# SHared automation Operating models for Worldwide adoption

# SHOW

**Grant Agreement Number: 875530**

## D2.1.: Benchmarking of existing business / operating models & best practices

This report is part of a project that has received funding by the European Union's Horizon 2020 research and innovation programme under Grant Agreement number 875530

## Legal Disclaimer

# Executive Summary

D2.1 provides the state-of-the-art for business and operating roles in the field of mobility services (MaaS, LaaS and DRT containing the mobility services canvas as description of the selected representative mobility services, the business and operating models describing relevant business factors and operation environment, the user and role analysis representing the involved user and roles for the mobility services (providing, operating and using the service) as well as identifying the success and failure models of the analysed mobility services and finally a KPI-Analysis (business-driven) to give a structured economical evaluation as base for the benchmarking. The final overall evaluation – the benchmarking – as the last part of D2.1 providing a base for the development of the new business and operating models A2.2 and the market analysis in A16.1.

D2.1 has 3 main elements the basic are represented in chapter 2 methodology and chapter 3 containing the relevant information for the benchmarking and best practices evaluation, chapter 4 to chapter 9 containing the state-of-the-art of mobility services covering PTO, LaaS, DRT services, car sharing, MaaS and demo site mobility services and last but not least chapter 10, which benchmarks the input from chapter 4 to chapter 9 using the methodology and the input of chapter 3 as well as providing 7 best practices (business and operating models) for the further development work in A2.2. It has to be mentioned that the selection of demo sites for chapter 9 has been made based on availability and quality of demo site data and to cover most relevant MaaS solution as well as their market maturity.

It should be noted that all figures in this document are taken from publicly available sources and normally provided by the companies themselves.

## Document Control Sheet

| | |
|---|---|
| **Start date of project:** | 01 January 2020 |
| **Duration:** | 48 months |
| **SHOW Del. ID & Title:** | D2.1 Benchmarking of existing business /operating models & best practices |
| **Dissemination level:** | PU |
| **Relevant Activities:** | A2.1 Benchmarking of existing business / operating models and best practices |
| **Work package:** | WP2 – Business models and roles |
| **Lead authors:** | Jörg Worschech (IESTA) |
| **Other authors involved:** | Albert Serra (BAX)<br>Ralf Willenbrock, Romina Quaranta (T-SYS)<br>Mihai Chirca, Christine Peyrot, Louis-René Chabannes (TRANSDEV)<br>Alberto Bellini (SWARCO)<br>Sevket Oguz Kagan Capkin (CTLUP)<br>Cilli Sobiech, Sigma Dolins (RISE)<br>Jenny Weidenauer (IESTA) |
| **Internal Reviewers:** | VEDECOM<br>VUB<br>CERTH/HIT |
| **External Reviewers:** | N/A |
| **Actual submission date:** | 12/10/2020 |
| **Status:** | Submitted |
| **File Name:** | SHOW_D2_1_Benchmark-Business-Operating-Models_SUBMITTED |

## Document Revision History

| Version | Date | Reason | Editor |
|---|---|---|---|
| 0.1 | 21/04/2020 | Initial creation | W. Rom, J. Worschech (IESTA) |
| 0.2 | 30/07/2020 | Input for Introduction and Methodology | J. Worschech (IESTA) |
| 0.3 | 15/08/2020 | Input to all chapters and first complete draft | J. Weidenauer (IESTA)<br>C. Sobiech, S. Dolins (RISE)<br>M. Chirca, (Transdev)<br>A. Serra (BAX)<br>A. Bellini (SWARCO)<br>R. Quaranta (T-SYSs) |
| 1.0 | 21/09/2020 | Version sent for internal peer review. | J. Worschech, J. Weidenauer (IESTA) |
| 2.0 | 01/10/2020 | Peer reviewed version sent for submission. | J. Worschech, J. Weidenauer (IESTA) |
| 2.1 | 12/10/2020 | Corrections to previous version | J. Worschech, J. Weidenauer (IESTA) |
| 3.0 | 12/10/2020 | Version finalized for second submission | H. Cornet (UITP) |

# Table of Contents

# List of Tables

# List of Figures

# Abbreviation List

| Abbreviation | Definition |
|---|---|
| AIT | Austrian Institute of Technology |
| AST | Anruf-Sammel-Taxi |
| ATAC | Azienda Tranvie ed Autobus del Comune di Roma |
| AV | Automated vehicles |
| B2B | Business to Business |
| B2C | Business to Customer |
| BMC | Business Model Canvas |
| BMI | Business Model Innovation |
| CAPEX | Capital Expenditure |
| CCAM | Connected and Cooperative Automated Mobility |
| CCAV | Connected and Cooperative Automated Vehicle |
| C - ITS | Cooperative Intelligent Transport Systems |
| $CO_2$ | Carbon dioxide |
| CRM | Customer Relationship Management |
| CZK | Czech Krona |
| DPMB | Dopravní podnik města Brna |
| DRT | Demand Responsive Travel |
| EMT | Empresa Municipal de Transportes de Madrid |
| ETA | Estimated time of arrival |
| FMCG | Fast-moving Consumer Goods |
| GA | Grant Agreement |
| IC | Information and Communication |
| ICT | Information and Communication Technology |
| ISO | International Organization for Standardization |
| IT | Information Technology |

| Abbreviation | Definition |
|---|---|
| KFV | Kuratorium für Verkehrssicherheit |
| KPI | Key Performance Indicator |
| LaaS | Logistics as a Service |
| MaaS | Mobility as a Service |
| MSC | Mobility Service Canvas |
| MTR | Mass Transit Railway |
| NCC | Noleggio Con Conducente |
| NGV | Natural Gas Vehicle |
| ODD | Operational Design Domain |
| ODT | On-demand transport |
| OEM | Original Equipment Manufacturer |
| OPEX | Operational Expenditure |
| P2P | Peer-to-Peer |
| PPP | Public Private Partnership |
| PPPP | Public Private People Partnership |
| PT | Public Transportation |
| PTA | Public Transport Authority |
| PTO | Public Transportation Operator |
| R&D | Research and Development |
| RATP | Régie autonome des transports Parisiens |
| RFID | Radio-frequency identification |
| RNAL | Rouen Normandy Autonomous Lab |
| ROI | Return of Investment |
| SEK | Swedish Krona |
| SHOW | Shared automation Operating models for Worldwide adoption |
| SL | Storstockholms Lokaltrafik |

| Abbreviation | Definition |
|---|---|
| SNCF | Société nationale des chemins de fer français |
| SotA | State-of-the-Art |
| SUMP | Sustainable Urban Mobility Plan |
| TCL | Transports en commun à Lyon |
| TCO | Total Cost of Ownership |
| TMC | Traffic Management Centre |
| ToD | Transport on Demand |
| UITP | Union Internationale des Transport Publics |
| UN | United Nations |
| US | United States |
| VaaS | Vehicle as a Service |
| VPC | Value Proposition Canvas |
| WoT | Web of Things |
| WP | Work Package |
| ZTL | Zonas a Traffic Limitado |

# 1 Introduction

## 1.1 Purpose of the document

The main target of this document is to present the state-of-the-art regarding existing business and operating models of mobility services, benchmark them and provide therefore a solid base for the development of new business and operating models. Within this deliverable also the user and roles as well as success and failure factures were identified and benchmarked to identify essential conditions for the development work in A2.2. All the benchmarking itself based on the developed KPIs of SHOW updated with business & operating specific KPIs covering intrinsic (CAPEX, OPEX…) and extrinsic factors (private car ownership, reduction of emissions…).

## 1.2 Intended Audience

The deliverable addresses the relevant project partners of WP12, WP16 or WP17 within consortium which needs state-of-the-art information regarding business and operating models covering development, evaluation, implementation and exploitation aspects during the whole duration.

Additionally, external stakeholders from the whole value chain of mobility and mobility service were involved to provide feedback on relevant business model and business ecosystem factors, e.g. success and failure facts or user roles, to generate an as complete as possible business picture.

## 1.3 Interrelations

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

- Internal interrelations
  - WP1 D.1.1 – Providing a first description of the SHOW environment and its participants and giving a first look of possible roles for the operating models
  - WP9 A9.1 – Evaluation framework: the main content for the relation are the business KPI and business impact (see chapter 3) as input for the project evaluation
  - WP12 - Demo sites leader: the main content for the relation are the implemented business models, services and information about existing ecosystem (see chapter 9) as base for the further development of new business model in WP2 A2.2
  - WP16 – Economic impact assessment: WP2 provide the economic base for the market analyses (A16.1), impact assessment (A16.2) as well the partner-specific exploitation by benchmarking relevant, highly representative business and operating models enlarged by the relevant ecosystem and additional analyses
  - WP17 – (Business) Guidelines: Especially with success and failure factors the development work in A17.1 will be supported, because they can act as base for the development of the business recommendations for the different stakeholder groups
- External interrelations
  - External stakeholders working on all kind of mobility: Providing relevant additional input to the existing business models and ecosystem and will be multiplier for the results (together with WP15).

## 1.4 Shared Mobility Services, Connectivity and Automated Vehicles

The innovative disruptive technologies combined with social trends and new business models promises to change the mobility map in Europe creating a huge opportunity for better economic, social, and environmental outcomes in the mobility system. By 2050, almost all cities in Europe could have an automated, multi-modal, on-demand mobility system.

Moving towards the implementation of a modern transport system will require not only innovative business models and disruptive technologies but also the confrontation of market imperfections.

The transport providers such as public transport operators have currently focused on promoting their own services to customers. Thus, there was a competitive relationship amongst the transport providers and each communication and pricing strategy was exclusively used for serving the provider's user engagement campaign. The new business models create cooperative relations between the transport providers which are not just competing but complement each other and adjust their mobility delivery approach in order to fulfil citizens' new mobility needs. Furthermore, the new models provide more interaction points between the users and the mobility providers. Hence, the new innovative transport schemas follow a more holistic approach towards the transport system and the user's needs.

Smartphones, big data, and the growing popularity of a sharing economy boost the new sharing models which are also popping up in transit transportation with the use of shuttle buses. The recognition of the business potential of such models by the investors is reflected on the €5 billion increase of the annual global VC investments in start-ups between 2013 and 2014[1], but the investments increased lately. Thus, the combination of disruptive technologies, social trends and new business models of shared and automated services promises to change the mobility landscape in Europe and create a huge opportunity to transform the mobility system for better economic, social, and environmental outcomes.

Although the technology and digital revolution could contribute to the integration of the new business models that would let people shift to shared and automated mobility, city governments often have difficulty designing a regulatory framework which balances stakeholder interests and ensures public safety and customer protection. However, there are many business models, as they are described in detail in the following chapters, that have already been successfully implemented in several European cities being examples of best practices.

[1] Research based on CrunchBase, Venture Scanner database, Pitchbook database, PreQin database.

# 2 Methodological Approach

This chapter describes the methodological approach for the D2.1 and is structured in the following way:

- **Introduction**: describes the starting point for the methodology;
- **Basic boundary conditions**: describes relevant limitations, assumptions and conditions for the benchmarking (and also for the further development of the new business and operating models in A2.2);
- **SHOW Methodological Approach**: describes the specific approach and solutions developed for SHOW.

## 2.1 Introduction

Looking to other relevant RTD-projects (see Grant Agreement proposal section 1, page 17) and the description of the DT-ART-04 call, existing business and operational models covering CCAV aspects as well as the methodology for the development of them are mainly focused on small solutions with less vehicles or taking into account the existing mobility services are strongly linked to PTO. When, analysing the current results it is obvious, that the existing methodology needs an extension covering usage and operation of large fleets of CCAV. This includes identifying opportunities for SMEs, start-ups and new market entrants, closing gaps in the value chain or covering tasks which occurs during the operations of the first installed services as well as extending the modes of operations for a refinement of existing value chains.

## 2.2 Basic boundary conditions

For the SHOW methodology some basic boundary conditions must be defined. For this purpose, existing conditions from former projects are used, extended but also limited in order to develop practical results. The identified boundary conditions are:

- Business conditions:
  - Extension of existing value chain by SME / Start-up / New market entrants;
  - Basic investments are done;
  - Business and operating models must list all relevant sub-services (e.g. IT services on hardware and software-level, cleaning services, parking services, upgrade services…).
- Technological conditions:
  - Analysed current services must be shared mobility services;
  - If possible, connected services are preferred;
  - If possible, services should cover MaaS, LaaS and DRT services.
- Usage of existing results:
  - Using existing results of former and running R&D-projects on national and European level;
  - Using existing information of established mobility services.
  - Using of SHOW D1.1 as the base for a common understanding of users and operating roles..

## 2.3 SHOW Methodological Approach

The following chapters describe the most relevant methods and tools for the SHOW WP2 methodology.

### 2.3.1 Methodological Approach

D2.1 is structured according the following approach using the input of all relevant SHOW partners, interview results, workshops, desktop research and selected tools:

- Chapter 3 describes relevant KPIs, which were used for the benchmarking of business and operating models.
- Chapter 4 contains the relevant information regarding business and operating aspects of PTO mobility services. The described PTO are chosen because of their high relevance for the SHOW project as well as for their maturity covering requirements of modern public transport. The following aspects will be described in detail:
    - State of the art of the PTO using the mobility service canvas and extending information.
    - Business and operating models showing existing business and operating models of the chosen PTO using business model canvas and value proposition canvas.
    - User & role analysis showing relevant user and roles within the business ecosystem of public transport. This is done on base of the mobility service canvas, basic research results and cross-checked with results of D1.1.
    - Success and failure lists relevant impact factors which can help or slow down the business / operational success of the provided PTO mobility services.
    - KPI-related analysis of PT / PTO services shows the business evaluation of the services based on the identified KPI in WP9.
- Chapter 5 contains the relevant information regarding business and operating aspects of logistic services (LaaS). The described LaaS are chosen because of their high relevance for the SHOW project as well as for their maturity covering requirements of modern logistic applications. The following aspects will be described in detail:
    - State of the art of the LaaS using the mobility service canvas and extending information.
    - Business and operating models showing existing business and operating models of the chosen LaaS using business model canvas and value proposition canvas.
    - User & role analysis showing relevant user and roles within the business ecosystem of logistic applications and services. This is done on base of the mobility service canvas, basic research results and cross-checked with results of D1.1.
    - Success and failure lists relevant impact factors which can help or slow down the business / operational success of the LaaS services.
    - KPI-related analysis of LaaS shows the business evaluation of the services based on the identified KPI in WP9.
- Chapter 6 contains the relevant information regarding business and operating aspects of DRT services. The described DRT services are chosen because of their high relevance for the SHOW project as well as for their maturity covering requirements of modern on demand services. The following aspects will be described in detail:
    - State of the art of the DRT services using the mobility service canvas and extending information.
    - Business and operating models showing existing business and operating models of the chosen DRT services using business model canvas and value proposition canvas.

    - User & role analysis showing relevant user and roles within the business ecosystem of DRT services. This is done on base of the mobility service canvas, basic research results and cross-checked with results of D1.1.
    - Success and failure lists relevant impact factors which can help or slow down the business / operational success of the DRT services.
    - KPI-related analysis of DRT services shows the business evaluation of the services based on the identified KPI in WP9.
- Chapter 7 contains the relevant information regarding business and operating aspects of car sharing services (CSS). The described CSS are chosen because of their high relevance for the SHOW project as well as for their maturity covering requirements of modern CSS. The following aspects will be described in detail:
    - State of the art of the CSS using the mobility service canvas and extending information.
    - Business and operating models showing existing business and operating models of the chosen CSS using business model canvas and value proposition canvas.
    - User & role analysis showing relevant user and roles within the business ecosystem of CSS. This is done on base of the mobility service canvas, basic research results and cross-checked with results of D1.1.
    - Success and failure lists relevant impact factors which can help or slow down the business / operational success of the CSS.
    - KPI-related analysis of CSS shows the business evaluation of the services based on the identified KPI in WP9.
- Chapter 8 contains the relevant information regarding business and operating aspects of mobility services (MaaS). The described MaaS are chosen because of their high relevance for the SHOW project as well as for their high market maturity covering requirements of modern mobility applications. The following aspects will be described in detail:
    - State of the art of the MaaS using the mobility service canvas and extending information.
    - Business and operating models showing existing business and operating models of the chosen MaaS using business model canvas and value proposition canvas.
    - User & role analysis showing relevant user and roles within the business ecosystem of MaaS. This is done on base of the mobility service canvas, basic research results and cross-checked with results of D1.1.
    - Success and failure lists relevant impact factors which can help or slow down the business / operational success of the MaaS
    - KPI-related analysis of MaaS shows the business evaluation of the services based on the identified KPI in WP9.
- Chapter 9 contains the relevant information regarding business and operating aspects of mobility services (MaaS) of SHOW different demo sites. The described MaaS are chosen because of their high relevance for the SHOW project as well as for their maturity covering requirements of modern mobility applications. The following aspects will be described in detail:
    - State of the art of the demo site MaaS using the mobility service canvas and extending information.
    - Business and operating models showing existing business and operating models of the chosen demo site MaaS using business model canvas and value proposition canvas.

    - User & role analysis showing relevant user and roles within the business ecosystem of the demo site MaaS. This is done on base of the mobility service canvas, basic research results and cross-checked with results of D1.1.
    - Success and failure lists relevant impact factors which can help or slow down the business / operational success of the demo site MaaS.
    - KPI-related analysis of demo site MaaS shows the business evaluation of the services based on the identified KPI in WP9.
- Chapter 10 benchmarks the results of chapter 4 to chapter 9 in a qualitative way mainly focusing on existing MaaS providers, user & roles as well as success and failure factors and finally describes 7 promising business model approaches (best practices) which will be the base for development work in A2.2.

The following chapters describe the used tools and their methodologies used in the different chapter of D2.1.

### 2.3.2 Mobility Services Canvas

The aim of the Mobility Service Canvas (MSC) – developed for SHOW – is to collect relevant organizational, economic and technical aspects of the provided mobility services in a structured way. The collected information will be used in the following chapters (4 to 9) to provide relevant information which can be used directly as state-of-the-art or as input for success and failure factors, user roles or business canvasses.

For a better understanding, what the canvas provides, the following table (Table 1) shows the mobility service canvas template including the explanation of what is the expected content (in italics written parts are neutral examples given for a better understanding of the template):

**Table 1 – Template for Mobility Service Canvas**

| Name | Content | How to fill out the table |
|---|---|---|
| Short description | The mobility service x provides mobility services in y | Please describe the analysed mobility provider / company |
| Website / Reference | www.xxx.eu | Please fill in the current link of homepage and/or other relevant references |
| Service Developers | • Service Operator Name 1<br>• Service Operator Name 2 | Please list all partners which have developed the service |
| Primary Operator | • Operator name 1<br>• Operator name 2 | Please list the operator(s) of the service |
| Target users and mobility needs | • Target user 1 and its mobility needs<br>• Target user 2 and its mobility needs | Please list the main target users of the mobility services and related mobility needs.<br>Please indicate if specific mobility services and related needs only apply to specific users |
| Mobility Services | • MS1: Mobility service name 1<br>• MS2: Mobility service name 2 | Please detail the sub-services offered (think of vehicles, service-platforms used, etc.) |
| Related Services | • MS1: related service name 1 (RSN1)<br>• MS1: related service name 2 (RSN2) | Please list other related services (e.g. information about events, shopping, infotainment …) |

| Name | Content | How to fill out the table |
|---|---|---|
| | • MS2: related service 1(RSN3) | |
| Mobility Service Operators | • RSN1: Mobility service operator name 1, mobility service operator name 2<br>• RSN2: Mobility service operator name 1, mobility service operator name 2 | Please list the relevant operator(s) for every service or service platform as mentioned in the line before |
| Access to the Services | □ Public<br>□ Registered users<br>□ Private | Please select at least one item by marking it with "x" |
| Type of environment | □ Urban<br>□ Interurban<br>□ Highway<br>□ Restricted access areas | Please select at least one item by marking it with "x" |
| Type of infrastructure used | □ Mixed traffic lane<br>□ Dedicated lane | Please select at least one item by marking it with "x" |
| Operations Parameters | • 5 vehicles per hour<br>• 12 hours per day<br>• 1,3 passengers per vehicle<br>• About 200,000 km per vehicle<br>• *4€ per ride* | • Service frequency (vehicles/h)<br>• Vehicle utilisation rate (hours of operation/24h)<br>• Pooling factor (passenger/vehicle)<br>• Expected vehicle lifetime mileage (km over lifetime)<br>• Price of the service (e.g. €/km, €/ride) |
| Status | □ Development, since …<br>□ Trial, since …<br>□ In operation, since … | Please list the status / level of maturity (development, trial, in operation) and - if possible - since when |
| Areas/routes covered and number of people/amount of goods transported per service | • MS1 covers 20 km$^2$ with the region of x | Please list km/km$^2$ covered and the amount of people / goods transported per service |
| Share of trip purpose per service | • 12% leisure trips<br>• 8% freight transport<br>• 70% commuters<br>• 10% others | Please list the share (%) of trip purpose needs of the users per service |
| 3rd Party Suppliers and related company size | • LE name 1<br>• SME name 1<br>• SME name 2<br>• RTO name 1 | Please use following abbreviations for company size:<br>• LE<br>• ME<br>• SME<br>• SE<br>• RTO<br>• Others |
| SME Aspects | • Number of SME<br>• Number of start-ups<br>• SME/start-up index<br>• SME service operator for vehicles | Please describe specific aspects related to SMEs like:<br>• Number of SMEs/Start-ups involved<br>• SMEs/Start-ups interest index (0-10; 0 - not interesting at all; 10 - highly interesting for SMEs/Start-ups)<br>• Specific SME role(s) |

| Name | Content | How to fill out the table |
|---|---|---|
| Model type (A) | PTO and non-PTO based shared mobility services:<br>• Carsharing<br>• Vehicle-based logistics<br>• TMC-based services<br>• Aggregator based services and applications | Please select at least one model by marking it with "x" |
| Model type (B) | from an organizational point of view:<br>• Central Model<br>• Liberal Model<br>• AaaS Aggregator<br>• Social innovation | Please select at least one model by marking it with "x" |
| Model type (C) | From a targeted client type point of view:<br>□ B2C<br>□ B2B<br>□ P2P<br>□ C2B (e.g. in case consumers sell their data) | Please select at least one model by marking it with "x" |
| Shared Mobility Aspects | Yes | Please state yes or no and describe the sharing aspect(s) |
| Connected Mobility Aspects | □ V2<br>□ V2I<br>□ V2P<br>□ V2N<br>□ None | Please mark at least one of the listed aspects with x |
| Electrified vehicles used per service | Yes | Please state yes or no and if yes give an estimation about the degree of electrification in % or number of electric vehicles used per service |
| Automated vehicles used per service | No | Please state yes or no and if yes give an estimation about the number of automated vehicles used per service as well as their automation level (SAE) |
| Number of vehicles used per service (fleet size) | 10 vehicles | Please state the number of vehicles used per service |
| Vehicle capacity | • seats per vehicles<br>• 100 seats for the whole service | • Seats: Number of seats per vehicle<br>• Total capacity: Total number of seats |
| Amplitude (Service Period) | □ Day<br>□ Rush hour<br>□ Off-peak hour<br>□ Night<br>□ Weekdays<br>□ Weekend<br>□ Vacation | Please select at least one option by marking it with "x" |

| Name | Content | How to fill out the table |
|---|---|---|
| MaaS/LaaS/DRT integration level | Fully integrated with all interfaces and sub services | Describe the level of integration of the overall service (e.g. integrated trip planning, booking, contracts, subscription, payment, …) |
| Relation to PT (coordinated by PT) | • PTO name<br>• Interface name 1<br>• interface name 2 | Please list the PT provider and the interfaces to or from them |

### 2.3.3 Business Model Canvas

The business model canvas will be used to describe the business model for the identified mobility services and its sub-services. The following table (Table 2) shows the template for collecting the necessary input according to the methodology of Osterwalder (Osterwalder, 2004) (in italics written parts are neutral examples given for a better understanding of the template).

**Table 2 – Template for Business Model Canvas**

| **Name** | **Content** | **How to fill out the table** |
|---|---|---|
| **Customer segments** | • Commuters<br>• Leisure trips<br>• Shopping trips<br>• Tourists<br>• Freight transport | Please all customer segments which are relevant for the business model |
| **Value propositions** | Full developed and integrated mobility service covering all kinds of person and freight aspects | Please give a summery from the related VPC |
| **Channels (communication, distribution)** | • Website<br>• App<br>• Social media<br>• Flyers<br>• Marketing events | Please describe all channels which are relevant addressing the customer segments |
| **Customer Relationships (per customer segment)** | • Person transport via payment of single trips<br>• Freight transport via long-term contracts | Please describe how the customer and the service are related within the business model |
| **Revenue Streams** | • Pay per use<br>• Contract fees<br>• Marketing income | Please list here all relevant revenue streams (names) and give quantifications (if possible) |
| **Key Resources** | • Mobility service app<br>• Website<br>• Social media channels<br>• Business network for freight transport | Please describe all resources which are relevant for the business model |
| **Key Activities** | • Marketing events and activities (web, app, events)<br>• Customer relationship management for freight transport customers | Please describe all activities which are relevant for the business model |
| **Key Partnerships** | • PTO<br>• Vehicle provider<br>• IT service provider<br>• Vehicle operation provider<br>• Research organizations for innovations | Please list all relevant partnerships (including user roles) for the business model and do not forget to crosscheck with the listed sub services in the MSC |

| Name | Content | How to fill out the table |
|---|---|---|
| | • Governmental organizations | |
| **Cost structure** | • Personnel costs<br>• IT infrastructure costs<br>• Operation costs for vehicles and infrastructure<br>• Marketing costs | Please list here all relevant cost categories and give quantifications (if possible) |

### 2.3.4 Value Proposition Canvas

The value proposition canvas details the value of the identified mobility services and its business models for the customers. It also lists indirectly specific failure factors (customer pains) and related business models. The following table (Table 3) shows the template for collecting the necessary input in order to produce the value proposition canvas.

**Table 3 – Template for Value Proposition Canvas**

| Name | Content | How to fill out the table |
|---|---|---|
| **Customer Segment** | • Commuters<br>• Leisure trips<br>• Shopping trips<br>• Tourists<br>• Freight transport<br>• Governmental organizations | Please list all customers (segments) which are involved |
| **Customer Pains** | • Availability of service (IT, locations, time to usage) and vehicles (number)<br>• Status of the vehicles<br>• Less impact to governmental goals<br>• Cost of service (for customers as well as for the providers) | Please list all factors which prevents customers from using/implementing the service |
| **Customer Gains** | • Communication with all kind of customers<br>• Diversity of usable mobility services which helps to provide easy accessible alternatives | Please list all factors which produces gains |
| **Customer Jobs** | • IT and IT service provider<br>• Communication provider<br>• App-Developer<br>• Vehicle maintenance and in operation services<br>• Vehicles driver for one or many mobility services | Please list all possible customer jobs in relation to the services listed in the MSC and if possible, user roles |
| **Value Proposition** | Biggest mobility service offer covering all kind of mobility request for person and freight transport | Please list relevant value propositions, USP or any other business advantages for the busines model |
| **Pain Relievers** | • Diversity of mobility services<br>• Diversity of business ecosystem and value chain participants | Please list all relevant factors which can be used to reduce the impact of the pain factors (failure factors) |

| Name | Content | How to fill out the table |
|---|---|---|
| **Gain Creators** | • Specific communication with all kind of customers<br>• Diversity of usable mobility services which helps to provide easy accessible alternatives<br>• Communication with the responsible governmental contact persons for offering an update service portfolio covering the political goals<br>• Real-time information for the mobility services prided *by PTO, Road operators…* | Please list all relevant factors offering the chance to create gains (success factors) |
| **Products & Services** | • App<br>• Website, flyers, social media communication<br>• Vehicle Maintenance Service<br>• Vehicle Operation Service<br>• Input to SUMP<br>• IT services (HW, SW, cloud) and communication<br>• Road infrastructure providing relevant traffic information | Please list all relevant products and services for the value proposition and the related business model |

The results of D1.1 are considered here, especially to check the consistency as well as the completeness of the users and the roles.

### 2.3.5 Business impact and KPI

For the evaluation of the existing business and operating models, WP2 has identified and developed relevant Key Performance Indicators (KPIs) focusing on more “money making aspects” like revenue streams and cost structure in order to create an economic base for the further development in A2.2 (called intrinsic factors). Additionally, some new business impacts must be defined to open interfaces and possibilities covering the project goals of SHOW (called extrinsic factors). This work will be done according to following steps:

- Step 1 - Collection of existing business impact factors and KPI must be done (from SHOW project, other R&D projects like AUTOPILOT as well as established ones) to cover the specific requirements within the project;
- Step 2 - Definition of relevant business categories to classify/categorize well-known business impact and KPI (from SHOW project, other RTD projects like AUTOPILOT as well as established ones) to cover the specific requirements within the project;
- Step 3 - Review and refinement of business KPI and impact factor together with WP9 and demo sites to ensure the usability (realizable, measurable) of the factors.

A more detailed description of the used KPIs and business impact can be found in chapter 3.

The whole process is done in close cooperation with:

- WP1 which provides the SHOW use cases and the description of the SHOW ecosystem including relevant roles as important technical boundary condition;

- WP9 A9.1 in order to create a common view for the specific and overall evaluation within SHOW;
- the demo sites (WP12) as the partners who will be responsible for the realisation of the new business and operating models developed in A2.2.

### 2.3.6 Workshops & Interviews

Within the SHOW proposal, interviews with the SHOW demo sites and external stakeholders were planned (for more details please refer to chapter 9). In order to cover this task an interview guideline for interviews with the demo sites has been developed. This guideline was developed by merging and considering relevant input from the demo site coordinator, the satellite site coordinator, from single demo site leaders as well as the task description of A2.1 and business and operating requirements relevant for every mobility service. Aim of the interview is to collect information focusing on business ecosystem, success and failure factors as well as users and roles within the mobility environment, contributing also to the current deliverable relevant sections.

The following table (Table 4) represents the developed interview guideline:

**Table 4 – Demo site interview guideline**

| Topics |
|---|
| **Introduction to SHOW:** Shared and cooperative automation in Public Transport (PT) in urban contexts<br>• What has been the **initial motivation** to define the pilots in SHOW? Is there a **motivation / need / reason** to transfer those use cases or exploring other complementary use cases in other parts of the city or other cities?<br><br>Please write down the answers here |
| **Introduction to their current Business Ecosystem**<br>• What is your **current business ecosystem structure** (stakeholders, processes, existing value chains)?<br>• Are you thinking of restructuring it in a particular way?<br>• What is **the level of maturity** of your ecosystem for shared CCAV (Cooperative Connected Automated Vehicle) services (idea, research, prototype, running business)?<br>• What are the **main user roles and responsibilitie**s in your ecosystem (passengers, infrastructure provider, vehicle provider, service providers…)?<br>• Are you planning to start **integrating automated vehicles** and related services within your operations?<br><br>Please write down the answers here |
| **Introduction to their socioeconomical and political context**<br>• How great is the current **acceptance of sharing solutions**?<br>• How **familiar** are people in your region / city **with automated driving**?<br><br>Please write down the answers here |
| **Selected research questions for SHOW WP2/WP16**<br>• How do Public Authorities and Public Transport Operators from cities in SHOW **define that a Pilot has been successful**, which are the **objectives** for them? How would those be evaluated? |

| Topics |
| --- |
| • Which measures of success do we apply to define what has been a **successful CCAV business model**? and particularly for an SME or a start-up/ new entrant?<br><br>Please write down the answers here |
| **Open discussion on potential CCAVs new business models**<br>(changing the revenue model and cost-revenue structures thanks to value network restructuration/evolution)<br><br>• **Success & Failure factors in the field of CCAV** (user, technical and organizational aspects)<br>• Assuming you had the ideal vehicle in place and basic investments done, what would be the **business model you would like to apply**? In which parts of the city?<br>• Which do you feel are the **minimum infrastructure/technological requirements** needed to have a positive CCAVs business case during the transition period?<br>Minimum infrastructure/technology is needed?<br><br>Please write down the answers here |
| **Items of traditional versus new cost-revenue (business) structure or cost-benefit (public, non-profit) structure**<br>(cost-effectiveness can only be evaluated after SHOW pilot implementation)<br><br>• How can a transit authority or municipality **assess the relevance of investing in CCAVs infrastructure** over other mobility or transport systems to achieve its SUMP goals?<br>How can SHOW help in this decision?<br>• Which **changes to your current cost and revenue structure** are the most relevant towards the introduction of CCAVs?<br><br>Please write down the answers here |
| **Best practices & processes to support SMEs and start-ups / new entrants**<br>• **Preconditions**? Do they need feasibility studies, funding/investment support etc?<br>• How do you identify the **right opportunities in the SHOW ecosystems for start-ups and SMEs?** Which are the most favourable ecosystems for SMEs and start-ups to flourish?<br><br>Please write down the answers here |
| **Other experts to contact that would be interesting/relevant to talk to that you could put us in contact with?**<br><br>Please write down the answers here |
| **Relevant reports/Deliverables from past related projects that will support the discussion further?**<br><br>Please write down the answers here |

| Topics |
|---|
| |

### 2.3.7 Benchmarking

The methodology for benchmarking of the existing business and operating models focusses on the clustering of existing mobility services (MaaS, LaaS, DRT) and harmonizing contents in order to provide a base for the benchmarking. On this harmonized base a direct comparison of results of the KPI-related analysis of the different mobility services can be performed. In addition, it enables the identification of similarities and differences between the existing mobility services, business and operating models on service level, background level, operating level and user roles.

The following table (Table 5) shows the most relevant factors for the benchmarking, which are a selection of the most relevant business KPIs defined within the overall SHOW KPIs of WP9:

**Table 5 – Benchmarking factors**

| Factor name | Factor description |
|---|---|
| CAPEX | Fixed costs (vehicles, infrastructure) |
| OPEX | Variable costs (personnel, maintenance, energy) |
| Revenue streams | Sources of income for the business |
| Pricing strategy | Price amounts and ways of generating revenue |
| Revenue growth | Increase in revenue respect to previous period |
| Return on investment after 3 years | Ratio of money gained or lost on an investment relative to the amount of money invested |
| Number and nature of partners: | Partners in the business model ecosystem |
| Vehicle utilization rate: | % of time a vehicle is in motion (not parked) |
| Occupancy rate | Average number of persons in a vehicle respect to total availability |
| Vehicle utilization efficiency | % of time (or km) a vehicle is loaded (at least one passenger on board) |
| Fleet replacement rate | Number of years a fleet of vehicles is expected to last |

D2.1 provides a qualitative benchmarking focusing on the success and failure factors as well as the users and roles within the mobility service business environment of the identified business models (see chapter 10.1). Furthermore, the benchmarking will compare the well-established mobility services (see chapter 10.2) to identify the greatest market potentials for the new business and operating models. For chapter 10.3 each chapter and its business models will be revisited, concluded and compared to give the best possible analysis of the already identified business models considering the conditions and requirements of the SHOW demo sites.

As last step, chapter 10 will identify 7 new or extended business models which will be the base for the development in A2.2. This identification will be supported by the results of demo sites interviews, the workshop as well as the feedback of the online survey. The supporting actions will ensure that the demo site specific requirements as well as new feedback from external stakeholders is considered.

# 3 Mobility Drivers, KPI and Metrics of SHOW

## 3.1 The role of Business Model Innovation in sustainable mobility transition

As described in socio-technical transitions and transition management studies, business model innovation (BMI) is increasingly recognized as a vital component of societal transitions towards sustainability[2]. BMI is seen as a tool to inform strategic and responsive governance activities[3], representing a cornerstone for transition management[4] and a key driver for a sustainable mobility transition[5].

The changes to the socio-technical regime of road transportation that is currently happening is the most transformative change since the introduction of Ford Model T in the early 1900s'. Key technological enablers such as ICT and automation, coupled with landscape pressures from global trends like population growth, global warming, the increasing scarcity of non-renewable resources and the subsequent related policy measures towards achieving a more sustainable economy and the preservation of environmental health and resources, are driving the undergoing transition.

“The interrelation and bond between science, research and the market is the requiring key factor for market penetration and sustainability” (Source: Vedecom, SHOW D1.1)

In the next sections we examine and describe the most important SHOW mobility drivers, KPIs and Metrics intrinsic to Business Model Innovation. BMI has the power to influence many aspects of the current socio-technical mobility transition in order to achieve the goal of introducing certain technologies (e.g. autonomous vehicles, connectivity, AI algorithms…) in stablished markets, but the key is to understand which are the most important ones to take into consideration given the SHOW context. Seen from a business and an economical perspective, markets represent the stablished regime in which new technologies, accompanied by new or updated business models, try to tap into and penetrate. For that reason, stablished technologies with established business models dominate a big portion of the mobility market today, while innovative business model aiming at capitalizing on innovative technologies need to take advantage of the windows of opportunity in the market created by breaks in the existing regime in order to succeed.

## 3.2 Identification of SHOW mobility drivers

In the draft proposal for a European Partnership under Horizon Europe for Connected, Cooperative and Automated Mobility (CCAM)[6], the vision to make Europe a world leader in the development of CCAM solutions is summarized as follows:

Matching citizens demand and end-user expectations for mobility and transport while contributing to the Sustainable Development Goals.

This chapter lays the foundation for the identification of SHOW Business Model intrinsic KPIs and metrics, which starts its definition from a first identification of the

[2] Bocken and Short, 2016; Boons and Lüdeke-Freund, 2013; Schaltegger et al., 2016
[3] Sarasini and Linder, 2018
[4] Rauschmayer et al., 2015; Loorbach and Wijsman, 2013
[5] Wainstein and Bumpus, 2016
[6] Partnerships connected and automated driving CCAM, RTD European Partnerships

main SHOW mobility drivers within different dimensions: User, Technology, Policy and Business/Operating Models.

### 3.2.1 Users

CCAM shall foster and support new mobility concepts, shifting design and development from a driver-centred to a mobility-user oriented approach. The shift towards a mobility-user oriented approach directly affects the development of new business models, especially regarding new value propositions, revenue streams and pricing strategies.

From a user-centred perspective, we identify two main areas of focus that go beyond traditional user segmentation in a car-centric mobility paradigm:

#### 3.2.1.1 Mobility Needs and Mobility Behaviours

Reducing car ownership

During recent years the western world is experiencing a reduction of licensed drivers among the youngest population groups. There are various reasons for that, from the economics of owning and maintaining a vehicle to the increasingly available alternatives to move around, especially in urban areas. The share of population living in dense urban areas is continuously growing with respect to non-urban areas, making urban space a scarce resource. An increase in the population and reduction of space per habitant in cities has led governments to start regulating the use of private vehicles, where a huge supply of public transportation offers the possibility to efficiently move thousands of passengers per hour. During the past decade, other alternative modes of transport like electric bikes and scooters have gained a lot of traction, thanks to various private and public initiatives offering alternatives to travel more conveniently and efficiently inside dense urban areas than by single-occupant cars. Researchers and institutions agree that the prevalent need of owning a vehicle is slowly reaching its end, at least in urban areas.

European cities with high motorization rates, as defined by the number of private vehicles per inhabitant, suffer from congestion and the need for lots of parking space not always available. Nevertheless, increased traffic and congestion causes air and noise pollution, which impacts negatively the livelihood of cities and the health of their citizens, making it a bigger problem in the long term. For these reasons, city authorities have started to regulate the acquisition and use of private vehicles.

However, being able to access a car when needed is still demanded by consumers, as the rise of car-sharing and ride-hailing Business Models demonstrates. The increasing popularity of these services exemplifies the shift from an ownership model to a user ship model, where a car is accessed and used only when needed, and owning and maintaining a car by individuals is no longer necessary.

Multi-modality – Different mobility services and attributes for each mobility need

People move around for different reasons. Among the most frequent, done on practically a daily basis, is to move from home to work or study and come back, so-called commuting. Other frequent mobility needs are related to recurrent activities like shopping or leisure and, finally, the less frequent but not less important occasional trips for travelling or going out from the city during weekends, including other non-frequent trips for e.g. business.

The frequency of each kind of trip and the need to perform it influences directly over peoples' decisions on which mode of transport to use. In order to design transport services that match user expectations, the purpose of the trip and the periodicity of it is very important. It is clear that when one travels to and from work or school, the importance given to transport mode attributes is not the same as when one goes out for a day shopping to the mall 20 km out of the city centre. This is one of the reasons why there is not a single transport solution for each user, but a multimodal offer through which a single user can cover various needs. This is one of the reasons why Mobility-as-a-Service (MaaS) concepts have started to boom recently. Why should I travel by car every time to everywhere I need to go, when there are available alternatives which are more convenient for a given situation?

There are two main variables that determine which mode of transport is more suited for a particular situation, the distance to be covered from origin to destination and the available time to spend while travelling. Besides these two main variables, others such as convenience, comfort and safety also play an important role. And last but not least, the costs associated to travelling also determine our travel choices, depending on the available travel budget of each family or individual.

<u>Willingness-to-pay</u>

Willingness to pay is among the most important factors for a mobility service to succeed and a sign for knowing if a particular business model would work. Willingness to pay bounds the pricing strategy of the service business model with the potential clients adopting it. The higher the willingness to pay from the customer side, the more flexibility in the pricing strategy of the business model is possible. A high willingness to pay is also a good indicator that the value proposition is matching well with the client's needs and desires.

From an intrinsic Business Model perspective, basic user's expectation from automation is that services become faster and cheaper to operate and use. Willingness-to-pay from a user side will be linked to the perceived added value of the service and its cost compared to other alternatives. When it comes to automation, the higher costs and investments related to the implementation of new technologies needs to be justified by superior performance with respect to other more mature and already stablished alternatives. Regarding the transport of passengers and goods, this translates to reduced costs and travel/delivery times.

Although one could consider tech enthusiast as having a high willingness-to-pay for a new technology even when more conventional approaches offer better results, wide scale adoption comes from meeting the needs of the general population, and this is especially relevant for Public Transport related services.

#### 3.2.1.2 Digital Attitudes and Digital Skills

Digital technologies and ubiquitous mobile phone connectivity are key enablers of a new mobility paradigm, offering travel choices and possibilities not available (or less available) before. However, in order to benefit from these new technologies and related new mobility service offers, citizens need to first get used and finally embrace the new digital technologies. Among the population, there are different attitudes and skills with regard to digital technologies and digitally enabled services. For technology enabled mobility services to appeal to a wide population, three main factors need to be taken into consideration:

<u>Technology acceptance process: from Pre-adoption to Appropriation</u>

Mobility behaviour prediction models and travel surveys are widely used in order to keep track and as tools to inform and influence travel choices and behaviours. However, intention does differ from action. Travel surveys try to understand the travel choices of citizens and capture the reasons for such travel choices in order to influence and/or change them. While these surveys have proven useful to determine the travel habits of a population, they normally fail in identifying the right triggers to make people change travel behaviours. The main reason is that intentions differ from actions. The reality is that people tend to choose the path of less effort or discomfort, which normally differ from good intentions. If I have my own car parked at home, why should I pay for a public transport ticket or a subscription to a bike-sharing service? I won't, unless the unpleasantness of driving my own car beats the extra efforts needed to use another alternative.

Fortunately, besides the application of policy regulations, incentives and law enforcements, BMI can also play a crucial role in changing users mobility behaviours towards more sustainable practices. By offering new value propositions and added value services, mobility service providers can attract new customers by filling-in the gaps between user intentions and acts.

Within the technology acceptance process, from pre-adoption to appropriation, Connected, Cooperative and Automated Mobility (CCAM) is still in the pre-adoption phase. For these new mobility services to succeed, user acceptance and appropriation is key. So far, CCAM is viewed from end-users with scepticism, with the highest concerns regarding safety and the perceived low added value of current automated services[7], with an added flavour of societal job loss risk perception due to automated driving services[8].

<u>Ease-of-use</u>

It is of crucial importance for new digitally enabled mobility services to succeed that they are easy to understand and use. The efforts of switching to alternative transport modes have to be minimized if they are to take people out of their private vehicles. A non-user-friendly interface or complex booking procedure with many steps can easily become no-go reasons for many potential users of new mobility services. Fortunately, this is something new mobility service providers and digital service developers take very seriously. However, the majority of research studies have found that users of digitally enabled mobility services are mostly young and highly educated, tech savvy individuals. One of the main reasons is that only the youngest portion of the population is familiar with digital processes and services, while the oldest portion of the population tends to find digital technologies hard to use, for various reasons.

We see, then, that digital technologies are enablers but also barriers to the use of new and alternatives transport modes, depending on the digital attitudes and digital skills of a given population.

<u>Data Privacy / Data protection</u>

Data privacy and personal data protection is among the hottest topics in mobility (and other digital services) today. With the recent GDPR regulation, some issues have been addressed concerning data privacy, however, a lot is still to be done in order to reach a transparent and fair data economy. The acquisition and processing of personal mobility data is extremely valuable for many purposes, both for businesses and public administrations. Through the collection of (anonymised) personal mobility data, thanks to ubiquitous mobile phone connectivity and the use of digitally enabled services, mobility providers, operators and transport authorities can have an extremely accurate monitoring of citizen travel behaviour, finally going beyond static travel surveys.

---

[7] EC Special Eurobarometer 496 – Expectations and concerns of connected and automated driving, April 2020

[8] JRC Technical Report – The impact of technological innovation on the Future of Work, March 2019

Tapping into such valuable streams of personal travel data is necessary for new mobility services to succeed and for public administrations to control and mitigate the negative impacts and externalities of transport. However, the responsible and transparent use of personal mobility data is still being questioned. Large internet and social media companies have been using personal data for business purposes not always accompanied with transparency and ethical principles of use. These kind of activities and business practices have led to a general discomfort and lack of trust from the public. Nevertheless, a still prevalent and generalized ignorance about exactly which kind of data companies are collecting and for which purposes, is still allowing many missuses and bad practices.

The current situation regarding data uses and data protection within many industries is still unclear, leaving a current data economy ecosystem where the rules of standardization, limitations, sharing and uses of data are undefined. This situation allows many missuses of data and hampers the realization of its potential to serve solve societal challenges and contribution to achieving the sustainable development goals.

### 3.2.2 Technology

When designing new business models, we must be careful with regards to what technology can provide and avoid falling into hype cycles. BMI aims at bridging new research and technological achievements with the market reality. This calls for a focus into what problems need and can be solved thanks to given technological advancements but also at acceptable change efforts.

#### 3.2.2.1 Automation

Automation in transport brings along a full set of new possibilities for mobility service providers. From safety enhancement features in early stages of transport automation to a whole range of new mobility services and possibilities once cars reach full autonomy (SAE level 5). However, in this section we are not going to describe the whole spectrum of possibilities brought by automation, but to emphasize the main drivers for current mobility service providers, which are related to service performance optimization, enhanced productivity and lower energy consumption. The main SHOW drivers for automating transport are to improve current operations and service performance, increasing safety, reducing costs and optimizing the utilization of assets, while expanding service offer to generate and capture more value from the market.

Introducing automation in Public Transport services may allow to reduce the operating costs, making such services more economically sustainable but this hypothesis still need to be proved. Automating public transport services can also allow for some currently non-viable services to become economically viable. This can be the case, for example, for low-demand services in areas with low population density which are today underserved by public transport options due to their high costs of operation and low demand.

#### 3.2.2.2 Connectivity

Transport connectivity to infrastructure and to other vehicles is another technological driver for new mobility services and to improve current operations. Without connectivity, many of today’s mobility services could not exist, at least in their present form. Think for example about the boom of car-sharing services during the last ten years. Despite car-sharing clubs have existed since mid-20$^{th}$ century, only with its coupling to mobile phone and infrastructure connectivity it has become an attractive option for many users, beating the more traditional car-rental companies that have not been able to adapt and satay up to date with these technological advances.

Connectivity technologies are key enablers for network synergies and system efficiencies like, for example, enabling various users that want to travel a similar route during the same time interval to share the same vehicle instead of using different vehicles, bringing positive impacts to the overall system. Also, connectivity allows traceability and movement monitoring of passengers, goods and assets, a key pre-requisite for resources optimization and the realization of positive impacts at system level thanks to increased coordination and understanding of the causal relationships between different aspects of the system.

To be able to exploit the full potential of connectivity, systems interoperability is key. Different connectivity technologies and protocols are being developed and deployed in the market, with efforts being made towards interoperability between them, although their non-homogeneous availability and incompatibility of certain communication protocols is still hampering the realization of connectivity's full potential when designing new business and operating models.

Harnessing the potential of real-time information acquisition and processing is only possible thanks to a good ubiquitous connectivity with low latency and uninterrupted communications. Additionally, cybersecurity is also a key pre-requisite for the deployment and operation of connected, cooperative and automated mobility systems.

The **SHOW Dashboard** architecture aims at allowing homogeneous fleet management and seamless integration of transport services with heterogeneous systems. The central idea is to exploit the Web of Things (W3C WoT) concept and related communication guidelines and protocols to be able to directly connect currently fragmented technologies and standards under a common, interoperable framework. The main goal is to develop a common architecture able to provide interoperable connectivity for cross-site, cross-vehicle and cross-operator data collection, analysis, fleet coordination and realization of common meta-services.

The **SHOW TMC** – CCAVs Traffic Management Control Tower Concept is a connectivity enabled traffic control centre for CCAVs in a city, allowing for their remote supervision and/or control in a centralized manner. The availability of modern connectivity technologies such as 5G our 4G private network opens up the possibility of centralizing the supervision and management of all automated vehicles from a central location, working analogously to an airport control tower, allowing for safer and more coordinated and cooperative operations between different CCAVs service providers and operators.

#### 3.2.2.3 Electrification and Hydrogen

Although SHOW demonstrator vehicles are all battery electric vehicles, project approach is to provide eco-friendly mobility, which may also consider hydrogen.

Transport electrification is a key step towards reaching sustainable and Green House Gas emissions-free transportation, but also an enabler for improved operations and new business models. For example, electric vehicles which are currently more expensive for individual customers can represent a cheaper option for fleet owners and operators, as operational costs for electric vehicles are lower when driven for long mileages, as many studies looking at the TCO break-event point between electric and internal combustion engine vehicles have highlighted.

Nevertheless, electric vehicles pose also new challenges for transport operations, mainly related to vehicle charging needs and vehicle range management. This requires an added level of complexity to daily operations, requiring to take charging schedules into account.

In relation to Business Model Innovation, electric vehicles have also a different Lifecycle than internal combustion engine vehicles, potentially lasting much longer and requiring less maintenance. Nevertheless there are still a lot of open questions related to the charging infrastructure especially when we refer to fleet of electric buses requiring a lot of energy.

#### 3.2.2.4 Digitalization/Datafication

The digitalization of services and operations opens up a full range of possibilities that were not available before, especially for new (small) players in the field. (Big) Data and its correct processing and use can enable the optimization of Business Models to achieve economic viability and sustainability while keeping passenger fares low. Through algorithms capable of fine-tuning pricing mechanisms and providing different fleet management strategies in real-time, costs can be minimized, and revenue increased.

Through the combination of connectivity and digitalization of services, SHOW Business Models can exploit the added value of the data economy through the demonstration of operational optimization algorithms and other added value services such as the creation of a digital marketplace environment enabling the creation of digital Business ecosystems.

In addition, the latest advancements in (Big) Data and Artificial Intelligence (AI) algorithms offers transport added-value services at different levels. Dr Kai-Fu Lee, a recognized expert and lecturer in the use and roles of AI, illustrates in Figure 1 below the synergies and frontiers between AI-based tools and human capabilities. Such illustration can be used to identify the areas of higher potential for silicon-based intelligence in CCAMs.

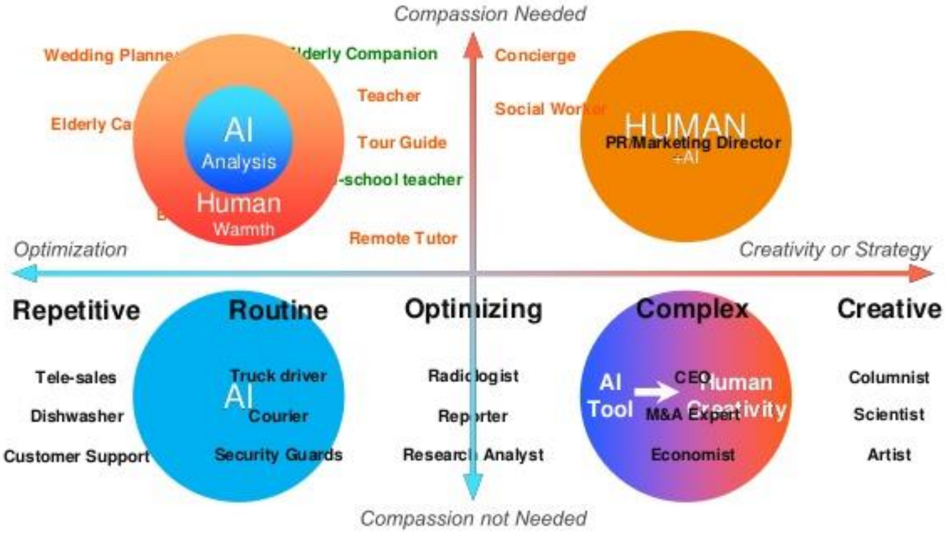



**Figure 1 – Schematic representation of the synergies between Human and Artificial Intelligence by Dr. Kai-Fu Lee (Source: Lee, 2018)**

The **SHOW Digital Marketplace** will be a toolset used by end-users to install, obtain or simply use external registered applications. Moreover, certified users will have the ability to maintain a user profile, register new kinds of services, and also review and rate applications through the toolset.

