- Level 2 (online): this level is made only for users who have mobility data. By providing more detailed data (e.g. network of cycle lanes, public transport lines, etc.), they receive also a more tailored recommendations, including e.g. the exact location of stops/stations, the number of vehicles needed, the capacity of stations and vehicles, etc.
- Level 3 (offline): is only for local authorities which use a transportation model. As this level implies a higher level of calculations, the third level requires the involvement of a local support partner such as a consultant, a university or a research centre. The users will receive even more detailed results, including "waiting times […], travel times […], number of served and unserved requests […] traffic emissions, car-ownership as well as induced demand due to the introduction of new shared mobility services."

The DST could be a basis for the development of a SHOW tool as it is flexible enough for users with variable amounts of data. However, in the context of SHOW, and in its

current state, this tool has two main limitations:

- It does not include any CCAM-related measures and indicators;
- It has been developed for a selection of 4 European cities only.

To conclude, the SHOW Decision Support Tool could build on the existing LEVITATE and MOMENTUM tools. The former can provide the basis for making strategic decisions regarding the types of CCAM measures and services to implement (or not) while the latter could provide recommendations on the implementation “parameters” of the measures. While the first tool would be more relevant for decision-makers in municipalities, regions or public transport authorities, the second tool has the potential to support the decisions of implementers in Public Transport Operators.

Taking inspiration from both tools, the SHOW DST should aim **at developing an online dynamic tool, accessible to all, compatible with any city, with any amount of available data.**

7 Conclusion

The active participation of local and/or regional authorities and Public Transport organisations in the deployment of shared CCAM services is necessary.

On the one hand, their participation guarantees the success of the project as they own and/or manage data, infrastructure, services and processes which have a direct impact on the deployment of shared CCAM services. The adaptation of road infrastructure, the inclusion of shared CCAM in the wider mobility planning processes and policies, or the experience of running transport services are prime examples of their crucial necessity.

On the other hand, their participation in the deployment of shared CCAM services is crucial for them to co-shape the type of services offered to residents and visitors. Indeed, by actively participating to the preparation and deployment phase, they will maximise the potential benefits of the shared CCAM services while minimizing the potential drawbacks of the technology.

Summarizing the results of the industry application guidelines, it can be concluded that they focus on realization with a high detail and low abstraction level, driven by the economic decision-making. Nevertheless, the boundary conditions given by the politics, legal regulations, social and economic targets and technology and the very purpose of a company, to make economic profit offer a great variety of decision-tree entry points which have to be realized and monitored during the deployment (beginning with research projects up to large deployment in real world). The shown tables (Table 18 to Table 155) represent a good overview for the guidelines but will be more detailed in D17.2 to cover the complexity of the deployment of SAMS. It has also to be mentioned, that the provided guidelines themselves cannot be too detailed, because then the positive effects will be decreased by being too specific to one application or by offering to many options which make the decision-making. This means a balancing of detail level of a single application and of a decision tree have to be done to present the right level of complexity, abstraction and detail.

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