The **SHOW meta-data added value services** based on Big Data analytics and AI algorithms intends to improve current CCAVs Business and Operating models thanks to leveraging data and connectivity to enhance different aspects, from improving real-time matching of supply and demand to reducing operational costs through predictive maintenance or flexible fleet scheduling, including dynamic charging.

### 3.2.3 Policy

Besides Technological and User-related mobility drivers, Political and regulatory frameworks are also greatly contributing to the development pathways of future mobility. Below we shortly describe the main overarching political and regulatory drivers shaping automated mobility and especially the influence on business opportunities today, and specially their influence on mobility business model innovation.

#### 3.2.3.1 Open

Public authorities are increasingly demanding for transparent and data-sharing schemes between transport operators and regulators in order to promote a common knowledge base regarding mobility operations and their impacts. This is being framed under the so-called PPPs (Public Private Partnerships) or the recently expanded concept PPPPs (Public Private People Partnerships), which aims at including the citizens also as partners in the business ecosystem with the final goal of making it more open and accessible to all participants of the market.

#### 3.2.3.2 Integration and interoperability

Key requirements that come from openness, cooperation and connectivity are those of integration and interoperability. Increasing levels of connectivity and collaboration at various system levels and between a huge diversity of actors requires a sharing of common procedures, protocols and requirements to enable synergic and fair participation.

#### 3.2.3.3 Inclusive

Social targets of universal accessibility, social inclusivity and economic equality are also driving urban mobility policies and transport policies in general. The design of new mobility services is aiming at leveraging automation to increase the supply of accessible public transport options for people living in low-densified areas or users with special needs, low demand cases which normally doesn’t justify the economic costs of setting-up regular public transport services. Future aspirations have put an eye over real-time on-demand services using small shuttles or Robo-taxis which can offer high mobility convenience at lower costs than car ownership for people living in suburban and rural areas, where private car modal share is the highest.

#### 3.2.3.4 Sustainability

Sustainability is at the core of any transport related innovation. The main goals are to achieve a reduction of transport related emissions and other negative externalities produced by our transportation systems. Many different strategies are being put in place to achieve a more sustainable transport system. Among them, we want to highlight the importance of strengthening public transport use and the sharing of rides between passengers that travel similar routes or to shared destinations. Ridesharing, ride-pooling and mass transit have proven to substantially reduce transport-related emissions thanks to improved transport and space efficiency. The high transportation capacity and energy efficiency of public transport and the high vehicle utilization rate of shared mobility have proven to have the lowest rates of negative environmental impacts per passenger, thanks to their ability to collectively transport many people on the same ride, contrary to single-occupant cars and other individual, motorized transport modes.

#### 3.2.3.5 Circular economy

The transition towards a circular economy also opens up many opportunities for the development of new business models. Although there are still few law enforcements in this regard and targets towards reaching a full circular economy are still unclear, many benefits from applying circular economy strategies when designing new business models can already be fulfilled. From cutting down costs to creating new revenue streams, circular economy principles offer a new range of possibilities for businesses. One clear example comes from the application of MaaS principles to the vehicles themselves. Moving from a typical vehicle purchase or leasing model towards a Vehicle-as-a-Service (VaaS) model, can help mobility service providers in achieving a positive business case, paying only for when the vehicle is in use and getting rid of costly operations such as maintenance and re-purposing. Having fleet flexibility as an operator and leaving the ownership of the vehicles to a specialized company that takes care of maintenance, upgrading, retro-fitting and other vehicle-related needs can benefit both companies if principles of circular economy are applied, in which the vehicle owning company can have a dedicated business unit in charge of continuously extracting value from these assets by performing repair, repurpose or recycling operations.

On the other hand, there are some other actors of the market which:

- Are looking to create in-house the “digital technology in order to optimise all the chain;
- Are thinking that competition should be created through an open market/competition/tendering (as done today under the PSO regulation) and not by a sub-sub-sub segmentation

#### 3.2.3.6 Legislative framework for CCAM

The operation of connected, cooperative and automated mobility requires the realization of existing legal frameworks covering aspects of data security, data protection (GDPR, DSGVO) and the creation of new regulatory frameworks that cover new domain areas such as automated vehicle functionalities and legal responsibilities in case of an accident where no driver is involved. Each country has its specific requirements and some countries in Europe are more experienced with these services than others, which creates a highly heterogeneous legislative framework to navigate through, representing one of the main barriers towards CCAM market deployment today, together with the lack of massive investment in European technologies. Despite this, public authorities are generally convinced about the potential benefits of shared transport automation and are responding positively and quickly to these new advancements in mobility, although also cautiously. Good reasons for public authorities and municipalities to perform many pilots and feasibility studies about shared automated mobility services before allowing its full market deployment is the high level of uncertainty regarding its long-term impacts, especially at the intersection of other key strategic areas such as urban planning and socio-economic development.

At least two main EU wide, harmonised regulatory frameworks should be agreed upon and developed to foster EU’s leadership in CCAM:

- One for Pilot/demonstration activities, flexible enough to encourage developments while stating the safety conditions.
- One for market services deployment, clearly specifying the necessary homologation, type-approval rules and share of legal responsibilities.

## 3.3 CCAVs Business/Operating Models: success/failure factors and indicators

In the last years, we saw the expansion of experimentations using automated vehicle in different countries, from US to China, whether in private sites or on open roads. Demonstrations were at the beginning focused around the technology, showcasing the vehicle driving without human driver. Then it accelerated to transporting people. More and more communications and marketing were done by the big players outside Europe with passenger cars and robotaxi showcasing such performance where the cars are driven autonomously around the urban areas, facing and solving difficult driving circumstances, and operating in smooth way without any accidents. Which positioned the ambition and the expectation towards stakeholders very high regardless of the reality of the service to be delivered.

And based on these marketing messages and high expectations, many stakeholders wanted to establish business models based on public and private shared transport with Autonomous Shuttles as they are the ones on the market. And many had no knowledge of the value chain nor of knowledge of the technology that both mainly impact the business models and its sustainability.

In the following we approach only the shared public and private transport business and operating models based on the Autonomous Shuttles with L4 autonomy as per the SAE of automated vehicle levels definition to provide extension and new aspects for the development work in A2.2.

### 3.3.1 Value chain

A simplified view of the stakeholders' value chain for public transport operations – the mobility service provider - which shows the common approach for business and operating models in the field of mobility services, can be seen as follows:

- Public Transport Authority (PTA): The stakeholder who decide of the creation/adoption of a new services, based on local needs, and partially finance the projects. Usually these stakeholders are the city authority or the transport authority and they are deciding for the tendering procedures. They are the one that decides/accept of putting in place the public transport experimentation with AV vehicles. Up today, almost all AVs are running under an "experimentation" regulation and very few countries accept "services" with AVs.
- Public Transport Operator (PTO): this stakeholder builds the most adapted mobility solutions and build the ecosystem of partners companies to ensure the best service at the best cost and executes it. He is the one reliable for the operations, quality, maintenance of the service in global. Including manpower, vehicles, IT, supervision and maintenance of all transport stations. In some city case, the PTA and the PTO are the same stakeholder and assume both responsibilities. We highlight that a Public Transport Operator can be a public or a private company.
- AV manufacturer (OEM): The stakeholder how provides the AV vehicles to be operated daily by the PTO. Although the OEM puts in place an autonomous vehicle, these vehicles need to be operated daily by a local stakeholder and

need to be connected remotely to a supervision centre. The AV can be in stand-alone to deliver only service.

Based on this PTA to PTO to OEM cascading roles, putting in place an AV shuttle operation should follow and respect the role and responsibility of each. Otherwise the service is due to fail before starting.

In private area where shared AV shuttles are used, the owner of the site assumes the role of the PTA. In order to be sure that is well known, we highlight that a PTO can be a public or a private company.

The concrete roles and responsibilities each stakeholder will carry out during operation must be very clear and well-defined. For example, there have been some stakeholders in the past wanting to purchase AV shuttles thinking that they can be used as a normal bus without a driver. And by just purchasing and installing them there will be no need putting in place a daily transport entity to operate them. You can program the area or road to follow, trigger a button and it provide 24/7 service. This readiness level of the technology is yet far from reality. More of that, under the experimentation regulation, a safety operator should on-board or exceptionally in some countries it can be outside (in the proximity of the vehicle or in a control tower).

### 3.3.2 Knowledge of the technology

The knowledge of the AV technology is crucial to establish the right service and associated business models.

As the focus is in SAE L4, the AV vehicle will operate on a well-known limited geo-fenced area (trajectory or multiple trajectories forming a network) and will not go outside of its limitation. In the last years this area become larger and the use cased covered more complex.

Two major elements are required to put a service in place: Automated vehicles and a safety analysis proving that the vehicles are able to perform safely in that particular road/area. It is often said that the ODD cover the road/area driving conditions.

An ODD (Operational Design Domain) is defined as: *"Operating conditions under* which a given driving automation system or feature thereof is specifically designed to function. Including, but not limited to, environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or road cha*racteristics."* Please note that both OD (Operational Domain) and ODD are used by the community.

And this links clearly the AV vehicles capabilities to the ODD. As per the vehicle ability to solve each and every part of the road path where it will operate and under the related conditions. For example: the shuttles will operate in an urban area of 5 km, passing priority stops & pedestrian crossing, traffic light, speed limited to 30km/h, 2 lanes roundabouts, road with slopes less than 15%, where temperature are between -5° and 45°, and not under heavy rain. If the slope of the road is above 15%, or we are on Highway and there is a partial part of road on highway or high speed, then the vehicle would not be able to operate as per its technological capabilities. One of the technical challenges is that the vehicle itself detect if it is under its ODD. Today this function is mainly ensured by the PTO and by the safety analysis computed before the beginning of the experimentation.

Also, the AV shuttles are also connected vehicles, they will need connectivity not only to send receive information or positioning but also to be connected to a control supervision centre that can manage the daily operations of the vehicles.

AV shuttles use also sensors technologies (sensor hardware, software, sensor data fusion algorithm) that are on the market. And many of these sensors are not yet able to support some harsh weather conditions. So, until either finding alternatives or having solid mature sensors in all weather, AV Shuttles cannot operate in some weather conditions and are still under the constraints of the what the sensors can do. Such hurdles are to be solved in the coming years.

In these manners, a pre-study is to be made by the OEM to validate or not the possibility of operating in shuttles in autonomous mode for the requested site.

One major failure of AV operations is coming from the miss understanding of the technology possibilities and forcing a use case to be put in place where the couple vehicle capabilities and ODD requested are not fitting. Example: Having AV shuttle to drive on an area where a portion of the road is a high speed higher than 50km/h. Or having shuttles to run even under snow in heavy winter days.

### 3.3.3 Other major elements

The main success and failures faced on the market are based on previous elements, the need for a value chain and the link between exploitation area and vehicle capabilities. Knowing that the technology is advancing quickly at all levels from new sensors, AI, connectivity localization precision… the vehicle will be able to extend the possibilities opening potential to more complex roads and situations. From urban, peri-urban to rural areas and from simple traffic to more dense traffic and higher speeds. But to achieve this there we still need to massively invest in technologies.

Business models experienced till today may not be same as the ones that are ahead of us, as some challenges will be solved. Taking for example the financial part it is split in:

- CAPEX
  - The cost of the fleet of vehicle;
  - The cost of the physical infrastructure and of the digital infrastructure,
    - along the trajectory
    - the depot (charging station, maintenance tools)
    - at the supervision centre, …
  - The cost of homologation or of all safety analysed made before the beginning of the service
  - …
- OPEX
  - The cost of the maintenance of the vehicle;
  - The cost of the maintenance of the infrastructure (digital and physical);
  - The cost of licences (software or not), the cost of authorization;
  - Cost of the energy;
  - Cost of cleaning;
  - Salaries: safety drivers, supervisors / traffic regulators, intervention team, safety team, cleaning teams,
  - Taxes
  - …

These elements despite their advancement may be a blocking point for business models that do not take them into account from the start. And they have seen in past experiences such failures due to PTOs that built up a business model where the operation can start in T0+3 and they have purchased AV shuttles and hired people to operate them. But the Time to Approval in the country, as it is the first time, took longer than they thought and costs overloaded their business models for experimentations.

### 3.3.4 Suggestions for a way forward

A controlled development by PTO of driverless shuttles / robot-taxi services as a complement to large capacity transportation means could solve the first and last mile issue and generate several positive impacts for the end-users and for the public transport operators.

- First, it could deter citizens that live too far from existing public transportation mean from using their private cars. It would decrease the level of congestion, and spread the investment cost and cost of service of existing infrastructure and transportation means across a higher number of users. It can also increase the overall level of safety thanks to a reduction of accidents.

- Second, it can save money to PTO that want to extend to new underserved / new build districts: with such services there is limited to no infrastructure cost, and reduced service cost vs. classical mini bus with a driver.

- Third, it can have positive externalities, for example for property developers that will be able to densify the buildings thanks to less space dedicated to parking lots (Barkarby example: number of parking per households under average). A scheme in which part of this positive externality is translated into a decrease cost born by the society could be imagined.

- Fourth, when technology will be ready to make driverless a significant portion of existing buses, overall cost will decrease, since driver's salary represents today 50 to 75% of the overall cost of the service. We can imagine then either a higher level of service (higher frequency for example) or reduced cost for the society.

In order to reach these goals, there are still important challenges to overcome:

- From a driverless technology point of view, level of guaranteed safety must still improve to:

    - Be able to withdraw the safety driver in order to have a positive business case;
    - Be able to circulate without a safety driver in a significant type of environments including adverse weather conditions;
    - Continue to reduce the need for expensive infrastructure (connected traffic lights, extended perception sensors, high capacity connectivity, landmarks, …).

- From an industrial and operational point of view, the total cost of the vehicle over its lifetime has to be decreased: leverage of scale effect new technologies (solid state Lidars for example) and experience curves of the sensor's manufacturers, optimized deployment and maintenance processes will be some of the key elements.

- From a normative point of view, the norm has still to be defined and harmonized across countries and regions to be able to assess and approve the level of safety of driverless shuttles.

- From a fleet management point of view, some standards may need to emerge in order to ensure that a city that wants to work with several different shuttle suppliers can ensure a central supervision of the overall fleet, and optimize if needed the interoperability between transportation means to achieve the full potential of Mobility as a Service. Pricing scheme may also have to be adapted, since the marginal cost of these new services will be in a first time higher than the ones of classical buses whereas the benefits will not be equally split across all the citizens of a city.

- From a regulation point of view: incentives / tax systems / special access to some lanes must be thought in order to promote robot taxi / shuttle with positive impact in terms of congestion i.e. in complement to high volume transportation means.

## 3.4 Identification of SHOW Business Model KPIs and corresponding metrics

*The overall aim of SHOW is to "support the migration path towards effective and* persuasive sustainable urban transport through technical solutions**, business models** and priority scenarios for impact assessment by deploying shared, connected, electrified, fleets of automated vehicles in coordinated Public Transportation, Demand responsive Transport, Mobility as a Service and Logistics as a Service operational chains in real-life urban demonstrations *across Europe".* **SHOW D9.1**

In order to select the most relevant KPIs and metrics for SHOW Business/Operating models, we followed a structured approach:

- We took the scope of shared and cooperative automation in Public Transport (PT) in urban contexts.
- We listed the first version of SHOW Research Questions as specified in Deliverable D9.1 and classified them in two categories with regard to their coverage within the work of SHOW WP2: Business and Operating Models. Only those research questions classified as Intrinsic will be addressed within the work of WP2 (the following list uses the nomenclature of the GA), because existing mobility service normally were evaluated using the intrinsic factors to show their business potential not the extrinsic ones, which impact are growing nowadays:

RQ 1 **– Extrinsic (Not addressed in WP2)**

How will road safety, traffic efficiency, mobility, and user acceptance be affected by AV traffic in a real city environment when operated at normal speed, in roundabouts, in interactions with VRUs, in an energy efficient way, as a combination of passenger and cargo transportation, in mixed flows and integrated to TMC or connected to operation service/remote supervision?

RQ2 **– Intrinsic**

Can a multi-actor business environment considering different operators, type of vehicles, type of road infrastructure and digital infrastructure improve quality, efficiency and safety of operation?

RQ3 **– Extrinsic (Not addressed in WP2)**

What will be the societal, economic, safety, and environmental effects of using seamless autonomous transport chains of Automated PT, DRT, MaaS, LaaS?

RQ4 **– Extrinsic (Not addressed in WP2)**

What will be the effect of mixed passenger/cargo automated transport on passenger and cargo delivery in terms of traffic efficiency, energy consumption, and user experience?

RQ5 **– Extrinsic (Not addressed in WP2)**

Can platooning of passenger and cargo transport at higher speed contribute to improved traffic efficiency, energy consumption and environmental impact in transport?

RQ6 – **Intrinsic**

Are operational services in semi-controlled environments like bus stops, depots and parking on servicing, cleaning, maintenance and parking feasible and efficient?

RQ7 – **Intrinsic**

Can transportation services be enhanced by using self-learning DRT for planning, routing, operation, or by using services based upon big data and AI algorithms?

1. We performed semi-structured interviews with SHOW Pilot Site Business representatives from: Madrid, Rouen, Vienna, Salzburg
2. We created an extensive list of Business KPIs following and in addition to the SHOW Impact KPIs list and refined them during the process.
3. And finally created a list of SHOW Business/Operating Models KPIs classified according to:
   - Business Model components: Cost structure, Operational performance, Revenue streams and Business environment represented in own tables (see table 6 to table 9)
   - CCAM objectives: Service Quality, Operational Excellence, Business Sustainability and Business ecosystem performance clustering the business impact of the KPI

### 3.4.1 SHOW Business Model KPIs

The following tables describes the identified and agreed WP2-related KPIs using one colour for one CCAM objective (green for business sustainability, yellow for operational excellence, brown for business ecosystem performance and blue for quality of service):

- **Cost structure KPIs**

**Table 6 – Cost structure KPIs**

| Business Model KPI | Description | Metrics / Measurement units | CCAM Objective | Data acquisition method (DAM) |
|---|---|---|---|---|
| CAPEX distribution | Structure and share of fixed costs (vehicles, infrastructure…) | Minimum level of necessary investment (€) to start operations | Business sustainability | Business Model Canvas |
| OPEX distribution | Structure and share of variable costs (maintenance, personnel, energy consumption) | €/vehicle-km or €/vehicle-trip or €/operation | Operational excellence | Business Model Canvas |
| Return on investment (ROI) | Ratio of money gained or lost on an investment relative to the amount of money invested | % | Business sustainability | Post-processing |
| Re-use of available infrastructure | Ratio between new and re-used infrastructure | % | Business ecosystem performance | Pilot observation |
| Vehicle lifetime costs | Total costs per vehicle over its lifetime | €/vehicle-year | Business sustainability | Post-processing |
| Fleet or Infrastructure replacement rate | Number of years a fleet of vehicles or infrastructure is expected to last | Years | Business sustainability | Business Model Canvas |

- ## Operational performance KPIs

### Table 7 – Operational performance KPIs

| Business Model KPI | Description | Metrics / Measurement units | CCAM Objective | Data acquisition method (DAM) |
|---|---|---|---|---|
| Vehicle utilization rate | Ratio between vehicle time in circulation and vehicle time in rest | % | Operational excellence | Pilot observation / Simulation |
| Vehicle utilization efficiency | Ratio between empty and non-empty trips | % | Operational excellence | Pilot observation / Simulation |
| Vehicle occupancy rate / pooling factor | Average number of persons in a vehicle respect to total vehicle capacity | % | Operational excellence | Pilot observation / Simulation |
| Waiting time (or 'pick-up time') | Average time the end-user is waiting | minutes | Operational excellence | Pilot observation / Simulation |
| Parking time | Average time the vehicle is standing | minutes | Operational excellence | Pilot observation / Simulation |
| Trip duration | Average trip duration | minutes | Operational excellence | Pilot observation / Simulation |
| Trip distance | Average trip distance | km | Operational excellence | Pilot observation / Simulation |
| Trip number | Average daily number of trips | Trips/day | Operational excellence | Pilot observation / Simulation |
| Trip costs with safety driver | Ticket faire if a safety driver is needed on-board the vehicle | €/vehicle-km or €/vehicle-trip | Operational excellence | Business Model Canvas |
| Trip costs with remote supervision | Ticket faire if a remote supervisor is needed for the vehicle | €/vehicle-km or €/vehicle-trip | Operational excellence | Business Model Canvas |

- ## Revenue streams and pricing strategy KPIs

### Table 8 – Revenue streams and pricing strategy KPIs

| Business Model KPI | Description | Metrics / Measurement units | CCAM Objective | Data acquisition method (DAM) |
|---|---|---|---|---|
| Revenue structure | Share of revenue from each revenue stream (incl. subsidies and subventions) | % | Business sustainability | Business Model Canvas |
| Revenue per vehicle | | €/vehicle-km | Business sustainability | Pilot observation |
| Willingness-to-pay | | €/service or €/trip or €/km | Business sustainability | Pilot observation |
| Service accessibility | How accessible is the service according to users | 7-point liker scale | Quality of service | User acceptance survey |
| Service ease of use | How easy is to use the service according to users | 7-point liker scale | Quality of service | User acceptance survey |
| Service reliability | Proportion of deliveries and pickups made in the right time slot | % | Quality of service | Pilot observation |
| Service quantity | Proportion of deliveries and pickups made in the right quantity (no loss or theft) | % | Quality of service | Pilot observation |
| Level of service personalization | Degree to which the service takes into consideration | 7-point liker scale | Quality of service | Value proposition canvas / Mobility service canvas |

| Business Model KPI | Description | Metrics / Measurement units | CCAM Objective | Data acquisition method (DAM) |
|---|---|---|---|---|
| | personal preferences | | | |
| Customer retention rate | Capacity of a service to retain customers during long time periods | Proportion between new and old customers (%) | Business sustainability | Pilot observation |
| Average trip length made by users | Average distance travelled by users with the service | Km/user-trip | Business sustainability | Pilot observation / Simulation |
| Average trip duration made by users | Average time travelled by users with the service | Minutes/user-trip | Business sustainability | Pilot observation / Simulation |

- **Business Environment KPIs**

**Table 9 – Business Environment KPIs**

| Business Model KPI | Description | Metrics / Measurement units | CCAM Objective | Data acquisition method (DAM) |
|---|---|---|---|---|
| Market readiness indicators | Relative rating of an innovation market readiness depending on the weighted influence of enablers and barriers | % | Business sustainability | Post-processing / Stakeholder Workshops |
| Market maturity indicators | Relative rating of an innovation's market maturity depending on the weighted influence of enablers and barriers | % | Business sustainability | Post-processing / Stakeholder Workshops |
| Market penetration rate | Market penetration rate of a particular SHOW service | % | Business ecosystem performance | Post-processing |
| Market growth rate | Market growth rate by region | % | Business sustainability | Pilot observation |
| Number and nature of players in the ecosystem | Partners in the business ecosystem | # and roles | Business sustainability | SHOW UCs fact sheet |
| Organizational structure | Type of business model structure | Category Type ((Liberal, Central, Aggregator, Social Innovation) | Business ecosystem performance | Mobility Service Canvas |
| New business ecosystem players/roles | Number of new players in the business ecosystem | # | Business ecosystem performance | Pilot observation |
| New products/services | Number of new products or services created | # | Business ecosystem performance | Pilot observation |
| New customers | Number of new customers | # | Business ecosystem performance | Pilot observation |
| New vulnerable users | Number of new vulnerable user customers | # | Business ecosystem performance | Pilot observation |
| Number of SMEs using SHOW services marketplace | SMEs that tap into the show services marketplace | # | Business ecosystem performance | Pilot observation |
| Number of new algorithms created | New algorithms created within SHOW | # | Business ecosystem performance | Pilot observation |
| Business responsible organization | Type of organization in charge of the business | Organization type | Business ecosystem performance | Mobility Service canvas / Business Model canvas |
| Rules of business participation | Existence of specific requirements for business partners/suppliers to | Type of requirements / Business interfaces | Business ecosystem performance | Mobility Service canvas / Business Model canvas |

| Business Model KPI | Description | Metrics / Measurement units | CCAM Objective | Data acquisition method (DAM) |
|---|---|---|---|---|
| | participate in the business | | | |
| Mode of transport substituted or complemented | Previous mode of transport used by the users of the service to cover the same travel needs | User modal shift | Business ecosystem performance | User acceptance surveys |
| Number of trips per trip purpose | Number of trips per week and per trip type (in total) | User mobility profiles | Business ecosystem performance | User acceptance surveys |
| Accessibility of low-density areas | Quantity of low-density areas reached | % Lower density area coverage compared to total area coverage | Business ecosystem performance | |

The same Business Models could fail applied in different geographic or socio-economic environments. The Operational environment of SHOW Pilot sites is described in more detail in D9.1, section 4.1.2 and will be further updated in D9.2 with infrastructure and functions requirements.

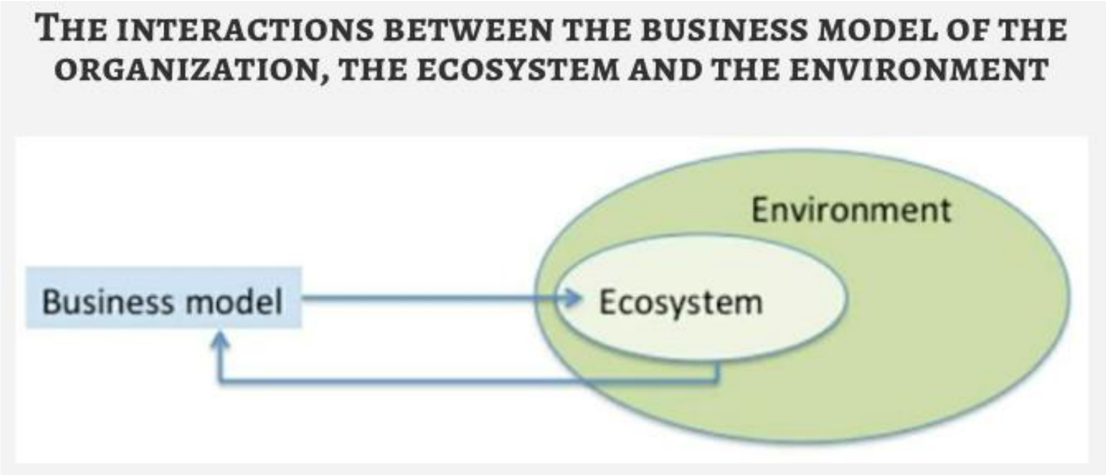



**Figure 2 – Schematic representation of the relationships between the Business Model, the Business Ecosystem and the Business Environment (Source: Demil et al., 2018)**

As illustrated in Figure 2 the Business Environment comprises also the business ecosystem. The Business Model design itself is seen as an independent unit of analysis from the Business Ecosystem and from the Business Environment. Within SHOW WP2 we will mainly deal with the Business Model component and touching upon the Business Ecosystem component through the relevant project connections with WP1. The Business Environment will be mainly addressed within WP16 and the relevant connections will be addressed within both work packages. In this chapter, the connection with the Environment is made through the next subsection 3.5 – Business Model exploitation: Scalability and Transferability.

### 3.4.2 Situational variables

Situational variables are those that influence either the functioning of a system or vehicle (the pilot vehicle) or the conditions that the vehicle finds itself in. Situational variables are of important consideration when introducing CCAVs in a city environment, as differences in these variables are expected to influence business model possibilities and outcomes. The listed situational variables are part of the work done in WP9 to identify relevant (technical) KPI for SHOW.

**Table 10 – Situation variables for test set influences**

| Short variable name | Description |
|---|---|
| Weather | Weather conditions such as dry/wet, sunny/cloudy/foggy, rain/snow/sleet/hail, etc. Road condition (wet/dry) may also be relevant. |
| Sight conditions | Unrestricted/restricted (e.g. fog, snow, rain, glare from sun) |
| Road type | Road or network characteristic: motorway, rural road, urban road, speed limits, number of lanes, number of intersections, … |
| Traffic conditions | From hardly any traffic to congested, period of the day, day of the week, season, holiday, … |
| Traffic composition | Vehicle types allowed / dominant type of vehicle types on the road / … |
| Penetration rate | Penetration rate (of automated vehicles/mobility concepts) |
| Other mobility measures | Other functions/services/measures deployed in the vicinity |
| Traffic control circumstances | Traffic control / traffic management (operational characteristics: traffic light states, bridge open, …) |
| HMI type | Human-Machine-Interaction (way of informing or warning travellers/drivers) |
| Area type | In- or outside built-up area |
| Area coverage | Geographical area covered by the transport mode (km2/total city or metropolitan area) |

| Short variable name | Description |
|---|---|
| Distance from city centre or mobility hub | Number of kilometres from city centre or from/to interchange terminal/mobility hub |
| Distance from commercial areas | Number of kilometres from terminal to nearest commercial centre |
| Distance from industrial areas | Number of kilometres from interchange/terminal to nearest industrial zone |

### 3.4.3 Calculation of Market indicators

Markets are defined as the sum of all the buyers and sellers in the area or region under consideration. The area may be the earth, or countries, regions, states, or cities. The value, cost and price of items traded are as per forces of supply and demand in a market. In that sense, **Markets in SHOW** can be directly related to the SHOW Pilot sites definition, being, from a local to a global scale:

1. Pilot locations;
2. Pilot cities;
3. Pilot countries.

Market readiness indicators (Lubello & Bousse, 2020)

$GMKTR = LR + \sum\ [(ETi) + \beta(ESi) + \beta Ei(ESi)] - \sum\ [\propto Ti\ (BTi) + \propto Si\ (BSi) + \propto Ei\ (BSi)]\ /\ 3(m + n)$

$LR$ = Level of readiness of the technology
$m$ = number of enablers
$\beta T$,, = Probability of contribution to improve access to the market (by the enabler)
$ET$,$S$,$E$ = Importance (low, medium, high) of technological/operational/economic (T), social/behavioural (S) and environmental/energy efficiency (E) enabler
$n$ = number of barriers
$\propto T$,, = Probability of contribution to the failure to improve access to the market (by the barrier)
$BT$,, = Severity (low, medium, high) of technological/operational/economic (T), social/behavioural (S) and environmental/energy efficiency (E) barriers

Market maturity indicators (Lubello & Bousse, 2020)

$GMKTM = \sum_{m,\ i=1} [(ETi) + \beta(ESi) + \beta Ei(ESi)] - \sum_{n,\ i=1} [\propto Ti\ (BTi) + \propto Si\ (BSi) + \propto Ei\ (BSi)]\ /\ 3(m + n)$

$m$ = number of enablers
$\beta T$,, = Probability of contribution to the consolidation of the market (by the enabler)
$ET$,, = Importance (low, medium, high) of technological/operational/economic (T), social/behavioural (S) and environmental/energy efficiency (E) enabler
$n$ = number of barriers
$\propto T$,, = Probability of contribution to the failure of consolidation of the market (by the barrier)
$BT$,, = Severity (low, medium, high) of technological/operational/economic (T), social/behavioural (S) and environmental/energy efficiency (E) barriers

#### 3.4.3.1 Business ownership structure

Besides the identification of roles in a business ecosystem, the identification of business ownership and assets responsibility are of main importance when thinking about Business Model Innovation. Within WP2, we will differentiate among:

Primary responsible/owner/orchestrator of the business

The primary business responsible will be the focus of analysis when evaluating the viability of the novel SHOW business models.

Owner/responsible of the assets

- Traffic or road infrastructure:

Traffic or road management authorities can provide special permits and access tariffs for CCAVs operating under different traffic environments and circumstances such as dedicated lanes, time intervals or with a certain occupation level.

- Automated vehicles:

Besides selling vehicles to transport operators, OEMs and other vehicle providers can act as managers of the vehicle assets in different ways. One such way is by offering Vehicles-as-a-Service (VaaS) and charging for their use.

- Infrastructure – Physical and Digital:

Providers of CCAM infrastructure can also opt for Infrastructure-as-a-Service (IaaS) business models which allow them to offer pay-per-use models instead of selling the whole infrastructure. This might, for example, provide better conditions for business scalability.

- Data:

Owners and managers of certain data might also have the possibility of exploiting and selling it to third parties for many different purposes, under properly defined business agreements and conditions. Data is increasingly becoming a new economic force and an enabler for the creation of new services or for improving existing ones. Data-as-a-Service could also become a relevant element of new CCAM business models. Never less, a level playing field should be created. The most of new mobility services require open data from all ecosystem but they are not sharing it back. It is not unusual that today, some actors are not creating some data in order to not be forced to share it.

- Added value services – Software APIs:

Software-as-a-Service is an already stablished business model among many industries. CCAM is expected to require the integration of many different software from various providers, making it an important piece of Business Models to consider.

Owner/responsible of the operations

- Traffic management:

The role of traffic manager is to manage the traffic, avoiding any situation which influences the throughput on the streets. This includes direct traffic management by traffic signals or indirect traffic management by collecting traffic data for traffic control strategies, streets maintenance tasks as well as the planning of new infrastructure.

- Fleet management:

The role of fleet managers can vary from managing the deployment and daily routing of the vehicle fleet to managing all the support operations from vehicle cleaning to vehicle maintenance and distribution. Fleet managers are often also the transportation service providers; however, a different company could take over some or even the totality of fleet management operations.

- Infrastructure management – Physical and Digital:

The owners and managers of the necessary infrastructure could also be different organizations. Differentiating both could represent a step forward towards decreasing the overall costs for the ecosystem and opening the opportunity for smaller players to tap into expensive infrastructure assets.

- Data management:

Data processors could also become relevant players in future CCAM ecosystems. Huge amounts of data will need to be generated, processed and distributed in nearly real-time conditions. The role of a data managers could eventually be a critical part of the ecosystem in order to keep data processes independent, well maintained and up to date.

- Service aggregators – Management of services ecosystem

Service aggregators are especially relevant in MaaS ecosystems, where different service providers come together in a single mobility ecosystem. Service aggregators might take different managing roles and responsibilities within the ecosystem, like providing and managing trip brokering services through the definition of access rights and participation conditions for service provision. Please note the 4 different philosophies of MaaS models as described by UITP in its policy brief. (UITP, 2019b)

#### 3.4.3.2 Business ecosystem performance

Value creation processes are evolving from a value chain structure to a value network structure, meaning many more relationships and dependencies are being created and leveraged between players in the business environment.

Business Models in future mobility would need to fulfil both public and private interests. In order to successfully achieve it, cross-sector collaboration is highly encouraged. Such cross-sector collaborations should pursue the deployment of affordable and economically sustainable mobility solutions, faire business participation mechanisms such as the agreements on distribution of returns and resilient value networks able to deliver value for the overall ecosystem and self-maintaining and politically acceptable operating models (e.g. through contract agreements that apply certain penalizations for inefficient operations or the creation of undesired external impacts).

Bahari and Maniak, 2015, describe three useful tools (ecosystem mapping, ecosystem matrix and histogram) for business model design going beyond a single firm and considering the whole business model ecosystem. The three tools can be easily applied to identify the viability of the business ecosystem in future CCAM scenarios. The tools can be further updated with additional business criteria to accommodate SHOW business model pilot evaluation needs.

## 3.5 Business model exploitation: scalability and transferability

### 3.5.1 Business model scalability

Scalability describes the ability of a system to adapt easily to increased workload or demand. Business Model scalability is seen thus as its ability to benefit from economies of scale.

We can for instance use the ratio between the costs/efforts and the revenues/benefits of putting a new service in place as a proxy to determine a business model scalability potential.

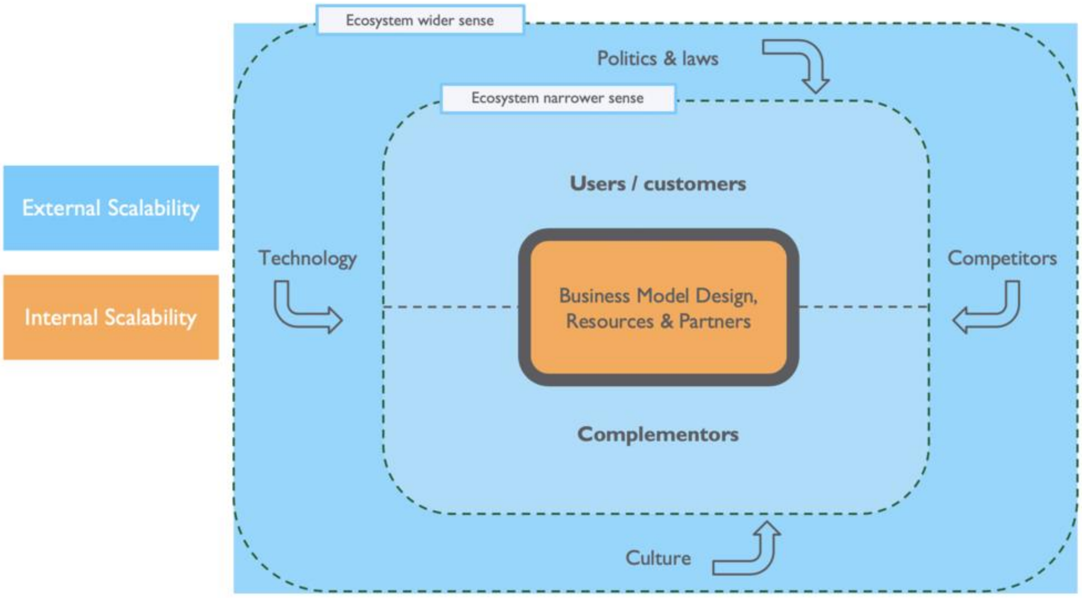



**Figure 3 – Illustrative dimensions affecting business model scalability potential differentiating between internal and external business model factors (Source: Hofmann, 2019)**

BMI differentiates between internal and external business model scalability as illustrated in Figure 3, where the Business Model design itself, partners and resources are considered the key pieces for Internal BM scalability, while the business ecosystem environment involving customers and complementors (narrow ecosystem) and policies/laws, competitors, technologies and culture (wider ecosystem) influence the external business scalability potential.

In order to determine the scalability potential of SHOW Business models, we have preliminary identified a list of factors that influence BM scalability, which will be further elaborated and refined along Activities 2.2 and 2.3 of this same WP.

**Table 11 – List of preliminarily identified factors influencing SHOW Business Model scalability**

| Short factor name | Description | Metrics / Measurement units | Dimension | Data acquisition method (DAM) |
|---|---|---|---|---|
| Automation of processes | Level of process automation from manual work to fully automated work. In the case of automated vehicles, the SAE levels (0-5) | 5-point scale | Technology | SHOW UCs fact sheet |

| Short factor name | Description | Metrics / Measurement units | Dimension | Data acquisition method (DAM) |
|---|---|---|---|---|
| | is taken as reference. | | | |
| Technical infrastructure | How easily can the infrastructures needed be extended to meet higher demand | 5-point scale | Technology | Stakeholder Workshops / Interviews |
| Technology readiness level (TRL) | Level of technological development of a certain technology according to standard TRL definition | 9-point scale | Technology | Pilot observation |
| Return to scale | Variation in productivity that is the outcome from a proportionate increase of all the input | Ratio between additional income generated with additional investment (%) | Cost & Revenue structure | Stakeholder Workshops / Interviews Or Pilot observation |
| High revenue for low costs | How well is the BM able to generate high revenue while keeping costs low (usually shown at the beginning of a venture) | Ratio between BM cost and revenue structures (%) | Cost & Revenue structure | Business Model Canvas |
| Minimum number of passengers/goods transported per day | The minimum amount needed to meet costs with paying customers | Passengers or goods/day | Cost & Revenue structure | Pilot observation / Post-processing |
| Legal barriers or boosts | How is the legal setting shaping the BM | 5-point scale | Policy | WP3 / WP16 |
| Language and culture | How much is the BM dependent on language and culture or resilient to others? | 5-point scale | User | WP16 |
| Customer lock-in effect | Ability to retain customers (cost - monetary or not - of user to switch to competition) | 5-point scale | Business Ecosystem | Pilot observation |
| Viral factor | Is the attractiveness of the service impacted exponentially with the in-/decrease of users | 5-point scale | Business Ecosystem | Business Model Canvas / Value proposition Canvas |
| Need-pull/Technology push | Degree to which the product/service is driven by a user need or by gains that a technology provides | 5-point scale | User | Mobility Service Canvas / User acceptance survey |
| Service ease-of-use | How easily can the service/product be used by the average user | 5-point scale | User | User acceptance survey |
| Familiarity | How close is the service/product from something the user already know/use | 5-point scale | User | Mobility Service Canvas / User acceptance survey |
| Willingness-to-pay | How much are the users willing to pay for the service offered | €/service | Cost & Revenue structure | Pilot observation / User acceptance survey |
| Unique value proposition | How unique and difficult to reproduce is the value proposition | 5-point scale | Business Model | Business Model Canvas / Value proposition Canvas |

| Short factor name | Description | Metrics / Measurement units | Dimension | Data acquisition method (DAM) |
|---|---|---|---|---|
| Incentives or subventions associated | BM dependency on government regulations or policies that incentivize the use of the service | Yes / No | Policy | SHOW UCs fact sheet / Pilot observation |
| Market share | Percentage of actual market to its maximum potential size | % | Business environment | WP16 |
| Market volatility | How stable or volatile is the market under consideration | 5-point scale | Business environment | WP16 |
| Business team/ecosystem experience | How experienced and performant is the business team/ecosystem | 5-point scale | Business ecosystem | Stakeholder Workshops / Interviews Or Pilot observation |
| Location (resources, customers & employees) | How well positioned is the company's location for resources, customers and staff pool? | 5-point scale | Business ecosystem | Stakeholder Workshops / Interviews Or Pilot observation |
| Partnerships gain vs. dependency | Ratio of gain obtained through partnerships and the dependency of the BM to run towards those partnerships | 5-point scale | Business ecosystem | Stakeholder Workshops / Interviews Or Pilot observation |

### 3.5.2 Business model transferability

Business model transferability is defined as the capability of the Business Model design itself to be transferred to a different Business environment, including a different business ecosystem.

**Table 12 – List of preliminarily identified factors influencing SHOW Business Model transferability**

| Short factor name | Description | Metrics / Measurement units | Dimension | Data acquisition method (DAM) |
|---|---|---|---|---|
| Strengths | Possessed resources and/or skills offering a competitive lead | 5-point scale | SWOT Analysis | WP16 |
| Weaknesses | Barriers preventing business from operating at optimum level performance | 5-point scale | SWOT Analysis | WP16 |
| Opportunities | Favourable external factors offering competitive advantage | 5-point scale | SWOT Analysis | WP16 |
| Threats | External factors with potential harm | 5-point scale | SWOT Analysis | WP16 |
| Political similarity | Similarity of governmental and political conditions | 5-point scale | PESTLE Analysis | WP16 |
| Economic similarity | Similarity of economic conditions | 5-point scale | PESTLE Analysis | WP16 |
| Social similarity | Similarity of social conditions | 5-point scale | PESTLE Analysis | WP16 |
| Technological similarity | Similarity of technological conditions | 5-point scale | PESTLE Analysis | WP16 |
| Legal similarity | Similarity of legal conditions | 5-point scale | PESTLE Analysis | WP16 |

| Short factor name | Description | Metrics / Measurement units | Dimension | Data acquisition method (DAM) |
|---|---|---|---|---|
| Environmental similarity | Similarity of environmental conditions | 5-point scale | PESTLE Analysis | WP16 |
| Operational Design Domain (ODD) similarity | Similarity of operational conditions under which a given driving automation system or feature thereof is specifically designed to function | 5-point scale | Business environment | SHOW UCs fact sheet |
| Customer habits | How well do users habits match with service/product offered or how well does it match what has proven to work so far | 5-point scale | User | Pilot observation / User acceptance survey |
| Customer purchasing power | What is the average income of people in targeted area/segment | €/habitant | User | Pilot observation / User acceptance survey |
| Customer density | What is the density of potential customers within the area of reach | Habitats/km2 | Business environment | SHOW UCs fact sheet |
| Customer PPP | Average power purchase parity of the customers | € | User | Post-processing |
| Market knowledge | How well do the BM's company know the target market/location/customers | 5-point scale | Business environment | Post-processing |
| Number of market competitors | How many other BM are competing for the same customer base? | # | Business environment | WP16 |
| Size and reach of competitors | How big are those competing BM / For how long have they been around? | Descriptive | Business environment | WP16 |
| Competitor relationship immutability | Are competitors doomed to stay as-is or could they be turned into partners or even customers? | Descriptive | Business environment | WP16 |

# 4 Overview and Analysis of Public Transport / PTO services

Public Transport services should ensure the growth over the long term and for future generations. This overall political, societal sustainability requirement can be detailed / understood in the following way:

**Climate and environmental challenges**
In 50 years, the sea level has risen by 10 centimetres. Severe weather phenomena (cyclones, hurricanes, droughts, heat waves, etc.) are on the rise, with often dramatic consequences (fires, floods, extinction of species, climate refugees, etc.). The UN predicts that 280 million people will be displaced worldwide by 2050. This situation considerably increases citizens' expectations of companies: as an example, in France 95% of citizens expect major companies to make concrete commitments. 52% of them consider the environment and climate to be a priority. This leads us to design cleaner solutions and to contribute actively to reducing the greenhouse gas emissions of our industry.

**Increased density, greater urbanization and territorial divides**
Around 70% of the world's population is expected to live in cities by 2040. By 2030, there will be 43 “megacities” with over 10 million inhabitants, compared to 31 today. Many countries will face challenges in meeting the needs of their growing urban populations, including housing, transportation, energy systems and other infrastructure, as well as employment and basic services. This rapid growth of cities creates major challenges to improve access to more rural areas, as well as new issues surrounding peri-urban areas and how to connect them to city centres. This requires developing new mobility solutions that satisfy all segments of the population.

**Aging population**
Between 2000 and 2050, the share of the world's population over the age of 60 will double from about 11% to 22%. Seniors need specific adapted services because they are more likely not to own a vehicle (unable to drive), but may also suffer from physical pathologies related to ageing or may feel insecure (due to crowds, getting on and off transit vehicles, etc.), which discourages them from using public transportation. This requires designing solutions that create a feeling of security and are better adapted to an aging population.

**Increased individuation and autonomy needs**
Individuation should not be confused with individualism. It reflects a culture of choice, not necessarily of the self. It is a reaffirmation of individual freedom, of the right of everyone to choose their lifestyle. This highlights the importance of offering customised/tailored solutions, which the proper use of data makes it easier to design and deliver.

**Data-centric innovation**
Technological advances in telecommunications networks and the spread of smartphones enable everyone to choose the mobility solution that suits them best, at the last minute and based on real time data. This convenience has created new expectations and new travel choices (immediate, simple, unified, personalized, sustainable, etc.). The growth of the sharing economy and consumption that focuses on use is already a reality in the transportation sector with the emergence of on-demand services (carpooling, carsharing, etc.), mobility platforms and a new vision of customer relations. A new intermodal landscape is taking shape, gradually erasing the

boundaries between public mass transit and on-demand and customized transportation solutions.

## 4.1 State of the Art of several PT networks / PT operators worldwide

Very often people associate Public Transport services with what we generally call Mass Public Transport which is only a part of the services that a Public Transport operator can offer. In the Figure 4 we present the vision of UITP about the redefinition of the Public Transport and we can observe the services are numerous.

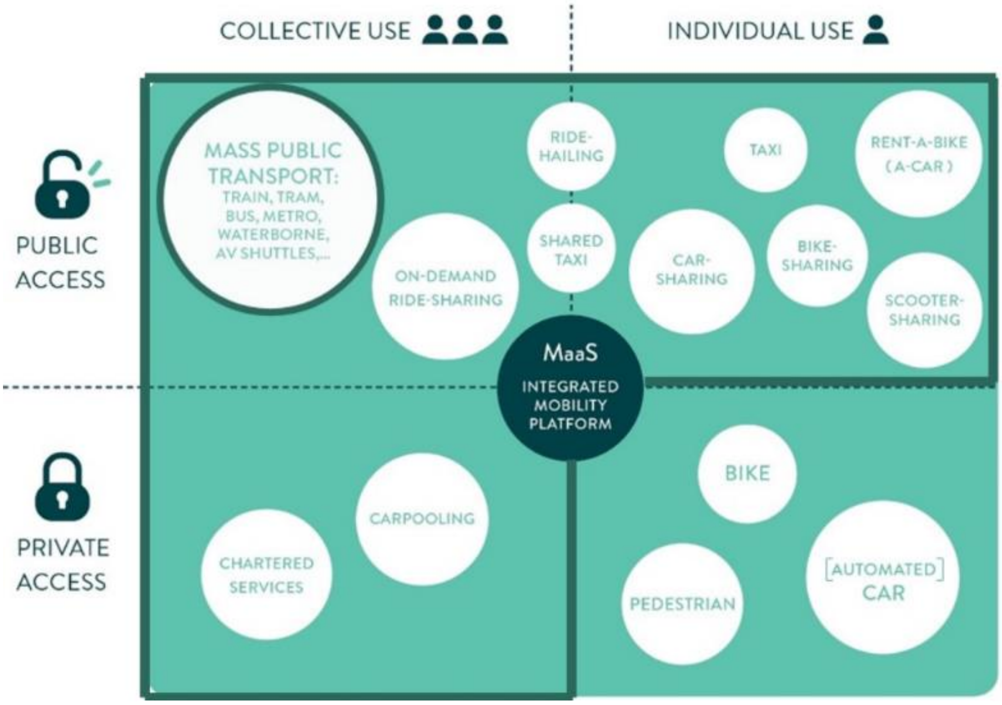



**Figure 4 – "Redefining Public Transport" by UITP**

As a representative example of the numerous modern transport services operated by a Public Transport Operator, we present in Figure 5 the situation of Transdev.

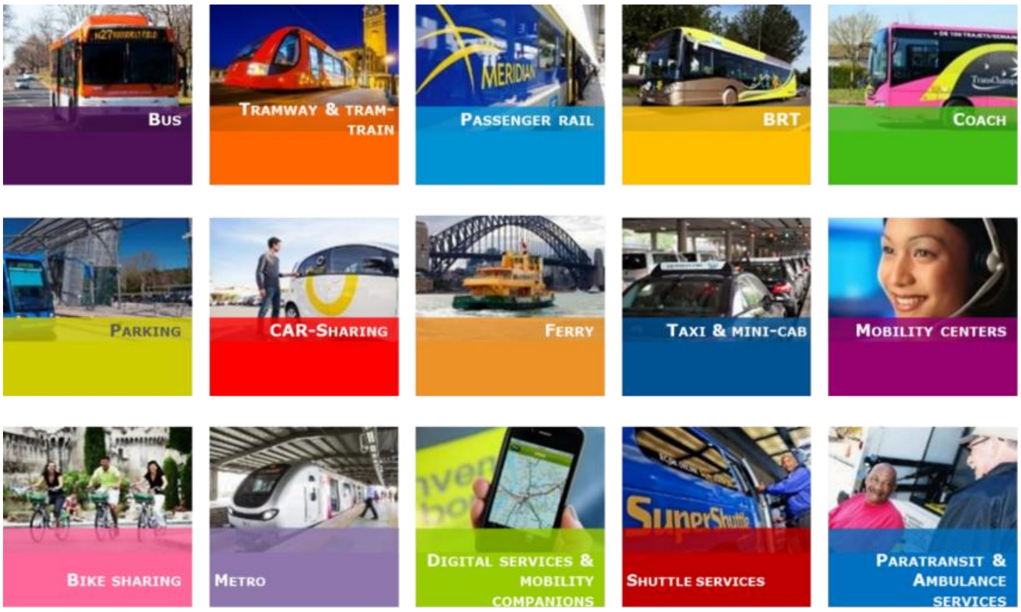



**Figure 5 – Example of services operated by Transdev, a Public Transport Operator (Source: Transdev)**

These modern services exist and interacts within a competitive environment within the mobility ecosystem:

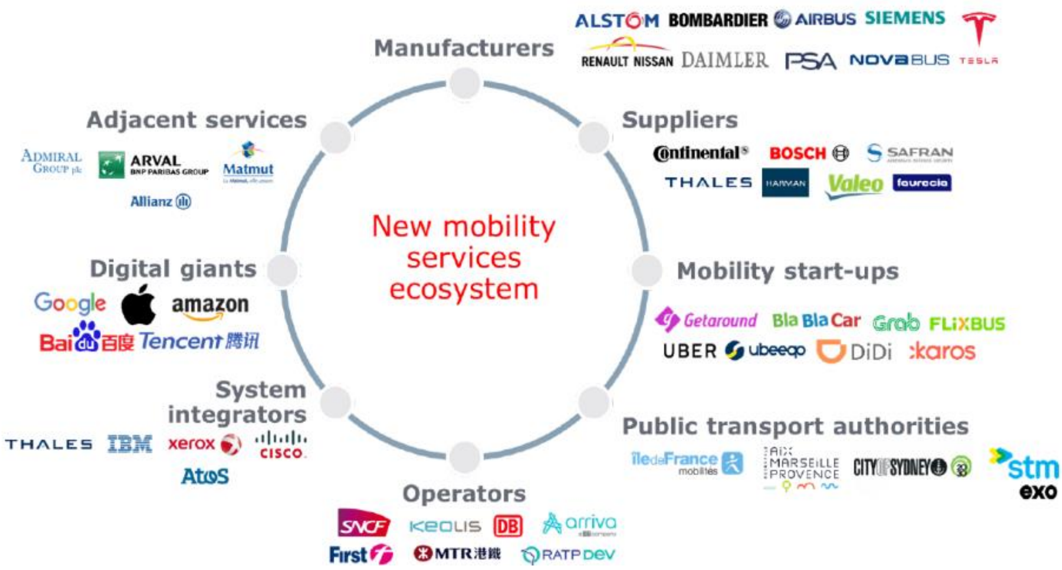



**Figure 6 – The mobility ecosystem - a competitive environment (Source: Transdev)**

Main conditions within mobility ecosystem:

- Historical competitors: Transdev, RATP, Deutsche Bahn, SNCF, Keolis, MTR...;
- Few transit authorities that increasingly operate services themselves, as their teams acquire greater transportation expertise. Who operates the services (PTO or in-house operation) varies a lot in different cities and a lot of parameters can affect the decision? For sure is that in most of the cities there is an increase range of mobility services, with even more constraints to be respected. It is well-known that the major constraint is the low budget allocated to the mobility.

- The global mobility market has been reshaped by the arrival of new players complementing existing PT services with new innovative services, in the field of micro mobility or on demand services:
    - start-ups that offer innovative services and implement new business models;
    - major groups originally positioned in other sectors: automobile manufacturers, equipment manufacturers, car rental companies and software publishers, which are increasingly active in the mobility sector.

One additional import factor of this ecosystem are the local, national and international stakeholders. At national and international level, the PTOs interact with a large ecosystem: mobility authorities, municipalities, shareholders, employees and their representatives, partners and subcontractors, suppliers, insurers, passengers, residents, associations and local players in employment and education, opinion leaders and think tanks, etc.

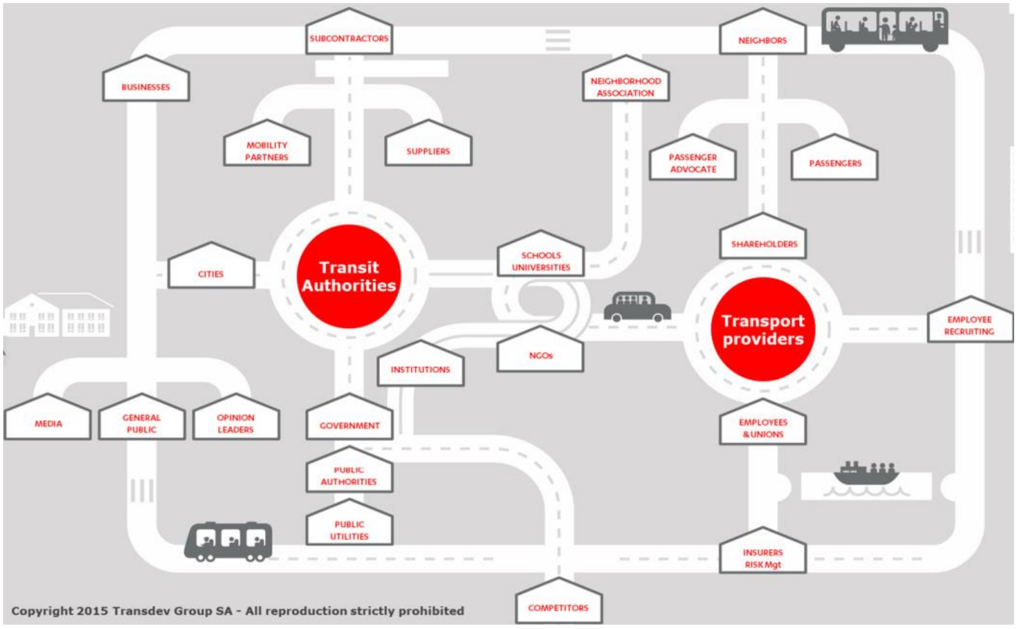



**Figure 7 – Local, national and international stakeholders involved in the mobility ecosystem (Source: Transdev)**

"Recent studies by MIT (New York), ITF (Lisbon) and the VDV (Stuttgart) have shown that it would be possible to take every citizen to their destination with at least 80% fewer cars! Removing four out of every five cars would have a significant positive impact for cities and affects not only the environment, traffic efficiency, and parking but also frees up a lot of urban space. In many cities, on-street parking accounts for a vast amount of land, which could be freed for other uses.

Fewer cars would also lower the cost of building and maintaining roads and generate less noise whilst having a smaller environmental impact. Driving patterns of vehicles could be algorithmically optimised, but most importantly: self-driving vehicles would also provide much safer roads as today 1.2 million worldwide a year die in automobile-related deaths and 90% of the accidents are due to human error.

BUT this will only happen if AVs are introduced in fleets of driverless shared automated vehicles of different sizes reinforcing an efficient high capacity public transport network supporting walking and cycling. Indeed, the above-mentioned studies clearly state that these results are only obtained if automated vehicles are shared and they complement an efficient high-capacity public transport system. Public transport is and remains the only solution able to fulfil the lion's share of trips by using a minimum amount of space in dense urban environments and enabling people to travel in a time-efficient manner." [Source UITP Policy Brief 2016]

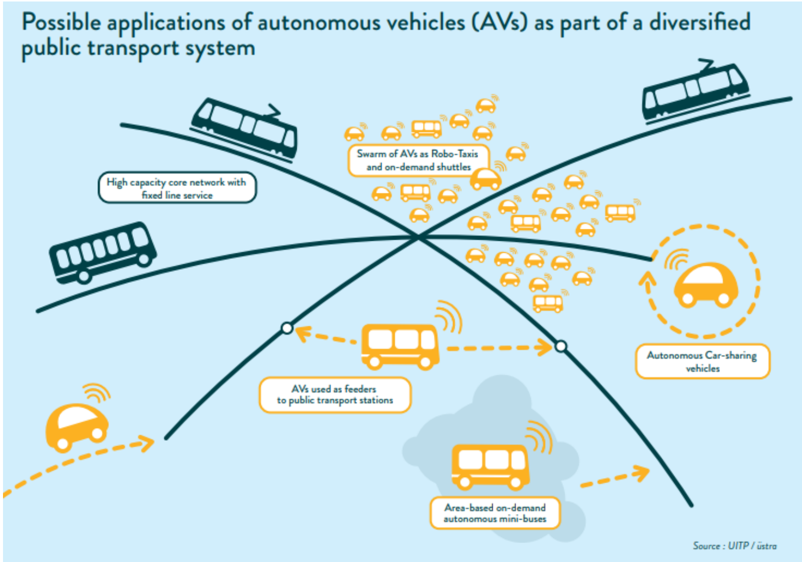



**Figure 8 – Possible applications of automated vehicles (AVs) as part of a diversified public transport system (Source: UITP Policy Brief)**

Public transport offers the quickest development path to full autonomy because it can start operating in a limited area.

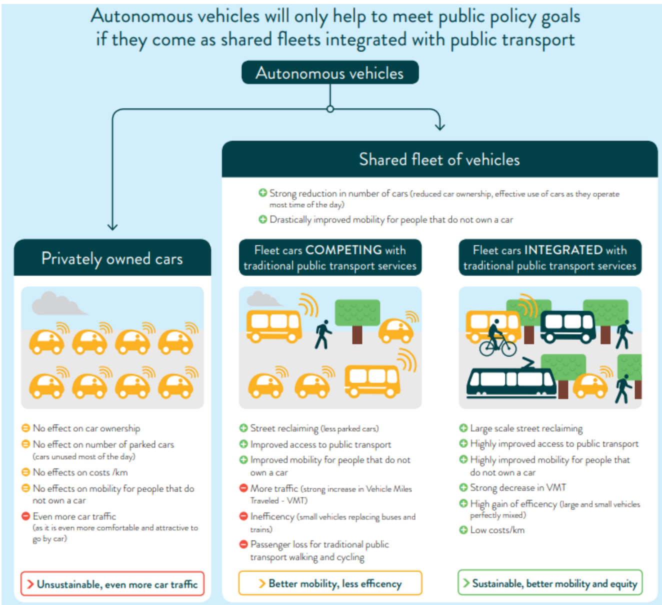



**Figure 9 – Automated vehicles will only help to meet public policy goals if they come as shared fleets integrated with public transport (Source: UITP Policy Brief)**

The following paragraphs describe representative public transport networks in different cities as example of modern PTO and their existing businesses and challenges. The given examples also includes the description of basic business ecosystem for the business and operating models represented in the mobility service canvasses.

### 4.1.1 The Public Transport Network in Rouen Metropolis

The Mobility Service Canvas (MSC) gives a fast overview over the services Transdev offers as well as other important information about the services and the mobility operator.

**Table 13 – Mobility Service Canvas Rouen Metropolis**

| Mobility Service Canvas | |
|---|---|
| **Name** | Transdev Group and Transdev Autonomous Transport Systems<br>transdev<br>the mobility company |
| **Short description** | Leader in public transport and AV mobility services:<br>• development and supply of ATS (Autonomous Transport System);<br>• operation of AV fleet (+50 experimentations worldwide);<br>• 2 major R&D projects:<br>○ RNAL : Rouen Normandy Autonomous Lab ;<br>○ Paris-Saclay Autonomous Lab |
| **Website / Reference** | • https://www.transdev.com/fr/<br>• https://www.rouennormandyautonomouslab.com/ |
| **Service Developers** | • Transdev Autonomous Transport System |
| **Primary Operator** | • Transdev Rouen |
| **Target users and mobility needs** | • Residents of Rouen<br>• Tourists<br>• Commuters |
| **Mobility Services** | • Public transportation services |
| **Related Services** | • Intermodal Hub in city centre;<br>• Mobile app for trip planning and booking;<br>• Fleet supervision for AVs, integrated to PT control centre, in permanent communication with passengers in AVs. |
| **Mobility Service Operators** | • Transdev Rouen;<br>• Transdev Autonomous Transport Systems |
| **Access to the Services** | x Public<br>□ Registered users<br>□ Private |
| **Type of environment** | x Urban<br>x Interurban - Suburban<br>□ Highway<br>□ Rural<br>□ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane |

| Mobility Service Canvas | |
|---|---|
| | □ Dedicated lane |
| **Operations Parameters** | • To be defined |
| **Status** | □ In development, since<br>□ First trial<br>x In experimentation since 2018 |
| **Areas/routes covered and number of people/amount of goods transported per service** | • No information available |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | • No information available |
| **SME Aspects** | • No information available |
| **Model type (A)** | x PTO (public transport operator)<br>□ non-PTO based shared mobility services<br>□ Carsharing<br>□ Bike sharing<br>□ Vehicle-based logistics<br>□ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | From an organizational point of view (see SHOW proposal)<br>x a Public Transport Authority regulated model (PSO)<br>□ Central Model<br>□ Liberal Model<br>□ Aggregator Model<br>□ Social innovation |
| **Model type (C)** | From a targeted client type point of view:<br>x B2G (government)<br>□ B2C<br>□ B2B<br>□ P2P<br>□ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>• Shared mobility services (shuttles or buses) |

| Mobility Service Canvas | |
|---|---|
| | • Metro |
| **Connected Mobility Aspects** | □ V2V<br>□ V2I<br>□ V2P<br>□ V2N<br>x None |
| **Electrified vehicles used per service** | Yes, all automated vehicles will be electric |
| **Automated vehicles used per service** | Automated shuttles and robo-taxi |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • No information available |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>□ Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | MaaS and DRT will be studied |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | Transdev Rouen itself is a PT operator. |

The following text gives a more detailed description of the state-of-the-art.

Rouen is a city on the River Seine in northern France. It is the capital of the region of Normandy. Formerly one of the largest and most prosperous cities of medieval Europe, the population of the metropolitan area (French: agglomération) is now 111,557.

In collaboration with the Rouen Normandie Metropolis, Transdev Rouen contributes to the development of the transport offer to support travellers from the Astuce network on all their journeys.

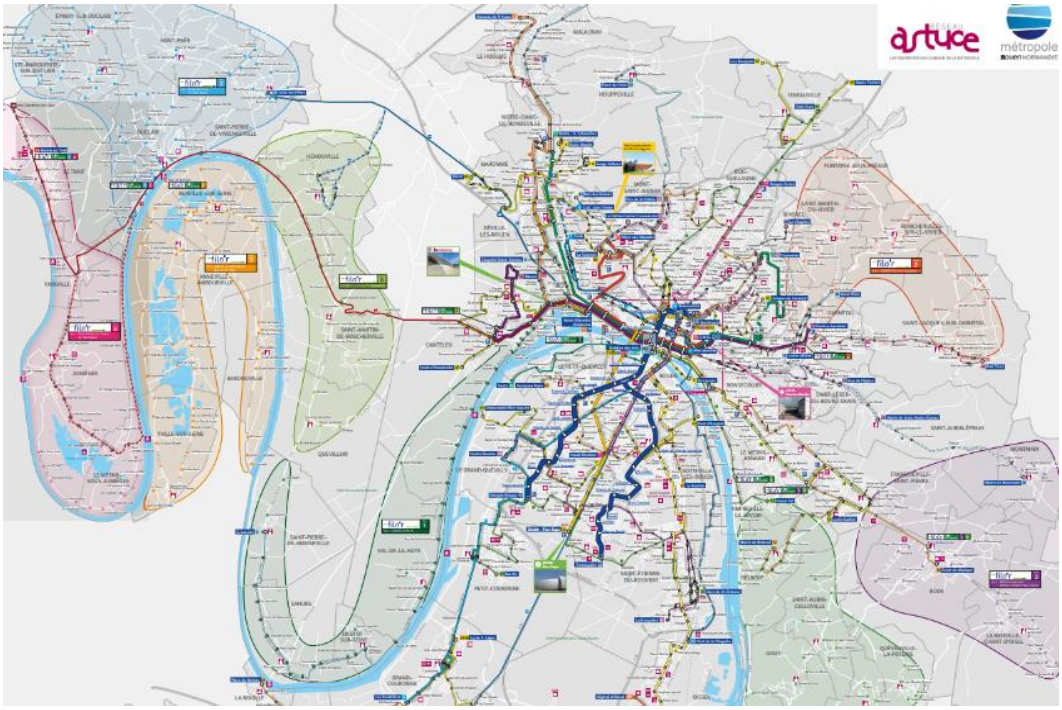


**Figure 10 – Rouen-France - Map of the PT network (Source: Réseau astuce Les Transports en Commun de la Métropole, 2020)**

The transport network covers 45 cities and villages, regrouping 415,800 inhabitants on 387 km$^2$. For Transdev it represents the biggest concession in France. In order to highlight the importance of the Public Transport in Rouen Normandy metropolis,  a few key data are:

- 1 155 employees
- 117 million euros of turnover
- 236 vehicles and 28 trams
- 50 million trips a year
- 14 329 million of kilometres a year
- Modes of transport:
    - 2 metro lines
    - 3 bus rapid transit lines “TEOR”
    - 5 high-performance bus lines
    - 60 bus & school lines
    - 4 on demand taxi lines and 1-night service

### A multi-modal network: METRO / TEOR / BUS

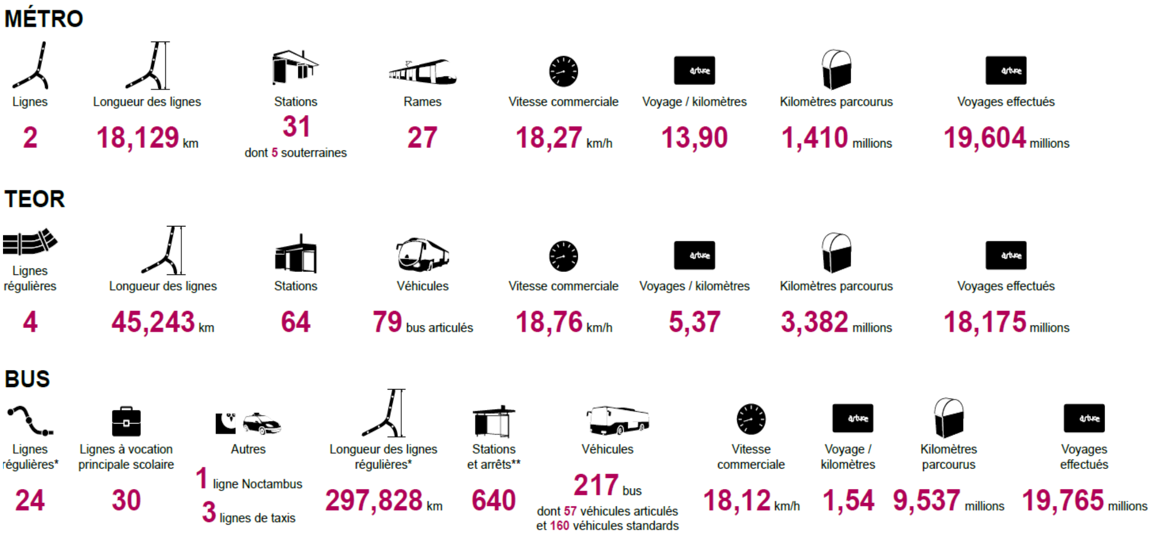



**Figure 11 – Key data about the multimodal public transport network of Rouen (Source: Transdev)**

### High Quality System Bus "TEOR": A first in France since 2001

Since 2001 the Rouen Metropolis invested in automation. The TEOR is a high-quality system with Level 2 SAE automated bused using optical guidance.

- Optical guidance system
- 3 lines – 79 vehicles (+15 new buses since 2018)
- A new line is in operation since September 2019

**Figure 12 – High Quality System: 3.7 km/year and more than 19M trips/year (Source: Transdev)**

**SMS Ticket: A first in France in 2017**

Another example of innovation is the SMS ticket. In 2017 this new way of buying tickets represented a first in France. The system became popular and the last year we noticed an increase of +25% of single trip tickets sold by SMS. The system is very simple to use: NO app, NO inscription required, it is enough to send an SMS to a dedicated number and the price of the ticked is rebilled by the mobile/telephone operator.

**Figure 13 – SMS Ticket (Source: Transdev)**

**On demand services**

Without going in the details, we would like to highlight the fact that two on demand services were implemented in Rouen:

- On demand buses
- On demand shared taxis on 3 fixed lines substituting buses during low demand periods.

**Connected driver hub: for all drivers since 2017**

Another innovation is represented by the connected driver hub. In few words, the driver has access whenever and wherever at shift schedule, holiday request management, roadworks, contacts, hr info…

This new tool makes drivers' shift management easier while improving their commitment. The success of the system is measured in numbers: more than 600 connections per day and 15,000 per month.

**Autonomous Transport Systems**

The presence of Transdev in 20 countries, across four geographical zones, enables them to implement a tailor-made development plan, managed by a dedicated team, for each autonomous fleet.

More than **3.5 million passengers transported, and 1.5 million km travelled** using Transdev shared autonomous transport services **(vehicles without steering wheel or pedals).** Transdev is leader in operating shared autonomous mobility services. We operate shared transport services using **automated vehicles from any manufacturer (**Figure 14**).**

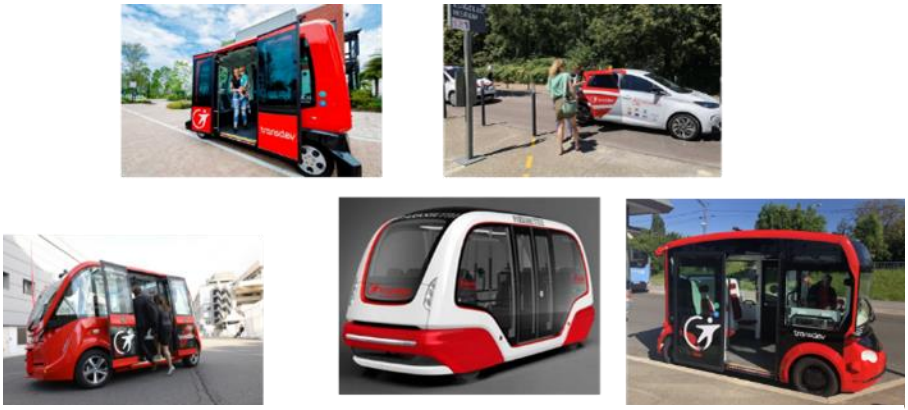


**Figure 14 – Transdev has a multi-manufacturer positioning, operating 5 different brands of AVs (Source: Transdev)**

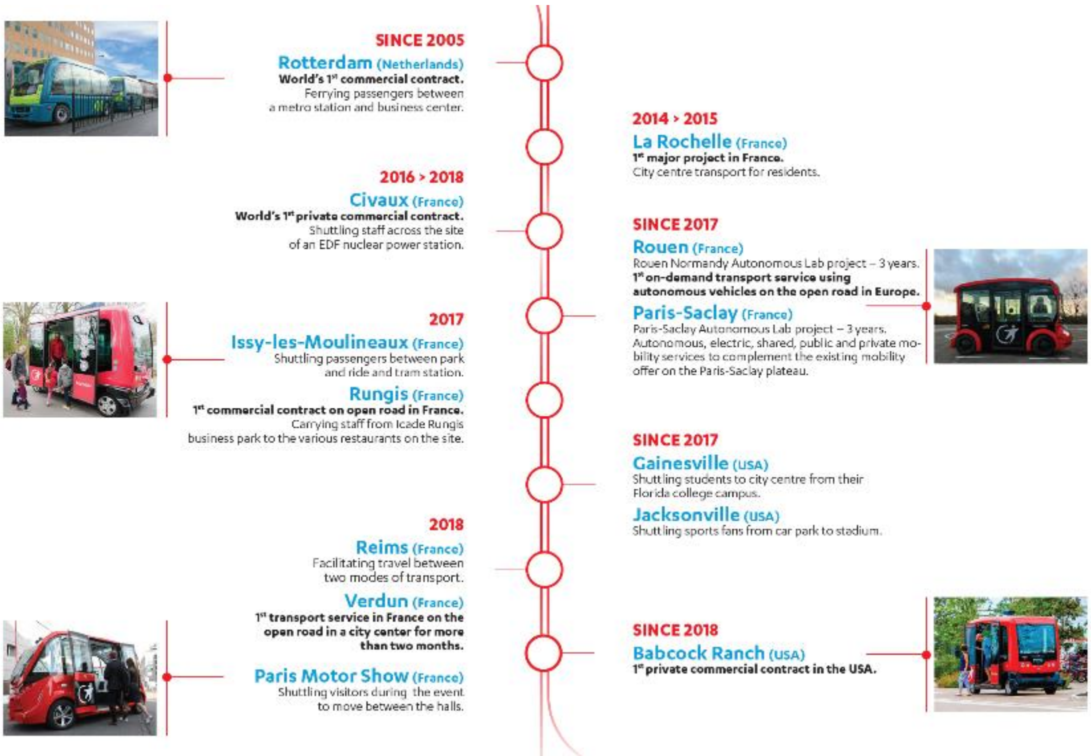



**Figure 15 – Transdev is leader in operating shared autonomous mobility services with 3.5 million passengers transported (Source: Transdev)**

One of the main projects where Transdev is highly involved in is based in Rouen. For 3 years (2017-2019) the RNAL Project (Rouen Normandy Autonomous Lab) is being implemented as the first on-demand transport service using autonomous electric vehicles on open road in Europe. The RNAL project is taking place in the heart of Le Madrillet one of the most dynamic areas in Rouen Metropolis, in a strategic point in the south entrance in Rouen.  In the RNAL project, four Renault ZOE all-electric cars, equipped with autonomous systems developed by Transdev and Renault, are being tested on open roads. The fleet will also feature an i-Cristal autonomous urban shuttle jointly developed by Transdev and Lohr. **The tests cover all use cases related to typical traffic conditions, such as other vehicles, intersections, roundabouts and building exits.**

The vehicles will run on three loops covering 10.5 kilometres, with 17 stops across the district.  All three loops are connected to the south east terminal of the Metropolis tramway and will be fully opened to public in 2019.

**Figure 16 – Rouen Normandy Autonomous Lab - Robotaxi (a), i-Cristal automated shuttle (b) and on demand app (c) (Source: Transdev)**

The demo will use ITS G5 networks, and in addition secure telecommunication networks (4G-5G). The required C-ITS stations and systems will be implemented for the project.

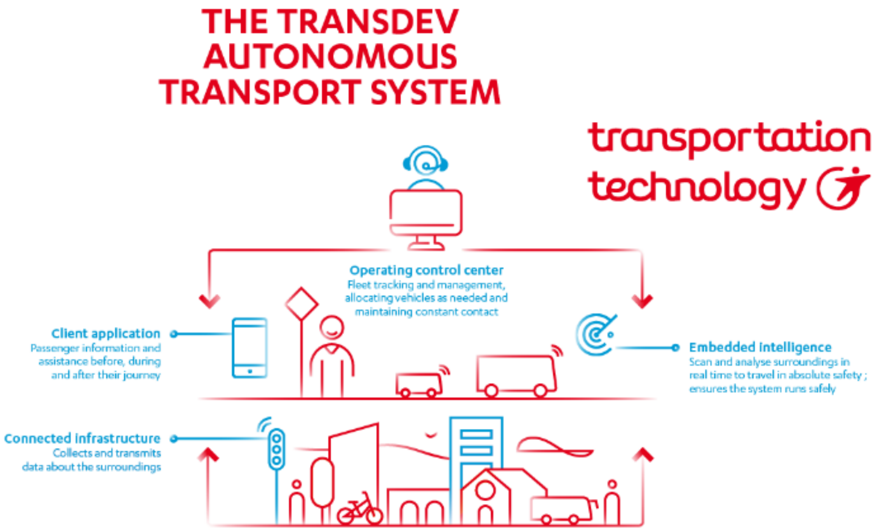



**Figure 17 – Transdev Autonomous Transport System - high level architecture (Source: Transdev)**

A supervision centre will be used in Rouen. The system includes a user app to request transportation, along with a fleet control room, smart infrastructure (extended perception) and secure telecommunications networks (4G-5G). The operator will monitor the fleet from the control room. Audio and video communications between passengers and the control room will also be possible at any time. The infrastructure is tested in Le Madrillet – RNAL Project and the best technical solutions will be implemented on the SHOW location. Both shuttles and automated taxis will use the same technology.

Transdev engaged to build a “complete” autonomous transportation system in order to and provide an open-road service at speeds equivalent to those of conventional vehicles while ensuring passenger safety. The aim is to integrate innovative fleet management concepts in order to provide a smart, smooth, safe and efficient traffic flow of automated vehicles.

In this project Transdev would like to:

- **Use of a single fleet control management system for multiple brands of vehicles** (Renault, Lohr); Standardisation of interfaces in order to facilitate the connection with a range of manufacturers;
- **Integrate the fleet control of the automated vehicles with the Operations Control Centre of the city of Rouen to facilitate the global management of the traffic in the city.**
- **Integrate ITS and intelligent communication** infrastructure (sensors at intersections or at points of vigilance) according to the use case (urban and peri-urban areas);
- **Provide recommendation for the standardization of supervision procedures for the fleet of vehicle and of the intervention procedure of the human operator** (remote supervision, monitoring...).

### 4.1.2 The PT Network in Kista, Stockholm

The Mobility Service Canvas (MSC) gives a fast overview over the services Keolis offers in Kista as well as other important information about the service and the mobility operator.

**Table 14 – Mobility Service PT service Kista**

| Mobility Service Canvas | |
|---|---|
| **Name** | **PT service Kista** |
| **Short description** | The PT service in Kista consists of metro, commuter trains and bus |
| **Website / Reference** | https://kista.com/english/ |
| **Service Developers** | • Keolis |
| **Primary Operator** | • Keolis |
| **Target users and mobility needs** | • Commuters<br>• Inhabitants of Stockholm, city district of Kista |
| **Mobility Services** | • Public transportation services: Metro, commuter train, bus |
| **Related Services** | • No information available |
| **Mobility Service Operators** | • Keolis |
| **Access to the Services** | x Public<br>☐ Registered users |

| Mobility Service Canvas | |
|---|---|
| | ϒ Private |
| **Type of environment** | x Urban<br>□ Interurban<br>□ Highway<br>□ Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | • No information available |
| **Status** | □ In development, since …<br>□ Trial, since …<br>x In operation, since |
| **Areas/routes covered and number of people/amount of goods transported per service** | Kista district in Stockholm |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | • No information available |
| **SME Aspects** | • No information available |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>□ Carsharing<br>□ Bike sharing<br>x Vehicle-based logistics<br>□ TMC-based services<br>ϒ Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>□ Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view: |

| Mobility Service Canvas | |
|---|---|
| | x B2C<br><br> B2B<br><br> P2P<br><br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | • No |
| **Connected Mobility Aspects** |  V2V<br><br> V2I<br><br> V2P<br><br> V2N<br><br>x None |
| **Electrified vehicles used per service** | Yes<br><br>• Number of electric vehicles: No information available<br>• Share of electrification: Metro and train 100% |
| **Automated vehicles used per service** | No |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • No information available |
| **Amplitude (Service Period)** | x Daytime<br><br>x Rush hour<br><br>x Off-peak hour<br><br>x Night-time<br><br>x Weekdays<br><br>x Weekend<br><br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br><br>MaaS - Mobility as a service<br><br>Laas - Logistics as a service<br><br>DRT - Demand-responsive transport | • No information available |
| **Relation to PT (coordinated by PT)**<br><br>PT – Public transport | The service of Kista itself is a PT service |

Keolis in a multinational public transport operator. In several of its markets, it has been testing and deploying automated vehicle pilots, as well as implementing on-demand transportation services, specifically in cooperation with the software development of Via.

For example, in Keolis' home market of France, collective transportation is considered a public service. Therefore, allocating public funds to ensure a minimum of accessibility to all is accepted by residents, and provided for by law. A public transport operator must fulfil all requirements under a public-service delegation contract but can limit financial risks either because part of the investment is covered by public funds or running costs are shared if the service is not profitable. The city of Pau decided to manage a multimodal supply, offering access to a public transport network, a bike-sharing system, and round-trip car sharing, which Keolis operates; this allows for a transportation authority that oversees managing all mobility services in the urban area. Such a fully integrated system is justified to offer a package of alternative services to car use and encourage reduced car ownership. The goal is to complement, or supplement other transport offers in off-peak hours, improve transport efficiency in areas with little coverage, and provide a customer experience that's flexible.

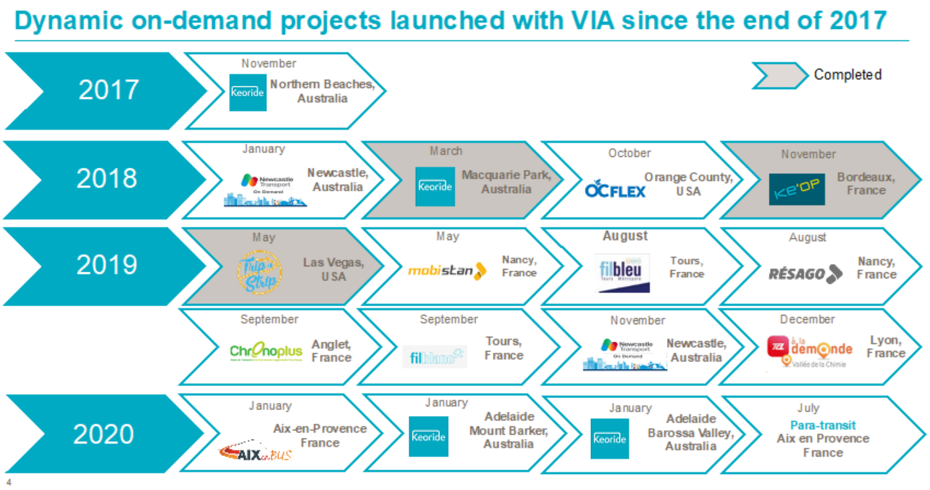



**Figure 18 – Dynamic on-demand projects launched by Keolis with VIA since the end of 2017 (Source: Keolis)**

At the end of 2019, the public transport authority SYTRAL in Lyon launched an on-demand transport service as part of the public transport network operated and maintained by Keolis. The service will operate in Lyon's 'Chemical Valley' (Vallée de la Chimie), an area south of the city which contains a high concentration of chemical industries. The aim is to provide a flexible transport solution for sparsely populated areas and large zones like business parks, as backup for traditional regular services and to refine existing transport services. The new service will operate from Monday to Friday, with 6 or 7 to nine-passenger vehicles, four of which run on natural gas and two of which are hybrid. Passengers will be able to use the on-demand transport service to travel wherever they wish inside the Chemical Valley area, or travel to the

**Figure 19 – Kista Science City, aerial view (Source: Stockholm Discovery AB, n.d.)**

Chemical Valley area from one of the TCL network connection points at Gare d'Yvours, Hôpital Feyzin Vénissieux and Saint-Fons 4 Chemins. Fully integrated in the existing network, these new link services can be used by passengers with a TCL ticket or travel card. Bookings can be made in advance or in real time, on the website tcl.fr, via the Allô TCL service, or using the special TCL Vallée de la Chimie app.

In the SHOW project, Keolis is managing automated vehicles and on-demand transport pilots in Kista Science City, a suburb north of the centre of Stockholm (see Figure 19).

The public transport network of the city comprises of buses (inner-city – outer city), metro lines (Tunnelbana), long-distance, regional rail, commuter train (pendeltåg), light rail and archipelago boats. The Stockholm public transport system (SL) consists of about 450 bus lines, three shuttle boat lines, metro stretching over a distance of 100 kilometres, in addition to other trams and local trains. Every day, almost 800,000 people travel by public transport in the region of Stockholm; during the next ten years, approximately 350,000 additional people are expected to move to Stockholm. According to a report in Dagens Nyheter, by 2027, the population will reach 2.6 million, an increase of 15 percent compared to 2018, making Stockholm the fastest growing city in Europe.

**Table 15 – Public transport infrastructure and service characteristics of Swedish and international cities. (Kenworthy, K2 Working Paper, 2020).**

| Variable | Units | Stockholm |
|---|---|---|
| Total length of public transport lines per 1000 persons | m/1000 persons | 4,867 |
| Total length of reserved public transport routes per 1000 persons | m/1000 persons | 234 |
| ** Busway length per 1000 persons* | *m/1000 persons* | 42 |
| ** Minibus reserved route length per 1000 persons* | *m/1000 persons* | 0 |
| ** Segregated tram network length per 1000 persons* | *m/1000 persons* | 0 |
| ** Light rail network length per 1000 persons* | *m/1000 persons* | 54 |
| ** Metro network length per 1000 persons* | *m/1000 persons* | 48 |
| ** Suburban rail network length per 1000 persons* | *m/1000 persons* | 90 |
| ** Ferry network length per 1000 persons* | *m/1000 persons* | 0 |
| Total public transport vehicles per 1000 persons | units/1000 persons | 1.31 |
| ** Buses per 1000 persons* | units/1000 persons | 0.95 |
| ** Minibuses per 1000 persons* | units/1000 persons | 0.00 |
| ** Tram units per 1000 persons* | units/1000 persons | 0.00 |
| ** Light rail units per 1000 persons* | units/1000 persons | 0.09 |
| ** Metro units per 1000 persons* | units/1000 persons | 0.20 |
| ** Suburban rail units per 1000 persons* | units/1000 persons | 0.06 |
| ** Ferry units per 1000 persons* | units/1000 persons | 0.01 |
| Total public transport vehicle kilometres of service per capita | v.km/person | 114.2 |
| ** Bus vehicle kilometres per capita* | *v.km/person* | 56.3 |
| ** Minibus vehicle kilometres per capita* | *v.km/person* | 0.0 |
| ** Tram wagon kilometres per capita* | *v.km/person* | 0.0 |
| ** Light rail wagon kilometres per capita* | *v.km/person* | 6.5 |
| ** Metro wagon kilometres per capita* | *v.km/person* | 43.0 |
| ** Suburban rail wagon kilometres per capita* | *v.km/person* | 7.8 |
| ** Ferry vessel kilometres per capita* | *v.km/person* | 0.5 |
| Total public transport seat kilometres of service per capita | seat km/person | 8,294 |
| ** Bus seat kilometres per capita* | *seat km/person* | 2,796 |
| ** Minibus seat kilometres per capita* | *seat km/person* | 0 |
| ** Tram seat kilometres per capita* | *seat km/person* | 0 |
| ** Light rail seat kilometres per capita* | *seat km/person* | 493 |
| ** Metro seat kilometres per capita* | *seat km/person* | 2,011 |
| ** Suburban rail seat kilometres per capita* | *seat km/person* | 2,905 |
| ** Ferry seat kilometres per capita* | *seat km/person* | 88 |
| Overall average speed of public transport | km/h | 33.6 |
| * Average speed of buses | km/h | 24.8 |
| * Average speed of minibuses | km/h | - |
| * Average speed of trams | km/h | - |
| * Average speed of light rail | km/h | 30.5 |
| * Average speed of metro | km/h | 34.0 |
| * Average speed of suburban rail | km/h | 56.3 |
| * Average speed of ferries | km/h | 20.4 |

The government encourages citizens to use public transportation and cycling at the expense of private cars; the establishing of Stockholm's congestion charge highlights this. The transport system needs to be reliable, faster, comfortable and solve parking problems.

A major part of the economic engine of Stockholm is Kista Science City, a creative melting pot in Stockholm where companies, researchers and students collaborate in order to develop and grow. The foremost sector in Kista is ICT (Information and Communication Technology), and as such it is the headquarters for Ericsson and Huawei's European division, among other companies in the telecommunications sector.

Kista Science City is an important component to the economic engine of Stockholm, however, despite the existence of a light rail station and a metro station (see Figure 20), there remain significant portions of the working population that commute by private vehicle, creating congestion issues and using valuable land resources for parking that would otherwise go into denser commercial or residential development. There are four bus lines that serve Kista Centrum, two commuting trains and one metro line (the 11). Parking charges around Kista reflect the high land prices; fees are applicable 24 hours a day, at rates of 1-4 hrs SEK 35/hr, 4-6 hrs SEK 125, or 24 hrs SEK 150.


**Figure 20 – Map of Kista Bus Stations, Metro Stations and Commuter Rail Stations (Source: Google Maps, 2020)**

Currently, people who have taken automated vehicle rides during a pilot that was held from January to June 2018 in Kista, Stockholm perceive using an AV service to be safe and comfortable. There are two user groups which require special attention: people who walk for daily trips and people who know well about automated driving technology. Persons in the former group view the AV service to be low quality with poor comfort, whereas people who understand the

**Figure 21 - Keolis and Telia showed new Technology for remote control of self-driving small buses. The demonstration took place at Ericsson in Kista in Stockholm for the UITP Congress (Source: Keolis)**

benefits and limitations of current AV technology are more sceptical about the safety of using an AV or connected vehicle service. If on-demand, automated vehicle services were priced competitively in comparison to traveling by metro and train given the same distance, existing car owners would switch from driving to using the service. This is the key goal with on-demand and AV services in the Kista area (see Figure 21).

The findings from that study (Chee, Susilo, Wong and Pernestål, 2020) show that service quality attribute perceptions play an important role in people's willingness-to-pay for AV services. People hold different expectations towards each type of AV service. These expectations act as the minimum requirements for people to pay for the AV services. Respondents are willing to pay more if the service is safe, provides good ride comfort and offers competitive price in comparison to the price travelling by metro and train given the same distance. This is useful to operators like Keolis who are keen to introduce new AV services into the Kista area. It can be applied to understand the expectations of potential users towards a new AV service, and to identify user groups which are willing to pay the service so that the new AV service is designed sensibly according to users' actual needs.

In order to develop AV services in Kista, Keolis and Ericsson have begun developing 5G control tower systems, exploring how this next-level communication technology can be used to remotely control autonomous vehicles (see Figure 22). The 5G technology makes it possible to transfer data at very high speeds in a very secure way so that the vehicle can be controlled in real time and remotely. The technology also makes it possible to determine the position of the vehicle with great precision. To ensure safety, digital fences, so-called geo-fencing, are used to prevent collisions. In addition, special, dedicated IT systems are used that guarantee a very high level of cyber security.

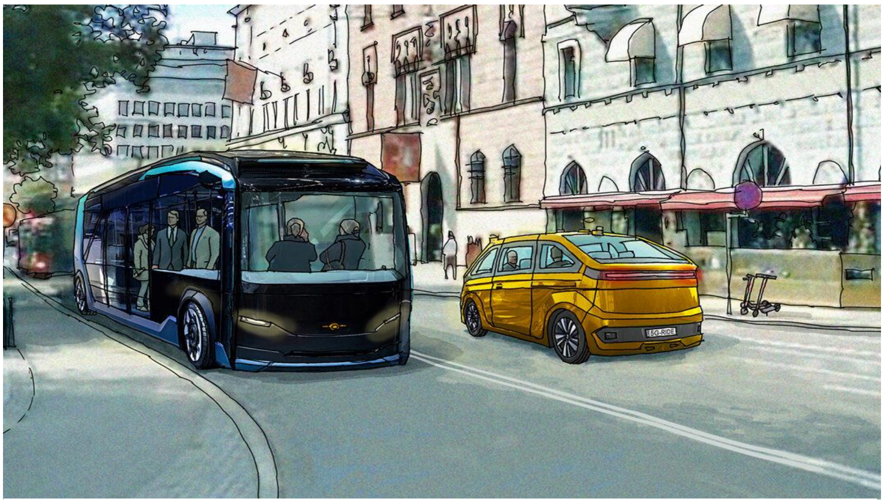


**Figure 22 – Artist rendering of Scania NXT autonomous buses and Navya Autonomous Cab on Kista streets (Source: Keolis)**

The long-term goal is to see a bus operator able to move from the vehicle into a control room and be responsible for several vehicles at the same time. At the demonstration, visitors could control the automated vehicle that was at Ericsson's head office in Kista, 15 kilometres away. The reaction time between the driver's command and the vehicle's reaction is within milliseconds, which means that an important step can be taken in the development of automated vehicles compared to what a 4G network is currently capable.

Based on the experience from the development work, Keolis aims to use 5G technology on self-driving electric minibuses on a large scale, beginning in Kista with the SHOW demonstration.

### 4.1.3 The PT Network in Vienna

The Mobility Service Canvas (MSC) gives a fast overview over the services Wiener Linien offers as well as other important information about the services and the mobility operator.

**Table 16 – Mobility Service Canvas Wiener Linien**

| Mobility Service Canvas | |
|---|---|
| **Name** | **Wiener Linien**<br><br>“The city at your fingertips with a single app” |
| **Short description** | **Wiener Linien** is the main public transportation operator in Vienna. Vienna’s public transport operator and is responsible for some 180 underground, tram and bus lines. The underground network extends to 83 kilometres, the tram network comprises around 220 kilometres, which makes it the sixth-largest in the world, and our bus lines travel a network of 850 kilometres.<br><br>**WienMobil** – the new mobility app from Wiener Linien – means that you now have the entire city at your fingertips. This new service combines the offerings of various mobility providers in a single app.<br><br>Regardless of whether you travel with public transport, by bike, with a car-sharing vehicle, a taxi, on foot or using a combination of these forms of mobility, WienMobil displays all the options available.<br><br>The app also allows you to buy a ticket, book a car-sharing option or a taxi – no problem. Everything in a single app.<br><br>Lighthouse project for other cities like Graz, Linz, Salzburg, Klagenfurt, Innsbruck and others |
| **Website / Reference** | https://www.wienerlinien.at/eportal3/ep/channelView.do/pageTypeId/66533/channelId/-3600061<br><br>https://www.wien.info/en/travel-info/transport/wienmobil<br><br>Video: https://youtu.be/7XG2gtoE7fI<br><br>https://youtu.be/g6Et2a8pFR0 |
| **Service Developers** | • Wiener Linien GmbH & Co KG |
| **Primary Operator** | • Wiener Linien GmbH & Co KG |
| **Target users and mobility needs** | WienMobil is an app which allows users to completely plan, book and pay for their journeys from door to door, using all different modes of transportation, as well as providing personalized journey planning. You can choose journeys based on any preferences, and also see how much energy and money you save by using the modes of transport you choose. |
| **Mobility Services** | • Public transportation services (Underground, Tram, Bus): timetable information, tickets, trip planning, passenger information |
| **Related Services** | • Railway: link to service provider |

| Mobility Service Canvas | |
|---|---|
| | • Car-sharing: link to service provider, reserve and find vehicles, discounts for WienMobil users<br>• Moped-sharing: link to service provider<br>• Scooter-sharing: link to service provider<br>• Bikesharing: link to service provider<br>• Rental Cars: link to service provider, display locations and the number of vehicles at each location, discounts for WienMobil users<br>• Taxi: link to service provider<br>• Parking: link to service provider<br>• Public Charing: link to service provider |
| **Mobility Service Operators** | • **Mobility service operator:**<br>○ PT: Wiener Linien, WESTBahn<br>• **Related service operators:**<br>○ Car-sharing: Car2go, DriveNow, ÖBB Rail&Drive, Stadtauto<br>○ Moped-sharing: ÖAMTC easy way<br>○ Scooter-sharing: Circ, TIER<br>○ Bikes-haring: Citybike Wien, nextbike<br>○ Rental Cars: Europcar<br>○ Taxi: Taxi 31300, Taxi 40100<br>○ Parking: WIPARK<br>○ Public Charing: Tanke Wien Energie |
| **Access to the Services** | x Public<br>☐ Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>☐ Interurban<br>☐ Highway<br>☐ Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | • No information available |
| **Status** | **Wiener Linien:**<br>☐ In development, since …<br>☐ Trial, since …<br>x In operation, since 1865<br>**WienMobil App:**<br>☐ In development, since …<br>☐ Trial, since …<br>x In operation, since 8.6.2017<br>More than 1.000.000 downloads (17/02/2020) |
| **Areas/routes covered and number of** | Vienna Area (Zone 100) |

| Mobility Service Canvas | |
|---|---|
| **people/amount of goods transported per service** | |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | • Circ (SME, LMTS Holding S.C.A.)<br>• Citybike Wien (LE, Citybike Wien is a project of Gewista Werbegesellschaft m.b.H)<br>• EUROPCAR Österreich ARAC GmbH (LE, subsidiary PORSCHE Holding)<br>• nextbikeAT GmbH (LE, part nextbike International)<br>• Österreichischer Automobil-, Motorrad- und Touringclub (ÖAMTC, LE)<br>• ÖBB Rail&Drive (LE, subsidiary ÖBB Holding)<br>• Stadtauto (LE, part of Wiener Linien)<br>• SHARE NOW GmbH (LE, former car2go and DriveNow)<br>• Tanke Wien Energie (LE, Wien Energie GmbH)<br>• TAXI 31300 VermittlungsgmbH (LE)<br>• Taxi 40 100 Taxifunkzentrale GmbH (LE)<br>• TIER Mobility GmbH (SME)<br>• WESTbahn Management GmbH (LE)<br>• Wipark Garagen GmbH (LE, part of Wiener Stadtwerke) |
| **SME Aspects** | • Circ<br>• TIER Mobility GmbH |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>☐ Carsharing<br>☐ Bike sharing<br>x Vehicle-based logistics<br>☐ TMC-based services<br>ϒ Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>☐ Liberal Model<br>☐ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>☐ B2B<br>☐ P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>Sharing aspects are:<br>• (e)car sharing |

| Mobility Service Canvas | |
|---|---|
| | • public charging infrastructure<br>• Shared-Use Mobility (taxi)<br>• Public Transportation<br>• Car-sharing |
| **Connected Mobility Aspects** | □ V2V<br>□ V2I<br>□ V2P<br>□ V2N<br>x None |
| **Electrified vehicles used per service** | Yes (tram, U, busses)<br>• Number of electric vehicles: No information available<br>• Share of electrification: Tram and metro 100%; Busses are NG |
| **Automated vehicles used per service** | Yes (see project auto.Bus Seestadt)<br>• Number of automated vehicles: 2<br>• SAE level: 2 – 3 |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • No information available |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | Maas: integrated planning, links in app, payment for Wiener Linien<br>Missing elements: integration of ÖBB/VOR (S-Bahn, Railway), no joint contracts, no single registration |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | Vienna's main PT provider Wiener Linien started WienMobil to integrate various mobility provider into one platform. |

The following text gives a more detailed description of the state-of-the-art.

Wiener Linien is Vienna's public transport operator and is responsible for around 180 underground, tram and bus lines. The underground network extends to 83 kilometres, the tram network comprises around 220 kilometres, which makes it the sixth largest in the world, and the bus lines travel a network of 850 kilometres. Wiener Linien is committed to providing the best possible service, and to thereby steadily increasing the public transport share of city traffic. The Viennese appreciate this effort: With 38% of all passenger trips in Vienna made using public transport, Wiener Linien lines annually carry a substantially higher share of the city's passenger traffic than do automobiles. Walking (28%) has replaced the car (27%) in second place. On average, some 2.6 million passengers per day use the Wiener Linien network, for which the public transport vehicles cover a distance of 214,000 kilometres – roughly the same distance as orbiting the earth 5 times. In total, approximately 961 million passengers used the Wiener Linien network.

For the fourth time in a row, the number of holders of a Wiener Linien annual pass (852,000) surpassed the number of registered vehicles in Vienna (by 143,000 in 2019). More than 260,000 passengers can ride 1,000 vehicles at a time – more than the number of inhabitants of Austria's second-biggest city, Graz. In 2019, Wiener Linien 450 buses, 500 trams and 150 undergrounds trains travelled a total of over 78 million kilometres. Wiener Linien highly values the welfare of its employees – as befitting one of the largest employers in Vienna. Some 8,600 Wiener Linien employees work 24/7-year-round to provide reliable and timely transportation for our passengers. Staffers work in a wide range of professions, and our HR department processes some 20,000 applications per year.

On 6 June 2019, the time had come for the first driverless bus to enter test operation. The auto.Bus - Seestadt research project (see Figure 23) is being funded by the Federal Ministry for Transport, Innovation and Technology as part of the "Mobility of the Future" scheme. Wiener Linien Managing Director Günter Steinbauer explains, "Autonomous driving is a megatrend with the potential to change cities for good. As a public transport provider, we will be at the forefront of this."

**Figure 23 – Wiener Linien – auto.Bus – Seestadt (Source: Wiener Linien, 2020)**

The auto.Bus – Seestadt project aims to enhance the operational quality of future autonomous bus routes by means of planned technological innovations. The goal is to sustainably increase the efficiency and operational safety of autonomous vehicles, with the goal of testing a bus line in Seestadt under real conditions – with stops, timetables and, of course, passengers.

Figure 24 – Wiener Linien Mass Platform (Source: Wiener Linien, 2020)

Wiener Linien invests into the integration of shared mobility into the PT network through the development of a new MaaS Platform (see Figure 24) and the implementation of mobility stations. Via the Wien Mobil mobile application, Viennese customers have access to routing, booking and purchase possibilities related to various mobility services including services such as car sharing or bike-sharing. The so called WienMobil stations provide physical access to a wide range of mobility services, such as bike sharing, scooter sharing, moped sharing, car sharing, taxi, e-charging, bike parking and cargo bikes.

## 4.2 Business and operating models using Canvas Methodology

### 4.2.1 Business models of Public Transportation

#### 4.2.1.1 Business model in Rouen and Rouen Normandy Autonomous Lab

**Table 17 – Business Model Canvas Rouen and Rouen Normandy Autonomous Lab**

| BUSINESS MODEL CANVAS | Rouen Normandy Autonomous Lab |
|---|---|
| **Value Proposition** | • PTO-centric value<br>  • Linked and highly integrated in the public transport network<br>  • Provide additional efficient public transport services during extended operating hours at lower cost<br>• Social value<br>  • Social inclusion: more mobility options for all (elderly people, disadvantaged communities, children, less populated areas)<br>• Environmental value<br>  • Green Mobility / Better decarbonisation<br>• Political & governmental value<br>  • Relevant decrease of private cars proportion<br>  • Less congestion and more liveable city<br>• Customer value<br>  • Shortened walking distances<br>  • PT stops closer to origins/destinations<br>  • Access to a shared motorized transport service<br>  • Comfortable and accessible transport solutions<br>  • Cost-effective transport alternatives |
| **Customer Segments** | • People living or working in Rouen, searching for transport options between home and workplace and other destinations<br>• Commuters<br>• Tourists<br>• People who want to decrease their transport costs or to decrease the carbon footprint using public transport<br>• Businesses located in Rouen (decreasing freight cost or increase utilization) |
| **Customer Relationships** | • Personal relationship with the operators of the vehicles when needed<br>• Marketing channels<br>• Apps for route planning and/or ticketing<br>• Other digital platforms |
| **Channels** | • The PT service itself<br>• Apps and digital platform for route planning and/or ticketing |

| BUSINESS MODEL CANVAS | Rouen Normandy Autonomous Lab |
|---|---|
| | • Local communication in bus stations or in vehicle<br>• Social media / Website |
| **Key Resources** | • PT service in operation<br>• Astuce app for route planning, ticketing and connected mobility offers |
| **Key Activities** | • Operating the Public Transportation Services in Rouen<br>• Expanding the market share of Transdev' services via new service offers<br>• Marketing activities |
| **Key Partners** | • Operator: Transdev<br>• Organizational stakeholders: Métropole Rouen Normandy, Région Normandie<br>• Vehicle provider: Groupe Renault<br>• Marketing provider: Mamut<br>• Billing system: Banque de Territoires – Caisse de Dépots |
| **Revenue Streams** | • Public Transport Authority regulated model:<br>  • Compensation schemas<br>  • Ticketing |

The business model canvas of Rouen shows the efforts of a PTO to fulfil the requests of a modern life driven by customers, environmental and political stakeholders and to establish a successful business.

#### 4.2.1.2 Business model in Kista, Stockholm

**Table 18 – Business Model Canvas Kista, Stockholm**

| BUSINESS MODEL CANVAS | Kista, Stockholm |
|---|---|
| **Value Proposition** | • Access to existing PT network in Stockholm<br>• Access to a shared motorized transport service<br>• Comfortable and accessible transport solutions<br>• Cost-effective transport alternatives |
| **Customer Segments** | • All people living and working in Kista<br>• Commuters<br>• Tourists<br>• People who want to decrease their transport costs (personal and freight costs)<br>• All companies located in Kista |
| **Customer Relationships** | • Personalized digital platform for route planning and ticketing.<br>• PT information on Keolis website and social media |
| **Channels** | • The PT service itself<br>• Keolis app<br>• Keolis website<br>• Social media |
| **Key Resources** | • PT service in operation<br>• Keolis app for route planning, ticketing and connected mobility offers |
| **Key Activities** | • Operating the public transportation services in Kista<br>• Expanding the market share of Keolis' services via new offers<br>• Marketing activities |
| **Key Partners** | • Partners for extending marketing activities<br>• Partners for service operation<br>• Technology partners |
| **Revenue Streams** | • Keolis tickets and passes. |

The business model canvas of KISTA shows the efforts to further integrate the city district Kista within the public transport network of Stockholm as well as dealing with innovations and new request of a modern transport system.

### 4.2.1.3 Business model in Vienna

**Table 19 – Business Model Canvas Vienna**

| BUSINESS MODEL CANVAS | Vienna |
|---|---|
| **Value Proposition** | • Customer value<br>◦ Shortened walking distances<br>◦ PT stops closer to origins/destinations<br>◦ Access to a shared motorized transport service<br>◦ Comfortable and accessible transport solutions<br>◦ Cost-effective transport alternatives<br>• Provide and manage an efficient transport network for a big European city |
| **Customer Segments** | • People working and living in Vienna<br>• Commuters<br>• Tourists<br>• People who want to decrease their transport costs (personal and freight costs)<br>• Companies located in Vienna |
| **Customer Relationships** | • Personal relationship with the operators of the vehicles<br>• Personalized digital platform for route planning and ticketing<br>• Information on Wiener Linien website and social media |
| **Channels** | • The PT service itself<br>• WienMobil app and other apps<br>• Website & Webshop<br>• Social media |
| **Key Resources** | • PT service in operation<br>• WienMobil app for route planning, ticketing and connected mobility offers |
| **Key Activities** | • Operating the public transportation services in Vienna |
| **Key Partners** | • Partners for extending marketing activities<br>• Partners for service operation<br>• Technology partners |
| **Revenue Streams** | • Wiener Linien tickets and passes<br>• Shareholder contributions<br>• Payment transactions |

The business model canvas of Wiener Linien shows the current approach of a PTO to provide a capable and modern transport system in big city in Europe.

## 4.2.2 Operating models of Public Transportation

### 4.2.2.1 Operating model in Rouen and Rouen Normandy Autonomous Lab

In Rouen, the Autonomous Transport Mobility services are operated directly by Transdev, the Public Transport Operator. As we are speaking about experimentation, at this moment multiple teams are involved:

- Fields teams
- Supervisory team
- R&D Teams from Transdev Group Innovation

The goal for the near future is to have a system that can be operated by any local team with the adequate training.

**Table 20 – Value Proposition Canvas Rouen and Rouen Normandy Autonomous Lab**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Commuting to job<br>• Using PT for leisure activities<br>• More sustainable commuting/traveling<br>• Mobility costs<br>• Access to a shared motorized transport service<br>• Comfortable and accessible transport solutions<br>• Cost-effective transport alternatives |
| Pains | • Time delays<br>• Dirty vehicles<br>• Crowded vehicles during rush hours<br>• Climatization of vehicles<br>• Ticket price strategy (single trip price)<br>• Network extensions and connection of peri-urban regions to PT |
| Gains | • Single contract, cashless payment with a single account (Astuce app/Astuce card) covering all services<br>• Access to sustainable and cost-effective transport solutions<br>• Reduction of car traffic and emissions in Rouen |
| **Value proposition** | |
| Products & Services | • PT services in Rouen and close areas<br>• My Astuce app integrating PT network infrastructure |
| Pain Relievers | • Well-established transport network<br>• Single app for planning, reservation and using different mobility services |
| Gain Creators | • Reliable and cheap access to mobility services substituting private owned cars |

#### 4.2.2.2 Operating model in Krista, Stockholm

**Table 21 – Value Proposition Canvas Kista, Stockholm**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Commuting to job<br>• Using PT for leisure activities<br>• More sustainable commuting/traveling<br>• Mobility costs<br>• Access to a shared motorized transport service<br>• Comfortable and accessible transport solutions<br>• Cost-effective transport alternatives |
| Pains | • Time delays<br>• Dirty vehicles<br>• Crowded vehicles during rush hours<br>• Climatization of vehicles<br>• Ticket price strategy (single trip price)<br>• Network extensions and connection of peri-urban regions to PT |
| Gains | • Access to sustainable and cost-effective transport solutions<br>• Reduction of car traffic and emissions in Kista |
| **Value proposition** | |
| Products & Services | • PT service in Stockholm<br>• Keolis App |
| Pain Relievers | • Well-established transport network |

| VALUE PROPOSITION CANVAS | |
|---|---|
| | • Single app for ticket purchasing, paying and route planning |
| Gain Creators | • Reliable and cheap access to mobility services substituting private owned cars |

The operating model in Kista is optimized for the PTO requirements driven by Stockholm as superordinate transport organization structure. So, the operating model offers the chance to test further developments and innovation, which can be rolled out to other districts or the whole city of Stockholm.

#### 4.2.2.3 Operating model Vienna

**Table 22 – Value Proposition Canvas Vienna**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Commuting to job<br>• Using PT for leisure activities<br>• More sustainable commuting/traveling<br>• Mobility costs<br>• Access to a shared motorized transport service<br>• Comfortable and accessible transport solutions<br>• Cost-effective transport alternatives |
| Pains | • Time delays<br>• Dirty vehicles<br>• Crowded vehicles during rush hours<br>• Climatization of vehicles<br>• Ticket price strategy (single trip price)<br>• Network extensions and connections of peri-urban regions to PT |
| Gains | • Access to sustainable and cost-effective transport solutions<br>• Reduction of car traffic and emissions in Vienna<br>• Single contract, cashless payment with a single account |
| **Value proposition** | |
| Products & Services | • PT services in Vienna and close regions<br>• WienMobil app<br>• Merchandise products |
| Pain Relievers | • Well-established transport network<br>• Single app for ticket purchasing, paying and route planning |
| Gain Creators | • Reliable and cheap access to mobility services substituting private owned cars<br>• Bring more mobility options for regular PT user |

The operating model in Vienna is optimized for the PTO requirements driven by the mobility and transport requirements of a big European city. So, the operating model lays a solid base to test further developments and innovation, which can be rolled out to districts or the whole city of Vienna.

### 4.2.3 Additional business ecosystem conditions

#### 4.2.3.1 Responding to local challenges at the lowest cost

The business model consists in imagining, building, organizing and operating appropriate mobility solutions for everyone, in a highly regulated global passenger transportation market that is open to competition in measures that vary considerably by country and transportation mode.

By example, for Transdev, over 75% of the activities involve contracts to manage transportation services on behalf of local authorities - BtoG activities (cities, metropolitan areas, departments, regions or national authorities). It also works for other private groups and associations.

If a market is open to competition, access thereto is usually decided through a competitive bidding procedure. When the bid documents are prepared, the mobility authority (the client) will determine the specific needs to be met. The bidder whose bid best meets these requirements in terms of understanding local specificities and that offers the most favourable price will be awarded the contract. Therefore, each contract is a unique response to a local demand in terms of transportation modes, and also takes into account the number of vehicles involved (see the section entitled "financing the vehicle fleet), the frequency of service, pricing and the commitments the bidder may make on future developments in the use of the transportation system.

#### 4.2.3.2 Business Model: Compensation by PTAs

When the PTO contracts with government bodies, its clients are mobility authorities. In such case, two forms of collaboration are possible:

- **Gross contracts**: the mobility authority undertakes to pay us a predetermined amount based on a volume of service (in hours or kilometres, for example). All passenger revenue is remitted to the mobility authority. In certain cases, the contract may provide for variable compensation tied to increases in ridership. Apart from such variable compensation, Transdev does not bear the risk of passenger revenue; however, Transdev generally bears the costs necessary to provide a proper level of service in accordance with the contract
- **Net contracts**: under these contracts, we receive a grant from the mobility authority in an amount agreed upon when the contract is signed. All or part of the profits generated from passenger revenue accrue to the PTO (directly, or indirectly under a bonus/penalty system), which assumes the risks in connection with revenue and cost management. The grant is intended to cover the difference between projected revenue and projected costs.

Overall, the allocation of these two types of contracts may vary significantly by country and activity.

#### 4.2.3.3 Cost control

Our most significant cost items are:

- Financing the vehicle fleet (→ not relevant for the further considerations within SHOW);
- Financing the physical and digital infrastructure;
- Employee payroll;
- Energy and fuel costs;
- Financial resources.

**Financing the vehicle fleet -** for contracts with mobility authorities (depending on geographical area and transportation modes), the fleet is provided:

- by the mobility authority; or
- by the PTO. In this case, two situations are possible:
    - The PTO own the equipment;
    - The PTO lease the equipment from a third party, in which case it is not exposed to residual value risk.

In all cases, the equipment must comply with the specifications established by the mobility authority.

**Financing the physical and digital infrastructure** – at this moment tit not clear how the business model will evolve and who will pay for what, but the technology experts consider that for the integration of shared automated vehicles in the global public transport ecosystem, the physical and digital infrastructure will play a crucial role.

Example of physical infrastructure:

- Road type, details and context, special road sections, lanes and carriageways, shoulders and kerbs;
- Road markings, Traffic signs;
- Intersections and connections, (Connected) traffic lights;
- Road equipment or furniture;
- Facilities for vulnerable road users;
- …

Example of digital infrastructure:

- Control centres
  - Fleet control centre[9]
  - Traffic control centre with traffic information system, traffic performance status on road network, …
- Positioning systems;
- HD maps;
- Intelligent sensors installed on infrastructure;
- …

**Employee payroll -** ordinarily, the PTO directly employs the teams that provide its services.

**Energy and fuel costs -** The vehicles are fuelled primarily by diesel, electricity, hydrogen and gas.

**Financial resources -** The PTO rely on a combination of financing, such as:

- the own capital;
- bonds;
- bank loans and placements;
- asset financing consisting primarily of operating leases;
- resources generated by operating working capital;
- profits from operations.

Innovation and attention paid to clients and passengers Our aim is to be a trusted partner of our clients, mobility authorities and private actors, a partner able to implement safe, efficient and innovative mobility solutions that meet evolving expectations in a constantly changing environment.

### 4.2.4 Operational boundary conditions

We have identified the operational risks that require policies, actions and programs to be implemented and deployed throughout our organization and coordinated at the highest level based on defined indicators. This risk identification operation involved all the Group's teams: operational and functional teams, the head office and country teams (see methodological note on risk management: identification, assessment, etc.).

[9] SPACE Project has developed a high-level reference architecture that aims at ensuring a comprehensive and seamless integration of driverless vehicles with other IT systems in the mobility ecosystem using a fleet orchestration platform.

The table below lists the risks and the issues to which they relate, the policies adopted to control them and the associated performance indicators.

## Environmental risks

### Table 23 – Environmental risks

| Main risks | Related issues | Our risk control policies and action plans | Our key performance indicators |
|---|---|---|---|
| Accidental ground pollution | Local pollution | Environmental policy + Our actions and programs in support of the energy and ecological transition and to fight against climate change | Rate of entities that experienced accidental pollution during the financial year |
| Gradual ground pollution | | | |
| Contractual non-compliance in environmental matters | | | Pollutant emissions g/100 km traveled |
| | | | Low-emission fleet rate* |
| Gradual air pollution | Energy transition and climate change | | GHG emissions kg/100km traveled |

*Low-emission fleet definition: Euro VI standards, hybrids, CNG biogas, electric, biodiesel, hydrogen*

## Safety and security risks

### Table 24 – Safety and security risks

| Main risks | Related issues | Our risk control policies and action plans | Our key performance indicators |
|---|---|---|---|
| Serious train accidents | Safety and security of passengers, employees and third parties | Safety policy | Major accidents rate |
| Serious bus accidents | | | Workplace accident frequency rate |
| Workplace accidents | | | Workplace accident severity rate |
| Assaults on employees or passengers | | Security policy* | Workplace accident frequency rate due to assault |
| | | | Workplace accident severity rate due to assault |
| | | | Number of physical assaults on passengers per million km** |
| Terrorist attack | | | Share of countries covered by a national security manager/total number of countries where the company is located* |

** This policy is being deployed* *** This indicator is being deployed and will be calculated on a full-year basis starting in 2020*

## Social risks

### Table 25 – Social risks

| Main risks | Related issues | Our risk control policies and action plans | Our key performance indicators |
|---|---|---|---|
| Absenteeism | Working conditions | Engagement policy<br>+<br>Talents approach and *Learning* approach<br><br>Group Diversity and Inclusion Program | Absenteeism rate |
| Low employee engagement (including psychosocial risks) | Employee development | | Employee turnover rate<br>Engagement policy deployment rate |
| Poor skills planning | | | Percentage of employees who received at least one training course during the year<br>Percentage of employees who had an annual interview* |

**KPI deployed starting in 2019*

## Societal risks

### Table 26 – Societal risks

| Main risks | Related issues | Our risk control policies and action plans | Our key performance indicators |
|---|---|---|---|
| CSR claims against a Supplier | Sustainable resources | Sustainable Procurement policy | Percentage of master contracts > €100,000 that incorporate the Suppliers' Charter (France) |

## Ethics and fundamental rights risks

### Table 27 – Ethics and fundamental rights risks

| Main risks | Related issues | Our risk control policies and action plans | Our key performance indicators |
|---|---|---|---|
| Active bribery of a public official or a regulatory authority and passive bribery of private individuals | Collaboration with local actors and innovative partnerships + business ethics | Ethics and Compliance policy | Percentage of managers trained in anti-corruption measures every 3 years |
| Influence peddling | | | |
| Inappropriate sponsorships | | | |
| Failure to respect human rights in the supply chain (forced labor and child labor) | | Fundamental Rights policy + Group Diversity and Inclusion Program | Annual percentage of projects approved by the Group Engagement Committees for which fundamental rights risks have been assessed and reduced to an acceptable level* |
| Failure to respect freedom of association | | | |
| Discrimination and diversity | Diversity and equal opportunities | | |
| Harassment | | | |

** Failure to respect human rights in the supply chain (forced labor and child labor), failure to respect freedom of association, discrimination, harassment*

# 4.3 User & Role Analysis including user profiles, mobility needs, relative utility

## 4.3.1 User & Roles Analysis in Rouen Normandy Autonomous Lab

In Rouen we are covering a large palette of users that will be able to experiment the services:

- Regular fixed-route shuttles services on a dedicated bus line for commuters, residents, students, PRM;
- Robo-taxi in city centre à residents, students, tourists;

All of them are searching for better transport options between their home/working place or train station (for tourists) and other destinations.

### 4.3.1.1 User roles

#### *4.3.1.1.1 Direct Value Chain Participants*

##### 4.3.1.1.1.1 Service Operator

The service Operator is the Transdev.

##### 4.3.1.1.1.2 Infrastructure and vehicle provider

The infrastructure of the PT network such as PT stops, bus and tram tracks is built by different construction companies.

Energy and fuel for the trams and buses are provided by energy suppliers.

Vehicle providers are companies which are providing Public Transport Authority (PTA) with new buses, trams etc.

##### 4.3.1.1.1.3 Maintenance operator

For the maintenance of the infrastructure, vehicles and buildings Transdev is most likely responsible itself by delegation of the Public Transport Authority (PTA).

##### 4.3.1.1.1.4 Ticket sale reseller

Tickets for the PT service can be directly bought at sales points operated by Transdev employees. But it can also be bought at ticket machines, or at third-party reseller like bar, tourism desk, train station…

##### 4.3.1.1.1.5 Billing system operator

For the digital payment of the tickets via app VISA, MasterCard, Google Pay and Apple Pay can be used. The banks then are responsible for the money transfer. The ticket can also be bough via text message for a regular cost directly charged on passengers' telco provider bill.

##### 4.3.1.1.1.6 IT provider

For the mobile app software is needed. This software was purchased by PTA from IT companies specialized in programming and not created by themselves. Especially, in the automated driving service area the PT provider is not able to contribute its own software for the future service.

##### 4.3.1.1.1.7 Communication provider

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

##### 4.3.1.1.1.8 Marketing provider

Advertising companies are used for marketing measures such as billboards, flyers, online advertising, etc.

For other advertising reasons such as imprints on vehicles printers are needed.

Transdev Rouen is part of the Transdev concern, this of course results in the fact that the concern is also promoting its businesses.

##### 4.3.1.1.1.9 Mobility needs growers

Around or within PT stops there are often businesses and/or restaurants that are profiting of the people using the PT network.

##### 4.3.1.1.1.10 End users

Rouen has a diversity of geographic areas from historic centre to rural areas, with differences in the passenger demand. Whereas the city of Rouen itself has about 111.000 inhabitants, there are in total nearly 500.000 in the metropolitan area. Many parts can be described as car-dependent. 10% of trips are made with PT, whereas 32% of trips in the city of Rouen is un-motorized and 63% motorized either with own car or as car passenger.

#### *4.3.1.1.2 Indirect Value Chain Participants*

##### 4.3.1.1.2.1 Safety provider

In case of accidents or other unplanned events insurances are crucial for transportation companies such as Transdev.

### 4.3.1.2 Mobility needs

#### *4.3.1.2.1 Direct mobility needs*

Public transportation is used to meet all conceivable mobility needs. Whether the services are used for commuting, leisure or business reasons. The frequency of the service adapts to the volume of passengers which changes regularly throughout the day.

#### *4.3.1.2.2 Indirect mobility needs*

Another need is to remove as much vehicles from the streets as possible to improve air quality and to prevent traffic congestion. Therefore, PTOs have always the task to expand the network according to the demand and find new mobility solutions.

### 4.3.1.3 Relative utility

Aim of public transportation operators is to provide sustainable public mobility for people. Even though new urban mobility services such as ride-hailing offers like Uber, carsharing or ridesharing are getting more prominent, these services alone have not the capability or capacity to meet citizens’ mobility needs or to solve other problems like the reduction of emissions and traffic congestion. Public transportation is still the backbone to reduce individual transport. (UITP, 2020) Especially people who are not allowed to drive a car are often dependent on public transportation services.

The same applies to Transdev. The company was founded to supply the citizens of Rouen with environmentally friendly and cheap mobility within the city.

### 4.3.2 User & Roles Analysis in Krista, Stockholm

#### 4.3.2.1 User roles

#### *4.3.2.1.1 Direct Value Chain Participants*

##### 4.3.2.1.1.1 Service Operator

The service Operator is the Keolis located in Kista, Stockholm.

##### 4.3.2.1.1.2 Infrastructure and vehicle provider

The infrastructure of the PT network such as PT stops, train and tram tracks is built by different construction companies. Energy and fuel for the trams and buses are provided by local energy suppliers. Vehicle providers are companies which are providing Keolis with new buses, trams, trains etc.

##### 4.3.2.1.1.3 Maintenance operator

For the maintenance of the infrastructure, vehicles and buildings Keolis is most likely responsible itself.

But to do this task equipment and tools are necessary which is provided by hardware stores.

##### 4.3.2.1.1.4 Ticket sale reseller

Tickets for the PT service can be directly bought by Keolis at its sales points and through employees of Keolis. But it can also be bought at ticket machines and other authorized ticket resellers.

##### 4.3.2.1.1.5 Billing system operator

For the digital payment of the tickets via app VISA, MasterCard, Google Pay and Apple Pay can be used. The banks then are responsible for the money transfer.

##### 4.3.2.1.1.6 IT provider

For the mobile app software is needed. This software was most likely purchased by Keolis from IT companies specialized in programming and not created by themselves. Especially, in the automated driving service area the PT provider is not able to contribute its own software for the future service.

##### 4.3.2.1.1.7 Communication provider

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

##### 4.3.2.1.1.8 Marketing provider

Advertising companies are used for marketing measures such as billboards, flyers, online advertising, etc.

For other advertising reasons such as imprints on vehicles printers are needed.

Transdev Rouen is part of the Transdev concern, this of course results in the fact that the concern is also advertising its businesses.

##### 4.3.2.1.1.9 Mobility needs growers

Around or within PT stops there are often businesses and/or restaurants that are profiting of the people using the PT network.

###### 4.3.2.1.1.10 End users

Every day, almost 800,000 people travel by public transport in the region of Stockholm; during the next ten years, approximately 350,000 additional people are expected to move to Stockholm. According to a report in Dagens Nyheter, by 2027, the population will reach 2.6 million, an increase of 15 percent compared to 2018, making Stockholm the fastest growing city in Europe.

#### *4.3.2.1.2 Indirect Value Chain Participants*

##### 4.3.2.1.2.1 Safety provider

In case of accidents or other unplanned events insurances are crucial for transportation companies such as Keolis.

### 4.3.2.2 Mobility needs

#### *4.3.2.2.1 Direct mobility needs*

Public transportation is used to meet all conceivable mobility needs. Whether the services are used for commuting, leisure or business reasons. The frequency of the service adapts to the volume of passengers which changes regularly throughout the day.

#### *4.3.2.2.2 Indirect mobility needs*

Another need is to remove as much vehicles from the streets as possible to improve air quality and to prevent traffic congestion. Therefore, PTOs have always the task to expand the network according to the demand and find new mobility solutions.

### 4.3.2.3 Relative utility

Aim of public transportation operators is to provide sustainable public mobility for people. Even though new urban mobility services such as ride-hailing offers like Uber, car-sharing or ridesharing are getting more prominent, these services alone have not the capability or capacity to meet citizens' mobility needs or to solve other problems like the reduction of emissions and traffic congestion. Public transportation is still the backbone to reduce individual transport. (UITP, 2020) Especially people who are not allowed to drive a car are often dependent on public transportation services.

The same applies to Keolis. The company was founded to supply the citizens of Stockholm with environmentally friendly and cheap mobility within the city.

## 4.3.3 User & Roles Analysis of Wiener Linien, Vienna

### 4.3.3.1 User roles

#### *4.3.3.1.1 Direct Value Chain Participants*

##### 4.3.3.1.1.1 Service Operator

The service Operator is Wiener Linien located in Vienna.

##### 4.3.3.1.1.2 Infrastructure and vehicle provider

The infrastructure of the PT network such as PT stops is built by different construction companies. Energy and fuel for the buses are provided by local energy suppliers.
Vehicle providers are companies which are providing Wiener Linien with new buses etc.

###### 4.3.3.1.1.3 Maintenance operator

For the maintenance of the infrastructure, vehicles and buildings Wiener Linien is most likely responsible itself.
But to do this task equipment and tools are necessary which is provided by hardware stores.

###### 4.3.3.1.1.4 Ticket sale reseller

Wiener Linien tickets can be bought at its sales points, ticket machines and other authorized ticket resellers such as the so called "Trafik" (Kiosk).

###### 4.3.3.1.1.5 Billing system operator

For the digital payment of the tickets via app after the project is a regular service VISA, MasterCard, PayPal can be used. The banks then are responsible for the money transfer.

###### 4.3.3.1.1.6 IT provider

For the mobile app software is needed. This software was most likely purchased by Wiener Linien from IT companies specialized in programming and not created by themselves. Especially, in the automated driving service area the PT provider is not able to contribute its own software for the future service.

###### 4.3.3.1.1.7 Communication provider

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

###### 4.3.3.1.1.8 Marketing provider

Advertising companies are used for marketing measures such as billboards, flyers, online advertising, etc.
For other advertising reasons such as imprints on vehicles printers are needed.

###### 4.3.3.1.1.9 Mobility needs growers

Around or within PT stops there are often businesses and/or restaurants that are profiting of the people using the PT network.

###### 4.3.3.1.1.10 End users

Vienna has 1.9 million inhabitants and in total 2.6 million in the metropolitan area. It attracts about 7 million tourists each year. On average, about 2.6 million passengers per day use the Wiener Linien network. In total, about 961 million passengers used the Wiener Linien network in 2019.

With 38% of all passenger trips in Vienna made using public transport, PT has a substantially higher share of passenger traffic than cars. Walking (28%) has replaced the car (27%) in second place. The number of holders of a Wiener Linien annual pass (852,000) surpasses the number of registered vehicles in Vienna (by 143,000 in 2019).

### 4.3.3.2 Mobility needs

#### *4.3.3.2.1 Direct mobility needs*

PT in Vienna is seen as of a high standard, following a consistent strategy and significant investment with regard to e.g. network extensions, adding new mobility services, scheduling/timetables and real-time traffic information. Still further advancements are to be made in terms of automation and barrier free mobility. Furthermore, with regard to expanding PT with private initiatives and commercial mobility providers as well as infrastructure to access mobility information.

Public transportation is used to meet all conceivable mobility needs. Whether the services are used for commuting, leisure or business reasons. The frequency of the service adapts to the volume of passengers which changes regularly throughout the day.

Public acceptance of sharing solutions is great. Bike-sharing is already available for 10 years with more than 100 stations and very low access fee. Car-sharing providers widely available, same as for Scooter and kick-scooter sharing providers recently. There are only few complaints from users about shared services, besides visual impact and space occupation by kick-scooters.

The MaaS platform is also used by more than 100,000 users, yet it is not always 100% integrated but with links to the operators. Automation is in introductory phase, yet the automated shuttles have a great acceptance so far on a fixed route of 2 km.

#### *4.3.3.2.2 Indirect mobility needs*

Another need is to remove as much vehicles from the streets as possible to improve air quality and to prevent traffic congestion. Therefore, PTOs have always the task to expand the network according to the demand and find new mobility solutions.

### 4.3.3.3 Relative utility

Wiener Linien gets very good ratings from users especially for intervals, reliability and price-performance ratio. About 98% of PT users are pleased with the services and offers of Wiener Linien. The two best rated quality features are the frequent intervals on the subway and the well-developed public transport network. In terms of capacity indeed more than 260,000 passengers can ride about 1,000 vehicles at a time.

Users recognize also that the network is constantly being expanded, the intervals are improved and new, state-of-the-art vehicles are acquired. Further positive aspects rated by users are security, cleanness, reliability, and punctuality, furthermore friendliness of staff and space inside the vehicles.

## 4.4 Success & Failure factors in the field of CCAM

In this section it will be tried to bring together without being exhaustive, success or failure factors that will impact the adoption of the Connected Cooperative Automated Mobility from the perspective of a PTO covering different aspects related to the user, to the technology and to the organizational aspects. The PTO Transdev is used as a cross-chapter example to illustrate the different PTO-relevant success and failure factors. So, the name Transdev stands as substitute for all PTO organizations.

As a basic assumption it can be stated that all challenges are at the core of the business, the mission and the daily operations of Transdev. They enable to reflect on the ability of Transdev to deliver attractive and integrated mobility services, which are designed and operated in consultation with local stakeholders and employees and are environmentally friendly.


**Figure 25 – In 2018, Transdev carried out a materiality analysis based on a series of interviews with representatives of its stakeholders (mobility authority clients, players in the mobility sector, employees and passengers) in four countries where the Group does business (France, USA, Germany and Australia). (Source: Transdev)**

As part of Transdev's mission, a duty is to take greater account of the environmental issues and adapt the services to the needs and expectations of the passengers; now more than ever, the company shall demonstrate ethical, fair and inclusive behaviour in order to earn the trust of Transdev's employees as well as all stakeholders in the long term; as a mobility operator, Transdev shall make a long-lasting contribution to the socioeconomic development and territorial cohesion of the areas in which Transdev operates (see Figure 25).

Transdev highlight the main ways that the company creates, values in all activities and that are also success / failure factors ("both sides of the same coin -approach"):

- **Meeting all needs of our customers**, whether they are passengers, mobility authorities or businesses; (see Figure 26)
- **Focusing on operational excellence** in order to provide the best possible service at any times and at the lowest cost;

- **Developing new solutions** for future needs and markets;
- **Safety above all;**
- **Customer acceptance;**
- **Test and learn approach / progressive approach;**
- **REX:** regular return of experience and feed-back from all parties, passengers and partners;
- **Level of cooperation between all partners of the projects**: creation of an ecosystem, with public/private actors, industrial, academic, large group, start-ups etc...

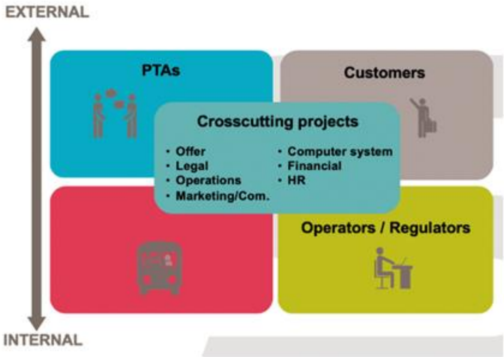



**Figure 26 – Main actors involved in the success & failure of the CCAM (Source: Transdev)**

In the following lines we are describing some of these factors relevant to all PTO covering success and failure potential at the same time:

- **Change management** is an important factor to be considered. Altering the behaviour of the public to increase the adoption of public transit and automated vehicles - requires internal and external global support, it involves all project actors: public transport authorities, customers, drivers, operators and supervisors, support services (legal, financial, HR, marketing, operations). It requires personalized support and communication adapted to each target user It is time-consuming, hence the importance of anticipating as much as possible. The evolutions brought about by digitalization are changing the habits/routines – both internally and externally, and the emphasis for travellers needs to be on the benefits associated with the changes planned.
- **Customer acceptance:** The introduction of a new technology in public space must be carried out with great care and a corresponding information strategy. A key aspect when introducing a new technology is the user acceptance. To achieve a pleasant driving experience, in case of an autonomous minibus, passengers and other road users have to be addressed as well. To overcome this challenge, tools for conveying autonomous driving decisions and context information of the vehicle for the passengers were developed. This is intended to strengthen confidence in the driving skills of the autonomous vehicle.
- **Concept and planning:** The concept and planning of the PT stops was converted to the special requirements of the vehicle (10-20 people and full autonomy of the vehicle). In particular, the development of solutions for barrier-free access is discussed. For this purpose, a computer-aid planning tool for evaluating vehicle interior and PT stop design for performance, comfort and safety is being further developed. This is only a success factor, but needs a continuous update process to cover the changes of customer needs.
- **Societal Impact - Traffic safety:** During the implementation of a new mobility service, the aspects of traffic safety have to be taken into account. The results are used to reduce conflicts with automated vehicles and thus increase traffic safety. For this purpose, an intersection in the test area was observed for several days. The observation was carried out with the help of several Mobility Observation Boxes, on the one hand to be able to examine all approaches of the conflict zone and on the other hand to ensure a seamless conflict analysis in the operating times of the autonomous bus.
- **Problem Resolution Management (PRM) process:** the creation and implementation of a project-specific problem resolution management process

based on ASPICE was carried out for occurring problem cases and situations. The process regulates the processes and responsibilities in the event of problems with the vehicles (e.g. technical problems, accidents, malfunctions, etc.). This will increase the customer satisfaction in case of a problem occurs.

Although it seems clear that AVs are coming, it not known yet, how they will be rolled out as this also largely depends on how they will be regulated. The following SWOT analysis (see Figure 27) shows the strengths, weaknesses, opportunities and threats that shared AVs represent for the future of cities:


**Figure 27 – SWOT analysis shows the strengths, weaknesses, opportunities and threats that shared AVs represent for the future of our cities (source UITP Policy brief)**

### Challenges in Change Making - Accepting Shared Autonomous Public Transport

MERGE Greenwich was a project which sought to determine how automated vehicle ridesharing could integrate with public transport systems. The project's consortium was led by Addison Lee with the help of Ford, TRL, Transport Systems Catapult, Immense Simulations and, DG Cities, jointly funded by the UK Government and industry. The £1 million project ran for 2017 to 2018 (12 months) and has released its culminating report last July 2018.

The user acceptance of shared autonomous public transport is a main success factor for the introduction of new mobility services. Therefore, the MERGE Greenwich project conducted the first known customer research to understand customer attitudes towards an AV ride-sharing service. The report, entitled: Customer attitudes to Automated vehicles and Ridesharing was released in April 2018. (Merge Greenwich, 2020) The overall result can be concluded in the following way (see Figure 28):

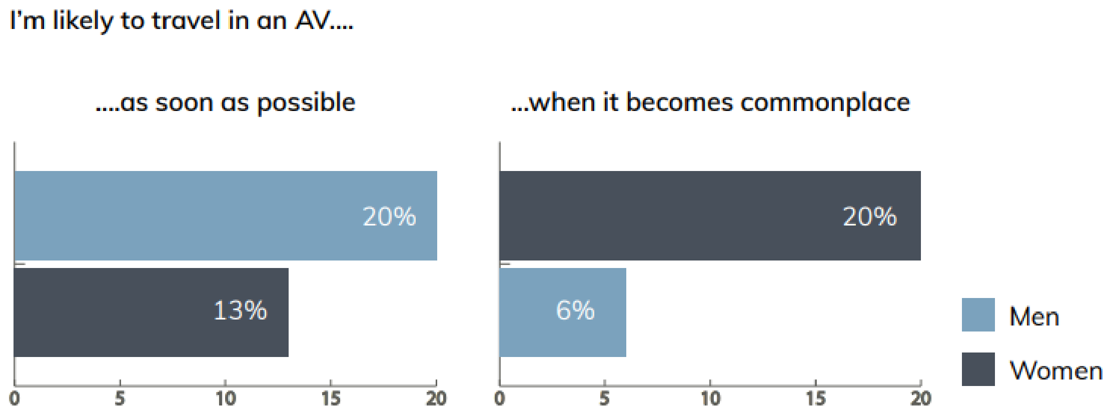



**Figure 28 – MERGE Greenwich project (Source: Merge Greenwich, 2020)**

Also, the following decision-making criteria were identified (see Figure 29):

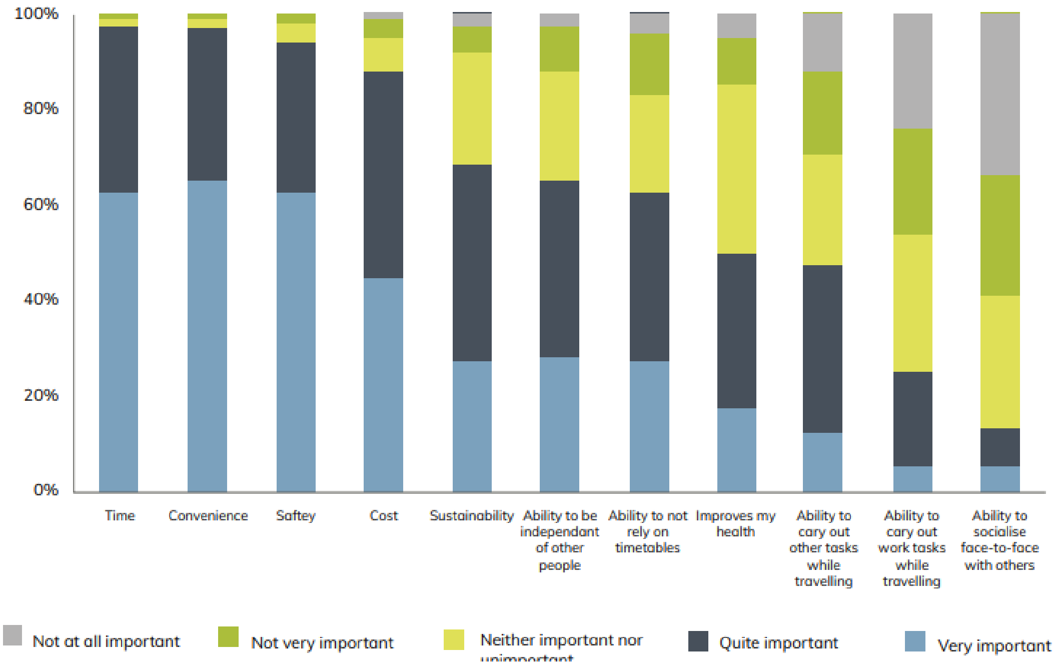



**Figure 29 – MERGE Greenwich report - Decision-making criteria for travel (Source: Merge Greenwich, 2020)**

A crucial takeaway from the report can be concluded as the follows: ”Overall, it is important to bear in mind that ride-sharing carries rational benefits (linked to reduced emissions and congestion due to less cars on the road, no need to think about parking, etc.) and the automated vehicle element presented emotional benefits (linked to the excitement around new technology). Understanding these distinctions between the rational and emotional benefits could help mobility service providers address the concerns potential customers may have about AV ride-sharing and develop a service which appeals to the motivations of potential users.”

## 4.5 KPI-related analysis of PT / PT operator service including best practices

The following sub-chapters show the potential of mobility services from the perspective of a PTO representing the best practice of PT /PTO accepting the challenges of a modern time.

### 4.5.1 KPIs for Transdev

Transdev is the PTO in France especially on the demo site of Rouen. The figures below are taken from the annual report 2019 of Transdev (Transdev Group, 2019). Figures for a KPI-related analysis of Transdev MaaS/Astuce are not available in particular, but some overall figures of Transdev showing the business potential of the mobility service are presented below.

**CAPEX (Fixed costs):** Fixed costs consists of different cost categories:

- Total assets: 5,877 million €

**OPEX (Variable costs):** Variable costs consist of different cost categories:

- Impairment of operating receivables, net of reversals: 12.2 million € (2019); 6.9 million € (2018)
- Depreciation costs: 592.5 million € (2019)
- Personnel costs: 3,954.5 million € (2019); 3,761,6 million € (2018)
- Gains (losses) on disposals of capital assets: 2.7 million €
- Other costs: 2,787.6 million €

**Revenue streams:** Ticketing, compensation schemas, marketing

**Pricing strategy:** There are different ticket packages offered by Transdev in France:

- Forfait Navigo jour
- Forfait Navigo annuel
- Forfait Navigo mensuel
- Forfait Navigo semaine
- Passe Navigo Découverte
- Passe Navigo Easy
- Navigo Liberté+
- Forfait Imagine'R Etudiant
- Forfait Imagine'R Scolaire
- Carte scolaire bus lignes régulières
- Forfait Améthyste sur carte Navigo
- Forfait Navigo gratuité
- Forfait Navigo Solidarité semaine ou mois
- Other special tickets e.g. for retired persons

**Revenue growth:**

The numbers for calculating are from the annual reports of Transdev. The shown numbers are revenues from ordinary activities (revenue from services, revenue from sales of goods and revenue from operating financial assets).

| | |
|---|---|
| Results for year 2019: | 7,415.5 million € |
| Results for year 2018: | 6,948.0 million € |
| Growth in €: | 467.5 million € |
| Growth in %: | 6.73 % |

#### 4.5.1.1 KPI - Operational (transport)

**Occupancy rate:** All values below are just best expert guesses

- Bus: 19 % (Umweltbundesamt GmbH, 2020)
- Tram: 19 % (same source as Bus)
- Trolleybus: 19 % (Trolleybuses are considered as line bus as well and therefore has the same occupancy rate as a normal Bus)

**Vehicle utilization efficiency:** Assuming that public transportation services are operating around the clock (0:00 – 24:00) and there is always a passenger in the vehicle (even at night, what is possible in a city like Rouen) the vehicle utilization efficiency is 100 % for bus, tram and trolleybus (best expert guess).

**Fleet replacement rate:** the operating life for the different vehicles are:

- Tram: 25 years
- Trolleybus: 20 years
- Omnibus: 9 years

The values are according to the official operating life values determined by law.(Bundesministerium der Finanzen, 2000)

### 4.5.2 KPIs for Vienna

Wiener Linien is the PTA in Vienna. It is part of the city corporation Wiener Stadtwerke Holding AG, managing energy supply and network, infrastructure, commuter trains, parking and cemeteries. The figures below are taken from the annual report 2019 of Wiener Stadtwerke (Wiener Stadtwerke GmbH, 2020). Figures for a KPI-related analysis of Vienna MaaS/WienMobil are not available in particular, but some overall figures of the division traffic of Wiener Stadtwerke (Wiener Stadtwerke GmbH, 2020).

- **Revenue growth**:
  - Result for year 2019: 710,600,000 €
  - Result for year 2018: 686,500,000 €
  - Growth in €: 24,100,000 €
  - Wiener Stadtwerke invested 2019 263,7 m€ in the division traffic. 3,5% more than in 2018. And 641,9 m€ in the development of the public transport network (2019).

KPI - Operational (transport)

**Occupancy rate:** All values below are just best expert guesses

- Bus: 19 % (Umweltbundesamt GmbH, 2020)
- Tram: 19 % (same source as Bus)
- Trolleybus: 19 % (Trolleybuses are considered as line bus as well and therefore has the same occupancy rate as a normal Bus)

**Vehicle utilization efficiency:** Assuming that public transportation services are operating around the clock (0:00 – 24:00) and there is always a passenger in the vehicle (even at night, what is possible in a city like Vienna) the vehicle utilization efficiency is 100 % for bus, tram and trolleybus (best expert guess).

**Fleet replacement rate:** the operating life for the different vehicles are:

- Tram: 25 years

- Trolleybus: 20 years
- Omnibus: 9 years
- Metro: 25 years

# 5 Overview and Analysis of logistic services (LaaS)

This section focuses on the analysis of LaaS “Logistic as a Service, its applications in the transport sector, its critical issues and potential.

Logistics refers to the process of coordinating and shipping resources from one location to a specified destination. Logistics management includes managing the flow of things from the point of origin to the point of consumption to meet customers’ need or corporations’ requirement. Logistics involves the implementation of a complex operation and the resources managed include tangible items (i.e., materials, equipment, fleets) and intangible items like as the time. The logistics of tangible items involves materials handling, production, picking and packaging, inventory, transportation, warehousing, and integration of information flow.

In this context LaaS is considered as a logistics network of organizations, people, information, and resources supported by the service-driven cyber-physics system. LaaS is employed to meet the enterprise’s requirements in the areas of collaboration, visibility, and efficiency within the logistics activities saving money in the whole supply chain. Intelligent multimodal logistics network plays an important role in LaaS that involves provision of an accompanying service in the worldwide logistics.

LaaS providers employ professional logistics solutions to inbound/outbound logistics from production facilities to warehouses, retailers, end users, and consumers; in addition, they manage the enterprise’s transportation network, which includes truck, rail, air freight, and pipeline. LaaS providers are dedicated to enhancing the efficiency in the supply chain management and provide a real-time data visualization by leveraging the extensive collaboration among every aspect of the logistics network.

The trend in LaaS provides great resources and powerful methodology to support the decision-making process and automation of logistics.

## 5.1 State of the Art of several LaaS worldwide

In state-of-the-art, LaaS is considered as a logistics network of organizations, people, information, and resources supported by the service-driven cyber-physics system. Furthermore, logistics automation is the application of computer software or automated machinery to improve the logistics operations efficiency undertaken by supply chain management and enterprise resource planning systems. The chosen LaaS represents relevant logistics application aspects (MODULUSHCA, EURODICE) covering freight transport technology and control as well as current provider of such a modern and flexible LaaS (Freelway).

### 5.1.1 Freelway

The Mobility Service Canvas (MSC) gives a fast overview over the services Freelway offers as well as other important information about the services and the mobility operator.

**Table 28 – Mobility Service Canvas Freelway**

| Mobility Service Canvas | |
|---|---|
| **Name** | Freelway – Service app to coordinate and organise transport/deliveries |
| **Short description** | Freelway is a service to coordinate and organise transport and deliveries. It is available as Freelway Go for private persons and Freelway HIT for companies or shops. |
| **Website / Reference** | http://www.freelway.com/ |
| **Service Developers** | • Freelway |
| **Primary Operator** | • Open to everyone |
| **Target users and mobility needs** | • Private users (Freelway Go)<br>• Companies (Freelway HIT) |
| **Mobility Services** | Mobility Service 1<br>• Delivery of groceries, medicine or post<br>Mobility Service 2<br>• Delivery from restaurant or cafe<br>Mobility Service 3<br>• Deliveries from private person to friends etc.<br>Mobility Service 4<br>• Customer to customer services |
| **Related Services** | • No information available |
| **Mobility Service Operators** | • Open for everyone |
| **Access to the Services** |  Public<br>X Registered users<br>ϒ Private |
| **Type of environment** | X Urban<br> Interurban<br> Highway<br> Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | X Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | • Register in app or on website as a user<br>• Register in app or on website as a supplier or carrier |

| Mobility Service Canvas | |
|---|---|
| **Status** | □ In development, since …<br>□ Trial, since ...<br>X In operation, since 2018 |
| **Areas/routes covered and number of people/amount of goods transported per service** | Sweden (different areas) |
| **Share of trip purpose per service** | □ Commuting<br>x Business<br>ϒ Leisure |
| **3rd Party Suppliers and related company size** | • No information available |
| **SME Aspects** | • No information available |
| **Model type (A)** | □ PTO (public transport operator) and non-PTO based shared mobility services<br>□ Carsharing<br>□ Bike sharing<br>□ Vehicle-based logistics<br>□ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>□ Central Model<br>x Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>x B2B<br>x P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>• Coordination and pooling of deliveries |
| **Connected Mobility Aspects** | □ V2V<br>□ V2I<br>□ V2P |

| Mobility Service Canvas | |
|---|---|
| | V2N<br><br>None<br><br>x Don´t know |
| **Electrified vehicles used per service** | • No information available |
| **Automated vehicles used per service** | • No information available |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • No information available |
| **Amplitude (Service Period)** | x Daytime<br><br>x Rush hour<br><br>x Off-peak hour<br><br>x Nighttime<br><br>x Weekdays<br><br>x Weekend<br><br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br><br>MaaS - Mobility as a service<br><br>Laas - Logistics as a service<br><br>DRT - Demand-responsive transport | • No information available |
| **Relation to PT (coordinated by PT)**<br><br>PT – Public transport | • No information available |

The following text gives a more detailed description of the state-of-the-art.

Freelway is a service app to coordinate and organize transport deliveries mostly in urban areas in Sweden since 2018. The Freelway targets each kind of users, shops, and companies (generally private ones) with use of app (suppliers and customers have the app for communication channel). It offers the following logistics services:

- Delivery of groceries, medicine or post (mail)
- Delivery from restaurants of cafes
- Deliveries from private person to friends
- Customer to customer services

The service (see Figure 30) is available for its registered users (everyone can be registered) during daytime, rush hour, off-peak hour, night-time, weekdays, weekend, and vacation. The users, companies, and shops can pay the cost "pay per use" or "subscription". The logistic vehicles use the same lanes of the local transport infrastructures. The value propositions are "easy process and handling of coordinated transport" and "adaptable for people with special needs (e.g. risk groups)". The service requires a payment for transport cost, has no tools for coordination of transport, and has not many flexible solutions for private users. However, it provides an effective coordination of deliveries and an amount of cost savings.

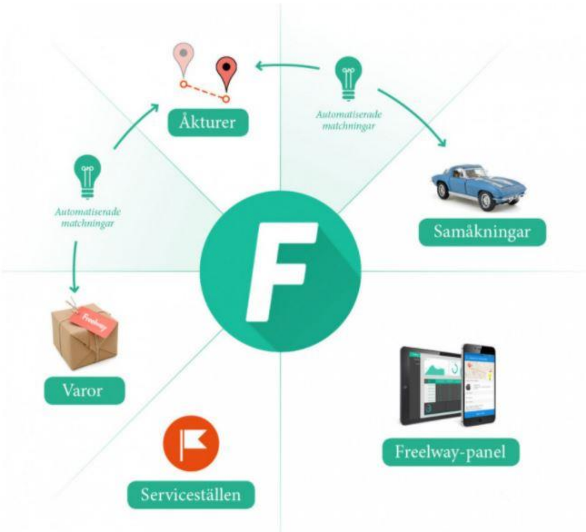



**Figure 30 – Freelway services (Source: Freelway, 2020)**

### 5.1.1.1 Delivery of the package

Freelway's freight and freight coordination service is used by companies and organizations for more efficient management of internal freight flows. The service is also used within corporate clusters to coordinate common resources and transport needs.

In rural areas, the service is used for a better postal parcel delivery service in areas where there are no major players' postal agents. A service point with Freelway's service can be opened, for example, in a country shop or by placing a parcel locker.

During the crown epidemic, Freelway developed the service to make it easier for organizations working with home deliveries of grocery bags, mailing packages and pharmaceuticals.

### 5.1.1.2 Car Pooling

Companies and organizations can easily reduce the costs and climate impact of transportation within the company by coordinating and sharing vacancies in their vehicle fleet.

Freelway's smart matching service finds vacancies for employees or hired travel operators who book company travel by taxi, rental and car pool. The service is also used by employees within organizations, companies and village teams / housing associations etc. For car sharing.

Along with public transport in Dalarna, Freelway has developed a completely new, more sustainable, and unique service, Dalway. The service increases travel autonomy in rural areas with the movements of existing vehicles.

As an event and tour operator, you can hire the service for a limited time to offer participants and visitors to travel together or book seats on chartered buses.

### 5.1.1.3 DalMaas

DalMaas creates more transportation options for people living in rural and sparsely populated areas, while transportation already underway can be used more efficiently.

At the same time, public transport increases revenue as tickets can be sold to vacant seats that were not previously available for booking.

Vacancies on public transport travel will be visible and bookable for local people through the Freelway service and app. Service trips can be travel services, medical visits, order traffic (call controlled), school bus, etc. These are travel and vehicle movements that usually have free seats.

The service can also be combined with Freelway's carpooling service as a complement to public transport travel offers.

### 5.1.2 MODULUSHCA

The Mobility Service Canvas (MSC) gives a fast overview over the services MODULUSHCA offers as well as other important information about the services and the mobility operator.

**Table 29 – Mobility Service Canvas MODULUSHCA**

| Mobility Service Canvas | |
|---|---|
| **Name** | MODULUSHCA |
| **Short description** | The aim of MODULUSHCA is to create a closer pan-European network for the logistics industry in close cooperation with its North American partners and the international Physical Internet Initiative. |
| **Website / Reference** | https://www.ptvgroup.com/en/innovation-research/overview-projects/modulushca/ |
| **Service Developers** | • EU project MODULUSHCA |
| **Primary Operator** | • Demo sites:<br>o Poste Italiane<br>o Jan de Rijk Logistics |
| **Target users and mobility needs** | • All participants of the Logistic value chain (from producer to the end customer) |
| **Mobility Services** | Mobility Service 1<br>• Logistics of fast-moving consumer goods |
| **Related Services** | • No information available |
| **Mobility Service Operators** | • No information available |
| **Access to the Services** | □ Public<br>x Registered users<br>x Private |
| **Type of environment** | x Urban<br>x Interurban<br>□ Highway<br>x Rural |

| Mobility Service Canvas | |
|---|---|
| | x Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | • No information available |
| **Status** | □ In development, since …<br>x Trial, until 31-01-2016<br>ϒ In operation, since 2018 |
| **Areas/routes covered and number of people/amount of goods transported per service** | • Italy<br>• The Netherlands |
| **Share of trip purpose per service** | □ Commuting<br>x Business<br>ϒ Leisure |
| **3rd Party Suppliers and related company size** | • No information available |
| **SME Aspects** | • No information available |
| **Model type (A)** | □ PTO (public transport operator) and non-PTO based shared mobility services<br>□ Car-sharing<br>□ Bike sharing<br>□ Vehicle-based logistics<br>□ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>□ Central Model<br>x Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>x B2B<br>□ P2P<br>ϒ C2B (e.g. in case consumers sell their data) |

| Mobility Service Canvas | |
|---|---|
| **Shared Mobility Aspects** | Yes<br>• Coordination and pooling of deliveries and vehicles |
| **Connected Mobility Aspects** | □ V2V<br>□ V2I<br>□ V2P<br>□ V2N<br>□ None<br>x Don´t know |
| **Electrified vehicles used per service** | • No information available |
| **Automated vehicles used per service** | • No information available |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • No information available |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Night-time<br>x Weekdays<br>□ Weekend<br>ϒ Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | • LaaS |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | • No information available |

The MODULUSHCA, Modular Logistics Units in Shared Co-modal Networks, project aims to create a genuine contribution to develop an interconnected logistics at the European level with the supporting of North American partners and the International Physical Internet Initiative. The project targets to enable operating with developed iso-modular logistics units of sizes adequate for real modal and co-modal flows of fast-moving consumer goods. MODULUSHCA integrates the following interrelated works:

- developing a vision addressing the user needs for interconnected logistics in the FMCG domain,
- the development of a set of exchangeable (ISO) modular logistics units providing a building block of smaller units,
- establishing digital interconnectivity of the units,
- development of an interconnected logistics operations platform leading to a significant reduction in costs and CO2 emissions
- demonstrated in two implementation pilots for interconnected solutions.

The project is completed in the beginning of 2016 and the achievements are the following:

- Finalization of a framework on how Physical Internet can enable an interconnected FMCG logistics system has been developed in several workshops with experts from industry partners, also explaining obstacles and success factors to a Physical Internet enabled system
- Development of modular boxes in the FMCG sector in two versions, version 1 focusing on interlocking mechanism and version 2 made by panels
- Algorithms for digital interconnectivity between different IT systems have been chosen and described as well as a sensor and communication approach for modular logistics units
- Recommendations have been developed for the standardization of iso modular containers
- Two implementation pilots have been carried out
- Active promotion of the Physical Internet and MODULUSHCA has been made, accompanied by dedicated dissemination material (brochure, templates, website, internal working space to share information, mailing lists, etc.)
- The Advisory board (Board of Directors) with experts from 13 industry and science institutions has been continued

### 5.1.3 EURIDICE

The Mobility Service Canvas (MSC) gives a fast overview over the services EURIDICE offers as well as other important information about the services and the mobility operator.

**Table 30 – Mobility Service Canvas EURIDICE**

| **Mobility Service Canvas** | |
|---|---|
| **Name** | EURIDICE |
| **Short description** | EURIDICE was an Integrating project that set out to create the necessary concepts, technological solutions and business models to establish an information services platform centred on the context of individual cargo items and their interaction with the surrounding environment and the types of users. |
| **Website / Reference** | https://trimis.ec.europa.eu/project/european-inter-disciplinary-research-intelligent-cargo-efficient-safe-and-environment |
| **Service Developers** | • EURIDICE EU project |
| **Primary Operator** | • EURIDICE EU project |

| Mobility Service Canvas | |
|---|---|
| **Target users and mobility needs** | • Logistics operators |
| **Mobility Services** | • Truck/wagon status<br>• Free space visibility<br>• Loading check<br>• Cargo condition monitoring<br>• Estimated Time of Arrival (ETA)<br>• Re-routing<br>• Tracking<br>• Triggering outbound asset<br>• Delivery confirmation |
| **Related Services** | • No information available |
| **Mobility Service Operators** | • Logistics operators |
| **Access to the Services** | □ Public<br>x Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>x Interurban<br>□ Highway<br>x Rural<br>x Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | X Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | • Logistic customer specific volume prices |
| **Status** | □ In development, since …<br>x Trial, until February 2012<br>ϒ In operation, since |
| **Areas/routes covered and number of people/amount of goods transported per service** | • Italy<br>• Austria |
| **Share of trip purpose per service** | □ Commuting<br>x Business<br>ϒ Leisure |
| **3rd Party Suppliers and related company size** | • No information available |

| Mobility Service Canvas | |
|---|---|
| **SME Aspects** | • No information available |
| **Model type (A)** | □ PTO (public transport operator) and non-PTO based shared mobility services<br>□ Carsharing<br>□ Bike sharing<br>□ Vehicle-based logistics<br>□ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>□ Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>□ B2C<br>x B2B<br>x P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>• Information sharing |
| **Connected Mobility Aspects** | □ V2V<br>x V2I<br>□ V2P<br>□ V2N<br>□ None<br>x Fright to Infrastructure |
| **Electrified vehicles used per service** | • No information available |
| **Automated vehicles used per service** | • No information available |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • No information available |
| **Amplitude (Service Period)** | x Daytime |

| Mobility Service Canvas | |
|---|---|
| | x Rush hour<br>x Off-peak hour<br>x Nighttime<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | • LaaS |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | • No information available |

The EURIDICE project is an integrating project that sets out to create the concepts, technological solutions, and business models to create an information service platform that centers on individual cargo items and interaction with environment and users.

The project has Intelligent Cargo concept, in which services can be combined with capabilities of self-awareness, awareness context, and connection through a global telecommunication network to support a wide range of information services. This brings a paradigm change and has an impact on organizational structures within the supply chain. The development of an innovative technology and new organizational structures generates new requirements in the competencies of involved staff. Thus, EURIDICE provides a learning framework aiming at providing all necessary training material for a successfully introduction of the Intelligent Cargo Concept.

The main objectives of EURIDICE project are the following:

- Supporting the interaction of individual cargo items with the surrounding environment and users in the field
- Improving logistic performances through application of the intelligent cargo concept and technologies in the working practices of operators and industrial users
- Developing collaborative business models to sustain, promote and develop an intelligent cargo infrastructure
- Realizing more secure and environment friendly transport chains through the adoption of intelligent cargo to support modal shift and door-to-door inter-modal services.

The EURIDICE platform simultaneously improved the logistics, business processes and public policy aspects of freight transportation, by dynamically combining services at different levels: Immediate proximity of a RFID tagged cargo item, mobile users and vehicle services; Producer Shipper and Carrier Supply chain including qualification, handling and routing; Freight corridor, represented by authority and infrastructure services including authorization, security and safety control.

The EURIDICE platform is based on the “Intelligent Cargo for Logistic Operators” and it has works as explain below:

The IC allows the logistics operators to efficiently plan and execute the transport. Using the IC, the logistics operators have the information on the fleet availability and on the available transport space/ weight on each truck/wagon that already has a mission assigned. This is possible thanks to the use of software agents and RFID technology. The logistics operator assigns a transport mission to a specific truck and related IC. When the truck is being loaded the IC performs the loading check: the details about the loaded items are listed and are compared with the loading plan. If the deviations are noticed or when the loading is finished, the identified actors are informed by the IC. During the travel, there is a possibility for the monitoring of different conditions (e.g. temperature, humidity, sealing). The vehicle needs to be equipped with the appropriate sensors. During transport, the identified conditions are recorded and in case of deviations from predefined thresholds, a notification is sent to the identified actors. The ETA to the destination is updated whenever the new traffic and weather conditions are available, and then sent to the identified actors. It can happen that the traffic and/or weather conditions require re-routing, and in those cases, the IC proposes the new route to the driver. When the cargo reaches a pre-established geographical area, the IC sends a notification to the operators that will receive the cargo. A tracking service is always available, and the authorized user can monitor shipment details such as conditions, quantity and type of items, ETA, etc. At the arrival to the destination, the IC reader compares the unloaded cargo with the order. If everything is in order, a proof of delivery is sent to the logistics operator, otherwise the IC sends the list of the discrepancies to the identified actors. Below a bullet point list which explain the detailed work of the IC by EURIDICE.

EURIDICE offers a set of functions for logistics operators to solve or overcome problems as:

- **Truck/wagon status**. The IC informs the logistics operator in real time if the truck/wagon is loaded, unloaded, or reserved.
- **Free space visibility**. The IC updates in real time the company system with the information about the free space inside a truck.
- **Loading check**. The IC lists the items that are loaded in a truck and compares them with the loading plan. In case of deviations or when the loading is finished, the IC informs the identified actors that can access this information.
- **Cargo condition monitoring**. While the shipment is inside the truck, the identified conditions (e.g. temperature, humidity, sealing, G-force) are recorded and constantly compared with the allowed threshold values. In case of deviations from a threshold, a notification is sent to the identified actors. The recorded data is always available to the identified users.
- **ETA. (Estimated Time of Arrival).** The ETA to the destination is updated whenever the new traffic and weather conditions are available, and then sent to the identified actors.
- **Delivery confirmation**. At the arrival, the IC compares the unloaded cargo with the order. If everything is in order, a proof of delivery is sent to the logistics operator, otherwise the IC sends the list of the discrepancies to the identified actors.

## 5.2 Business and operating models using Canvas Methodology

The following business model canvas approach shows a general overview for business and operating models for LaaS:

**Table 31 – General Business Model Canvas for LaaS**

| BUSINESS MODEL CANVAS | |
|---|---|
| Value Proposition | LaaS is designed to reduce transportation costs while also increasing customer service. |
| Customer Segments | • Private companies<br>• shippers,<br>• company's transportation including truck, rail, ocean and air freight<br>• Public Authorities<br>• Road operators<br>• Traffic management operators<br>• Public Transport operators<br>• Service Providers<br>• Fleet Owners |
| Customer Relationships | • Dedicated personal assistance<br>• Through customer service department (key account manager)<br>• Periodic meetings with customers<br>• Long-term partnerships<br>• Ensuring quality, reliability, respect of timeline, state of the art technology<br>• Sharing roadmaps<br>• Based on trust (built through evidence)<br>• Customer service<br>• To manage data |
| Channels | • Direct contact<br>• Advertisement<br>• website<br>• digital media<br>• web presence<br>• newsletter<br>• participation at events<br>• demos<br>• Working group for standardization<br>• Private companies and public operators should promote the system. |
| Key Resources | • Personnel<br>• Technical resources for R&D activities,<br>• logistics professionals to manage a company's transportation network,<br>• test and validation engineers,<br>• software developers (not mandatory),<br>• experts on regulations (also to follow standardization groups)<br>• Sales/commercial human resources<br>• Financial<br>• Resources for R&D activities to improve the LaaS.<br>• Venture capital<br>• Maintenance of mobile app (not mandatory)<br>• Business developers<br>• Offices<br>• CRM system |
| Key Activities | • Technical<br>  ○ Technical development to find the logistic transport solution<br>  ○ Optimization<br>• Quality management<br>  ○ Test and validation<br>  ○ Test scalability of the system<br>• Business development<br>  ○ Customization of the final product<br>  ○ commercial and sales<br>  ○ marketing and promotion |
| Key Partners | • Main logistic business partners |

| BUSINESS MODEL CANVAS | |
|---|---|
| | • Who sell traffic data<br>• City authorities<br>• Road operators<br>• Testing service company for system reliability Users for pilot testing<br>• Bank<br>• Regulatory agencies and standardization |
| Revenue Streams | • Subscription<br>• for service and maintenance (updating)<br>• monthly fee to access real-time traffic data,<br>• premium service<br>• One off solution<br>• Mobile applications |
| Cost structure | • Research cost<br>• R&D personnel (FTE salaries)<br>• prototyping<br>• Development/evolution<br>• Overheads<br>• Computer<br>• Offices<br>• Heating<br>• Personnel cost<br>• Testing<br>• Certification<br>• Marketing and advertisement<br>• cost to updating service/maintenance |

Logistics as a Service providers employ logistics professionals to manage a company's transportation network including truck, rail, ocean and air freight, and inbound/outbound logistics from production facilities to warehouses, retailers, and end users/consumers. The logisticians are experts at efficiency—always looking for ways to do it better, faster, and for less money. They understand how ever-changing market conditions, such as capacity issues, driver shortages, rising carrier costs, and customer service demands can impact the supply chain.

As written in the lines above, Logistics as a Service providers work to maximize a company's transportation budget through people, process, and technology.

**"People"** is defined as a team of logistics experts dedicated to putting all their energy into a company's supply chain on a daily basis—saving time and resources internally.

**"Process"** involves investigating the current transportation activities and engaging in new opportunities for cost savings.

**"Technology"** streamlines planning and execution while also collecting data to be leveraged for detailed analytics reporting on a company's supply chain effectiveness.

### 5.2.1 Business models of LaaS services

#### 5.2.1.1 Business model of Freelway

**Table 32 – Business Model Canvas Freelway**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | Freelway is focused on a sharing service where individuals help each other to reduce the costs and climate impact of transportation within the company by coordinating and sharing vacancies in their vehicle fleet. |
| **Customer Segments** | • Private companies **with** traveling employees **and** shippers<br>• Fleet Owners from the area of public transport |

| | |
|---|---|
| **Customer Relationships** | • The customer service is provided by the Mobile App “Freelway” |
| **Channels** | • Direct contact via local B2B network<br>• Website<br>• Mobile App |
| **Key Resources** | • Mobile App<br>• Suppliers and delivery<br>• All kinds of shops and companies |
| **Key Activities** | • Partner network (Private and customer)<br>• Knowledge on customer group<br>• Automatization of certain services |
| **Key Partners** | • Main business network - All kinds of company and shops<br>• Tour operator<br>• Research and Consultant provider<br>• Vehicle provider<br>• Innovation and Knowledge provider |
| **Revenue Streams** | • Subscription with monthly fee<br>• One off solution with pay per use |
| **Cost structure** | • Research cost for prototyping and development/evolution<br>• Testing<br>• Certification<br>• Marketing and advertisement<br>• cost to updating service/maintenance |

The main goal of Freelway is that companies and organizations can easily reduce the costs and climate impact of transportation within the company by coordinating and sharing vacancies in their vehicle fleet.

Freelway's smart matching service finds vacancies for employees or hired travel operators who book corporate taxi, rental and carpooling trips. Furthermore, for car sharing, Freelway has developed a service that increases travel autonomy in rural areas with the movement of existing vehicles.

The second strength of Freelway is the freight transport and coordination service which is used by companies and organizations for a more efficient management of internal freight flows. The service is also used within corporate clusters to coordinate common resources and transport needs.

In rural areas, the service is used for better postal parcel delivery service in areas where there are no major players' postal agents. A service point with Freelway's service can be opened, for example, in a country shop or by placing a parcel locker.

#### 5.2.1.2 Business model MODULUSHCA

**Table 33 – Business Model Canvas MODULUSHCA**

| **BUSINESS MODEL CANVAS** | |
|---|---|
| **Value Proposition** | The goal of the project was to enable operating with developed iso-modular logistics units of sizes adequate for real modal and co-modal flows of fast-moving consumer goods (FMCG) |
| **Customer Segments** | • Private companies<br>• Logistic operators,<br>• Private users,<br>• City operators, |
| **Customer Relationships** | The customer service is provided by dedicated personal assistance<br>• Through customer service department (key account manager)<br>• Periodic meetings with customers |
| **Channels** | • Direct contact<br>• Network P2P |

| BUSINESS MODEL CANVAS | |
|---|---|
| | • Website |
| **Key Resources**<br><br>**Key Activities**<br><br>**Key Partners** | • All activities where there is a massive movement of private and public fleets as the major European or US cities<br>• Experts on regulations and sales/commercial human resources<br>• Technical development and maintenance of the service<br>• Knowledge on customer group<br>Automatization of certain services<br>• Main<br>    ○ Who sell traffic data<br>    ○ City authorities<br>• Road operators<br>• Users for pilot testing<br>• Regulatory agencies and standardization |
| **Revenue Streams** | • Subscription<br>    ○ for service and maintenance (updating)<br>    ○ monthly fee to access real-time traffic data,<br>    ○ premium service |
| **Cost structure** | • Research cost<br>    ○ R&D personnel (FTE salaries)<br>    ○ prototyping<br>    ○ Development/evolution<br>• Overheads<br>• Personnel cost<br>• Testing<br>• Certification<br>• Marketing and advertisement<br>• Cost to updating service/maintenance |

MODULUSHCA is a project with a specific goal: to connect and organize the largest number of factories and shops through the use of the physical network and iso-modular logistic units. Through the use of these units and the physical Internet it is possible to better organize freight transport trips and improve transport between plant and plant, plant and warehouse and warehouse and end users.

To create this chain MODULUSHCA established the digital interconnectivity of the units and the development of an interconnected logistic operating platform.

### 5.2.1.3 Business model EURIDICE

**Table 34 – Business Model Canvas EURIDICE**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | The basic idea of EURIDICE is the implementation of a federative platform for information services related to intelligent cargo in the centre are the single goods and their interactions with the most different IT systems and users. |
| **Customer Segments** | Private companies<br>• Logistic operators,<br>• Port, airport, logistic hubs, rails, trucks |
| **Customer Relationships** | The customer service is providing dedicated personal assistance<br>• Through customer service department (key account manager)<br>• Periodic meetings with customers |

| BUSINESS MODEL CANVAS | |
|---|---|
| **Channels** | • Direct contact via Network P2P<br>• Website |
| **Key Resources** | • All activities where there is a massive movement of goods such as ports, airports and logistic hubs<br>• Experts on regulations and sales/commercial human resources |
| **Key Activities** | • Technical development and maintenance of the service<br>• Knowledge on customer group as well as Automatization of certain services |
| **Key Partners** | • Main business network with all kinds of goods transport companies<br>• Logistic companies<br>• Technology provider<br>• Research and Development Institutes<br>• Communication provider<br>• Universities<br>• IT Provider |
| **Revenue Streams** | • One off solution with pay per use |
| **Cost structure** | • Research cost for prototyping and development/evolution<br>• Personnel cost<br>• Testing<br>• Certification<br>• Marketing and advertisement<br>• cost to updating service/maintenance |

The main objective of the project is to provide an information services platform with the focus on individual cargo items, their interactions with the surroundings and the stakeholders. EURIDICE therefore provides a fixed and mobile web services infrastructure, for enabling real-time access to cargo information, if needed, to private and public stakeholders along the transportation chain, supporting information retrieval related to the cargo for back-offices and field staff. The table above (Table 34) shows the business model canvas.

## 5.2.2 Operating models of LaaS services

### 5.2.2.1 Operating model Freelway

**Table 35 – Value Proposition Canvas Freelway**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| **Customer Jobs** | • Private users<br>• Shippers |
| **Pains** | • Process and handling of coordinated transport |
| **Gains** | • Higher quality of life, save time, save money |
| **Value proposition** | |
| **Products & Services** | • Development of a conceptual sharing service for the transport of goods and people |
| **Pain Relievers** | • Reduce the costs and climate impact of transport by coordinating and sharing vacancies in their vehicle fleet |

| | |
|---|---|
| **Gain Creators** | • Savings in costs (time and money)<br>• Better organization of the fleets and a less congestion in the city. |

Freelway has developed a concept sharing service for the transport of goods and people. The service initially focused on a sharing service where individuals help each other.

In 2015 and 2016, the service was developed with input from the municipalities of Vingåker and Uppsala, who also set up their own test beds for service evaluation, which changed the target group from private to freight coordination to internal and between organizations / companies.

In 2018 and 2019, the target group and the area of use were expanded to also include the coordination of passenger transport with a car-pooling service. The passenger transport service was expanded in 2019 by integrating also with public transport and can be integrated with the digital booking of order transport

### 5.2.2.2 Operating model MODULUSHCA

**Table 36 – Value Proposition Canvas MODULUSHCA**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| **Customer Jobs** | • Goods management companies,<br>• Private users |
| **Pains** | • Emissions<br>• Goods coordination |
| **Gains** | • Higher quality of life<br>• Save transport cost |
| **Value proposition** | |
| **Products & Services** | • Strategy for interconnected FMCG logistics system |
| **Pain Relievers** | • Organization and coordination of cities and warehouses |
| **Gain Creators** | • More sustainable solution for organizing the supply chain based on an open network |

MODULUSHCA project is the first real experience of the Physical Internet vision in Europe which proposes to encapsulate all goods in smart, modular, eco-friendly and standard units loads to handle, store and transport them as best fit through shared facilities across open networks.

The innovations and earnings that MODULUSHCA brings for the management of goods is above all thanks to the Physical internet. A series of hubs connects the different plants and stores. The function of the hub is to divide and combine different loads and standardized volumes that can be transported more efficiently. the system physical internet + hub can support the e-commerce, the home delivery city logistics and the transport to the store. This method can optimize the volume in the truck saving money and time with a better management of the travels.

#### 5.2.2.3 Operating model EURIDICE

**Table 37 – Value Proposition Canvas EURIDICE**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| **Customer Jobs** | • Logistic operators,<br>• Port,<br>• Airport,<br>• Logistic hubs,<br>• Rails,<br>• Trucks |
| **Pains** | • Control of the full chain in goods transportation |
| **Gains** | • Save cost:<br>○ Time<br>○ Money |
| **Value proposition** | |
| **Products & Services** | • Intelligent cargo system |
| **Pain Relievers** | • Automation to check the full chain goods transportation |
| **Gain Creators** | • A more sustainable solution for the checking of the goods management |

EURIDICE is based on an intelligent loading system that supports all activities of the freight transport chain. There can be many errors along the entire transport chain of a commodity and the IC allows logistics operators to plan and execute the transport efficiently.

Using the IC, logistic operators have information on fleet availability and available transport space / weight on each truck / wagon already assigned a mission.

This technology allows to increase the utilization of the fleet capacity, increased truck / wagon load factor, reduction in the number of trips, decrease in the time required to select a wagon / lorry to perform the delivery.

All these benefits allow to create a more efficient and safer and automated transport chain.

## 5.3 User & Role Analysis including user profiles, mobility needs, relative utility

Each LaaS service is used by different users, covers different mobility needs and has its own relative utility.

### 5.3.1 Freelway

#### 5.3.1.1 User profiles

Freelway's services create transportation options for people living in low density areas with a poor transportation network. In this way Freelway helps private users living in rural areas to have more choice for travel and helps public transport companies to fill their vehicles, increasing the tickets sold.

In addition, both private users and companies working in the city can use Freelway to coordinate employee travel with taxi, car sharing and rental vehicle bookings.

Freelway's coordination services can also help any shop to reduce costs and time for the delivery.

Together all the mentioned participants within the Freelway value chain shows the relevant customers/users. The following sub-chapters will provide an overview about the additional roles which linked to the Freelway business ecosystem.

##### *5.3.1.1.1 Investors*

Freelway is a LaaS service owned by a private company and has several investors such as Sodra Arefjallen, Energy evolution centre, Closer, Sustainable Innovation and ivl Svenska Miljonstitutet.

##### *5.3.1.1.2 Mobility operators*

The mobility partners are several local mobility operators such as Södra Årefjällen and Dalatrafik both located in Sweden.

##### *5.3.1.1.3 IT provider*

For using the Freelway app as well as other technology software is needed. The technology behind the app comes probably from an IT programming company and was not created by Freelway itself.

##### *5.3.1.1.4 Communication provider*

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

##### *5.3.1.1.5 Billing system operator*

The Freelway system works with an app which is used for booking and paying for the services offered. All the payments are done in digital form and transferred by companies specialized in that aspect such as with credit card monthly.
The banks then are responsible for the money transfer.

##### *5.3.1.1.6 Marketing provider*

Advertising companies are used for marketing measures such as flyers, online advertising and network marketing.
Public Authorities such as the city of Mariestad or Eskilstuna has a marketing impact as well due to mentioning Freelway in publications etc.

#### *5.3.1.1.7 End user*

The end users of Freelway are essentially in Sweden. At the end of 2019 the service had more than 1000 app downloads.

### 5.3.1.2 Mobility Needs

Freelway's services cover many companies and private users and must meet mobility needs for different days and hours. The app must always be functional and available during the day, rush hour, off-peak hours, night, weekdays, weekends and holidays.

The Freelway service is therefore adaptable to circumstances, will have different solutions depending on the geographical area (city or rural areas), the time and day (peak time and weekdays or weekends) and the type of goods to be delivered. For example, during the Covid-19 pandemic, Freelway's services gave priority to the delivery of groceries and drugs

### 5.3.1.3 Relative Utility

Freelway's purpose is to help people with each other with transportation.

Sharing services have become increasingly important in recent years because they allow you to save on costs and transport time and have a much smaller impact on the environment. These services go well with standard travel services, helping both public transport with an increasingly defined coordination and management of fleets and private transport by putting users in contact with the same destination and sharing the vehicle.

## 5.3.2 MODULUSHCA

### 5.3.2.1 User profiles

In the whole MODULUSHCA chain there are many stakeholders interested in this project directly or indirectly and they are the following:

#### *5.3.2.1.1 University*

MODULUSHCA is a research project and many universities are interested in this innovative project such as the École Polytechnique Fédérale de Lausanne or the Technische Universität Berlin.

#### *5.3.2.1.2 IT provider*

MODULUSHCA works thanks to a platform of interconnected logistic operations that must be followed and developed by competent technical companies.

#### *5.3.2.1.3 Communication provider*

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

#### *5.3.2.1.4 Security system*

The creation and maintenance of a connected and interconnected network obviously requires a safety network both during the transport of goods and for the servers that must not be violated in any way to have a correct functioning of fleet management.

#### *5.3.2.1.5 Logistic operators*

MODULUSHCA wants to connect and interconnect many plants and warehouses and the need for different delivery or logistics services such as Poste Italiane and ITENE.

#### *5.3.2.1.6 End user*

MODULUSHCA, thanks to its physical internet, allows a greater connection between plants and shops and final customers to guarantee a better solution in the goods delivery. For this reason, a lot of companies are interested in MODULUSHCA and their services such as CHEP UK LIMITED and Procter and Gamble EUROCOR N.V.PG.

### 5.3.2.2 Mobility needs

To function properly, the physical internet system needs well-connected facilities and stores from hubs that divide and combine different loads into standardized volumes that can be transported more efficiently. Therefore, an intelligent iso-modular container must be developed with a focus on logistics, handling, warehousing and last mile delivery. modular containers combine without limits for the best optimization for each specific stroke.

The transport chain is as follows:

The container is filled with the products, then the digital information is stored to track the contents and multiple containers are combined into one cargo of goods, the information on inbound cargoes is automatically updated and the cargoes are temporarily stored until they are finally delivered or transferred to another plant or store as programmed.

### 5.3.2.3 Relative Utility

The strengths of the MODULUSHCA project are essentially three and are the following:

MODULUSHCA has focused all its attention on the development of a structure on how the physical Internet can enable an interconnected FMCG logistic system and has been developed in several workshops with industry partner experts, also explaining obstacles and success factors to an Internet-enabled physical system. Subsequently, the most important part of the project was the development of modular boxes in the FMCG sector in two versions, version 1 focused on the interlocking mechanism and version 2 made from panels. These two modular boxes are the basis of the process of optimizing the transport and delivery of goods. At the end, algorithms were chosen and described for digital interconnection between different IT systems, as well as a sensory and communication approach for modular logistic units.

## 5.3.3 EURIDICE

### 5.3.3.1 Users profiles

In the whole EURIDICE chain there are many stakeholders interested in this project directly or indirectly and they are the following:

#### *5.3.3.1.1 University*

EURIDICE is a European research project and many universities are interested in this innovative project such as the Venice International University and Gebrüder Weiss Gesellschaft M.B.H.

##### 5.3.3.1.2 IT provider

For using the EURIDICE services as well as other technology software is needed. The technology behind the app comes probably from an IT programming companies that are involved in the project.

##### 5.3.3.1.3 Communication provider

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

##### 5.3.3.1.4 Mobility operators

EURIDICE is designed for a correct management of goods in the interchange nodes of goods and therefore many companies of control agencies of ports, interports and railways that manage large flows of goods on a daily basis, helping to control every step in the management of a commodity. Companies involved in this project can be: Fachhochschule Vorarlberg GMBH, SeRail EEIG, SeaRail Oyy, Stazioni aeroportuali doganali GORIZIA SPA, and Autorità portuale di TRIESTE.

##### 5.3.3.1.5 Marketing provider

Advertising companies are used for marketing measures such as flyers, online advertising and network marketing.

##### 5.3.3.1.6 Communications companies

EURIDICE allows real-time monitoring of the condition of freight transport and for this reason it needs communications companies that receive and send data from the centre services and the trucks or other connected vehicles. A typical company involved in EURIDICE is TELIT Communications S.p.A.

##### 5.3.3.1.7 Logistic companies

EURIDICE with its services connects different means of transport such as airplanes, ships and trucks and needs logistics companies such as Kuehe Nagel Societe Anonyme for Transport & Logistic to manage the loads and to avoid bottle necks in the interchange nodes.

#### 5.3.3.2 Mobility Needs

The nodes of exchange of goods in each country require excellent synchrony in the management of goods and vehicles to avoid confusion. The movement of goods from one vehicle to another and the entry and exit of vehicles from the interchange nodes must be regulated at every hour of the day to avoid so-called "bottle neck" situations with consequent delays.

#### 5.3.3.3 Relative Utility

Many of the logistics operators still use manually collected and updated information. Manual input is more prone to errors that can subsequently cause erroneous deliveries to the final customer and/or delays in the shipment status information. Moreover, many of the logistics operators do not have real time information on the transport volume/weight availability of their fleet, nor about the arriving cargo in order to schedule the outbound activities. EURIDICE by monitoring the status of the vehicle (loading or unloading), the loading conditions, the estimated time of arrival and the confirmation of arrival manages to reduce human and non-human errors, greatly favoring the flow of vehicles in the node and facilitating the work of employees.

## 5.4 Success & Failure factors in the field of CCAM (user, technical and organizational aspects)

### 5.4.1 Overview

#### 5.4.1.1 Overall success factors for LaaS approach

**"Supply chain optimisation"** - Freight consolidation is a key area where transportation costs can be reduced. Logistics professionals can identify opportunities to move smaller orders onto full truckloads. Inventory pooling increases the amount of product picked up at a location to decrease the number of stops. These are just a few areas to be considered; there are a lot of consolidation opportunities LaaS can produce. A LaaS provider will present cost-saving solutions to the company and assist in the implementation of needed changes to enhance efficiency.

**"Process Improvement"** - One of the first areas a LaaS provider dive into is process improvement. This includes evaluating a company's standard operating procedures, routing guides, forecasting, and accessorial management. One simple area to save money is to establish guidelines with carriers to improve on-time performance, utilization, and reduce detention costs.

**"Targeted procurement"** - The carrier relationship is an important part of running an efficient supply chain. A LaaS provider has more established relationships with carriers than one company on its own. By leveraging benchmarking data, logistics professionals will evaluate how much money a company is paying the carrier for their lanes. If the amount is outside of current benchmarks, then a procurement event will be organized to establish a new routing guide. It's important to always monitor the current indexes since the market is impacted by many fluctuating variables.

**"Mode shift" -** Another area to explore is how a company is transporting goods and if there is a more cost-effective alternative, either based on current forecast or lead time in orders. What works today may not be the answer for tomorrow. the successful way is monitor business trends and make proactive recommendations as a shipper's business changes. If a mode shift is feasible, transportation spend can be reduced through fuel costs.

**"Shipper collaboration"** - On their own, a shipper may find it difficult to collaborate with other shippers outside their business. This becomes easier for a LaaS provider, through their relationships with multiple shippers and visibility into both supply chains. If a company's dedicated fleet has capacity for product, and another company has a less-than-truckload load to be planned, a LaaS provider often provides visibility into that potential solution for shipper collaboration, benefitting both companies.

#### 5.4.1.2 Failure factor to improve LaaS and Proposal to solve this.

**"Insufficient degree of innovation in the implementation of digital technologies"** that conditions also, the negotiation phases of the contractual relationships, still carried out with traditional dynamics, and the data sharing.

**"Excessive bureaucratization in procedures"** which in many cases, today, is still dependent on paper documents

**"Too many empty return journeys"** with consequent repercussions on the congestion and road safety

**"Long waiting times for loading and unloading of goods"** that produce a bottle-neck congestion.

**"Insufficient implementation of the "platooning"** as a traffic rationalization system. heavy, used vehicles that can improve the safety and impact of road traffic environmental, as well as reducing fuel consumption

#### 5.4.1.3 Proposals for operational solutions

The proposals to overcome the inefficiencies and the consequent higher costs that weigh on the entire logistics system, focus on the massive use of intelligent systems and of the operational applications attributable to them, with a view to reaching the digitization of the sector.

**"Simplification and dematerialisation of procedures"** through the digitization of documents and certifications relating to the logistics sector proceed with the digitization of the documents accompanying the goods, with the objectives of reducing costs and time, ease of checks, less possibility of errors.

**"Reduction of return journeys without load"** with regard to road transport on own account, implementing and making systems interoperable. Furthermore, it would be useful to encourage the use of optimization techniques, capable of combining the travel of the same person or of several different subjects (through cooperation mechanisms), with increased company profits, reduced congestion on road arteries and on the reduction of negative externalities (e.g. pollution and accidents)

**Implementation of "platooning"**, with interconnected rows of trucks, with automatic driving and assisted driving, where the first vehicle in the row is able to communicate to those who follow it the optimal route, the speed to be maintained, the safety distance to be observed experimentation for the use of blockchain technology that allows exchanges of information and instantaneous transactions (negotiations, contracts, payments, etc.) between the logistic actors, ensuring the traceability of the goods.

### 5.4.2 Freelway

The following success and failure factors were specifically identified for Freelway and complete the overall success and failure factors of LaaS.

#### 5.4.2.1 Success factors

One of the greatest successes of the Freelway mobile service is that of having an effective coordination of deliveries, especially in rural areas and poorly served by traditional means.

- The service can be used by a wide range of consumers and is available both for the coordination and management of people and goods, guaranteeing the interoperability of the service.
- A further strength of Freelway is the reduction of costs for companies to transport goods and employees on the road. For example, in May 2015, Freelway had just over 700 users and had saved around 1,300 driving miles and their relative costs.

#### 5.4.2.2 Failure factors

- Increase the number of people registered: vehicles are not always optimized and have reached the maximum capacity because there are not many people registered for the service.
- Cooperation with traditional systems is not optimized there may still have conflict with each other.

### 5.4.3 MODULUSHCA

The following success and failure factors were specifically identified for MODULUSHCA and complete the overall success and failure factors of LaaS.

#### 5.4.3.1 Success factors

The Physical Internet allows the logistic operators and cities to plan and manage the goods with a better solution.

The main points of this technology are:

- Fundamental improvement is a shortening of the supply chain between manufacturer and consumer.
- The PI can make very easy for consumer to find exactly the product that they want.
- Leave a single private view to join a much more open view. Expand its pool of possible customers in different interconnected countries.
- Optimize last mile delivery.
- Development of an interconnected logistics operations platform leading to a significant reduction in costs and $CO_2$ emissions

#### 5.4.3.2 Failure factors

The two main challenges in this project are the following:

- Cooperation with colleague and competitors coordination and cooperation with foreign companies is not optimized because there could be issues with interoperability
- Build enough trust so the shippers won't be afraid to send their goods in an open system

### 5.4.4 EURIDICE

The following success and failure factors were specifically identified for EURIDICE and complete the overall success and failure factors of LaaS.

#### 5.4.4.1 Success factors

The IC allows the logistics operators to plan and execute the deliveries in an efficient way since the reliable information is available in real time. This leads to:

- Increase of the fleet capacity utilization.
- Increase of the truck/wagon loading factor.
- Reduction of the number of travels.
- Decrease of the labor costs for rescheduling and dispatching the outbound activities.
- Decrease of the time needed to select a wagon/truck to execute the delivery.

- Increase of the contractual power of the logistics operators establishing with certainty the responsibility for damages. EURIDICE allows to calculate in advance all the risks due to that transport in a mathematical and precise way and having this information I can ask my customers a higher price

#### 5.4.4.2 Failure factors

Moreover, the customer service can be improved through:

- Increase of the correct order fulfilment.
- Diminishing of the customer response time

## 5.5 KPI-related analysis of LaaS including best practices

The KPI for LaaS are slightly different from the other mobility services because freight logistic and its business impact focus not on persons but on volume or weight transported and delivered. So, the following overview shows the adapted KPI for LaaS:

Cost structure KPI

- CAPEX distribution
- OPEX distribution
- ROI (return of investment) in 3 years

Operational Performance KPI

- Waiting time
- Trip distance
- Trip number

Revenue Streams and Pricing KPI

- Service reliability
- Service quantity
- Customer retention rate

### 5.5.1 Freelway

#### 5.5.1.1 KPI – Cost & revenue structure

**CAPEX (Fixed costs):** Fixed costs consists of different cost categories:

- Cost of vehicle fleet: no owned fleet
- Cost of physical infrastructure: no owned physical infrastructure
- Costs of digital infrastructure: no owned digital infrastructure
- Machines and equipment: server cost 6,235.57 SEK

**OPEX (Variable costs):** Variable costs consist of different cost categories:

- Repairs, maintenance, services: server maintenance 2078,52 SEK
- Depreciation costs: The inflation rate is equal to 1.9% in the 2019 and 2.2% in the 2018
- Personnel costs: 250,000.00 SEK each year since 2014
- Other costs

**Revenue streams:** Pay per use, subscription

**Pricing strategy:**

- Carpooling: 2,490.00 SEK each month
- Delivery: 2,490.00 SEK each month
- DalMaaS: variable price
- Springcreek (Packaging cabinet): 59,000.00 SEK

#### 5.5.1.2 KPI – Actors in business ecosystem

**Number and nature of partners:** 5

#### 5.5.1.3 KPI - Operational (transport)

**Operation of the app:**

- the service is active 24 / 24h 7/7 days with an operating rate of 100% except during maintenance hours

### 5.5.2 MODULUSHCA

#### 5.5.2.1 KPI – Cost & revenue structure

**CAPEX (Fixed costs):** Fixed costs consists of different cost categories:

- Cost of vehicle fleet: Cost of truck
- Costs of digital infrastructure: Traceability equipment
- Machines and equipment: Cost of the first M-box and Cost of the second M-box are the fixed equipment costs.

**OPEX (Variable costs):** Variable costs consist of different cost categories:

- Material consumption: Cost of materials for the production of two box types

**Revenue streams:** Pay per use, subscription

#### 5.5.2.2 KPI – Actors in business ecosystem

**Number and nature of partners:**

The first important remark out of the Market and policy analysis is that the M-box has a high degree of compliance (79% over 100%) of the initial design requirements (Functional groups). But at the same time, there is a lot of room for improvement. Improvements in folding/collapsing, strength and durability would have a very positive impact because these functional groups have a high relative weight. The second important remark is that some current market packaging solutions have also a good level of compliance. Foldable/Stackable plastic (injection) group has a 75%, rigid plastic box pallet group has a 71%; ISO rigid plastic box group and ISO rigid metallic box group have a 61%. This implies that any of these groups could be used for some of the functional test of the pilots instead of the M-box prototypes, in order to prove some aspects of the physical internet concept.

### 5.5.2.3 KPI - Operational (transport)

Ergonomics (weight, grip handle): According to the project, the following figures show the ergonomic KPIs of two types of M-boxes (see Figure 31 and Figure 32)).


First M-box prototype design

KPI´s of the first M-box prototype

| KPI - M-box (actual prototype design) | |
|---|---|
| Outer dimensions [in mm] | 300x400x300 |
| Inner dimensions [in mm] | 270x360x275 |
| Volume usage | 74.25% |
| Weight | 6.7kg |

**Figure 31 – First M-box prototype dimensions (Source: Modulushca, 2020, p. & table by SWARCO)**

Second M-box prototype

| KPI - M-box (new prototype design) | |
|---|---|
| Outer dimensions [in mm] | 300x400x300 |
| Inner dimensions [in mm] | 270x360x275 |
| Volume usage | 74.25% |
| Weight | 4.5kg |

**Figure 32 – M-box prototype dimensions (Source: Modulushca, 2020 & table by SWARCO)**

The boxes also covering the following general requirements of a LaaS:

- Quality assurance (cleanability, package and product damage)
- Safety (fire protection)
- Handling,
- (un)loading,
- Reversed logistics,

Utilization of truck capacity: The truck of the project is loaded like in the following figure (see Figure 33), and it has the given features

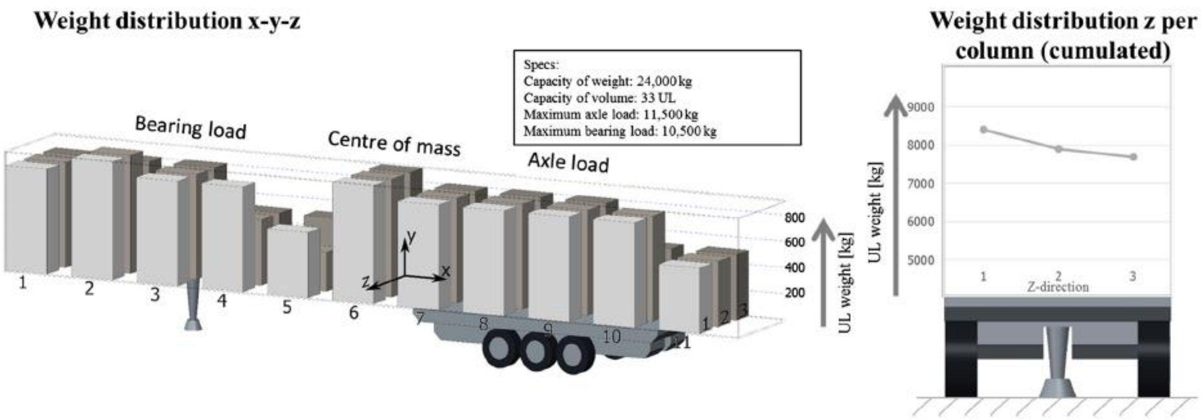



**Figure 33 – Weight distribution x-y-z (Source: SWARCO)**

Stackability/ utilization of freight vehicles

| | Item utilization of the M-box's volume (%) | M-box utilization of the unit loads volume (%) | Item utilization of the unit load (%) | Number of trailers used | Difference to the current situation (%) |
|---|---|---|---|---|---|
| Five M-boxes | 56 | 100 | 56 | 745 | 5 |
| Nine M-boxes | 63 | 100 | 63 | 652 | −8 |
| Full set (155 out of 440) | 81 | 100 | 81 | 549 | −22.5 |

**Figure 34 – Stackability/ utilization of freight vehicles (Source: SWARCO)**

Robustness: The first M-box has the general structure of the first and second types of M-boxes and the following figure (see Figure 35) is representing it:

First physical M-box prototype

| M-Box functions | fulfilled now | fulfilled at 2nd gener. |
|---|---|---|
| fold unit | ✗ | ✗ |
| encapsulate product | ✓ | ✓ |
| carry product | ✓ | ✓ |
| Fold doors/sides | ✗ | ✗ |
| combine units | ✓ | ✓ |
| stack units | ✓ | ✓ |
| Distinguish boxes | ✗ | ✓ |
| Open/close box | ✓ | ✓ |
| include a passive track & trace system | ✗ | ✗ |
| Identify contents | ✗ | ✓ |
| Handle units | ✗ | ✓ |
| withstand normal usage | ✓ | ✓ |

**Figure 35 – M-box usability for freight transport (Source: ResearchGate, 2020 & table by SWARCO)**

### 5.5.3 EURIDICE

#### 5.5.3.1 KPI – Cost & revenue structure

**CAPEX (Fixed costs):** Fixed costs consists of different cost categories:

- Cost of vehicle fleet: no owned fleet
- Cost of physical infrastructure: no owned physical infrastructure
- Costs of digital infrastructure: no owned digital infrastructure

**OPEX (Variable costs):** Variable costs consist of different cost categories:

- Repairs, Maintenance, Services:
- Depreciation costs:
- Personnel costs: 5,580,000.00€ for the entire project
- Equipment consumption: 6,975,000.00€ for the entire project
- Other costs: 1,350,000.00€ for business travel and certifications for the entire project

**Revenue streams:** Pay per use

**Pricing strategy:** Selling the EURIDICE software

#### 5.5.3.2 KPI – Actors in business ecosystem

**Number and nature of partners:** 23 covering aspects, research, development, logistics application, freight transport, IT services and payment and billing services

# 6 Overview and Analysis of DRT services

Demand Responsive Transit (DRT), Transport-on-Demand (ToD), bus-on-call, micro transit, on-demand-transport, dial-a-ride… all these designations cover a specific category of service among mobility services: public transport services that require the passenger to book its trip.

Demand Responsive Transport is a way to extend public mobility services in time and space and bring some public service in places and at period of the day when precisely, there is not enough public to run a regular service.

Indeed, Traditional public transit—bus, light rail, and metro—works best in dense downtowns and inner suburbs.

Tackling lower-density neighbourhood mobility has put transit agencies in a conundrum: either expand fixed-route bus lines at high costs and with low frequencies or tolerate poor services for low-density areas.

## 6.1 State of the art of several DRT services worldwide

Lack of services forces passengers to walk long distances for the "first and last mile" and leads to increase use of one's own car instead of public transit services to reach their destination[10.]

Because the passenger manifest himself prior to the service, it is possible to introduce a greater flexibility regarding the route and the timetable, thus enhancing the passenger's experience and increasing the service efficiency.

DRT services:

- **Offer flexible** transportation service to serve in an efficient manner low density area or complement regular lines in staggered times of the day
- **Improve quality of service** and passenger experience through tailor-made service design and digital tools allowing personalized services
- **Decrease cost** of transportation service through smaller vehicles and a cost structure mostly variable

Success of an on-demand transport service lies in the combination of different parameters

- **Service design**: finding the right proposition of service to meet the demand for mobility in a cost-effective way: service area, routing constraints (stop-to-stop, stop-to-hub...), time range, vehicle characteristics, customer pathway…etc.
- **Business models**: building a cost-effective production model, through internal and outsourced resources, routing and grouping optimization capabilities and adjusted pricing scheme.
- **Deployment**: fostering ridership and service use through communication, digital marketing, and on the field presence.

---

[10] Research in the US shows that needing to walk more than 0.8 kilometres (0.5 miles) to the nearest transit stop reduces trips by around 90 percent. See Bouton, S., et al (2017). "Public-Private Collaborations for Transforming Urban Mobility", McKinsey Insights Report, McKinsey Company, available at www.mckinsey.com.

- **Operations and continuous improvement**: reaching targeted level of service and quality engagement in day-to-day operations with continuous improvement effort.

**Computational capabilities and digital services support** enhanced customer experience (plan book pay), service productivity and quality (algorithm for routing and grouping optimization). But they are not at the forefront of what passengers are expecting from the service. They are tools supporting a mobility service

An international review performed in 2018 and 2019 of on-demand transit services and pilots (using conventional vehicles and drivers, not autonomous ones) examined both subsidised and commercial services. This other review was specifically done to understand if new technology and vehicle formats were improving the delivery of demand responsive transport (Pettersson, 2019).

The types of vehicles and fleet sizes vary widely, but in most cases, fleet sizes are quite small, ranging from four to 16 vehicles (Table 2). Also, typically, smaller vehicles (buses, and passenger vans) are used. Keoride, one of the first ODT trials in Australia and New South Wales, was included as part of the 2018 study.

The study revealed that most trials are aimed to provide public transport services in “low density, low-demand peripheral urban or semi-rural areas.” However, most cases that were reviewed for the study (because of data availability) were concentrated in an urban context.

### Comparison of 12 International ODT Services and Pilots

**Table 38 – Type and number of vehicles in the different cases; adapted from Pettersson, F., 2019**

| Case and Country of Origin | Type of Vehicles | # of Vehicles | Location | Operating Hours |
|---|---|---|---|---|
| Kutsuplus<br>(Finland) | Minibus | 15 | Helsinki, Finland | Mon–Fri 06.00–24.00 |
| RideKC: Bridj<br>(USA) | Mininus | 12 | Boston, Washington DC, Kansas City (US) | Mon–Fri 06.00–22.00 and 15.00–19.00 |
| VTA Flex<br>(USA) | Bus | 6 | San José, USA | Mon–Fri 17.30–20.30 |
| RideCo: Go Connect<br>(Canada) | Minibus | 14 | Milton (CA) | Mon–Fri 06.00–08.30 and 16.45–20.2 |
| Via<br>(USA) | Typically, a Mercedes Shuttle (normally 6 seats, but a range of vehicles are used) | N/A | Via as TNC (NY, Washington DC, Chicago) Via in partnership with cities (US): Arlington TX, West Sacramento CA; (US) | Via NYC: 24/7<br>Via Arlington, TX: Mon–Fri 06.00–21.00, Sat 09.00–21.00<br>Via West Sacramento: Mon–Fri 07.00–22.00, Sat 09.00–22.00 |
| ArrivaClick (Sittingbourne, UK) | Minibus | 5-6 | UK | Mon–Sun 06.00–20.00 |

| Case and Country of Origin | Type of Vehicles | # of Vehicles | Location | Operating Hours |
|---|---|---|---|---|
| ArrivaClick (Liverpool, UK) | Minibus | 12 | UK | Mon–Sat 06.00–22.00 |
| PickMeUp<br>(UK) | Minibus | 8 | UK | Mon–Fri 06.00–1100, Sat 07.00–12.00, Sun 09.00–21.00 |
| Plustur<br>(Denmark) | N/A | N/A | North Jutland (DK) | Depending on general PT system operating hours |
| Breng Flex<br>(Netherlands) | Minibus and electric cars | 16 (8 minibuses and 8 cars) | Nijmegen, Arnhem, Molenhoek (NL) | Breng flex: Arnhem/Nijmegen: Mon–Fri 06.30–24.00, Sat 07.00–24.00, Sun 09.00–24.00<br>Breng flex: Molenhoek: Mon–Fri 07.00–19.00, Sat 10.00–16.00 |
| Résa'Est<br>(France) | Minibus | 3 | France | Mon–Fri 06.15–19.00, Sat 07.00–19.30 |
| Keoride,<br>Northern Beaches, Macquarie Park<br>(Australia) | Minibuses, cars | 8 | Australia | Mon–Wed 06.00–22.00, Thu & Friday 06.00–23.30, Sat 07.00–23.30, Sun 07.00–21.30 |

Most of the shared vehicles could be requested by passengers through smartphone apps, with the vehicles being scheduled or re-routed in real time based on the booking. The services varied as to being able to cater to passengers in real-time or advanced bookings, either being available for both or only one of two. Some services were made to be an on-demand service and operate within a certain time frame or scheduled waiting time for passengers. They identified particular pick-up and routing strategies such as physical and virtual stops or corner-to-corner service, pick-up points or a combination of both. However, it was pointed out that most services require passengers to walk to a certain fixed point to be picked up. This is found to be an inconvenience and a departure from the original mission, since this provision strays away from a central part of ODT history of serving physically challenged passengers who would have difficulty with regular bus services. Of the studied ODT programs, only three offered door-to-door services, namely: Breng flex, Go Connect, and Keoride (Northern Beaches). (Note: Keoride in Northern Beaches no longer offers door-to-door connectivity as of January 2020.)

Operating hours varied from urban trials being offered round the clock, to during peak hours only. In terms of pricing, most services used flat pricing models and a few could be paid using public transport cards, or were otherwise integrated in their local public transport system. However, most services used independent payment schemes that are seldom linked with other public transportation services, creating another hurdle for passengers. Users found the services' pricing schemes to be "cheaper than taxis but still more expensive than the usual bus" (Pettersson, 2019).

In terms of patronage, some services had lower demand than was expected before their trials started. Particularly, productivity was lower in comparison to "traditional ODT", and this was the main reason for the end of their respective trials. It is worth noting that of the examined use cases, Keoride in Northern Beaches (at the time of the international review, in 2018) had the second highest metric for passengers per hour, evidenced in the table below. It is worth nothing that the focus groups held in in Northern Beaches and Macquarie Park (where Keoride operates) from the willingness-to-share research held in October and November 2019 revealed extremely high levels of satisfaction from users.

**Ridership Comparison across International ODT Programs and Pilots**

**Table 39 – Passengers per Revenue Hour (e.g. ride density and resource sharing) (Pettersson, F., 2019)**

| Case | Passenger Trips / Month | Revenue Hours / Month | Passenger Trips / Hour |
|---|---|---|---|
| Kutsuplus (Finland) | 8333 | 5700 | 1.5 |
| RideKC: Bridj (USA) | 123 | 2057 | 0.06 |
| Via Flex (USA) | 452 | 1993 | 0.2 |
| RideCo: Go Connect (Canada) | 1083 | 759 | 1.4 |
| Resa Est (France) | 2077 | 1024 | 2 |
| ArrivaClick (UK) | 4583 | 1733 | 2.6 |
| Keoride (Northern Beaches) | 9816 | 3891 | 2.5 |
| Brengflex (Netherlands) | 16500 | 8297 | 2 |

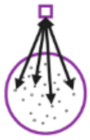
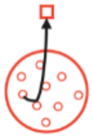
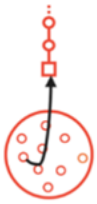
Based on the trials in Pettersson's review, it seems that new technological features in booking have failed to produce promising results in the majority of cases. Another comprehensive international review produced by Monash University in 2019 also noted that ODT services since 2000 (as the starting point of when new technologies began to be introduced into ODT programs) have not been lowering costs, but in fact increasing costs per passenger (Currie, G. & Fournier, N, 2019).

Part of this failure may be attributable to a poor understanding of new skill acquisition on the part of the customer base (learning a new service or new way to book ODT rides); another factor could be the relatively small fleet sizes, especially when compared to the large, flexible fleet supply of TNC on-demand ride hailing services; and lastly, the psychological component of weighing price, time, and comfort for each customer, which is different in a shared van setting (with potentially six other riders) compared to a taxi, or shared taxi model (with at most 3 other passengers). The results from the Monash University studied showed that "simpler" routes (fixed route with deviation, rather than on-demand routing) had lower failure rates, and suggested that specialist services (i.e. paratransit) and simpler service design were helpful for developing successful ODT programs.

### 6.1.1 Different DRT service

The following table gives an overview about DTR services and their main types:

**Table 40 – Overview on the types of DRT services**

| DRT type | Pictogram | Definition |
|---|---|---|
| **Addresses-to-addresses** |  | Connection between any addresses to any others in a defined zone |
| **Addresses-to-hub** |  | Feeder model<br><br>Connection between a hub and any address in a defined area – both ways. |
| **Virtual line** |  | Regular line only operated only after at least one demand. |
| **Stops-to-stops** |  | Zonal.<br><br>Connection between stops in a defined zone. |
| **Stops-to-hub** |  | Feeder model.<br><br>Connection between a hub and on-demand stops in a defined zone. |
| **End-of-line-to-stops** |  | Feeder model.<br><br>Regular line serving on-demand stops beyond terminal point |

Variations of the DRT are ensured by some services rules (Table 41):

**Table 41 – DRT Service rules**

| | | |
|---|---|---|
| **Detour time**<br>**Time on board** |  | Maximum additional trip time as compared to direct trip<br>Maximum time one passenger can spend on board the vehicle. |
| **Stops** |  | Number of predefined stops |
| **Pick-up or drop-off flexibility** |  | Maximum time variation around requested pick-up or drop-off time |
| **Booking time period** |  | Maximum/minimum time period you can book your trip |

### 6.1.2 Different steps to a DRT service

The following figure (Figure 36) shows the relevant steps for the creation/introduction of a DRT service:


**Figure 36 – The different parameters / steps that lies to success of a DRT service (Source: RISE)**

**Success of an on-demand transport service lies in the combination of different parameters**

- **Opportunity study and Service design**: finding the right proposition of service to meet the demand for mobility in a cost-effective way: service area, routing constraints (stop-to-stop, stop-to-hub...), time range, vehicle characteristics, customer pathway…etc.
- **Business models**: building a cost-effective production model, through internal and outsourced resources, routing and grouping optimization capabilities and adjusted pricing scheme.
- **Technology:** Computational capabilities and digital services support enhanced customer experience (plan book pay), service productivity and quality (algorithm for routing and grouping optimization). But they are not at the forefront of what passengers are expecting from the service. They are just tools supporting a mobility service
- **Deployment**: fostering ridership and service use through communication, digital marketing, and on-the-field presence.
- **Operations and continuous improvement**: reaching targeted level of service and quality engagement in day-to-day operations with continuous improvement effort.

On-demand solution is just one link in a wider mobility spectrum, going from mass transit services like tramway or DRT to first mile / last mile solution like on-demand scooter… or vehicle.
A public on-demand shuttle service needs to be effectively linked to the rest of public transit networks:

- Visible connection with all other transport mode on mobility hub
- Organized time connection between on-demand services and regular services
- Enhanced customer experience through on-demand and regular operations connection

### 6.1.3 Example of DRT services

#### 6.1.3.1 DRT by Transdev

##### *6.1.3.1.1 Rouen Normandy Autonomous Lab*

One of the main projects where Transdev is highly involved in is based in Rouen. For 3 years (2017-2019) the RNAL Project (Rouen Normandy Autonomous Lab) is being implemented as the first on-demand transport service using autonomous electric vehicles on open road in Europe. The RNAL project is taking place in the heart of Le Madrillet one of the most dynamic areas in Rouen Metropolis, in a strategic point in the south entrance in Rouen.  In the RNAL project, four Renault ZOE all-electric cars, equipped with autonomous systems developed by Transdev and Renault, are being tested on open roads. The fleet will also feature an i-Cristal autonomous urban shuttle jointly developed by Transdev and Lohr. **The tests cover all use cases related to typical traffic conditions, such as other vehicles, intersections, roundabouts and building exits.**

Rouen Normandy Autonomous Lab (see Figure 37) is the first mobility service delivered with electric autonomous cars driving on opens roads, and open to the public in Europe. This innovative and sustainable transportation service showcases a fine know-how with innovative capabilities jointly developed between key actors of tomorrow's mobility.

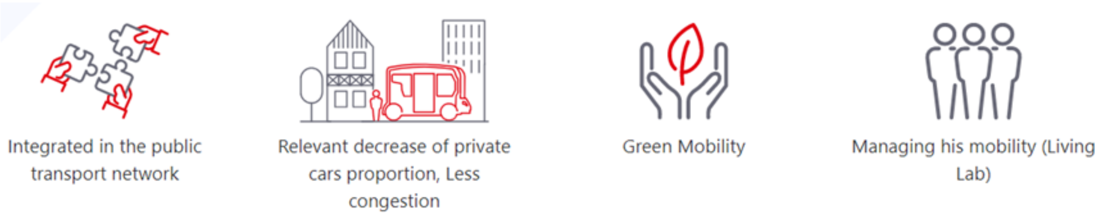



**Figure 37 – Rouen Normandy Autonomous Lab DRT (Source : Transdev)**

The vehicles (see Figure 38) will run on three loops covering 10.5 kilometres, with 17 stops across the district. All three loops are connected to the south east terminal of the Metropolis tramway and will be fully opened to public in 2019.


**Figure 38 – Car of Rouen Normandy Autonomous Lab /Source: Transdev)**

### *6.1.3.1.2 Chronopro TAG – Digital DRT service for low density area - Grenoble Métropole France*


**Figure 39 – Chronopro TAG - Digital DRT service for low density area - Grenoble Métropole France (Source: RISE)**

**Context:**

Saint-Pierre-de-Mésage and Notre-Dame-de-Mésage are two small mountain towns with a low population-density (under 2,000 inhabitants in total for the two towns). Integrated within the Grenoble metropolitan area, they did not have a satisfactory public transport services due to their low population density. The two villages were chosen to experiment an on-demand shuttle service as part of a LEMON lab initiative - the framework for new mobility services in the Grenoble-Alpes Métropole (see Figure 39).

**Objectives:**

- Answer to a need expressed by residents and elected officials to connect these two towns the southernmost of Grenoble to the regular public transit network;
- Experiment with a 100% digital, on-demand transport service in a low-density area.

**Transdev's answer:**

**90% of the population now have a stop no more than 300m away:** With Chronopro TAG, customer can ask to be picked-up, at the chosen time, on one of the 23 stops of the area. They can then be dropped-off in Vizille, where they will be able to access services and a shopping centre, or at one of the stations of Express line n°3, which will take him to inner Grenoble centre. The service offers 10 trips from Monday to Saturday (4 trips from towns to hub in the morning, 1 round-up at noon and 4 trips back to the towns in the evening).

**A service fully connected with the regular PT service:** The service has the same pricing scheme as the local public transports. The customer can buy a ticket to the driver when he gets in the vehicle. Connection with the Express line 3 is guaranteed. One-way tickets costs €1.60 and allows several connections with the broader PT service with in a 1-hour period.

**A 100% digital and flexible service:** The customer can book its journey on the service mobile smartphone application or on a dedicated website. Trips can be booked until 40 minutes ahead of departure time. Booking, routing and dispatch is powered by OPTYCALL software from Cityway, Transdev IT subsidiary. Cityway designs solutions to simplify travel and optimize production means.

**Key figures:**

- **Network**: 23 stops in the villages of Notre-Dame-de-Mesage and Saint-Pierre-de-Mesage linked with 2 hubs: regular public transport station (line 3) and a shopping centre;
- **Vehicles**: 1 dedicated shuttle, adjusted to the service specific mountain environment;
- **Price**: €1.60 for the customer (network pricing scheme);
- **Staff**: 2 drivers are dedicated to this service;
- **Booking options**: On the mobile application, or on the Chronopro Tag website.
- **Results:**
    - 90% of the population have a stop accessible no further than 300m from this house;
    - up to 260 users and 150 trips per month;
    - 25% of users make more than 2 trips / week.

### *6.1.3.1.3 PTFlex services – The Netherlands*


**Figure 40 – The TexelHoppe, the PTFlex service of Texel island (Source: RISE)**

**Integrating On-Demand services within existing networks**

Shared rides are a key component of region’s long-term mobility strategy in the Netherlands as a complement to existing regular bus lines network. Transdev initiated discussions with several public transit authorities in the Netherlands to integrate ridesharing services into transit networks, with the main goal of providing mobility services that fit better with the need of the citizens and the characteristics of the area.

In 2016, Transdev launched BrengFlex (see Figure 40), the first fully integrated with public transit on-demand solution in the Netherlands. Following the success of BrengFlex (the Transdev PTflex), the concept was launched in several public transit concessions in the Netherlands, in different environment, from the Schiphol airport area to the rural borough of Texel island.

**Objectives**

- Provide public transit authorities with on demand mobility solutions tailored to local needs;
- Reduce the cost per passenger-kilometres for transit authorities in low-density areas;
- Guarantee seamless trips.

**Transdev's answer**

There is no fixed timetable for our PTflex services. A small bus will pick you up at a bus stop at the agreed time and will take you as quickly as possible to your selected bus stop. You may have to share the vehicle with other passengers. But that only happens if your arrival time is not affected. Reservations can be made via a free flex-app or by calling. The advantage of booking via the app is that you can continuously see where your driver is, when you will be picked up and what your expected time of arrival is.

**World-class technology developed in-house**

- All Flex services use world-class routing technology, an app, and a website that were developed by Transdev Netherlands;
- Most bookings are made through the purpose-built app;

- This routing and app technology have also been used for Transdev's on-demand first- and last-mile solutions in Australia or the United States.

**Tailoring the first and last mile to local needs**

- The diversity of the operations shows that Flex technology can be easily adapted to complement local public transit networks;
- For all operations, dual branding with Flex and the network name maintain continuity while highlighting an innovative new service.

**Great customer data**

- We collect advanced and segmented customer data, allowing us to adjust the service to best meet passenger needs, and to market our solutions to the most likely users;
- Regular passenger feedback lets us know what works and what doesn't, so we can make changes quickly when needed.

**Accessible for all**

- All Flex operations are fully accessible.
- Accessible shuttles are equipped with an electric ramp and on-board wheelchair space.
- Customers without smartphones and credit cards can book by calling in and can pay with the public transit system's smartcards.
- We engage with mobility-challenged passengers in person at roadshows to nursing homes and aged care facilities.)

**Key figures**

- **Ridership**: 22,000 passengers/month on average; 5,300+ active user/month on average;
- **Operations**: 60 vehicles (from 5 to 20 vehicles per operation), ranging from minivan to electric 4 doors car;
  - **Booking** options: By app or by phone through our call centre; 85% of "book now" reservation on AML on average;
  - **Results**:
    - Ridership growth - all contracts have seen consistent growth since starting operations;
    - High customer satisfaction: Average ratings 4.7/5 for BravoFlex, and 4.4/5 for AMLFlex.

#### *6.1.3.1.4 On-demand Sydney Ferries - Sydney, Australia*

Searching the current (DRT) markets a new on-demand-ferry in Australia is the newest member in the group of DRT-services.

**New on-demand ferry service in Bays Precinct**

**Figure 41 – On-demand ferry service (Source: RISE)**

Although the Bays Precinct is popular with both tourists and regular public transport customers, the wharves inside the Bay were not serviced by regular ferries (see Figure 41).

Leveraging on our experience gained with the TfNSW's innovative On Demand Public Transport Trials started in November 2017, Transdev put forward the idea that on Demand service would help to connect this area to Barangaroo, served by regular sea and road transport.

**Objectives:**

- Extend the ferry mobility service to un-serviced bay area;
- Operate the services as a complementary and integrated part of the mass transit mix;
- Provide customers with a service as fast, reliable, and convenient as a private car.

**Transdev's answer**

Transdev has applied a fundamental learning from our on-demand experience – a service must be simple to use, integrated with the rest of the network and be dynamically requested to generate the demand that is necessary to make it successful.

**Simple to use**

- Extended working hours: The On-demand service is available between 7am and 10pm on weekdays and 8.30am and 7.30pm on weekends;
- A fixed fare: A one-way trip is $7.60 for adults and $3.80 for concessions;
- Book at the wharf: The digital kiosk will notify you when the ferry is expected

**Integrated with traditional transit**

- the on-demand ferry connects wharves at the Fish Markets, Blackwattle Bay and Pirrama Park with Barangaroo, where customers can continue their journey on another ferry, bus or train;
- Concession fares are available for concession card holders, including pensioners, seniors, students and apprentices.

**100% digital**

- easy to get: book your Ferry On-Demand service using the mobile phone application, or on one of the digital kiosks located at the wharves.

- The size of the "on-demand" area has been determined to allow optimized round trips with reduced waiting time, even when booking for immediate departure.

**Key figures:**

- **Network**:
    - Sydney ferries: 8 lines, 32 vessels, 500+ employees; 15M+ annual trips
    - Vehicles: 1 MiniCat vessel (12m) with 43 seats and which has an overall capacity of passengers 60.
- **Staff**: the MiniCat is operated by a single crew member.
- **Booking** options: via Tranzer application on mobile phone or at the digital kiosks located at the wharves.
- **Results** (after two months of operation)
    - Ridership growth: 120 passengers / day on average;
    - High customer satisfaction: 96% of positive feedback.

### 6.1.3.2 DRT by KEOLIS

Keolis launched a new on-demand service in Lyon at the end of 2019 (see Figure 42). The new service links industrial areas to the Lyon transport network for the first and last kilometre. The service will operate in Lyon's 'Chemical Valley' (Vallée de la Chimie), an area south of the city which contains a high concentration of chemical industries. The aim is to provide a flexible transport solution for sparsely populated areas and large zones like business parks, as backup for traditional regular services and to refine existing transport services. It's based on real-time on-demand technology where the customers can reserve a space, even booking right up to the last minute. They can change it as they need to, and there aren't fixed hours or even fixed routes. The routes and the hours are calculated according to the demand received, thus creating a service that is much more flexible for customers, as well as for operating. It's a very different way to operate, aiming for a much more efficient use of public money which puts the resources where they're needed. Prior to the advent of COVID-19, the Lyon service was already clocking 100 bookings a day.

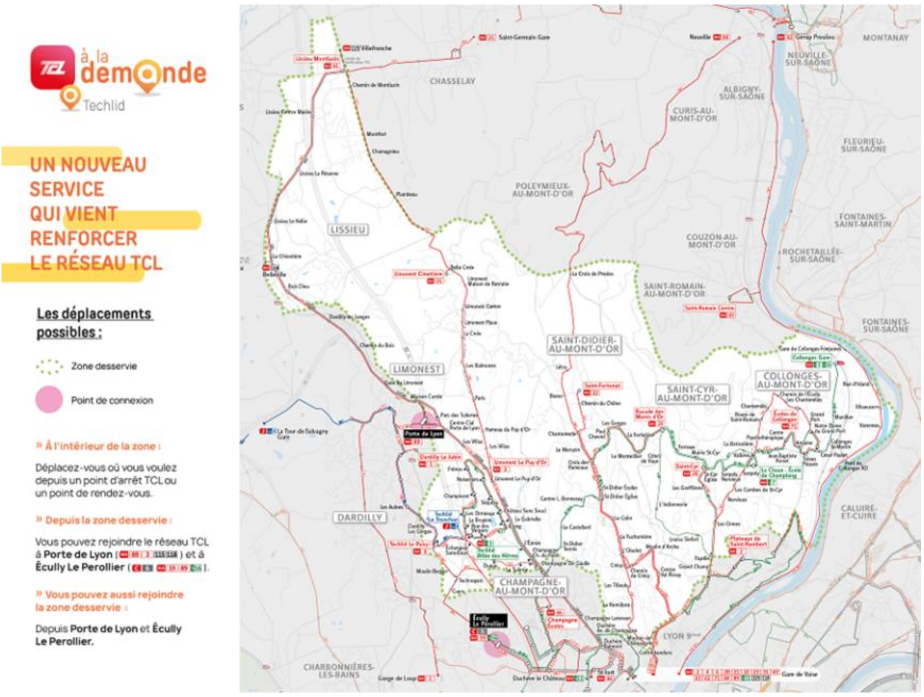


**Figure 42 – Service area of On-Demand Transport in Lyon (Source: Keolis)**

TCL network passengers will be able to use the on-demand transport service to travel wherever they wish inside the Chemical Valley area, or travel to the Chemical Valley area from one of the TCL network connection points at Gare d'Yvours, Hôpital Feyzin Vénissieux and Saint-Fons 4 Chemins. Fully integrated in the existing network, these new link services can be used by passengers with a TCL ticket or travel card. Bookings can be made in advance or in real time, on the website tcl.fr, via the Allô TCL service, or using the special TCL Vallée de la Chimie app, which offers a number of services to improve travel including pedestrian navigation to the closest stop and real-time vehicle identification and visualisation.

The new service is in a zone that lacked public transport services before, so the PTA in Lyon are pleased with a new transport offer that is both economically efficient and more flexible. The aim is to better serve these areas that are being more and more built up as industrial sites, and to capitalise on this on demand technology in different networks (Bordeaux, Orléans, Nancy and other networks in France) over the last 18 months. The following conditions are defined for the KEOLIS DRT service:

- On-demand service, with 15-minute slots;
- Operating hours: Monday to Friday from 6am to 8pm;
- Booking: mobile app + web + phone service;
- Booking possible up to 4 weeks in advance;
- Mobile app passenger and driver with real-time monitoring available;
- Fare: included in the network offer (in the case of Lyon, the presentation of a TCL ticket);
- Fleet: 6 vehicles with 7 seats (subcontracting) NGV & hybrid.

## 6.2 Business and operating models using Canvas Methodology

### 6.2.1 Overall business model for DRT services

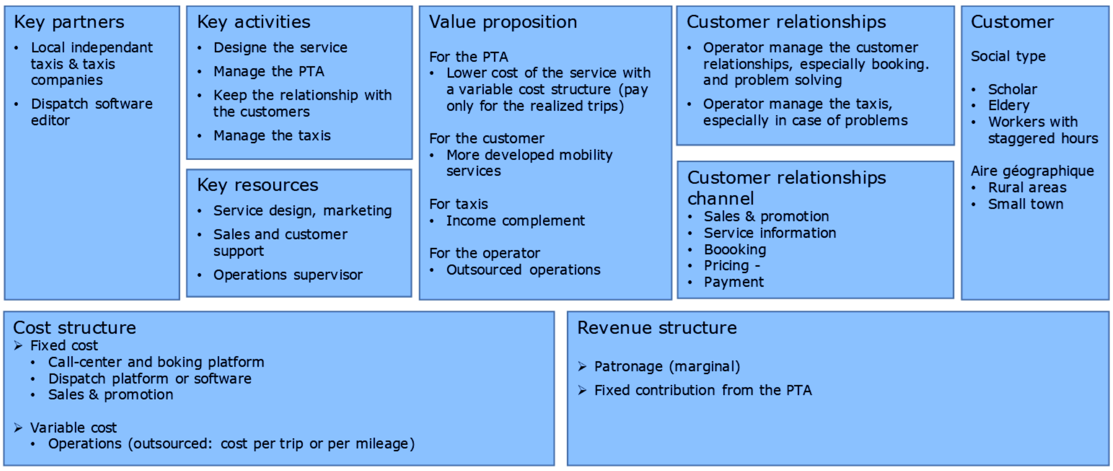



**Figure 43 – Example of a business CANVAS for a DRT service in general (Source: SHOW internal)**

Figure 43 describes all relevant business factors from a perspective of an overall business models of DRT services covering all relevant aspects for all kind of DRT services. The following chapter describe the difference between DRT services (four types are currently identified) regarding the cost structure and therefore fore the benchmarking within chapter 10.

### 6.2.2 Cost structures of DRT services

It has been suggested that there are four types of DRT in terms of their cost structure:

- Commercially viable DRT
- Acceptable subsidy DRT
- Justifiable subsidy DRT
- Financially unsustainable DRT

- Commercially viable DRT

Commercially viable DRT, which makes a profit on its operations, is more common than is generally thought with most taxi and minicab services falling into this category along with airport shuttles and jitneys in some cities.

- Acceptable subsidy DRT services

Acceptable subsidy DRT operates at a subsidy level which may be similar to other forms of fixed route transport. In the United Kingdom a number of DRT schemes appear to have achieved subsidy levels akin to those enjoyed by conventional buses. A review of DRT schemes showed that the majority of the schemes reviewed were operating at a subsidy level exceeding 2.18€ per passenger, with slightly over half having a subsidy exceeding 5€ per passenger trip. According to the report this would be viewed as an acceptable subsidy level within the industry, based on the cost of operating conventional bus services. The researchers also found that schemes that offered a season ticket tended to have lower subsidy levels.

- Justifiable subsidy DRT services

Justifiable higher subsidy services may be sustainable as long as the justification remains valid. Many community transport operations would come under this definition. Others, such as patient transport services, may appear to come under this rubric although often the higher subsidy may not be really justified on the basis of the high-quality nature of the service but rather because of operational inefficiencies. For many DRT schemes, the continuing need for subsidy focuses upon a longstanding rationale for DRT services. This is that, on a per trip basis, DRT is still often far cheaper for public authorities to provide than conventional specialist health, education, or social service transport services. This is the justifiable higher subsidy rationale. DRT may be expensive, but for the markets it serves it is cheaper than the alternatives. This is how DRT became established as a public transport service for people with disabilities – dial-a-ride and ring-and-ride.

- Financial unsustainable DRT services

Unfortunately, many trials and pilots of DRT services have proven to be financially unsustainable. This may happen for a number of different reasons including flawed service design, unrealistic expectations, failure to adequately work with the users in the service development stage and not explaining how the services are to work to prospective passengers.

A number of ways of reducing the cost of demand responsive transport have been suggested including:

- the use of established stops or collection points
- limiting the number of off-route requests accepted per vehicle trip

- accepting last-minute requests (including those made at the time of boarding) only on a space available basis
- reserving the right to pick up or drop off passengers several blocks from their actual origins or destinations

### 6.2.3 Operating models of DRT services

Sustainable DRT services are not that long on the market, so analysis of operating models using the value proposition canvasses are not available or confidential. Therefore, an overall operating model covering all necessary/specific aspects for all kind of DRT services and which can be used for the development of new business and operating models was prepared.

**Table 42 – Value proposition canvas for overall DRT service**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Costumer: specific transport for VRU and elderly people or time-critical freight<br>• Cities: future mobility strategy<br>• Transport providers: connect to multi area system |
| Pains | • Multiple contracts and different platforms for various mobility providers<br>• Car traffic overload in cities |
| Gains | • All personal mobility data in a single app<br>• All-inclusive plan - your ticket is always at hand<br>• Environmentally friendly mobility systems<br>• Combination of person and freight transport |
| **Value proposition** | |
| Products & Services | • Pay as you go for a single DRT<br>• flat rate for all transport needs |
| Pain Relievers | • One app for all transport needs (planning, booking, payment)<br>• Reliable service covering in-time requirements<br>• Combination of different transport means with a single contract and unified and comfortable payment<br>• Clear vision of future mobility for cities |
| Gain Creators | • Open DRT (and MaaS) partner platform<br>• Mixed services (DRT + MaaS) increasing business impact |

## 6.3 User & Role Analysis including user profiles, mobility needs, relative utility

Sustainable DRT services are not that long on the market, so analysis of users and roles considering user profiles, mobility needs as well as relative utility are not available or confidential. Therefore, an analysis of the necessary/specific aspects that can be used for the development of new business and operating models was prepared. To overcome possible lack of information this chapter also considered the input of the online survey to ensure the completeness and usability of the overall argumentation and control our results.

### 6.3.1 User profiles

There are several reasons that the need for DRT will increase, such as:

- An increasing dissatisfaction with conventional public transport provisions in terms of it being inflexible, cumbersome and unreliable — and the ability of DRT to become a 'third way' between the bus and the private car
- The lack of adaptability of conventional bus and taxi services coupled with the inherent variability of the public transport market. Different users (indeed the same users at different times) can have very different requirements from a transport service that are perhaps easier to resolve using DRT than with a bus service
- More dispersed land use patterns leading to increased car ownership and use, and a less viable market for conventional public transport services
- An increasing governmental interest in using DRT to address social inclusion/accessibility and modal shift public policy goals, coupled with the idea of using DRT as a means of integrating the delivery of community transport, social services, education, and public transport services into a single system.

Different user types include:

- Transportation Advocates
- Environmental Groups
- Chambers of Commerce
- Outdoor Advertising Industry
- Manufacturing staff
- Public transit operators' staff (e.g. drivers, mechanics, depot managers)
- Civic Organizations
- Pedestrians & Bicyclists
- Conventional Motorists
- Real Estate Developers
- Urban Planning Agencies
- Communication provider

For example, for Transdev's operation near Grenoble France (Chronopro TAG), we conducted a survey that shows the service reached all ages, from students to retired people and all professional background, from workers to executives. 44% of users were between 25 and 64-year-old; 38% were employees or from intermediate occupation; 21% were pupils (under 18-year-old)

### 6.3.2 Mobility needs

Most general mobility needs and use case for DRT system are:

- Connecting a low-density neighbourhood in rural or suburban areas with the broader PT system or with;
- First/last mile solutions;
- Connecting business park with the rest of the PT network;
- Reducing the need for point-to-point CFVs;
- Providing night services;
- Providing point to point mobility to disabled or elderly people.

### 6.3.3 Relative utility

- First and last Mile connection;
- Mobility service gap filling.

## 6.4 Success & Failure factors in the field of CCAM

### 6.4.1 Basic conditions and rules for DRT success and failure factors

On-demand solution is just one link in a wider mobility spectrum, going from mass transit services like tramway or BRT to first mile / last mile solution like on-demand scooter or vehicle. A public on-demand shuttle service needs to be effectively linked to the rest of public transit networks:

- Visible connection with all other transport mode on mobility hub;
- Organized time connection between on-demand services and regular services;
- Enhanced customer experience through on-demand and regular operations connection.

To identify and develop success and failure factors the following guidelines have to be considered:

**From service design to day-today operations: all steps are required**

Success of an on-demand transport service lies in the combination of efficient service design, cost-effective production scheme, impactful deployment actions and high-quality day-to-day operations. Computational capabilities and digital services support enhanced customer experience (plan book pay), service productivity and quality (algorithm for routing and grouping optimization).

**Business models are fragile and must be closely monitored**

Service design will strongly impact cost structure (variable/ fixed cost), needs for tech development and potential increase in global resources needed (#vehicles; #driving-hours). It will also determine the pricing scheme (specific or network's). Patronage is often marginal compared to global cost and service relies mostly on the PTA's subsidy.

**Moreover, it is key for success to bind together the parameters defining on-demand mobility services:**

Tech tool without close connection to real-life passenger experience will create customer disappointment and loss-making services

Digitalization has brought some new capabilities in service design, operations efficiency and customer experience for on-demand service. However, successful operations and services rely on efficient feedbacks between drivers and operating teams, customer support and marketing and tech teams to reach the required level of service quality.

Building on our experience at Transdev, we advise the following:

- simultaneously handling service design and tech choice allows to create a demand-meeting mobility service;
- Choosing the right tech allows to build a strong sustainable business model based on reliable mileage production and grouping rate.

Perfect service design without deployment skills is useless

On-demand transit services bring in a new mobility offer into areas where transit services were poorly used or inexistent. Not only the service must be carefully designed; it also needs to be actively promoted to meet its commercial objectives.

Based on our experience at Transdev, a successful launching campaign is based on 3 principles:

- Easiness, through clear and didactic service documentation;
- Visibility, through a strong identity, visible in public space (stop and vehicles livery) and digital space (internet, social media);
- Customer intimacy, through street teaming and community events.

Continuous improvement approach is mandatory to achieve success.

On-demand service are tailored to fit one community specific needs.

Even though initial service design will attempt to consider all parameters, only the live testing will prove it right. On-demand services need to be carefully monitored, almost on a day-to-day basis, and constantly adjusted to better meet demand. Relying on our experience at Transdev, we recommend a continuous improvement approach based on:

- **Drivers training** so that field experience and customers' feedbacks is accurately reported and considered.
- **Agile approach on main operation parameters:** ToD area, time range, booking channels, number and quality of vehicles

Finally, an integrated approach clarifies responsibilities in delivering the service: **one single point of entry for customers and for the PTO.**

### 6.4.2 Success and Failure Factors of DRT services

DRT services, especially sustainable ones, are not that long on the market, because of that dedicated and comprehensive analysis of single DRT services are currently not available. First evaluation was done during research projects and were used together with the knowledge for existing mobility services results of chapter 6.4.1 to develop and describe the following overall success and failure factors for DRT services.

#### 6.4.2.1 Success factors

##### *6.4.2.1.1 Innovation of PT provider*

Flexibility, interoperability and fast technology innovation cycles as well as fast changing user requirements and business ecosystem adaptions requires a highly flexible, scalable and transferable innovation cycle of the PTO. As result of the PTO innovation power they are early involved into experiments with on-demand transit and MaaS, like Keolis is now developing remote control and 5G operations technology with Ericsson, at the Kista Science City site.

##### *6.4.2.1.2 Company and Service image*

Keolis would be a recognizable provider of AV services in Stockholm and Sweden. This fact is going to create a positive image for the operator.

##### *6.4.2.1.3 Future market potential*

According to ABI Research the size of the mobility as a service market will exceed global revenues of 1 trillion US-Dollars by 2030. (Bay, 2020)

### 6.4.2.2 Failure factors

#### *6.4.2.2.1 Global influence of mobility needs like COVID-19*

Autonomous and shared mobility requires certain levels of user participation to be considered successful. With the recent pandemic, there are concerns that travel and commuting are "depressed" and we will not see the kinds of usage of the services that we expected prior to COVID-19.

#### *6.4.2.2.2 DRT service capacity planning*

Due to high interest in a new technology it is possible that the demand is higher than the service can offer. This could lead to crowded vehicles and time delays.

#### *6.4.2.2.3 Trust in the service*

Contrary to sub-chapter 6.4.2.2.2 it is also possible that the service fails due to mistrust in the new technology. This could lead in people not using the service and with that additional costs for the operator and not solving the mobility problem.

## 6.5 KPI-related analysis of DRT including best practices

Sustainable DRT services are not that long on the market, so evaluations are not available or confidential. DRT-services with subsidies do not represent a view to the real business KPI, because subsidies distort the impact of cost and revenues.

Therefore, an analysis of the necessary/specific KPIs that can be used for the development of new business and operating models as well as in the context of the evaluations in A2.3, which can compensate for the effects of subsidies, was also prepared.

The following KPI represent the main business-related results of the analysis and together with the KPI defined in WP9 can be used as relevant reference values for nearly all kinds of DRT services:

- Service productivity:
    - Passenger / operated hour / vehicle;
    - Cost / pax.trip or cost / pax.km.
- Service attractiveness:
    - Number of trips / customers;
    - Number of active customers.
- Service efficiency:
    - Grouping Rate (average number of passengers per ride);
    - Refusal Rate (number of trips declined by passenger).

The performance measures commonly used are Passenger KM per Vehicle, Passenger Trips per Vehicle, Operating Expense per Passenger Trip, and Operating Expense per Passenger KM. Past reviews of DRT best practices indicate major gains are possible in productivity of a system (such as an increase in Passenger KM per Vehicle, annually) but that there is no corresponding cost impact. The use of Advanced Communications technology was found to have a beneficial impact on operating cost, however there was no corresponding productivity impact. These results suggest that policy makers should continue to implement Advanced Communications systems features such as automatic vehicle location and automatic passenger location data, particularly since the advanced digitalization of the DRT services being implemented in SHOW have been created for the purpose of reducing operation expenses over the long term. Finally, past studies which used "Revenue KM" or "Revenue Mile" show that this KPI was in fact a poor representation of service, as related to evaluation of productivity, so the use of this calculation should be avoided. Policy makers and other stakeholders should instead focus on Trip Requests and Trip Requests Serviced as better KPI for DRT performance.[11]

[11] Dessouky, M., Palmer, K., & Abdelmaguid, T. (2003). Benchmarking best practices of demand responsive transit systems.

# 7 Overview and Analysis of car sharing services (CSS)

Car sharing is a form of car rental that leverages connectivity and mobile applications to ease the booking process in a way that is faster and more user friendly. Car sharing offers the possibility to have temporary access to a car when needed, without the burden of car ownership and maintenance. It has become very popular, especially for young citizens that occasionally need a car while not being able to afford the associated costs of ownership and also for families living in dense urban areas with limited parking spaces. Recently, a lot of attention has been put to the benefits that car sharing can bring to the overall mobility system and society. Many studies about the impacts of car sharing have shown that, properly deployed, car sharing brings about a lot of benefits, from reducing congestion and the need for parking in cities to offering the convenience of private mobility access to everyone with a valid driving license. For instance, while privately owned cars are only used about 5% of the time and rest idle for long periods, shared cars are used up to 60% of their lifetime thanks to being used by many people.

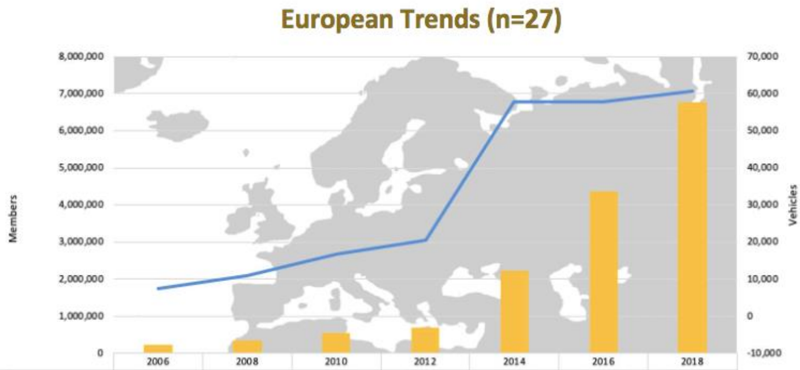
## 7.1 SotA of several CSS worldwide

Car sharing business models worldwide have experienced a rapid growth during the past 10 years. What started as a community-based initiative to promote shared ownership and use of cars among neighbourhoods in Germany, has evolved into a growing trend that aims at optimising mobility by car, reduce pollution and congestion in cities and overcoming the need for many families to own private cars, reducing the total number of cars in circulation and the total miles driven.

Figure 44 to Figure 46 below show the growth of car sharing globally, in Europe, in Asia and in North America, for both number of total car sharing vehicles and the number of total car sharing members.

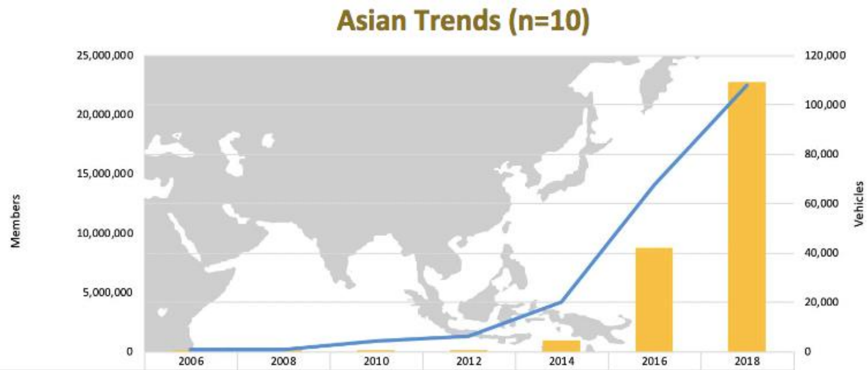

| | 2006 | 2008 | 2010 | 2012 | 2014 | 2016 | 2018 |
|---|---|---|---|---|---|---|---|
| Members | 346,610 | 670,822 | 1,163,645 | 1,788,027 | 4,842,616 | 15,050,192 | 31,813,491 |
| Compound Annual Member Growth Rate (2 yr) | 0% | 39% | 32% | 24% | 65% | 76% | 45% |
| Vehicles | 11,501 | 19,403 | 31,967 | 43,554 | 104,125 | 157,416 | 198,418 |
| Compound Annual Fleet Growth Rate (2 yr) | 0% | 30% | 28% | 17% | 55% | 23% | 12% |
| Member-Vehicle Ratio | 30.1 | 34.6 | 36.4 | 41.1 | 46.5 | 95.6 | 160.3 |

**Figure 44 – Worldwide car sharing growth trends (Source: Innovative mobility Carsharing Outlook - Spring 2020, Susan Shaheen and Adam Cohen)**



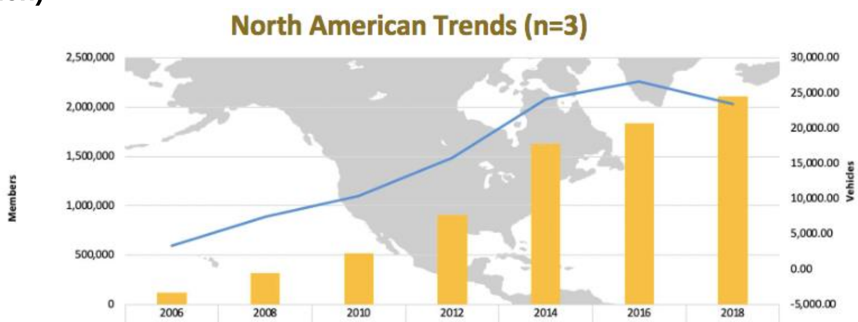

| | 2006 | 2008 | 2010 | 2012 | 2014 | 2016 | 2018 |
|---|---|---|---|---|---|---|---|
| Members | 212,124 | 334,168 | 552,868 | 691,943 | 2,206,884 | 4,371,151 | 6,761,688 |
| Compound Annual Member Growth Rate (2 yr) | 0% | 26% | 29% | 12% | 79% | 41% | 24% |
| Vehicles | 7,491 | 10,833 | 16,779 | 20,464 | 57,947 | 57,857 | 60,622 |
| Compound Annual Fleet Growth Rate (2 yr) | 0% | 20% | 24% | 10% | 68% | 0% | 2% |
| Member-Vehicle Ratio | 28.3 | 30.8 | 32.9 | 33.8 | 38.1 | 75.6 | 111.5 |

**Figure 47 – European car sharing growth trends (Source: Innovative mobility Carsharing Outlook - Spring 2020, Susan Shaheen and Adam Cohen)**




| | 2006 | 2008 | 2010 | 2012 | 2014 | 2016 | 2018 |
|---|---|---|---|---|---|---|---|
| Members | 15,700 | 12,546 | 81,817 | 160,500 | 955,880 | 8,722,138 | 22,707,000 |
| Compound Annual Member Growth Rate (2 yr) | 0% | -11% | 155% | 40% | 144% | 202% | 61% |
| Vehicles | 608 | 810 | 4,315 | 6,155 | 20,344 | 67,329 | 108,097 |
| Compound Annual Fleet Growth Rate (2 yr) | 0% | 15% | 131% | 19% | 82% | 82% | 27% |
| Member-Vehicle Ratio | 25.8 | 15.5 | 19.0 | 26.1 | 47.0 | 129.5 | 210.1 |

**Figure 45 – Asian car sharing growth trends (Source: Innovative mobility Carsharing Outlook - Spring 2020, Susan Shaheen and Adam Cohen)**




| | 2006 | 2008 | 2010 | 2012 | 2014 | 2016 | 2018 |
|---|---|---|---|---|---|---|---|
| Members | 117,656 | 318,898 | 516,100 | 908,584 | 1,625,652 | 1,837,854 | 2,110,111 |
| Compound Annual Member Growth Rate (2 yr) | 0% | 65% | 27% | 33% | 34% | 6% | 7% |
| Vehicles | 3,337 | 7,505 | 10,420 | 15,795 | 24,210 | 26,691 | 23,376 |
| Compound Annual Fleet Growth Rate (2 yr) | 0% | 50% | 18% | 23% | 24% | 5% | -6% |

**Figure 46 – North American car sharing growth trends (Source: Innovative mobility Car-sharing Outlook - Spring 2020, Susan Shaheen and Adam Cohen)**

Several companies are tapping into this new opportunity, from new mobility start-ups to major OEMs and public transport operators.

The different types of car sharing business models are generally classified as:

- B2C: Business-to-Consumer: A company operates and offers a fleet of car sharing vehicles that can be used at any time by their subscribed customers in a pay-per-use basis, most commonly based on time and/or distance driven.
- B2B: Business-to-Business: A company operates and offers a fleet of car sharing vehicles to other companies. This model offers an alternative to the more traditional company car.
- P2P: Peer-to-Peer: This model offers the possibility to share a vehicle between private owners. The vehicle owner or driver receives a monetary compensation for offering its private car use to others, sharing the ride or simply renting the vehicle. An online platform provider normally mediates the interactions between vehicle owners and renters for a small fee, and provides the necessary telematics and connectivity devices for the vehicles.

Car sharing operating models are further distinguished between:

- Free-floating (also called one-way): Free-floating car sharing schemes are constrained to an operational area within which the cars are free to move around, normally taking advantage of the use of public parking slots within this area. Customers can pick-up the car parked at the street or a designated parking slot and drive to their destination anywhere comprised inside the operational area. Once arrived to its destination, the customer parks the car and this one is available for the next customer that comes.
- Station-based (also called roundtrip): Station-based car sharing works more like conventional car rental, where cars need to be picked up at a centralized location and returned to the same location after use. This is why it is also known as roundtrip. As opposed to free-floating schemes, station-based car sharing is not geographically constrained to an operational area, but is free to go virtually anywhere. Roundtrip car sharing is normally driven for longer time periods and distances than free-floating.

Some consider ride hailing and ride sharing or carpooling as different Business Model categories, independent from car sharing. However, when considering automated vehicles with no driver, the distinction between car sharing and ride hailing becomes less clear, and both can be considered together. Ride sharing or carpooling is considered as car sharing with passengers sharing the same ride with others that have the same or a similar destination, being able to share the total travel costs and thus being a cheaper car sharing alternative.

The different operating models are finding their adoption to be country and even city dependent, with different factors influencing consumer choices in favor of one or the other. Such factors include demographics, politics and socio-economic differences regarding the use of cars. As we can see in Figure 48 below, while the amount of roundtrip and one-way car sharing members worldwide are very similar, there are huge differences among continents. Asian countries account for the largest portion of members worldwide, with more of them choosing a roundtrip model. In Europe, the second world region with the largest number of car sharing members, has more than double one-way car sharing members than roundtrip members.

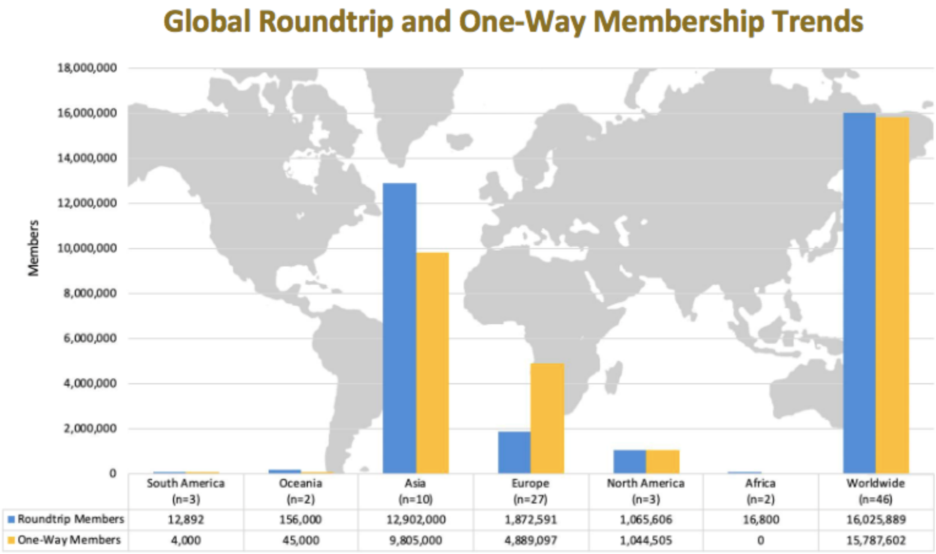



**Figure 48 – Global Roundtrip and one-way car sharing memberships (Source: Innovative mobility Carsharing Outlook - Spring 2020, Susan Shaheen and Adam Cohen)**

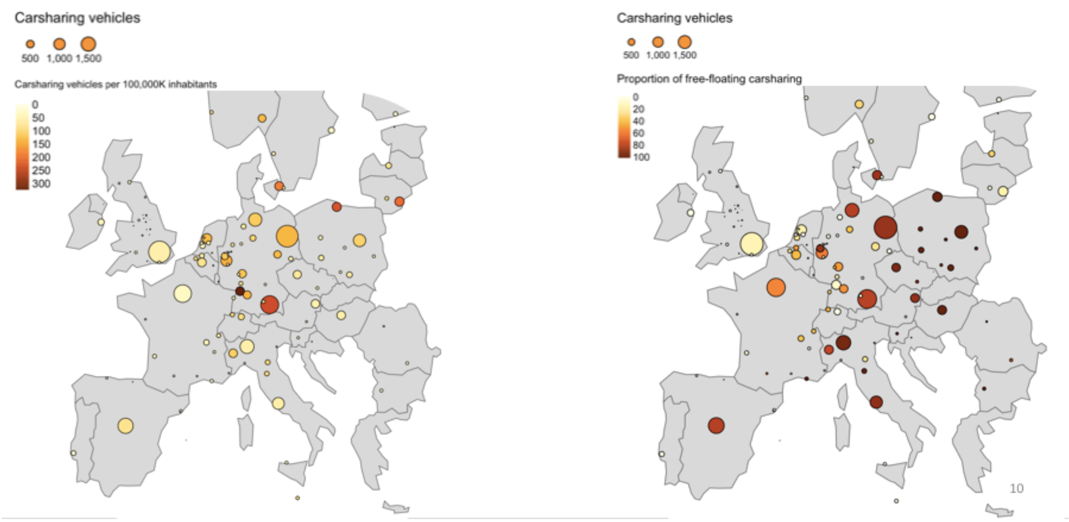



**Figure 49 – Number of carsharing vehicles in main European cities. Left: absolute numbers of vehicles and number of vehicles for each 100k inhabitants. Right: absolute number of vehicles proportion of free-floating vehicles (Source: Bax&Comapny)**

A recent study performed by Bax&Company and the University of Rotterdam investigated the differences between car sharing adoption in more than 80 European cities, finding also adoption heterogeneities between the two main car sharing business models (Figure 49). The absolute number of car-sharing vehicles is higher in European capitals, while car-sharing vehicles per inhabitant vary widely across the cities studied, with German cities accounting for the highest rates of car-sharing vehicles per inhabitant. Regarding the proportion between free-floating car-sharing vehicles and station-based, we see a tendency among central and southern European cities towards free-floating schemes, while northern European cities show a preference towards station-based car-sharing schemes.

The different business models have different usage patterns and related impacts to the overall mobility system, as has been widely studied in different initiatives such as the H2020 STARS (H2020 STARS, 2020) or the ShareNorth projects (ShareNorth, 2020). While station-based car-sharing is mostly used as a substitute for a private car, free-floating car-sharing is mostly used as a complement to the private car and sometimes even as a substitute to public transport.

So, in the further section one (current) example of every car sharing system will be presented and analysed to get the relevant information for the benchmarking as well as the development of the business and operating within A2.2.

### 7.1.1 State-of-the-Art of Share Now (Car2Go + DriveNow)

The Mobility Service Canvas (MSC) gives a fast overview over the services ShareNow offers as well as other important information about the services and the mobility operator.

**Table 43 – Mobility Service Canvas ShareNow**

| Mobility Service Canvas | |
|---|---|
| **Name** | **ShareNow (Car2Go + DriveNow)** |
| **Short description** | ShareNow is a carsharing operator of BMW and Daimler. The company operates in 16 urban areas which are in eight different countries. |
| **Website / Reference** | https://www.drive-now.com/de/de/special/share-now |
| **Service Developers** | • BMW Group<br>• Daimler AG |
| **Primary Operator** | • SHARE NOW GmbH |
| **Target users and mobility needs** | • People on the go with last-minute reservations<br>• One-way travellers, including drivers headed to/from the airport<br>• Businesses<br>• Drivers who want a premium car model<br>• Drivers taking trips within the city<br>• Eco-conscious individuals |
| **Mobility Services** | • Carsharing |
| **Related Services** | • Park Now: digital parking space management / Parking meter<br>• Charge Now: charging stations for electric cars and hybrids<br>• Reach Now: Route planner<br>• Free Now: arrangement of passenger transport / taxi app |
| **Mobility Service Operators** | • SHARE NOW GmbH |
| **Access to the Services** | ☐ Public<br>x Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>x Interurban<br>x Highway |

| Mobility Service Canvas | |
|---|---|
| | x Rural<br><br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br><br>ϒ Dedicated lane |
| **Operations Parameters** | • Free-floating carsharing<br>• 24h operation<br>• 2 to 5 passengers per vehicle<br>• Car Sharing depending on time:<br>  ○ Beginning by 25 cent/minute up to 36 cent/minute<br>  ○ 9 €/hour<br>  ○ 80 €/day |
| **Status** | □ In development, since …<br><br>□ Trial, since …<br><br>x In operation, since 2019 |
| **Areas/routes covered and number of people/amount of goods transported per service** | • Berlin, Germany<br>• Frankfurt am Main, Germany<br>• Hamburg, Germany<br>• Munich, Germany<br>• Rheinland (Düsseldorf & Köln), Germany<br>• Stuttgart, Germany<br>• Mailand, Italy<br>• Rom, Italy<br>• Turin, Italy<br>• Amsterdam, The Netherlands<br>• Budapest, Hungary<br>• Copenhagen, Denmark<br>• Madrid, Spain<br>• Paris, France<br>• Vienna, Austria |
| **Share of trip purpose per service** | x Commuting:<br><br>x Business:<br><br>x Leisure: |
| **3rd Party Suppliers and related company size** | • No information available |
| **SME Aspects** | • No information available |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br><br>x Carsharing<br><br>□ Bike sharing<br><br>□ Vehicle-based logistics<br><br>□ TMC-based services<br><br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br><br>x Central Model |

| Mobility Service Canvas | |
|---|---|
| | □ Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>□ B2B<br>□ P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>• Carsharing<br>• Electric cars charging<br>• Shared-use mobility (taxi) |
| **Connected Mobility Aspects** | □ V2V<br>□ V2I<br>□ V2P<br>□ V2N<br>x None |
| **Electrified vehicles used per service** | • Yes<br>○ 3260 vehicles |
| **Automated vehicles used per service** | • No |
| **Number of vehicles used per service (fleet size)** | • 12270 vehicles in total |
| **Vehicle capacity** | • 2 to 5 seats per vehicle |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Nighttime<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service | MaaS: integrated planning, booking, payment |

| Mobility Service Canvas | |
|---|---|
| DRT - Demand-responsive transport | |
| **Relation to PT (coordinated by PT)**<br><br>PT – Public transport | • No information |

The following text gives a more detailed description of the state-of-the-art.

Share Now GmbH was formed from the merge between predecessors Car2Go and DriveNow. It is an OEM owned company, a joint venture between Daimler and BMW providing free-floating car sharing services to customers in 16 cities across 8 European countries. Users are charged by the minute, with hourly and daily rates also available. Share Now has been a perfect platform for this two main European OEMs to deploy fleets of electric vehicles as an alternative to the private car market, which had less demand for electric vehicles than car-sharing schemes. It represents also one step forward for traditional OEMs to start experimenting with new mobility business models, moving from the traditional vehicle sales model towards mobility operator models. Depending on the market they operate, the vehicle fleet is composed of all-electric small urban vehicles like the Smart ForTwo or Smart ForFour (e.g. Stockholm, Madrid, Stuttgart) or hybrid fleets with larger vehicles, mainly in the USA. Car2Go and Drive Now were among the fastest growing car sharing companies in terms of customer memberships thanks to two main reasons: having no membership entry fee and a fully automated and quick registration process including automated drivers' license and credit card checks. The merge between Daimler's Car2Go and BMW's Drive Now allowed both companies to reduce operational costs and strengthen their global positioning as mobility service providers with the goal of competing with market leaders such as Uber and Didi.

### 7.1.2 State-of-the-Art of Cambio

The Mobility Service Canvas (MSC) gives a fast overview over the services Cambio offers as well as other important information about the services and the mobility operator.

**Table 44 – Mobility Service Canvas Cambio**

| Mobility Service Canvas | |
|---|---|
| **Name** | **Cambio Carsharing** |
| **Short description** | Cambio Carsharing is a station-based carsharing service with over 1,000 stations in 29 German and 54 Belgian cities. The service has in total around 138,000 customers. |
| **Website / Reference** | https://www.cambio-carsharing.de/?cms_knschluessel=HOME&cms_Feurocode=BIL |
| **Service Developers** | • Cambio Mobilitätsservice GmbH & Co. KG |
| **Primary Operator** | • Cambio Mobilitätsservice GmbH & Co. KG |
| **Target users and mobility needs** | • Occasional users<br>• Students & Young drivers<br>• Drivers going long distances or on long trips |

| Mobility Service Canvas | |
|---|---|
| **Mobility Services** | • Carsharing |
| **Related Services** | • No information available |
| **Mobility Service Operators** | • Cambio Mobilitätsservice GmbH & Co. KG |
| **Access to the Services** | □ Public<br>x Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>x Interurban<br>x Highway<br>x Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | • Station-based carsharing<br>• 24h operation<br>• 2 or 5 passengers per vehicle<br>• Car Sharing prices depending on tariff:<br>o Campus-Tariff<br>o Basis-Tariff<br>o Active-Tariff<br>o Comfort-Tariff |
| **Status** | □ In development, since …<br>□ Trial, since …<br>x In operation, since 2000 |
| **Areas/routes covered and number of people/amount of goods transported per service** | • 589 cambio stations in 29 German cities<br>• 598 cambio stations in 54 Belgian cities |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | • No information available |
| **SME Aspects** | • No information available |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>x Carsharing |

| Mobility Service Canvas | |
|---|---|
| | □ Bike sharing<br>□ Vehicle-based logistics<br>□ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>□ Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>x B2B<br>□ P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>• Carsharing |
| **Connected Mobility Aspects** | □ V2V<br>□ V2I<br>□ V2P<br>□ V2N<br>x None |
| **Electrified vehicles used per service** | • Yes |
| **Automated vehicles used per service** | • No |
| **Number of vehicles used per service (fleet size)** | • 3,250 vehicles in total |
| **Vehicle capacity** | • 2 to 5 seats per vehicle |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Nighttime<br>x Weekdays<br>x Weekend<br>x Vacation |

| Mobility Service Canvas | |
|---|---|
| **MaaS/LaaS/DRT integration level**<br><br>MaaS - Mobility as a service<br><br>Laas - Logistics as a service<br><br>DRT - Demand-responsive transport | MaaS: integrated planning, booking, payment |
| **Relation to PT (coordinated by PT)**<br><br>PT – Public transport | • No information |

The following text gives a more detailed description of the state-of-the-art.

Cambio was formed in 2000 with the merge of three small car sharing companies that were operating in Belgium and Germany. Cambio is now one of the largest station-based car sharing operators in Germany and Belgium, with operations in more than 50 cities. Cambio has its cars placed in dedicated stations next to public transport hubs but also spread around neighbourhoods with poor public transport supply, aiming at bridging transport supply gaps and connecting those neighbourhoods to nearest public transport nodes. Cambio targets students and any customer in occasional need of a car. It offers very flexible renting periods, which can range from minutes up to several days. Customers are charged per usage time and driven mileage. Currently Cambio-group has over 138,000 users and provides more than 3,250 vehicles distributed at over 1,000 stations. The company Cambio Mobility Services GmbH doesn't operate vehicles itself, but provides all central services like software and call centre services to all subsidiary and partner companies. Depending on the location, the cars are fully-electric or gasoline. Cambio has strengthened its market positioning thanks to taking part in initiatives such as the Mobi-hubs in Bremen and by demonstrating its positive environmental impact and private car reduction among its members.

## 7.2 Business and operating models using Canvas Methodology

### 7.2.1 Business models of car sharing services

Within the main categories that distinguish car sharing business models – free-floating or station-based – each car sharing company has developed and experienced different business model variants in an attempt to dominate the market. The main differences are reflected in the different business model ownership and cost structures and revenue models, while key activities, resources and value propositions tend to be quite similar.

Below we exemplify the main differences between some of the leading car sharing companies in Europe using the Business Model Canvas methodology, with selected examples from an analysis performed within the H2020 project STARS.

#### 7.2.1.1 Business model ShareNow

**Table 45 – ShareNow Business Model Canvas (Source: H2020 STARS)**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | • Free parking in public car lots<br>• No deposit required<br>• No insurance, fuel or electricity costs<br>• 24/7 availability<br>• Offers electric cars<br>• Mercedes-Benz or Car2Go smart cars<br>• Credit given for refuelling or recharging cars |
| **Customer Segments** | • People on the go with last-minute reservations<br>• One-way travellers, including drivers headed to/from the airport<br>• Businesses<br>• Drivers who want a premium car model<br>• Drivers taking trips within the city<br>• Eco-conscious individuals |
| **Customer Relationships** | • Customer service at Car2Go shop |
| **Channels** | • Website<br>• Mobile app<br>• Customer service shop |
| **Key Resources** | • IT platform<br>• Premium vehicles<br>• Free parking spaces |
| **Key Activities** | • Maintaining fleet<br>• Platform management<br>• Customer service |
| **Key Partners** | • Public transport operators for digital integration & marketing/customer service<br>• Local governments<br>• (Social) services for cleaning & maintenance<br>• Businesses<br>• Universities<br>• Car manufacturer<br>• Key shareholder: Daimler |
| **Revenue Streams** | • Airport charge<br>• Usage fee (minute, hourly & daily rates, plus per km) |
| **Cost Structure** | • IT platform<br>• Fleet maintenance<br>• Personnel costs<br>• Customer service |

The Share Now business model is the same in all markets, although rates vary across the different locations. The company charges a per minute rate, with discounted fixed rates for hourly and daily usage also available and applied automatically. The rates are all-inclusive and cover rental, gas, insurance, parking (in authorized areas), and maintenance, a low fixed annual fee is sometimes also charged. In most markets, Car2Go vehicles can park in either specially designated parking spots, or in standard parking areas, with a special permit from the local municipality which allow customers to park free of extra charge. Users have the option of refuelling cars with a supplied charge card, receiving bonus minutes for performing this service. Share Now offers different types of vehicles but their fleet is mainly composed of small, electric urban-sized cars.

### 7.2.1.2 Business model Cambio

**Table 46 - Cambio Business Model Canvas (Source: H2020 STARS)**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | • Users of public transport have special tariffs, & can use the same key card<br>• Complementary to public transport<br>• No fuel costs<br>• Cars can be driven in multiple European countries<br>• Free city parking<br>• Offers electric cars |
| **Customer Segments** | • Occasional users<br>• Students & Young drivers<br>• Drivers going long distances or on long trips |
| **Customer Relationships** | • Customer service call centre |
| **Channels** | • Website<br>• App<br>• Customer service call-centre |
| **Key Resources** | • Vehicle fleet<br>• Platform<br>• Partnerships with local government<br>• Chip card |
| **Key Activities** | • Fleet maintenance<br>• Customer service |
| **Key Partners** | • Automotive industry<br>• Housing projects<br>• Local government<br>• City council<br>• Public service providers<br>• Public transport operators (for marketing / customer service, digital integration)<br>• Car manufacturers (depending upon the branch) |
| **Revenue Streams** | • Subscription fees (depending on branch, 0 – 35 €)<br>• Usage fees (per hour & every 15 minutes, and per km)<br>• Deposit, depending upon the branch (0 – 500 €) |
| **Cost Structure** | • Vehicle fleet acquisition<br>• Fleet maintenance & cleaning<br>• Platform development & management<br>• Insurance costs<br>• Personnel costs |

Cambio business model differentiation lies in their strong collaboration with public transport providers and their strategic distribution of car-sharing stations around small cities and towns, with a reduced number of vehicles in each station but covering a very wide geographical area, while targeting neighbourhoods with lower than average private car ownership and poor public transportation supply (e.g. peri-urban residential areas and university campuses). Another advantage for Cambio users is the possibility to drive across different European countries, thanks to its wide service area coverage. Cambio offers a huge variety of vehicles in its fleets, from small urban cars to C-class vehicles and even vans, covering a wide range of user needs and travel purposes.

### 7.2.2 Operating models car sharing services

#### 7.2.2.1 Operating model ShareNow (Car2Go + DriveNow)

**Table 47 – Value Proposition Canvas ShareNow**

| VALUE PROPOSITION CANVAS | |
|---|---|
| | **Customer segments** |
| Customer Jobs | • Costumer:<br>  • Students and young drivers<br>  • Drivers going long distances across EU countries<br>  • Occasional private car users<br>• Cities: future mobility strategy<br>• Public transport operators: connection to low supply areas |
| Pains | • Last-mile connection to PT<br>• Low parking availability and high costs in cities<br>• Bulk shopping when not having a private car |
| Gains | • Occasional car access without the burden of car ownership<br>• High geographical spread of stations |
| | **Value proposition** |
| Products & Services | • Fleet of small, all-electric vehicles<br>• Pay-per-use car mobility, all included<br>• App-based service with smart card vehicle access |
| Pain Relievers | • Free parking in public car lots<br>• No deposit required<br>• No insurance, fuel or electricity costs<br>• No car maintenance |
| Gain Creators | • 24/7 availability<br>• Offers electric cars<br>• Mercedes-Benz or Car2Go smart cars<br>• Credit given for refuelling or recharging cars<br>• Quick and easy vehicle pick-up and drop-off |

The value of ShareNow services lies on providing the convenience offered by private car mobility in densified urban areas without the need of driving one’s own car. Having guaranteed parking with no additional costs and the flexibility of pick-up and drop-off zones, including even in some cities the access to low-emissions zones makes it a good alternative to private car mobility and good addition to public transport if bridging the last-mile is required.

#### 7.2.2.2 Operating model Cambio

**Table 48 – Value Proposition Canvas Cambio**

| VALUE PROPOSITION CANVAS | |
|---|---|
| | **Customer segments** |
| Customer Jobs | • Costumer: |

| VALUE PROPOSITION CANVAS | |
|---|---|
| | • Commuting to job / Moving across the city<br>• Using Mobility for leisure activities<br>• More sustainability travelling/commuting<br>• Lower mobility costs/efforts (e.g. parking, last-mile connection)<br>• Cities: future mobility strategy |
| Pains | • Car ownership<br>• Low public transport availability |
| Gains | • Quick last-mile connections<br>• Environmentally friendly mobility<br>• Variety of vehicles offered |
| **Value proposition** | |
| Products & Services | • Pay-per-use car mobility, all included<br>• Internet and call centre reservation possible |
| Pain Relievers | • Granted parking at arrival<br>• No car maintenance, no insurance costs |
| Gain Creators | • 24/7 availability<br>• Quick and easy vehicle pick-up and drop-off<br>• Different vehicles for different needs |

Cambio's value proposition is mainly focused on offering a good alternative to private car ownership for its members, allowing occasional access to a variety of cars for different purposes. A good geographical spread and placement of stations next to Public Transport hubs is also at the core of Cambio's value proposition to customers, allowing them to travel to and from areas with low public transport supply. The possibility to reserve and access the car via various channels (app, internet, call centre) covers the needs of various user segments. If combined with annual Public Transport subscriptions, the subscription fee for Cambio services is free, a clear incentive for promoting more sustainable travel behaviours among their members.

## 7.3 User & Role Analysis including user profiles, mobility needs, relative utility

### 7.3.1 User & Role Analysis of car sharing services worldwide

#### 7.3.1.1 User profiles

Most car sharing users are found to be young (30s' – 50s') and educated individuals with higher than average income profiles and mostly living in dense urban areas. Besides the convenience offered by car sharing to those not able or not willing to own a car, the other main cited reasons for using car sharing services are sustainability, additional benefits such as free parking and included insurance and the possibility of covering occasional increases in family mobility needs[12].

[12] The State of European Car sharing – momo Car-sharing project, Final Report D2.4

Many studies have investigated the relative utility of using car sharing services among car sharing members and compared it to non-car sharing members. For example, some results from surveys performed during the STARS project are illustrated in Figure 50 below.

| Dimension | Roundtrip | Free-floating |
|---|---|---|
| **Age, gender & family status** | Average age: ~50<br>Slightly more men than women<br>2.1 persons per household<br>1/3 with children in household | Average age: ~40<br>Slightly more men than women<br>2.0 persons per household<br>Only 14 % with children in household |
| **Education, job status & income** | Over 70 % with university degree<br>High employment rate (74 %)<br>Above average hh income (3.503 €) | Group consists of two sub-groups: well payed employees and students<br>Over 70 % with university degree<br>High employment rate (69 %); above average rate of students<br>Above average hh income (3.584 €) |
| **Use of cars, public transport & bike** | Car-free households: 81 %<br>Weekly use of car: very low<br>PT-card owners: 68 %<br>Use bike daily: 30 % | Car-free households: 32 %<br>34 % use private car at least 4 times per week (driver)<br>PT-card owners: 47 %<br>Use bike daily: 17 % |
| **Attitude towards cars & public transport** | Car = more means to an end<br>Positive attitude towards pt | Car = more fun<br>Rather car than pt (if possible)<br>More car-affine and pt-averse then non-users owning a car |
| **Use of car sharing** | Main use case: longer & planned trips<br>Main activity: bulk shopping<br>Frequency of use: 6-12 per year | Main use case: short inner city trips/convenience rides<br>Main activity: dinner in restaurant<br>Frequency of use: 12- 52 per year |
| **Attitude towards car sharing** | Car sharing = substitute for private car<br>Satisfaction with vehicle availability: high | Car sharing = addition to private car<br>Satisfaction with vehicle availability: low |

**Figure 50 - Characterization of users of the two main car sharing variants (Source: The influence of socioeconomic factors in the diffusion of car sharing – H2020 STARS)**

### 7.3.1.2 Mobility needs

The mobility needs of car sharing customers are basically to have occasional access to a car when needed, having the gains of private car mobility without the pains of private car ownership. It is also used as a complement to private car ownership in households with many drivers and fewer cars, or when the convenience of having free parking or combining public transport with car sharing for the last-mile is greater than driving the personal car all the way from A to B. Some users also like the possibility of having access to different types of vehicles for different purposes, complementing their family car with smaller cars for inner-city trips or the possibility of renting bigger cars for weekend trips as a complement to their small, urban-sized vehicle. More particularly for users of free-floating services, it offers the possibility of combining public transport and car mobility in cities, depending on the situation (e.g. travelling to poorly connected areas in the city, bulk shopping, avoid parking fees…).

### 7.3.1.3 Relative utility

Significant differences in transport mode utility are found between members of roundtrip and free-floating car sharing schemes, with mobility patterns from free-floating members being much closer to those of non-car sharing members, more prone to choosing their private car. Generally, car sharing is mostly used for occasional trips such as bulk shopping, when the convenience of having a car is highly appreciated. On the other hand, regular trips such as way to work or education are rarely done with car sharing, as it quickly becomes a much more expensive option if regularly needed. Looking at the mobility choices from different car sharing scheme members, it appears that those subscribing to roundtrip or combined models are using car sharing as a substitute to the private car and have a higher degree of multimodal travel behaviour. Free-floating and Peer-to-peer members, on the contrary, seem to use car sharing more as a complement to their private cars, similar to a taxi service (see Figure 51).

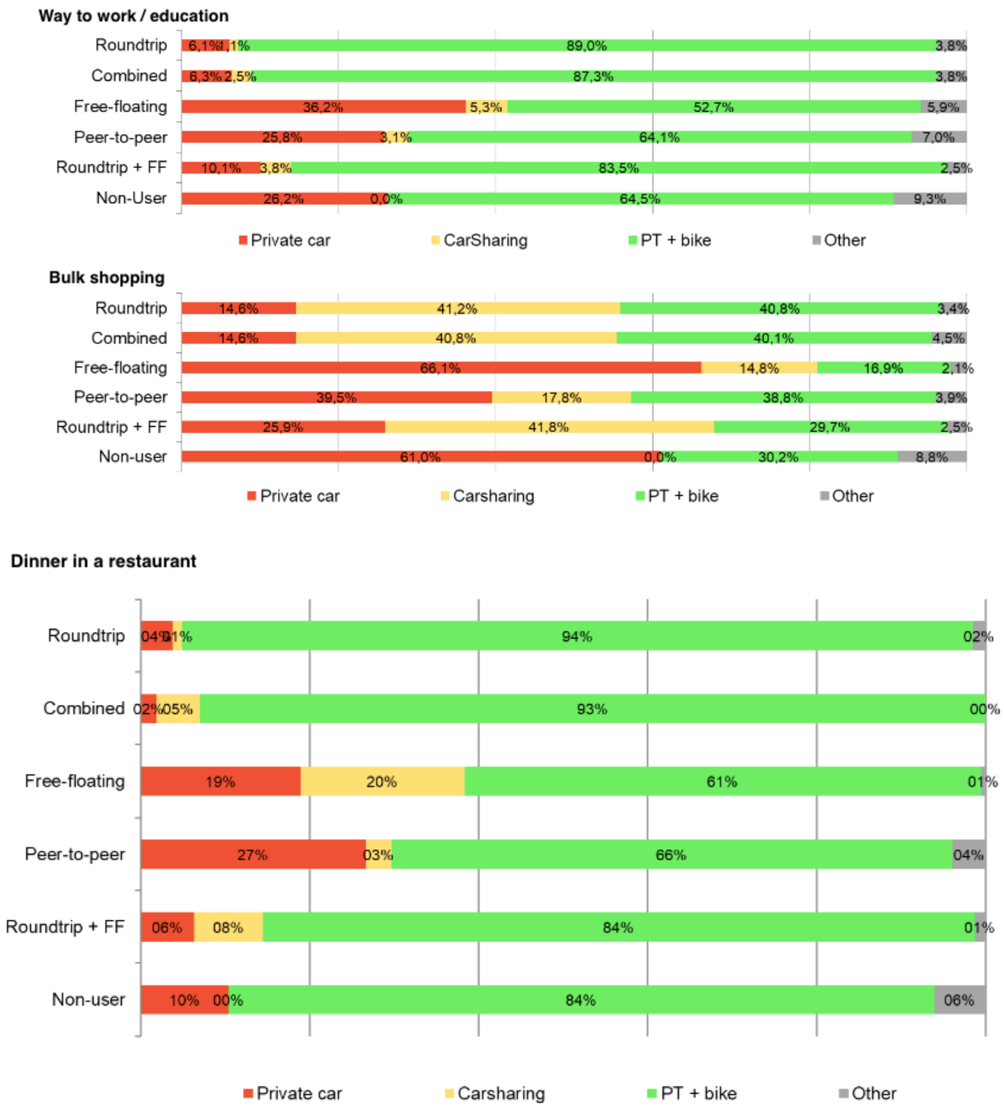



**Figure 51 – Relative utility of transportation mode choices for three trip purposes - commuting, bulk shopping and dinner - from different car sharing modality users and non-users (Source: H2020 STARS)**

Besides the relative utility perceived by end-users of car sharing services, focus is also put on the likelihood for car sharing success in a specific city environment, given the critical importance of key city characteristics found in recent studies[13]. Figure 52 below illustrates, for example, the relationship between demographic and economic parameters of major European cities with their respective car-sharing profit margins. Population density and specially the share of population density in hot-spot areas – areas with high local population density – are found to be good proxy parameters for car-sharing business success, as illustrated by the car-sharing profit margin in each city.

| City | Population (thousands) | Population in hot-spot areas (thousands) | Area (km²) | Population density (1/km²) | Share of population in hot-spot areas | Car-sharing profit margin | Car owner rate | Salary index |
|---|---|---|---|---|---|---|---|---|
| Berlin | 3,520 | 1,783 | 892 | 3,946 | 51% | 32% | 29% | 95% |
| Munich | 1,450 | 422 | 310 | 4,677 | 29% | 32% | 33% | 117% |
| Hamburg | 1,790 | 427 | 755 | 2,371 | 24% | 19% | 33% | 105% |
| Cologne | 1,060 | 216 | 405 | 2,617 | 20% | -5% | 34% | 107% |
| Düsseldorf | 610 | 110 | 217 | 2,811 | 18% | -9% | 35% | 101% |
| Frankfurt | 730 | 83 | 248 | 2,944 | 11% | -80% | 30% | 119% |
| Stuttgart | 628 | 13 | 207 | 3,034 | 2% | -177% | 47% | 126% |
| Dortmund | 585 | 25 | 280 | 2,089 | 4% | -1056% | 41% | 101% |
| Essen | 580 | 94 | 210 | 2,762 | 16% | -131% | 40% | 105% |
| Bremen | 555 | 30 | 327 | 1,697 | 5% | -1025% | 35% | 105% |
| Dresden | 545 | 97 | 329 | 1,657 | 18% | -250% | 34% | 97% |
| Hannover | 530 | 71 | 204 | 2,598 | 13% | -196% | 32% | 101% |
| Nuremberg | 510 | 71 | 187 | 2,727 | 14% | -172% | 37% | 101% |
| Milano | 1,190 | | 182 | 6,538 | | 9% | | |
| Vienna | 1,790 | | 415 | 4,313 | | 16% | | |
| Brooklyn | 2,560 | | 180 | 14,222 | | -46% | | |
| Miami | 454 | | 143 | 3,175 | | -154% | | |
| Prague | 1,200 | Not available | 496 | 2,419 | Not available | -55% | Not available | |
| Paris | 2,200 | | 109 | 20,183 | | 81% | | |
| Zurich | 403 | | 92 | 4,380 | | 14% | | |
| Kopenhagen | 780 | | 88 | 8,864 | | 58% | | |
| Helsinki | 635 | | 214 | 2,967 | | -26% | | |
| Brussels | 1,175 | | 161 | 7,298 | | 49% | | |

**Figure 52 – Comparison of demographic and economic parameters for major European car sharing cities (Source: A.T. Kearney analysis)**

## 7.4 Success & Failure factors in the field of CCAM

The introduction of highly automated vehicles (SAE automation levels 4 and 5) in car sharing services had a hype period during 2018 and 2019 with the announcements of major players like Apple, Uber and Google launching their first service trials in North America and Japan. However, after some technical and regulatory drawbacks, the viability for these services to start soon operating commercially on a regular basis has been put in question. For instance, in early 2019 Daimler announced their plans to put 10.000 automated taxis in place by 2021 but the company stepped back later and announced focus shifting towards automated long-haul trucks instead. Reasons are mainly attributed to the higher short-term viability for use cases involving less driving complexity. At the moment of writing this report, autonomous car sharing or ride hailing services remain a future promise waiting for development challenges to be solved. Their viability in specific use cases might be possible in the short/mid-term, but with some important constraints related to operational areas and conditions (e.g. speed limits, only in good weather conditions). Focus should now be put on the first viable commercialisation steps, involving suitable use cases that can be profitable in the short/mid-term.

[13] Explaining carsharing supply across Western European cities, Münzel and Frenken, 2019

For car sharing business models involving highly automated vehicles to be profitable, many challenges and operational constraints still need to be overcome. Nevertheless, a lot of progress is being made through various pilot projects worldwide. Within SHOW, the Rouen and Madrid sites will pilot automated cab services which will be evaluated also regarding their business cases and financial viability.

### 7.4.1 General success factors

Now that car sharing business models have been quite stablished in markets worldwide, after an initial experimentation and market penetration phase of more than 20 years, today's car sharing business success relies on the company's ability to maximize user turnover while reducing the costs of operation, each one requiring different strategies. Figure 53 below shows the general costs and revenue structure items of car sharing business models and a list of typical profit-sensitivity factors and KPIs in specific business model types.

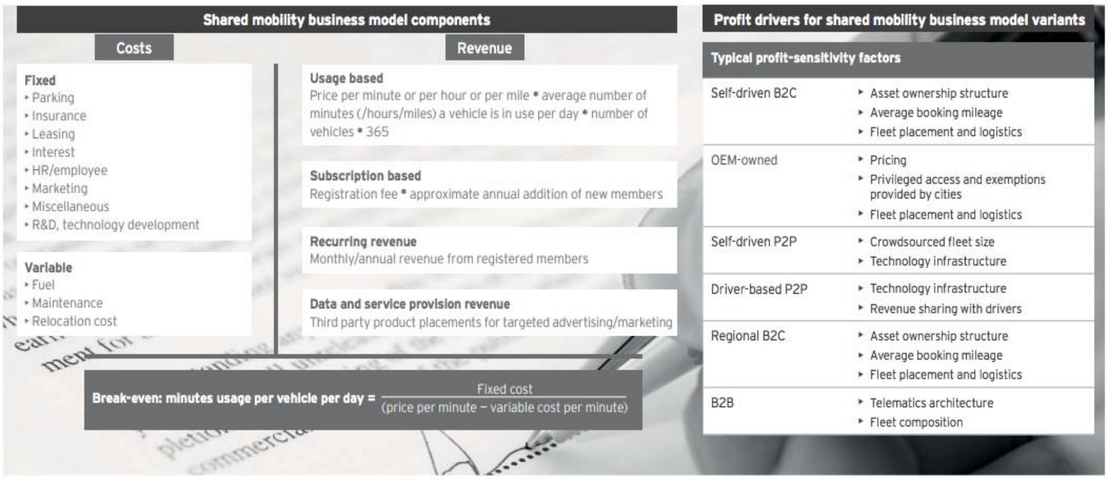



**Figure 53 – Comparison of demographic and economic parameters for major European car sharing cities (Source: EY - Urban mobility redefined)**

The strategies mostly used today by car sharing firms to reduce their costs of operation are to shift from fixed to variable costs, like changing the ownership structure of assets or applying dynamic pricing models based on different demand-supply scenarios, or to directly reduce fixed costs through partnerships with public authorities (e.g. free parking) and public transport operators (e.g. joint ticketing and booking platforms).

Regarding the strategies to increase revenues without increasing fixed costs, accomplishing optimal vehicle utilization rates is among the most important ones. Knowing where to best locate the fleet of vehicles to maximize their utilisation during day, night, weekdays or weekends, depending on the specific mobility needs of your customers, and when or where to increase or decrease vehicle supply to keep both vehicle availability and utilisation high is key for success.

As an example, Figure 54 below shows a comparison of critical car sharing business model KPIs between different world regions and business model types.

| | Number of users | Number of vehicles | Ratio: users/car $\frac{user}{vehicle}$ | Utilization rate/user (%) | Utilization rate/car (%) | Occupancy rate (%) | Pooling Factor | Replacement rate (years) |
|---|---|---|---|---|---|---|---|---|
| EUROPE | | | | | | | | |
| Station-based | 1.500.000 | 32.000 | 47 | 0,2 | 5-10 | 100 | 1,3 | 3-5 |
| Free-floating | 2.900.000 | 26.000 | 112 | 0,1 | 8-12 | 100 | 1,3 | 3-5 |
| P2P | 1.450.000 | 68.000 | 21 | 0,3 | 5-7 | 100 | 2 | 10-14 |
| Ride-hailing | 45.500.000 | 5.050.000 | 9 | 1,2 | 20-30 | 30-40 | 2,4 | 5-8 |
| USA | | | | | | | | |
| Station-based | 1.000.000 | 17.000 | 59 | 0,1 | 5-10 | 100 | 1,6 | 3-5 |
| Free-floating | 812.000 | 9.000 | 90 | 0,1 | 8-12 | 100 | 1,6 | 3-5 |
| P2P | 2.900.000 | 131.000 | 22 | 0,3 | 5-7 | 100 | 2 | 10-14 |
| Ride-hailing | 42.000.000 | 750.000 | 56 | 0,1 | 20-30 | 50-60 | 2,4 | 5-8 |
| CHINA | | | | | | | | |
| Station-based | 7.800.000 | 65.000 | 120 | 0,08 | 5-10 | 100 | 2,5 | 3-5 |
| Free-floating | 935.000 | 2.000 | 468 | 0,02 | 8-12 | 100 | 2,5 | 3-5 |
| P2P | 30.000.000 | ? | ? | ? | 5-7 | 100 | 2,5 | 10-14 |
| Ride-hailing | 257.700.000 | 67.000.000 | 4 | 3,4 | 20-30 | 40-50 | 2,5 | 5-8 |

**Figure 54 – Car sharing operational KPIs comparison between different world regions and business models (Source: Bax&Company study, 2017)**

Other more general strategies are used by car sharing companies to maximize their market penetration and success. Among them, having the right market positioning in cities with high car sharing success potential is in the top list. As we have seen earlier in this chapter, different car sharing operating models find their adoption rates and profit margins vary widely across European cities. This is due to different factors. Among them, existing collaboration between Public Transport Operators and car sharing companies, the active promotion of car sharing by Public Authorities through marketing and awareness campaigns and the user/municipality preference for free-floating or station-based operating models are found to significantly contribute to the positive growth of car sharing, according to a recent study performed by Bax&Company and the University of Rotterdam.

## 7.4.2 Success & failure factors ShareNow

### 7.4.2.1 Success factors

#### *7.4.2.1.1 Customers*

- New technologies (electric vehicles) often not available for the public can be used
- Car mobility solution for solving the last-mile problem in cities
- No membership registration fee
- Fully automated booking process and easy vehicle access
- Free parking

#### *7.4.2.1.2 Mobility provider (ShareNow)*

- Reliable and easily scalable technology
- More customers per vehicle than a station-based service

#### 7.4.2.2 Failure factors

##### *7.4.2.2.1 Governmental/Organizational resistance against free-floating car sharing model*

There are cities which are against free-floating schemes, as they are suspected to compete with public transport and active modes of travel.

##### *7.4.2.2.2 Deployment strategy*

Deploying in areas with low demand such as low-density neighbourhoods, areas with low parking availability or highly congested. Another hindrance in deploying a free-floating carsharing system is if cities have a low EV charging infrastructure or there are already well-established competitors.

##### *7.4.2.2.3 Re-distribution of vehicles*

The problem of vehicle re-distribution represents one of the biggest challenges for free-floating operators, leading to low utilisation rates and poor vehicle availability.

### 7.4.3 Success & failure factors Cambio

#### 7.4.3.1 Success factors

##### *7.4.3.1.1 Carsharing system type*

Station-based car sharing is more likely to be used by people who do not want to own a private car. Accordingly, station-based car sharing is rarely used for routine and short trips, but rather serves as a supplement to public transportation. Station-based car sharing thus promotes the change in mobility behavior more strongly than free-floating systems. (VCÖ - Mobilität mit Zukunft, 2020)

##### *7.4.3.1.2 Carefully selected high demand areas for operation*

Organic growth strategy and vehicle deployment in carefully selected areas with high demand potential and fostering cross-country connectivity and connectivity to public transport hubs.

##### *7.4.3.1.3 Marketing and visibility of the service*

Highly visible stations and extensive awareness and marketing campaigns in collaboration with Public Transport Authorities and operators. Promotion of sustainable travel habits and focus on offering a real and convenient alternative to car ownership.

##### *7.4.3.1.4 Close cooperation with PTOs and MaaS applications*

Integration of their services with Public Transport and MaaS applications, with Public Transport annual pass holders and university student accreditation don’t need to pay the subscription fee**.**

### 7.4.3.2 Failure factors

#### *7.4.3.2.1 Balance of user requirements and business impact*

It is difficult to find the right balance between vehicle utilization and availability, easily leading to under or over-sized fleets and stations, which quickly reduces profit margins.

#### *7.4.3.2.2 Fleet and capacity management*

The possibility of picking-up the vehicle in one station and dropping it into other leads to increased operational costs for vehicle re-location, which makes it a non-profitable option in many cases.

#### *7.4.3.2.3 Technology driven user acceptance*

In the past, some frequent problems with the vehicle access technology and the low familiarity of older users caused severe member drop-offs

#### *7.4.3.2.4 Station-based instead of free-floating carsharing*

The fact that Cambio only offers station-based vehicles whereas other operators (Car2Go, Enjoy, etc.) offers a free-floating service often results in less revenues. That is because the vehicles of these operators are spread around the city and the people do not need to go to a station that could be located at a place which is further away than the next (as an example) Car2Go vehicle.

#### *7.4.3.2.5 Lower customers per vehicle*

An EVA-CS study shows that a station-based car sharing system acquires less customers per vehicle than a free-floating system. For example, the statistical average for Germany as a whole is 45 customers per station-based vehicle and 126 customers per free-floating vehicle at the beginning of 2016. (Bundesverband CarSharing e.V., 2016)

#### *7.4.3.2.6 Desired car not always available*

It is possible that the desired vehicle is not always available. This can turn out to be a restriction of independence and flexibility. In certain situations, early planning and timely reservations of particular car models is necessary.

## 7.5 KPI-related analysis of CSS including best practices

### 7.5.1 General car-sharing KPIs

The KPIs in Figure 55 are general values which can be applied to station-based and free-floating car sharing systems in Europe, USA and China and therefore they could be used for the development of the new business and operating models.

| | Number of users | Number of vehicles | Ratio: users/car $\frac{user}{vehicle}$ | Utilization rate/user (%) | Utilization rate/car (%) | Occupancy rate (%) | Pooling Factor | Replacement rate (years) |
|---|---|---|---|---|---|---|---|---|
| EUROPE | | | | | | | | |
| Station-based | 1.500.000 | 32.000 | 47 | 0,2 | 5-10 | 100 | 1,3 | 3-5 |
| Free-floating | 2.900.000 | 26.000 | 112 | 0,1 | 8-12 | 100 | 1,3 | 3-5 |
| P2P | 1.450.000 | 68.000 | 21 | 0,3 | 5-7 | 100 | 2 | 10-14 |
| Ride-hailing | 45.500.000 | 5.050.000 | 9 | 1,2 | 20-30 | 30-40 | 2,4 | 5-8 |
| USA | | | | | | | | |
| Station-based | 1.000.000 | 17.000 | 59 | 0,1 | 5-10 | 100 | 1,6 | 3-5 |
| Free-floating | 812.000 | 9.000 | 90 | 0,1 | 8-12 | 100 | 1,6 | 3-5 |
| P2P | 2.900.000 | 131.000 | 22 | 0,3 | 5-7 | 100 | 2 | 10-14 |
| Ride-hailing | 42.000.000 | 750.000 | 56 | 0,1 | 20-30 | 50-60 | 2,4 | 5-8 |
| CHINA | | | | | | | | |
| Station-based | 7.800.000 | 65.000 | 120 | 0,08 | 5-10 | 100 | 2,5 | 3-5 |
| Free-floating | 935.000 | 2.000 | 468 | 0,02 | 8-12 | 100 | 2,5 | 3-5 |
| P2P | 30.000.000 | ? | ? | ? | 5-7 | 100 | 2,5 | 10-14 |
| Ride-hailing | 257.700.000 | 67.000.000 | 4 | 3,4 | 20-30 | 40-50 | 2,5 | 5-8 |

**Figure 55 – Car sharing operational KPIs comparison between different world regions and business models (Source: Bax&Company study, 2017)**

### 7.5.2 ShareNow

#### 7.5.2.1 KPI – Cost & revenue structure

**Revenue streams:**

- Vehicle usage fees (per minute, hourly, daily or per km)
- Airport charges
- Drop-off fees
- Driver protection fee

**Pricing strategy:**

- Depending on the market and vehicle used; from 0.4 to 3 €/minute
- Charge per km also if distance driven is larger than 200km: 1 km extra = 0.39€

#### 7.5.2.2 KPI – Actors in business ecosystem

**Number and nature of partners:** 5

- 2 OEMs: Daimler and BMW
- Car rental company: Europcar Group
- Public authorities as partners depending on the location
- Technology provider: Daimler Mobility Services

#### 7.5.2.3 KPI - Operational (transport)

**Vehicle utilization rate:** 10 – 20 %

**Occupancy rate:** 100 %

**Vehicle utilization efficiency:** 30 %

**Fleet replacement rate:** 3 – 5 years

### 7.5.3 Cambio

#### 7.5.3.1 KPI – Cost & revenue structure

**Revenue streams:**

- Vehicle usage fees (per minute, hourly, daily or per km)
- Subscription fees

**Pricing strategy:** Examples

- 3 hours and 40 km in a Ford Fiesta (Price class S) for 18.20 €, fuel included
- 5 hours and 28 km in a Ford Transit (Price class L) for 29.58 €, fuel included
- 2 days and 142 km in a Ford Focus (Price class M) for 87.04 €, fuel included

- Subscription fees depending on the market: 0 – 35 €

#### 7.5.3.2 KPI – Actors in business ecosystem

**Number and nature of partners:** 5

- Public Transport operators in Germany and Belgium: e.g. STIB (Brussels Public Transport Company),
- NGOs: Greenpeace Energy, Taxi stop
- Charging infrastructure provider: Park pod
- Technology provider: Cambio Mobility Services GmbH

#### 7.5.3.3 KPI - Operational (transport)

**Vehicle utilization rate:** 20 – 40 %

**Occupancy rate:** 100 %

**Vehicle utilization efficiency:** 30 %

**Fleet replacement rate:** 5 – 8 years

# 8 Overview and Analysis of existing MaaS services

MaaS services integrate various forms of transportation services into a single mobility service accessible on demand. Operators of such services offer different transportation options such as public transport, ride-, car- or bike sharing, car rental or taxi services, or even a combination of them. To facilitate the usage of these services the operators can offer single applications with singe payment channels instead of multiple ticketing and payment operations, which can result in people not using the offered services because of the hassle it would cause.
Aim of MaaS services is to provide an alternative for private cars to reduce congestions and emissions within cities. And it is taking away the hassle of finding the most suitable mobility option for the planned trip.

Advantages of MaaS (RS Web Solutions, 2020):

- MaaS services are more focused on the needs and values of costumers than the traditional transportation system. With that customer-centric behaviour the customer is given higher preferences.
- MaaS is much more efficient for the entire transportation system than the present mode of transportation.
- MaaS services integrate different types of transportation options under one roof. With that the customer can always access a transportation service if needed.

MaaS is an important and unavoidable milestone in creating a better mobility system. The number of mobility services and its importance will most likely continue to increase in the future. Automated vehicles will be the ultimate game changer and will help that the different sharing systems (car- and ridesharing as well as ride-hailing) become mainstream.

Within this chapter an overview and analysis of five selected MaaS services are done, which are: Dopravní podnik města Brna (DPMB), ROMA Mobilità, tim (täglich.intelligent.mobil), UbiGo and whim. All these services are located in different cities around Europe and offer several kinds of MaaS services.

These services were chosen to cover a wide variety of different MaaS services, business models and operators (private operator or public authority). They are giving the best overview as well as showing the differences and similarities between the MaaS services for the benchmarking. It is expected to get actual results which can be used for D2.2 and A2.2.

## 8.1 State-of-the-Art of several MaaS worldwide

In this chapter the state-of-the-art of the five selected MaaS services are described. Including general information of the company, network numbers and services offered.

### 8.1.1 Dopravní podnik města Brna (Brno, Czech Republic)

The Mobility Service Canvas (MSC) gives a fast overview over the services Dopravní podnik města Brna (DPMB) offers as well as other important information about the services and the mobility operator.

**Table 49 – Mobility Service Canvas DPMB**

| Mobility Service Canvas | |
|---|---|
| **Name** | **Dopravní podnik města Brna** |
| **Short description** | Dopravní podnik města Brna (DPMB) is a public transport authority owned by the City of Brno. It operates public transport for nearly half a milion citizens. |
| **Website / Reference** | https://www.dpmb.cz/en/novinky/all |
| **Service Developers** | • The City of Brno (Statutární město Brno) |
| **Primary Operator** | Dopravní podnik města Brna (DPMB) |
| **Target users and mobility needs** | • Everybody (there is no specific target group, the service is intended to be used by everybody who is living in Brno or visiting it).<br>• The only specific user group are elderly for whom there is a special service called Seniorbus which is on demand service (booked over telephone). It is a service equipped with a fleet of custom designed minivans that are able to meet the need of elderly and/or disabled people with limited movement abilities. |
| **Mobility Services** | • Buses<br>• Trams<br>• Trolleybuses<br>• Minivans<br>• Boats (seasonal) |
| **Related Services** | • Ticket sales (on board as well as in ticket machines and information booths and shops).<br>• On-board information and advertisements in paper and digital form.<br>• Custom built “Pub tram” offering rides in a tram that is fully equipped as a pub with beers from local brewery (seasonal).<br>• Tourist oriented boat rides on city’s water reservoir (seasonal). |
| **Mobility Service Operators** | • Dopravní podnik města Brna |
| **Access to the Services** | x Public<br>☐ Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>x Interurban<br>☐ Highway<br>☐ Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>x Dedicated lane |
| **Operations Parameters** | • 360 883 000 passengers transported in 2018.<br>• 39 263 000 passengerkilometers in 2018.<br>• Operations 24/7.<br>• Frequency is 2 minutes during rush hours on busiest routes, average frequency is 10 minutes, 20 minutes during off peak hours, and 30 minutes during night operations.<br>• Ticket price is 25 CZK (1 EUR) for 1 hour.<br>• Prepaid yearly ticket costs 4750 CZK (174 EUR).<br>• Price for a ride in Seniorbus is 50 CZK (2 EUR). |

| Mobility Service Canvas | |
|---|---|
| **Status** | □ In development, since …<br>□ Trial, since …<br>x In operation, since 1869 |
| **Areas/routes covered and number of people/amount of goods transported per service** | Total area served by DPMB is approximately 230 km2.<br>• Routes served by buses: 40.<br>• Routes served by trams: 11.<br>• Routes served by trolleybuses: 13.<br>• Routes served by boats: 1.<br>• Transported passengers by buses: 123 431 000/year.<br>• Transported passengers by trams: 191 714 000/year.<br>• Transported passengers by trolleybuses: 45 504 000/year.<br>• Transported passengers by boats: 234 000/year. |
| **Share of trip purpose per service** | x Commuting: 45 %<br>x Business: 30 %<br>x Leisure: 25 % |
| **3rd Party Suppliers and related company size** | • Does not apply. |
| **SME Aspects** | • No SMEs or start-ups involved. |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>□ Carsharing<br>□ Bike sharing<br>x Vehicle-based logistics<br>□ TMC-based services<br>ϒ Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>□ Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>□ B2B<br>□ P2P<br>□ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes (All services provided by DPMB are shared services.) |
| **Connected Mobility Aspects** | □ V2V<br>□ V2I |

| Mobility Service Canvas | |
|---|---|
| | □ V2P<br>x V2N<br>ϒ None |
| **Electrified vehicles used per service** | 100 % trams are electrified (317 vehicles)<br>100 % trolleybuses are electrified (156 vehicles)<br>100 % boats are electrified (6 vehicles) |
| **Automated vehicles used per service** | No (There is currently no automated vehicle in service). |
| **Number of vehicles used per service (fleet size)** | 322 buses<br>317 trams<br>156 trolleybuses<br>20 minivans<br>6 boats |
| **Vehicle capacity** | • Around 40 seats per standard bus and 70 seats per long buses. Around 40 seats per trolleybuses. Around 15 seats per minivans. Around 40 seats per tram. Around 100 seats per boat.<br>• Total capacity of seats 30 - 120. |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | Scheduled operations, timetables available online and printed at every stop. Digital information boards at majority of stops. Online tracking of all vehicles. In some selected vehicles, contactless payments for tickets are possible. |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | Dopravní podnik města Brna is a PT provider |

The following text gives a more detailed description of the state-of-the-art.

Dopravní podnik města Brna (DPMB) is a **public transport** authority owned by the city of Brno which is in operation since 1869. It offers public transport for nearly half a million citizens and operates in urban and interurban environments around the clock (24/7) and through all seasons.

Vision of the company is to improve the quality of the local public transport system, to maintain the position DPMB holds within the South Moravian Region Integrated Transport System and to provide attractive public transport at European Union standards.

DPMB has in total 2,604 employees and 1,502 stops and transported in 2019 around 362,000,000 people.

### 8.1.1.1 Mobility services

DPMB offers PT mobility services for the citizens of Brno and tourists with following aspects:

- Buses
- Trams
- Trolleybuses
- Minivans
- Boats

The 40 bus, 11 tram, 13 trolleybus and one boat lines cover an area of approximately 230 km$^2$. These lines have in total 322 buses, 327 trams and 147 trolleybuses. Each bus has a traffic performance of about 17,913,000 km per vehicle, each tram 14,937,000 km per vehicle, each trolleybus 5,954,000 km per vehicle and each boat 38,000 km per vehicle in the year 2017. The public network plan can be seen in the following picture (Figure 56):

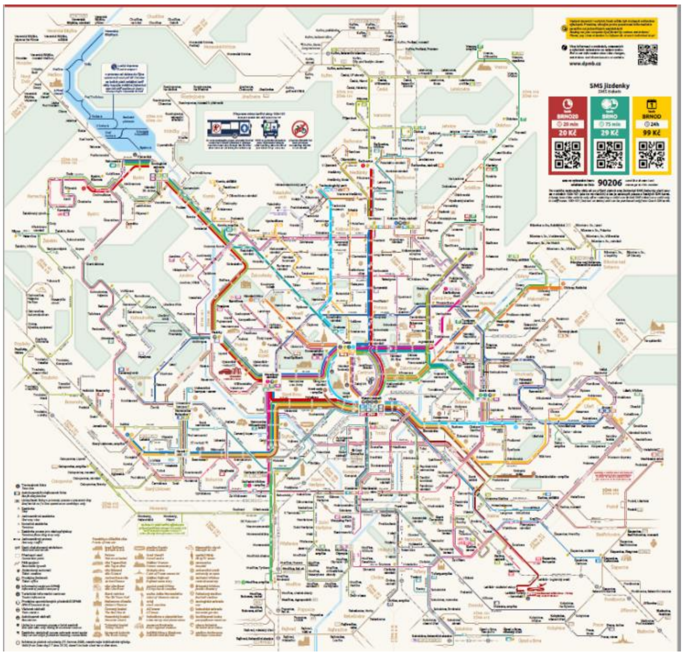


**Figure 56 – Network of DPMB (Source: DPMB)**

### 8.1.1.2 Related services

Beside the regular PT services DPMB has other related services:

- Senior bus
- Pub tram
- On-board information and advertisements in paper and digital form as well as advertisements directly on vehicles
- Ticket sale

#### *8.1.1.2.1 Senior bus*

The senior bus is an on-demand service especially made for all Brno citizens older than 70 years. It is possible to reserve a trip via phone between 7 and 17 o’clock on working days up to six times a month. The driver of the vehicle picks up the customer up as well as drop them at an agreed address. The price of the service has to be paid directly to the driver and each customer is allowed to be accompanied by one person who is allowed to use the service for free.

#### *8.1.1.2.2 Pup tram*

The pub tram is – as the name suggest – a tram that can be used as a mobile pub. The bar offers three different beer kinds for at regular trips or it can be reserved by groups. It only operates in the evening (18:00 – 21:55) at Wednesdays. At every first

Wednesday of the month there is even a so called “Pub-Quiz” for which customers has to sign up beforehand.

### *8.1.1.2.3 On-board information and advertisements in paper and digital form as well as advertisements directly on vehicles*

DPMB also offers on-board information and advertisements for companies in digital or paper form. It is even possible for companies to pay for city boards or even all-over advertising on vehicles.

### *8.1.1.2.4 Ticket sale*

Of course, the PT operator sales its tickets at different locations such as on board of the PT vehicles, at ticket machines and information booths and shops. It is even possible to purchase a ticket via SMS or directly in the vehicle via card. How this is done, can be seen in the next figure (Figure 57):


**Figure 57 – Contactless purchase of a ticket (Source: DPMB, 2020)**

### 8.1.2 ROMA Mobilità (Rome, Italy)

The Mobility Service Canvas (MSC) gives a fast overview over the services ROMA Mobilità offers as well as other important information about the services and the mobility operator.

**Table 50 – Mobility Service Canvas ROMA Mobilità**

| **Mobility Service Canvas** | |
|---|---|
| **Name** | **RomaMobilità** |
| **Short description** | **Roma Capitale** has **100%** shareholding of the company. The company oversees strategies, plans, supervises, coordinates and controls private and public mobility. It carries out activities like **planning, development, implementation and management of mobility services and supports the communication** with Roma Capitale and the other shareholding companies.<br><br>Information about how to move in Rome (by public and private transport), an helpdesk to deal with all the different permits-access to Limited Traffic Zones (ZTL), permit to park in the toll parking areas, licences for taxis, NCC (hired vehicles with driver) and horse carriages (botticelle), access and circulation of tourist coaches and delivery vans: Roma Servizi per la Mobilità is in charge of all these tasks.<br><br>It also manages the Car Sharing Roma service, offering families, professionals and business enterprises the chance to share a vehicle and decrease the use of private car, cutting the costs of owning a car and bringing environmental benefits. |
| **Website / Reference** | https://romamobilita.it/en<br><br>https://car-sharing.romamobilita.it/site/romamobilita.php |
| **Service Developers** | • Roma Capitale (municipality)<br>• ASSTRA – Associated Traffic AG<br>• POLIS – Cities and Regions for Transport Innovations<br>• TTS Italia – Italian ITS Association |
| **Primary Operator** | Roma Capitale – Dipartimento Mobilità e Trasporti (Roma Capital Department of Mobility and Transport) |
| **Target users and mobility needs** | • Passengers of public transportation<br>• Tourists<br>• Families,<br>• Professionals<br>• Business enterprises<br>• Car owners |
| **Mobility Services** | Carsharing<br>• Deliveries in urban area by carsharing<br><br>Connection to PT:<br>• Timetable and route information<br><br>Bike-sharing<br>• Commuters |

| Mobility Service Canvas | |
|---|---|
| | • Inhabitants<br><br>Billing for<br><br>• Tourist buses<br>• Toll parking<br><br>Permitting for entrance in ZTL<br><br>• Yes, there are parking areas<br><br>Licences for taxis<br><br>• No<br><br>Electrical vehicles charge stations<br><br>• Yes, each parking area has charge stations |
| **Related Services** | Service 1<br><br>• Roma public transport services<br>• Roma information system |
| **Mobility Service Operators** | • Roma Mobilità:<br>o Carsharing: RomaMobilità has owned cars<br>o Bikesharing: RomaMobilità has owned bikes<br>o Billing platform for Tourist "Bus Multi Entry Card"<br>o Platform for searching PT lines<br>o Platform for calling taxi<br>o Infrastructures for electric cars |
| **Access to the Services** | □ Public<br><br>x Registered users<br><br>ϒ Private |
| **Type of environment** | x Urban<br><br>□ Interurban<br><br>□ Highway<br><br>□ Rural<br><br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br><br>ϒ Dedicated lane |
| **Operations Parameters** | • On-demand service<br>• 24h operation<br>• 2 or 5 passengers per vehicle<br>• Car Sharing depending on distance: 0.49-0.65 €/km or 0.33-0.56€/km<br>• Car Sharing depending on time: 2.5-3.3 €/hour or 1.4-1.7 €/hour |
| **Status** | □ In development, since …<br><br>□ Trial, since …<br><br>x In operation, since 2009 |

| Mobility Service Canvas | |
|---|---|
| **Areas/routes covered and number of people/amount of goods transported per service** | The service covers Rome Capital areas. |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | • PT provider: ATAC (PTO), Rome's public transport operator includes some regional trains inside Rome Capital area<br>• Taxi: all licenced taxis |
| **SME Aspects** | • No information available |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>x Carsharing<br>x Bike sharing<br>x Vehicle-based logistics<br>x TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>x Liberal Model<br>x Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>□ B2B<br>□ P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>• Carsharing<br>• Electric cars charging<br>• Shared-use mobility (taxi)<br>• Public transportation<br>• Demand response system<br>• Ridesharing<br>• Private shuttles<br>• Cargo delivers by carsharing |
| **Connected Mobility Aspects** | □ V2V<br>x V2I: fleet management for RomaMobilità vehicles (position, access, fuel level, car features, ...) |

| Mobility Service Canvas | |
|---|---|
| | □ V2P<br>□ V2N<br>ϒ None |
| **Electrified vehicles used per service** | • Yes (percentage of electric vehicles is not available) |
| **Automated vehicles used per service** | No |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • 2 or 5 seats per vehicle<br>• Some vehicles for freight transport |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | MaaS: integrated planning, booking, payment |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | • Rome Capital operates carsharing<br>• Service areas at PT stations<br>• Some promotions to the annual ticket holder when they use carsharing or non-central parking areas |

The following text gives a more detailed description of the state-of-the-art.

The company ROMA Mobilità (in operation since 2009) owned by ROMA Capitale offers different kinds of on-demand transportation services for registered users in an urban environment (Rome).

ROMA Mobilità is an instrumental company responsible for strategic planning, supervision, coordination and control of public and private mobility. Designing, developing, implementing and managing of the mobility services and providing communication support to ROMA Capitale and its subsidiaries are the tasks of the company.

One of the main tasks of ROMA Mobilità is to supervise daily the different (mobility) needs of citizens and city users. Beside the offered services for customers written above the company is also in charge for licenses for taxis, hired vehicles with drivers and horse carriages.

### 8.1.2.1 Mobility services

The following mobility services operate during all seasons, times and vacation days:

- Carsharing for transportation of people and freight (Cars owned by ROMA Mobilità)
- Connectivity Service (Timetable and route information of PT in Rome)
- Billing platform for tourist buses and toll parking
- Permitting for entrance in ZTL
- Offering charging infrastructure for electric vehicles
- Administrational activities regarding historic horse carriages (Botticelle)
- Platform for managing taxi and NCC licenses automatically
- Platform for calling taxis
- Platform for existing bicycle lanes

#### *8.1.2.1.1 Car-sharing*

The car-sharing system in Rome has in total 2,300 vehicles from four different operators. One of these operators is ROMA Mobilità with a fleet of 190 vehicles and 151 stations for the collection of vehicles, spread over 13 of the 15 urban municipalities in the year 2018. This service is the only station-based car-sharing system in Rome. The other three operators offer a flee floating system (Car2Go, Enjoy and Share'nGo). The station-based car sharing system has as well 190 parking spaces for the service. Around 3,000 people are subscribed to the service and is used 75 times a day.

#### *8.1.2.1.2 Connectivity Service*

ROMA Mobilità offers maps with metro and railway lines, stations and times as well as mobility possibilities how to get from the airport within the city of Rome. It also shows where existing bike lanes are.

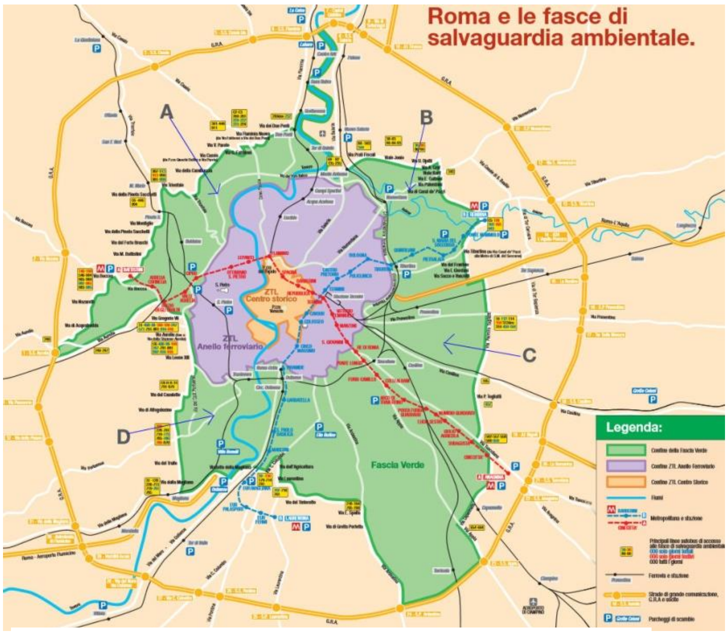
#### *8.1.2.1.3 Billing platform for tourist buses and toll parking*

Tourist buses need permits to enter certain areas. These areas are divided into the categories A, B and C. For each category an own application must be made or the so called Multi entry card can be requested for the areas A and B. Area C is the city center of Rome and therefore need special permission for entering (Colosseum Area's Permits and Vatican Area's Permits).

#### *8.1.2.1.4 Permitting for entrance in ZTL*

ZTLs are so called "Zonas a traffico limitato" which are "Limited traffic zones" in Italy. These zones were created to protect historic city centres from excessive traffic which would make the city less attractive. Rome has in total three different zones:

- Fascia verde: Monday – Friday from 00:00 to 24:00 all vehicles are allowed if they fulfil the minimum standard. That would be Euro level 2 for petrol driven vehicles and Euro level 3 for diesel driven vehicles.
- Railway ring: The same as for Fascia verde applies here, only the Euro level for petrol driven vehicles needs to be level 3 and for diesel driven vehicles level 4
- City center: No vehicles allowed without permission




There are different permissions that can be requested, dependent on the cause e.g. inhabitant, transit, permission for mechanics and night shift workers etc. When the cause is known a request needs to be made and send to ROMA Mobilitá to get a permission for the ZTLs.
In the picture (Figure 58) the three zones mentioned can be seen. The green one is “Fascia verde”, the purple one “Railway ring” and the orange one “City center”.

**Figure 58 – ZTL areas in Rome (Source: Comune di Roma, 2020)**

#### *8.1.2.1.5 Offering charging infrastructure for electric vehicles*

During the project “Rome Plan for public recharge” 118 charging stations of which 97 are for cars, 12 for motorbikes and 9 for car-sharing were created. These stations were activated by ENEL with the coordination of ROMA Capitale and the technical support of ROMA Mobilità.

#### *8.1.2.1.6 Administrative activities regarding historic horse carriages (Botticelle) licenses*

ROMA Mobilità are doing the administrative activities for historic horse carriage licenses in Rome. At the website different digital documents are available that need to be filled out for different request regarding licenses such as renewing or duplicating licenses.

#### *8.1.2.1.7 Platform for managing taxi and car rental with driver (NCC) licenses automatically*

This is a new digital platform that allows the automated management of all administrative practices related to taxi licenses and NCC (Noleggio Con Conducente) licenses of ROMA Capitale. Operators in the sector can initiate most online practices without having to go to the public counter of ROMA Mobilitá.

#### *8.1.2.1.8 Platform for calling Taxis*

The platform is called “CallTaxi 060609”. Customers can call the taxi with the number 060609 or with the app which has the same name as the platform. After ordering a taxi the customer gets a license number and the approximate arrival time of the vehicle. The request via the CallTaxi 060609 app enables data to be entered by touch, GPS recognition of the customer’s location and finally direct voice contact with the nearest taxi.

#### *8.1.2.1.9 Platform for existing bicycle lanes*

On the website of ROMA Mobilità it is possible to get an overview of the bicycle lanes in Rome via a digital map.

### 8.1.2.2 Related services

Other related services are:

- ROMA public transportation services
- ROMA information system
- Bike sharing

#### *8.1.2.2.1 ROMA public transportation services*

ROMA Capitale is also in charge of the PT system in Rome. In total Rome has four metro lines, six tram lines and 362 bus lines. The fleet of vehicles consists of 2,599 vehicles of which 165 are tramway convoys and 27 % are driven with electricity or CNG.

Rome's public transport system has two operators: ATAC and which is a public transport company owned by ROMA Capitale and runs most of the public lines (all metro and tram lines and 259 bus lines) in the city and Roma TPL which only runs 103 bus lines.

In total the public transportation services in Rome transported in total 952,860,000 million passengers in the year 2017.

#### *8.1.2.2.2 ROMA information system*

ROMA Capitale also offers on its website a great variety of different information services such as data and statics in areas like population, economy, health, environment, mobility and transport, etc. News with different topics such as mobility, culture, school, sports, and environment etc. can also be seen on the website.

#### *8.1.2.2.3 Bike sharing*

According to some blog entries ATAC runs a city bike sharing program. To use the service the customer has to get a so called "Smartcard" and charge it with a certain amount of money. With this card users are able to take a bike from one of the many bike stations dotted around the city. The Smartcard costs 5 € and a bike costs 1 € for every half hour and must be returned to any stations within 24 hours. (Collins, 2010)

### 8.1.3 tim (täglich.intelligent.mobil) (Graz, Austria)

The Mobility Service Canvas (MSC) gives a fast overview over the services tim offers as well as other important information about the services and the mobility operator.

**Table 51 – Mobility Service Canvas of tim**

| Mobility Service Canvas | |
|---|---|
| **Name** | **tim (täglich.intelligent.mobil)** |
| **Short description** | "tim" is an innovative mobility model that combines different forms of personal mobility together<br><br>tim Graz (pilot site):<br><br>"tim" is an offer from Holding Graz together with external partners, operated by "Graz Linien". "tim" is based on the project „KombiMo II", funded by the Austrian Federal Ministry of Transport, Innovation and Technology (bmvit). The project partners of KombiMO II were: City of Graz, Energie Graz, Wirtschaftskammer Steiermark, TU Graz, FH Joanneum, e-mobility, quintessenz, IBV Fallast.<br><br>tim Linz:<br><br>"tim" is an offer from Linz AG together with external partners, operated by "LINZ AG LINIEN" for Linz area. |
| **Website / Reference** | https://www.tim-oesterreich.at/<br><br>Video:<br><br>https://youtu.be/EAvSuUePSJw |
| **Service Developers** | • City of Graz (municipality),<br>• Energie Graz (regional energy provider),<br>• Wirtschaftskammer Steiermark (chamber of commerce),<br>• TU Graz,<br>• FH Joanneum,<br>• e-mobility,<br>• quintessenz,<br>• IBV Fallast |
| **Primary Operator** | • Graz: Holding Graz – Kommunale Dienstleistungen GmbH / Holding Graz Linien<br>• Linz: LINZ AG |
| **Target users and mobility needs** | • Passenger transport for population<br>• Commuting, Business, Leisure |
| **Mobility Services** | MaaS<br><br>• Carsharing<br>• Billing platform for e-Taxis, rental cars and Public charging<br>• Connection to PT: timetable information<br>• Ride sharing (Anruf-Sammel-Taxi AST) – Linz only |
| **Related Services** | Indirect via Shareholder Holding Graz / LINZ AG:<br><br>• Energy (Gas, Electric Power, Heating)<br>• Municipal services |

| Mobility Service Canvas | |
|---|---|
| **Mobility Service Operators** | • Carsharing: “tim”-owned pool cars<br>• Billing Platform for e-Taxis: “tim card” service<br>• Graz: e-Taxis: several local e-taxi service providers with “tim” contract<br>• Linz: Ride sharing (Anruf-Sammel-Taxi AST)<br>• Rental Cars: international rental car service provider (Europcar) with discount and payment with “tim card”<br>• Public Charging: e-Auto Naturstrom (Energie Graz) |
| **Access to the Services** | □ Public<br>x Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>□ Interurban<br>□ Highway<br>□ Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | 24x7 Service<br>Carsharing Prices (Graz):<br>• 4€/hour (1st,2nd hour)<br>• 6€ (3rd, 4th hour)<br>• 9€ (5th to 9th hour)<br>• 77€ (daily rate)<br>Carsharing Prices (Linz):<br>• 5€/hour (1st,2nd hour)<br>• 8€ (3rd, 4th hour)<br>• 10€ (5th to 9th hour)<br>• 88€ (daily rate) |
| **Status** | □ In development, since …<br>□ Trial, since …<br>x In operation, since 2016 (Graz), 2018 (Linz)<br>Styria central area: start scheduled for 2020 |
| **Areas/routes covered and number of people/amount of goods transported per service** | Graz: 15 tim sites, no restrictions on routes/areas<br>Linz: 5 tim sites (mid 2020)<br>Vehicles: e-Golf, Skoda Fabia combi, Peugeot Transporter |
| **Share of trip purpose per service** | x Commuting<br>x Business |

| Mobility Service Canvas | |
|---|---|
| | x Leisure |
| **3rd Party Suppliers and related company size** | PT provider:<br><br>• Graz: Graz Linien (PTO), Steirischer Verkehrsverbund (joined platform of 54 regional PT provider, PTO)<br>• Linz: LINZ AG Linien<br><br>Taxi:<br><br>• Graz: eTaxi: Taxi 878 GmbH & Co KG (LE) and 2 more<br>• Linz: Ride sharing AST: LINZ AG (LE)<br><br>Rental cars:<br><br>• EUROPCAR Österreich ARAC GmbH (LE), subsidiary PORSCHE Holding (LE)<br><br>Public charging:<br><br>• Graz: Energie Graz AG (LE)<br>• Linz: LINZ AG (LE) |
| **SME Aspects** | None |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>x Carsharing<br>x Bike sharing<br>□ Vehicle-based logistics<br>□ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>□ Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>□ B2B<br>□ P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>Sharing aspects are:<br>• (e)car sharing<br>• public charging infrastructure |

| Mobility Service Canvas | |
|---|---|
| | • Shared-Use Mobility (taxi)<br>• Public Transportation<br>• Carsharing<br>• Ridesharing (Linz) |
| **Connected Mobility Aspects** | □ V2V<br>x V2I<br>□ V2P<br>□ V2N<br>ϒ None |
| **Electrified vehicles used per service** | Graz: Yes (37 %, 17/45)<br>Linz: Yes |
| **Automated vehicles used per service** | No |
| **Number of vehicles used per service (fleet size)** | Graz: 45 |
| **Vehicle capacity** | Up to 5 Persons |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | Maas: integrated planning, booking, contracts, subscription, payment |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | Urban PT provider operates carsharing (long term/short term) as well as eTaxi as supplementary offer<br>Service areas at PT stations, carsharing vehicles shall be returned to same service area (complement to PT).<br>Free membership for PT annual ticket holders |

The following text gives a more detailed description of the state-of-the-art.

tim is an innovative mobility model operated by Holding Graz – Kommunale Dienstleistungen GmbH/Holding Graz Linien since 2018 and was developed in the frame of the project "Kombinierte Mobilität" as innovative mobility service in the year 2015.
Around 2,100 people are registered at tim und 500,000 km were driven with the e-cars the carsharing service offers.

### 8.1.3.1 Mobility services

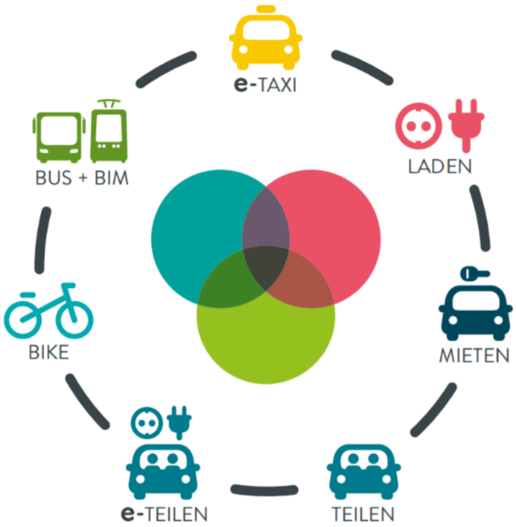



**Figure 59 – tim mobility services (Source: Graz HOLDING, 2020)**

It offers different mobility services for registered users in an urban environment (Graz) for all seasons, times and vacation days (see Figure 59):

- Car sharing with tim owned pool cars
- Ride sharing (only in Linz)
- Taxi service and billing platform for e-taxi (e-taxi service providers with tim contract)
- Rental Cars (Provider is Europcar; discount and payment with "tim card")
- Freight bicycle
- Connectivity service (Timetable information for PT)

tim has nine different locations situated in Graz where <u>(e)-carsharing</u> and <u>car rental</u> can be used, where <u>e-taxis</u> can be called and where <u>private cars can be charged</u>: Hasnerplatz, Jakominigürtel, Eggenberger Allee, Schillerplatz, Lendplatz, Wirtschaftskammer, Brauquartier Puntigam, Andreas-Hofer-Platz, Mohsgasse. Another important location is the airport where it is possible to rent a car or use carsharing vehicles.
At the following locations only, conventional vehicles are available for carsharing: Eisernes Tor, Geidorfplatz, Kernstockgasse, Stremayrgasse and St.-Peter-Pfarrweg. All the mentioned locations are situated in such a way that they are directly connected to the public transportation network.
Even in the districts Graz-Umgebung and Voitsberg there are some tim locations available which were developed during the project "REGIOtim": Hart bei Graz, Laßnitzhöhe, Nestelbach bei Graz, Premstätten, Lieboch, Gratwein-Straßengel, Söding-Sankt Johann, Voitsberg, Köflach and Bärnbach.
Because of the success of the service it expanded to Linz where it is operated by LINZ AG Linien. There five tim mobility nodes were opened at Linzer main square, LINZ AG-Center, JKU – Johannes-Kepler-University, Tabakfabrik Linz and Grüne Mitte Linz.
Linz as location offers exactly the same services as Graz, but only in this city ride sharing is also available.

#### *8.1.3.1.1 Car sharing*

In total there are 60 vehicles available of which 20 vehicles are electrified. For the station-based car sharing system the following vehicles are available: VW e-Golf, Skoda Fabia Combi and Peugeot Transporter. The vehicles can be found at the previous mentioned locations and can be booked via app. After the time ends the vehicle was booked (e.g. four hours) the vehicle needs to be returned to the location it was picked up (e.g. Hasnerplatz in Graz).

#### 8.1.3.1.2 Ride sharing (only in Linz)

Only in Linz ride-sharing by tim is offered. This service is offered by the operator AST (Anruf-Sammel-Taxi) and at every tim location there are AST departure points. After booking the service by entering the starting and end point of the trip the app shows the costs, travel time and driving distance for the customer.

#### 8.1.3.1.3 Taxi service and pilling platform for e-taxis

At every tim-location tim e-taxis are also available. But they also can be called with the following numbers: 878, 889, 2801. The taxis offer space for up to six people and can be paid with the tim card without cash. The collected amount of money will be charged at the end of the month by collective invoice from the taxi company Taxi 878 GmbH & Co KG.

#### 8.1.3.1.4 Rental cars

Another mobility service of tim is car-rental. At the mentioned locations above a car can be rented from at least one day up to one month. The Skoda Oktavia Combi is the only tim-owned rental car available. If other vehicles are needed the mobility partner “Europcar” offers other cars for a special tim-price.

#### 8.1.3.1.5 Freight Bicycle

Since 3rd August 2020 tim users can book a freight bicycle, which is located at Schillerplatz.

#### 8.1.3.1.6 Connectivity Service

Tim also offers direct connection to maps and the ticketing system of the PT system in Graz. Owner of an annual pass of the PT network in Graz can save money when subscribing to tim: the registration fee of 15 Euro and the monthly subscription fee of 7 Euro are dropped as long as the validity period of the annual pass is valid.

### 8.1.3.2 Background services

#### 8.1.3.2.1 Billing platform

After the registration every user of tim gets the so called “tim”-card. With this card all services can be used and all costs are registered. Then the costs are paid via credit card or online bank transfer.

#### 8.1.3.2.2 Public charging for electric cars

tim offers charging possibilities for private used electrical vehicles at tim locations. Everybody subscribed at tim can use these charging stations. The energy used is produced by Solar Graz and comes from 100 % renewable energy sources.

### 8.1.3.3 Related services

Indirect services via the Shareholder Holding Graz/LINZ AG are following services.

#### 8.1.3.3.1 Energy (Gas, Electric Power, Heating)

Holding Graz holds 51 % of the energy provider Energie Graz. With this it provides energy, gas and heating to around 61.000 households in the city of Graz. In Linz the LINZ AG is responsible for this task.

#### *8.1.3.3.2 Municipal services*

Beside supplying Graz with Energy and heating it is responsible for other municipal services such as the public transportation, the water and sewer management, waste management, road maintenance and cleaning, and green space maintenance. In Linz the LINZ AG is responsible for these tasks.

### 8.1.4 UbiGo – MaaS (Stockholm/Gothenburg, Sweden)

The Mobility Service Canvas (MSC) gives a fast overview over the services UbiGo offers as well as other important information about the services and the mobility operator.

**Table 52 – Mobility Service Canvas of UbiGo**

| **Mobility Service Canvas** | |
|---|---|
| **Name** | UbiGo - MaaS |
| **Short description** | UbiGo is a MaaS which can be used in Stockholm and Gothenburg/Sweden. It gathers your mobility needs under one roof, you are freed of having to deal with multiple services and payments. |
| **Website / Reference** | https://www.ubigo.me/en |
| **Service Developers** | • Volvo<br>• City of Gothenburg/Stockholm<br>• Regional PTA (SL/Västtrafik)<br>• RISE (Viktoria ICT previously)<br>• Lindholmen Science Park<br>• Chalmers<br>• Via-ID (investor) |
| **Primary Operator** | • UbiGo |
| **Target users and mobility needs** | • Urban citizens |
| **Mobility Services** | Mobility Service 1<br>• Public transport (e.g. SL in Stockholm)<br>Mobility Service 2<br>• Carpool (Move about)<br>Mobility Service 3<br>• Car rental (Hertz)<br>Mobility Service 4<br>• Taxi (Cabonline) |
| **Related Services** | • None |
| **Mobility Service Operators** | • Public transport (e.g. SL in Stockholm)<br>• Carpool (Move about)<br>• Car rental (Hertz)<br>• Taxi (Cabonline) |

| Mobility Service Canvas | |
|---|---|
| **Access to the Services** |  Public<br><br>x Registered users<br><br>ϒ Private |
| **Type of environment** | x Urban<br><br> Interurban<br><br> Highway<br><br> Rural<br><br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | X Mixed traffic lane<br><br>ϒ Dedicated lane |
| **Operations Parameters** | • Subscription is done via UbiGo app, with each mobility service with its own conditions and price<br>• Car rental and taxi can be booked without a subscription (via app)<br>• No membership fee, pay for subscription with each individual service<br>• Subscriptions can be paused or changed each month<br>• If you planned on taking SL public transit and this causes a delay of more than 20 minutes, you can book a taxi for free (between the two intended stations/stops) |
| **Status** |  In development, since …<br><br>x Trial, since 2014 in Gothenburg<br><br>x In operation, since 02/2019 in Stockholm |
| **Areas/routes covered and number of people/amount of goods transported per service** | • Gothenburg<br>• Stockholm |
| **Share of trip purpose per service** | x Commuting<br><br> Business<br><br>x Leisure |
| **3rd Party Suppliers and related company size** | • No information available |
| **SME Aspects** | • No information available |
| **Model type (A)** | x PTO (public transport operator) and non-PTO based shared mobility services<br><br>x Carsharing<br><br> Bike sharing<br><br> Vehicle-based logistics<br><br> TMC-based services<br><br>x Aggregator-based services and applications |

| Mobility Service Canvas | |
|---|---|
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br> Central Model<br>x Liberal Model<br> Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br> B2B<br> P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>• Public transport<br>• Carpool |
| **Connected Mobility Aspects** | V2V<br> V2I<br> V2P<br> V2N<br> None<br>x Don´t know |
| **Electrified vehicles used per service** | Carpool from Moveabout is 100% electrified vehicles |
| **Automated vehicles used per service** | • No |
| **Number of vehicles used per service (fleet size)** | + 100 in carpool |
| **Vehicle capacity** | • Depending on the service |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |

| Mobility Service Canvas | |
|---|---|
| **MaaS/LaaS/DRT integration level**<br><br>MaaS - Mobility as a service<br><br>Laas - Logistics as a service<br><br>DRT - Demand-responsive transport | Service 1: UbiGo<br><br>• Subscription is done via UbiGo app, with each mobility service with its own conditions and price<br>• Car rental and taxi can be booked without a subscription (via app)<br>• No membership fee, pay for subscription with each individual service<br>• Subscriptions can be paused or changed each month |
| **Relation to PT (coordinated by PT)**<br><br>PT – Public transport | For Stockholm/SL = PT:<br><br>Together with SL, UbiGo offers a flexible subscription of day tickets at a competitive price point compared to using the pay as you go-service or the monthly pass. With our tickets, you travel back and forth to work, or as many times as you want during the day - until 04:30 am.<br><br>A subscription can be paused and edited on a monthly basis, so that it always suits your current need. Share subscription with your family members and get a better overview over your travel costs - and lower ticket prices.<br><br>Order in the UbiGo app:<br><br>one or more SL cards, that UbiGo mails to you. The cards can be regular or configured with discounts for youths/seniors.<br><br>Choose your subscription:<br><br>Find the ticket subscription that best suits your needs.<br><br>Ride: The cards are ready to be used when you receive them, you use them as you would use a regular SL card at the turnstiles and ticket controls. |

The following text gives a more detailed description of the state-of-the-art.

UbiGo is a Maas which can be used in Stockholm and Gothenburg in Sweden operated by UbiGo itself since 2014.

### 8.1.4.1 Mobility services

It offers different mobility services (see Figure 60) for registered users in an urban environment (Stockholm and Gothenburg) during all seasons, times and vacation days:

- Public transport (Operator: SL in Stockholm)
- Carpool (Operator: Move about)
- Car rental (Operator: Hertz)
- Taxi (Operator: Cabonline)


**Figure 60 – UbiGo mobility services (Source: UbiGo Innovation AB, 2020)**

#### *8.1.4.1.1 Public transport*

Together with SL UbiGo offers flexible subscription of a day tickets at a competitive price point compared to using the pay as you go-service or the monthly pass. With the tickets it is possible to travel as many times as wanted during the day (until 04:30 am). There are different subscriptions available to choose from: starting with 10-day tickets subscription up to 40-day tickets subscription.
Depending on the customer's needs it is possible to change the subscription monthly and to pause the subscription twice a year for a duration of two months.

#### 8.1.4.1.2 Carpool

The carpool UbiGo offers is station-based and operated by the operator Move about. In total that are over 100 vehicles which are all electrified. Offered subscriptions are starting with three hours up to 30 hours.
Here as well, depending on the customer's needs it is possible to change the subscription monthly and to pause the subscription twice a year for a duration of two months.

#### 8.1.4.1.3 Car rental

Renting a car is only possible for weekends (Friday 9:00 am until Monday 8:00 am) at Hertz stations which is a partner of UbiGo. Four different sets are offered: Small, Medium, Standard and Large/Premium. All sets have other vehicles available:

- Small: Toyota Yaris or equivalent
- Medium: Volvo V40 Automatic or equivalent
- Standard: Volvo V60 Automatic or equivalent
- Large/Premium: Volvo XC60 Automatic or equivalent

The following is always included in the price: Excess reduction collision damage, Insurance, free mileage, toll fees, free cancellations up until the time that booking starts.

#### 8.1.4.1.4 Taxi

It is also possible to book taxis offered by Cabonlines via the UbiGo app. The prices are predetermined and paid is the next month via invoice. A special offer for UbiGo subscribers is that if it was planned to take the public transportation system and it causes a delay of more than 20 minutes, it is possible to take a taxi instead for free. But only between the two intended stations/stops.

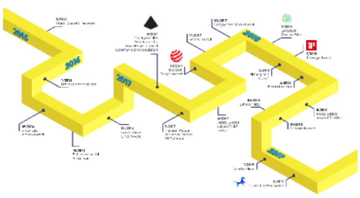
### 8.1.5 whim (international)

The Mobility Service Canvas (MSC) gives a fast overview over the services UbiGo offers as well as other important information about the services and the mobility operator.

**Table 53 – Mobility Service Canvas of whim**

| **Mobility Service Canvas** | |
|---|---|
| **Name** | **whim (MaaS Global Ltd)**<br>Partner (Helsinki): |
| **Short description** | Whim, the first all-inclusive MaaS solution commercially available on the market, gives its users all city transport services in one step, letting them journey where and when they want with public transport, taxis, bikes, cars, and other options, all under a single subscription (bookings, tickets, payment) |

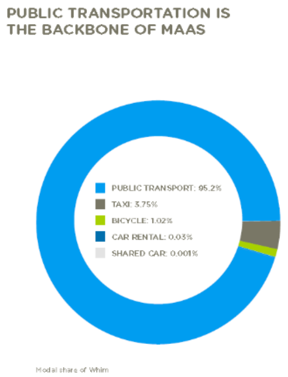
| Mobility Service Canvas | |
|---|---|
| **Website / Reference** | https://whimapp.com/<br>Video: https://youtu.be/iDlbj9xcZ58 |
| **Service Developers** | Whim App: MaaS Global Ltd (IT und Services) |
| **Primary Operator** | MaaS operator: MaaS Global Ltd |
| **Target users and mobility needs** | **One app for all your transport needs**<br>MaaS - Better Than Your Own Car<br>Imagine if all your daily travel needs would be covered, with one simple app, with one simple payment – directly from your mobile. Travel as much as you like with a flat fee, or pay-as-you-go, with buses, trains, taxis, bikes, cars and more. MaaS provides you the ultimate way to move around.<br>Our revolutionary mobile app, Whim, liberates people from timetables, fixed routes, parking worries and the high costs of owning a car. Born out of a need to be spontaneous, it gives people access to a huge variety of transport options. A Whim subscription means true freedom of mobility. (www.whimapp.com) |
| **Mobility Services** | MaaS (Service offer depending on location)<br>• Public Transport: unlimited travel (buses, metro, ferry, and commuter trains in HSL area)<br>• City bike<br>• Taxi: transfer to the nearest train or metro station (max. 5km taxi rides), 15% discount for all taxi rides<br>• Rental car<br>• E-scooter |
| **Related Services** | Maas open ecosystem for Businesses:<br>Innovation platform for new breed of digital services (https://whimapp.com/businesses/)<br>Currently no additional service active |
| **Mobility Service Operators** | Whim strategy: MaaS open ecosystem for transport providers:<br>• We operate no services ourselves and want to work with everyone.<br>• We say no to exclusive deals. People deserve choice, and we welcome competition with open arms.<br>• Public transport will always be the backbone of MaaS.<br>• We share data in the name of the virtuous cycle, not to monetize our users' data; by helping our partners to improve their services, Whim becomes better helping more people to ditch their cars.<br>Various operators for provided services in different areas/cities:<br>• Local PT provider (e.g. HSL in Helsinki, Wiener Linien in Vienna)<br>• Car Rental (e.g. TOYOTA, Hertz, SIXT)<br>• Scooter (e.g. TIER)<br>• Taxi (e.g. Taksi Helsiki, 31300 Vienna)<br>• Carsharing (e.g. ALD Sharing)<br>• City Bike sharing |
| **Access to the Services** | ☐ Public |

| Mobility Service Canvas | |
|---|---|
| | x Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>x Interurban<br>☐ Highway<br>☐ Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | Offer of different plans (depending on location)<br>• Whim to Go (Pay as you go)<br>• Whim Urban 30 (PT 30 days ticket, limited use of Taxis/city bikes/E-Scooter, reduced rate for Rental car)<br>• Whim Weekend (Urban 30 + Rental car on weekend)<br>• Whim Unlimited (mobility flat rate) |
| **Status** | ☐ In development, since …<br>☐ Trial, since …<br>x In operation, since Oct. 2016 (Helsinki)<br>**Helsinki:** Homebase, first commercial ride: 17.10.2016, operation since 11/2017, Pay as you go and subscriptions<br><br>Rollout:<br>**Birmingham:** pilot since 15.12.2016, operation since 3/2018, Pay as you go and subscriptions<br>**Antwerp:** pilot since 30.9.2017, operation since 3/2018, Pay as you go and subscriptions<br>**Vienna:** operation since 10/2019, Pay as you go – no subscriptions<br>**Greater Tokyo:** pilot starting soon |

| Mobility Service Canvas | |
|---|---|
| | **Singapore:** pilot starting soon |
| **Areas/routes covered and number of people/amount of goods transported per service** | Full service in designated areas |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | Area Helsinki<br>• PT provider: HSL (PTO)<br>• Rental Car: Toyota Car Rental (LE), Hertz (LE), SIXT (LE)<br>• Permanent Car Rent: VEHO GO (LE)<br>• Taxi: Taksi Helsiki (LE), Lähitaksi (LE), Kajon (LE), Menevä (LE)<br>• Carsharing: ALD Automotive (LE)<br>• Scooter: TIER (LE)<br>Global and regional 3rd Party suppliers integrated into whim App. |
| **SME Aspects** | Whim strategy: MaaS open ecosystem for transport providers and businesses<br>https://whimapp.com/become-a-partner/ |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>x Carsharing<br>x Bike sharing<br>☐ Vehicle-based logistics<br>☐ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>☐ Central Model<br>x Liberal Model<br>x Aggregator Model<br>ϒ Social innovation |

| Mobility Service Canvas | |
|---|---|
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>x B2B<br>x P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>Sharing aspects are:<br>• Shared-Use Mobility (taxi)<br>• Public Transportation<br>• Carsharing<br>• Fixed-route system<br>• Private shuttles |
| **Connected Mobility Aspects** | □ V2V<br>□ V2I<br>x V2P<br>□ V2N<br>ϒ None |
| **Electrified vehicles used per service** | Yes (according service offer of mobility partners) |
| **Automated vehicles used per service** | No |
| **Number of vehicles used per service (fleet size)** | according service offer of mobility partners |
| **Vehicle capacity** | according service offer of mobility partners |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | Integration of:<br>• Planning<br>• Booking<br>• Contracts<br>• Payment |

<table>
<tr><th colspan="2">Mobility Service Canvas</th></tr>
<tr><td>Relation to PT (coordinated by PT)<br><br>PT – Public transport</td><td>Public transport will always be the backbone of whim services.




Source: https://ramboll.com/-/media/files/rfi/publications/Ramboll_whimpact-2019.pdf</td></tr>
</table>

The following text gives a more detailed description of the state-of-the-art.

whim is an all-inclusive MaaS solution available in different cities in Europe and is operated by MaaS Global Ltd since 2016. It is planned to offer the services in two Asian cities in the near future.

### 8.1.5.1 Mobility services

It offers different mobility services (see Figure 61) for registered users in an urban and interurban environment during all seasons, times and vacation days:

- Public Transport (Operator: e.g. HSL in Helsinki, Wiener Linien in Vienna)
- City bike
- Taxi (Operator: e.g. Taksi Helsinki, 31300 Vienna)
- Car Rental (Operator: e.g. Toyota, Hertz, SIXT)
- E-Scooter (Operator: e.g. TIER)


**Figure 61 – whim mobility services (Source: MaaS Global Oy, 2020)**

The whim app is available or planned for the following cities:

- Helsinki, Finland
- West Midlands, Great Britain
- Antwerp, Belgium
- Vienna, Austria
- Greater Tokyo, Japan (planned)
- Singapore, Singapore (planned)
- Turku, Finland

The plans whim offers are depending on the city the app is used. For reasons of simplicity only the plans offered in Helsinki, Finland are described in the following sub-chapters.

##### *8.1.5.1.1 Public transport*

Depending on the plan chosen different tickets for the public transport service of Helsinki is available:

- Whim Urban 30: HSL 30-day ticket
- Whim Student 30: HSL 30-day student ticket
- Whim Weekend: HSL 30-day ticket
- Whim Unlimited: Unlimited HSL single tickets

Helsinki is divided into different zones starting with A to D. Depending on which zones taken the price for the service can change.

##### *8.1.5.1.2 City bike*

Depending on the plan chosen different tickets for the City bikes service of Helsinki is available:

- Whim Urban 30: Included (max. 30 minutes per ride)
- Whim Student 30: Only season pass
- Whim Weekend: Included (max. 30 minutes per ride)
- Whim Unlimited: Included (max. 30 minutes per ride)

##### *8.1.5.1.3 Taxi*

Depending on the plan chosen different tickets for the taxi service of Helsinki is available:

- Whim Urban 30: 4 times 10 € (max. 5 km rides), other rides to normal price
- Whim Student 30: Pay as you go
- Whim Weekend: -15 % on each taxi ride
- Whim Unlimited: 80 rides (max. 5 km rides); other rides to normal price

##### *8.1.5.1.4 Car Rental*

Depending on the plan chosen different tickets for the car rental service of Helsinki is available:

- Whim Urban 30: 49 €/day
- Whim Student 30: Pay as you go
- Whim Weekend: Only on weekends
- Whim Unlimited: Unlimited

##### *8.1.5.1.5 E-Scooter*

Depending on the plan chosen different tickets for the e-scooter service of Helsinki is available:

- Whim Urban 30: TIER Standard pricing
- Whim Student 30: TIER Standard pricing
- Whim Weekend: TIER Standard pricing
- Whim Unlimited: TIER Standard pricing

#### 8.1.5.2 Related services

Whim is a MaaS open ecosystem for businesses and therefore provides an innovation platform for businesses interested in the world of MaaS. At this platform participants are able to build a new breed of digital services that will help businesses reduce emissions, attract employees and save money. They share information about MaaS in their vicinity, where the market is moving and what opportunities and challenges are there.

## 8.2 Business and operating models using Canvas Methodology

### 8.2.1 Business models of MaaS services

#### 8.2.1.1 *Business models Dopravní podnik města Brna (Brno, Czech Republic)*

**Table 54 – Business Model Canvas DPMB**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | Providing mobility in a place that is poorly served by transportation modes |
| **Customer Segments** | • University students and staff |
| **Customer Relationships** | • Personal relationship with the operators of the vehicles<br>• Personalized digital platform for route planning and ticketing<br>• Information on DPMB website and social media |
| **Channels** | • Mobile application<br>• Website<br>• Social Media |
| **Key Resources** | • Automated vehicle<br>• Booking application |
| **Key Activities** | • Marketing and analysis of travellers' behaviours |
| **Key Partners** | • Automated vehicle developers<br>• IT provider |
| **Revenue Streams** | • Per ride payment<br>• Subscription |
| **Cost Structure** | • CAPEX:<br>o Cost of vehicle fleet<br>o Cost of physical infrastructure<br>o Cost of digital infrastructure<br>o Machines and equipment<br>• OPEX:<br>o Repairs, Maintenance, Services<br>o Depreciation costs<br>o Personnel costs<br>o Material consumption<br>o Fuel consumption<br>o Energy consumption<br>o Other costs |

DPMB has planned to provide an autonomous driving service for university students, university staff and employees of technological companies in an area (the "campus") that is poorly served by transportation services. Only one transportation service that is quite rudimentary is available and which cannot cover the high demand of mobility that is needed.

There might be a circular service operation around the most frequented places and an on-demand service. The service is paid per use or per subscription fee for people who use the service regularly, with that the customer saves money. In both cases the service uses mobile applications that allows the users to track the position of the vehicle or to book a ride.

Key partners for the project are the automated vehicle developers and DPMB will do the marketing and analyses the behaviour of the travellers.

#### 8.2.1.2 Business models ROMA Mobilità (Rome, Italy)

**Table 55 – Business Model Canvas ROMA Mobilità**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | The Car Sharing Roma service, offering families, professionals and business enterprises the chance to share a vehicle and decrease the use of private car, cutting the costs of owning a car and bringing environmental benefits. |
| **Customer Segments** | • Rome's citizens<br>• Companies in Rome<br>• Professionals |
| **Customer Relationships** | • Personalized digital platform for booking and billing<br>• Information on ROMA Mobilità website and social media |
| **Channels** | • Mobile App<br>• Social Media<br>• Website |
| **Key Resources** | • Vehicles<br>• Mobile application |
| **Key Activities** | • Car-sharing |
| **Key Partners** | • Rome municipality<br>• Fiat |
| **Revenue Streams** | • Subscription<br>• Pay per use |
| **Cost Structure** | • CAPEX:<br>o Intangible fixed assets<br>o Tangible fixed assets<br>• OPEX:<br>o Personnel costs<br>o Depreciation costs<br>o Expenses for services<br>o Material consumption<br>o Rent costs<br>o Fuel consumption |

ROMA Mobilità offers a station-based carsharing service for Rome's citizen, companies and professionals. This service can be booked via the mobile phone app. The app and the vehicles are the key resources of the service and the Rome municipality and Fiat the key partners.

#### 8.2.1.3 Business models tim (täglich.intelligent.mobil) (Graz, Austria)

**Table 56 – Business Model Canvas tim**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | Offering the first MaaS service in Graz including carsharing, car rent, taxi service, ride sharing and charging stations for electrical cars |
| **Customer Segments** | • PT users with additional mobility needs<br>• Passenger transport for population at urban areas (Commuting, Business, Leisure) |
| **Customer Relationships** | • Tim Service centre<br>• Customer contract<br>• Hotline |
| **Channels** | • PT promotion platform<br>• Website (www.tim.at)<br>• Tim App |
| **Key Resources** | • PT connected locations<br>• Infrastructure for parking/hand-over and charging<br>• IT-Platform<br>• Contracts<br>• Vehicles |
| **Key Activities** | • Marketing and sales<br>• Infrastructure setup and maintenance including own vehicles<br>• Enhancement of provided services |
| **Key Partners** | • PT provider: Graz Linien<br>• Taxi operator: Taxi 878 GmbH & Co KG<br>• Other companies included in the HOLDING Graz: e.g. Energie Graz<br>• Municipalities, urban areas and local communities: Graz, Linz, Styria<br>• Car rental provider: Europcar |
| **Revenue Streams** | • Subscription<br>• Pay per use<br>• Payment transactions<br>• Shareholder contributions |
| **Cost structure** | • Cost structure: (example)<br>• CAPEX:<br>o Planning, booking, ticketing and accounting system<br>o Vehicles<br>o Infrastructure establishment<br>• OPEX:<br>o Vehicles operating cost<br>o Infrastructure maintenance<br>o Depreciation costs<br>o Personnel costs<br>o Marketing and communication |

The customer segment tim focuses on are PT users with additional mobility needs and general the population at urban areas. If customers have any questions regarding the services, they can get help at the tim service enter and the hotline. The channels the service is transported to the customer are the PT promotion platform, the website of tim and the tim app.

For proper functioning of the company key resources are needed. In case of tim they are the PT connected locations spread through Graz and Linz, the infrastructure for parking and charging the vehicles, the IT-platform and contracts with the costumers and of course the vehicles itself. Of course, these resources need to be set up and maintained, which is a key activity of the company. Other important activities are the marketing and sales and the further enhancement of the services.

tim is working very closely with the PT system of Graz as well as with the local municipalities, taxi operators and other companies withing the HOLDING Graz concern, therefore they are the key partners of the company.

Revenues are accumulated through the subscription fees every tim member has to pay monthly, the pay per use income, payment transactions and shareholder contributions.

#### 8.2.1.4 Business models UbiGo – MaaS (Stockholm/Gothenburg, Sweden)

**Table 57 – Business Model Canvas UbiGo**

| **BUSINESS MODEL CANVAS** | |
|---|---|
| **Value Proposition** | MaaS app - gathering different mobility needs from commuting to free time activities, cost control |
| **Customer Segments** | • Urban commuters<br>• Free-time activities travellers<br>• Car rental user<br>• Car pooling user<br>• Taxi service user |
| **Customer Relationships** | • Personalized app for booking, route planning, billing (UbiGo)<br>• PT users (SL)<br>• Car rental/carpool contact<br>• Hotline<br>• E-Mail |
| **Channels** | • Via app or SL cards with additional subscriptions to other services<br>• Website<br>• Hotline<br>• Social media |
| **Key Resources** | • PT network<br>• Carpool<br>• Rental cars<br>• App service<br>• Customer service |
| **Key Activities** | • Partner network for gathering mobility services<br>• Finding investors<br>• Pilot to test and adapt service<br>• Support from municipalities & PT<br>• Knowledge on customer group & experience (incl. research/pilot studies) |
| **Key Partners** | • Vehicle provider: Volvo<br>• Municipality: City of Gothenburg/Stockholm<br>• Investors: Via-ID<br>• Regional PTO: SL/Västtrafik<br>• Carpool operator: Move about<br>• Car rental operator: Hertz<br>• Taxi operator: Cabonline<br>• Research: e.g. RISE, Chalmers |
| **Revenue Streams** | • Subscription (no membership fees) |

| BUSINESS MODEL CANVAS | |
|---|---|
| **Cost Structure** | • CAPEX:<br>○ Vehicle fleet costs<br>○ Physical infrastructure costs<br>○ Other non-current assets<br>• OPEX:<br>○ Personnel costs<br>○ Other external expenses |

UbiGo gathers different mobility services together and offers them to the population of Stockholm and Gothenburg, especially urban commuters and people traveling in their free time are in focus. The channels the services can be used are the app or the SL cards with additional subscriptions to other services.

The key resources – as with every MaaS service that is similar to UbiGo – are the PT network, the carpool, the rental cars, the app and customer service. The company itself has no own vehicles, instead they need to find partners who are providing the services offered. Who exactly they are, can be seen in the table above in the section "key partners".

Therefore, UbiGo's activities lie in networking for gathering mobility services, finding investors, create pilots to test and adapt the services, getting the support from municipalities and the PT operators and have knowledge on the customer groups and experience, including research and pilot studies.

#### 8.2.1.5 Business models whim (international)

**Table 58 – Business Model Canvas whim**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | • "All transport in one app - Public transport, city bikes, taxis, and affordable rental cars"<br>• "Multimodal and sustainable mobility services addressing customers' transport needs by integrating planning and payment on a one-stop-shop principle" (MAASSiFiE project consortium)<br>• enables the user to plan and buy trips from a suite of Transportation Service Providers as packages<br>• Flat rate, all-inclusive plan |
| **Customer Segments** | • People changing from own car to multimodal mobility<br>• Urban Citizens<br>• Transport providers<br>• Innovative Businesses |
| **Customer Relationships** | • Whim App<br>• Whim partner platform and partner network |
| **Channels** | • Whim App<br>• Website<br>• Social Media<br>• MaaS open ecosystem for:<br>○ Transport providers<br>○ Innovative Businesses<br>○ Cities |
| **Key Resources** | • Booking and payment platform (IT)<br>• Contracts to transport providers<br>• Data (customers, trips, services) |
| **Key Activities** | • Managing and operating services<br>• Attracting customers and partners |

| BUSINESS MODEL CANVAS | |
|---|---|
| | • Expand network of regions and cities |
| **Key Partners** | • PT provider and transport providers<br>• Municipalities and local communities |
| **Revenue Streams** | • Subscription<br>• Pay per use<br>• Payment transactions |
| **Cost Structure** | • CAPEX:<br>  ○ Vehicle fleet costs<br>  ○ Physical infrastructure costs<br>• OPEX:<br>  ○ Personnel costs<br>  ○ Other external expenses |

The MaaS service app whim not only focuses on urban citizens who are changing from their own car to multimodal mobility but also on transport providers, cities and innovative businesses as customers, because whim has an open ecosystem. Relationships with these customers are created with via the whim app and the different partner platforms and networks.

Resources whim uses are the booking and payment platform, contracts to the transport providers and data regarding customers, trips and services. Managing and operating the different services, attracting customers and partners for the MaaS service and expanding the network of the different regions and cities are the main activities whim does. The partners that are attracted are various PT and transport providers as well as municipalities and local communities implementing the whim system in their communities. Revenue is gained through subscription, pay per use and payment transactions.

### 8.2.2 Operating models of MaaS services

#### 8.2.2.1 Operating Models Dop*ravní podnik města Brna* (Brno, Czech Republic)

**Table 59 – Value Proposition Canvas DPMB**

| VALUE PROPOSITION CANVAS | |
|---|---|
| | **Customer segments** |
| Customer Jobs | • Getting to the event (lecture, meeting, etc.) in time<br>• Mobility costs |
| Pains | • Limited available time<br>• Walking long distances<br>• No regular PT service in the area |
| Gains | • Time savings<br>• Getting to the event in time<br>• Sustainable mobility |
| | **Value proposition** |
| Products & Services | • Providing autonomous mobility in places where is no transportation service available |

| VALUE PROPOSITION CANVAS | |
|---|---|
| Pain Relievers | • Transportation service on the route where users travel most often |
| Gain Creators | • Automated vehicles transporting users rapidly between their places of interest |

In Brno there is an area (a campus) where no transportation service is available. That results in the students and the staff walking long distances and having limited available time between events. To eliminate this problem DPMB plans to implement a new automated driving service which transports users rapidly between their places of interest. With that time can be saved and getting to the event in time is easier. As a side effect even a sustainable transportation mode was chosen. The service will most likely be implemented where users travel the most. The only thing the consumers have to consider here is to get to the event in time and to be responsible for paying the costs for the service. The service itself can be used via app where the booking as well as the paying is done.

To implement such a service more than just the PT provider DPMB is necessary. It is also important to include other companies when developing a new transportation mode. These are for example, IT providers which are responsible for the development of the software (App and the vehicle); billing service operators such as PayPal and banks which are doing the money transfer; marketing provider which are introducing the new service and make it known to the public, the infrastructure and vehicle provider because without the vehicle or the infrastructure the service cannot operate in the first place; maintenance provider which are responsible for the repairs and services of the vehicle and infrastructure.

#### 8.2.2.2 Operating Models Roma Mobilità (Rome, Italy)

**Table 60 – Value Proposition Canvas Roma Mobilità**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Commuting to job<br>• Using Mobility for leisure activities<br>• More sustainable commuting/traveling<br>• Mobility costs |
| Pains | • No entrance zones (ZTL) and private car use in central area<br>• Time and cost consuming process in getting a ZTL permission |
| Gains | • Allow to enter ZTL |
| **Value proposition** | |
| Products & Services | • Car-sharing vehicles<br>• Renting a car |
| Pain Relievers | • Ease of car use in ZTL and ease of finding parking |
| Gain Creators | • No own car is necessary<br>• Time and money can be saved because no ZTL permission is needed |

Without permission private cars are not allowed to enter certain areas (so called ZTLs). To get a permission can be quite time and cost consuming when traveling out of business or leisure reasons. Therefore, a carsharing and rental car service was implemented for Rome's citizens. With the cars of the service it is possible to enter these zones without the struggle to get a ZTL permission. It even has the advantage of reserved parking lots in ZTLs which reduce the stress of finding a parking lot. The service itself can be used via app where the booking as well as the paying is done.

It is also important to include other companies when developing a new transportation service. These are for example, IT providers which are responsible for the development of the software (App); billing service operators such as credit card providers and banks which are doing the money transfer; marketing provider which are introducing the service and make it known to the public, the infrastructure and vehicle provider because without the vehicle or the infrastructure the service cannot operate in the first place; maintenance provider which are responsible for the repairs and services of the vehicle and infrastructure.

#### 8.2.2.3 Operating Models tim (täglich.intelligent.mobil) (Graz, Austria)

**Table 61 – Value Proposition Canvas tim**

| VALUE PROPOSITION CANVAS | |
|---|---|
| | **Customer segments** |
| Customer Jobs | • Commuting to job<br>• Using Mobility for leisure activities<br>• More sustainable commuting/traveling<br>• Mobility costs |
| Pains | • Customers: Multiple contracts and different platforms for various mobility provider<br>• Partners:<br>  ○ Interoperability of different IT-systems and interfaces<br>  ○ Data ownership<br>  ○ Marketing is expensive<br>  ○ "Critical mass of customers" |
| Gains | • Customers:<br>  ○ Availably check and reservation platform<br>  ○ Single contract, cashless payment with a single account<br>  ○ Access to e-mobility<br>  ○ Short time car rental<br>• Owner / Primary operator:<br>  ○ climate protection goals<br>  ○ reduction of car traffic |
| | **Value proposition** |
| Products & Services | • Carsharing: "tim"-owned pool cars<br>• Billing Platform for e-Taxis: "tim card" service<br>• e-Taxis: several local e-taxi service providers with "tim" contract<br>• Rental Cars: international rental car service provider (Europcar) with discount and payment with "tim card"<br>• Public Charging: e-Auto Naturstrom (Energie Graz, LINZ AG) |
| Pain Relievers | • Simple portal and app for planning, reservation and operating the vehicle<br>• tim card for all administration and payment tasks |
| Gain Creators | • Bring more mobility options for a regular PT user<br>• Substitute for private owned cars |

Beside the PT system in Graz the citizens have no other transportation possibility than the own car. This was until tim was introduced which offers different mobility services such as carsharing, taxis and rental cars. Which has the advantage that only one contract for all services are needed and not for each service one contract. But other services are also provided by tim such as public charging and the billing platform for e-taxis which can be paid with the “tim card” even if the taxis are not tim owned. This service brings more mobility options for regular PT users and even can be a substitute for a private owned car.

But not only end users are profiting from this service, the operator and the city also do by contributing to the reaching of the climate protection goals and reducing the traffic volume. At company level it even solves problems that could be caused if each operator has its own service. These would be for example, the interoperability between IT-systems and interfaces, data ownership and the expensive marketing that would be necessary for each service.

It is also important to include other companies when developing a new transportation service. These are for example, IT providers which are responsible for the development of the software (App); billing service operators such as credit card providers and banks which are doing the money transfer; marketing provider which are introducing the service and make it known to the public, the infrastructure and vehicle provider because without the vehicle or the infrastructure the service cannot operate in the first place; maintenance provider which are responsible for the repairs and services of the vehicle and infrastructure.

#### 8.2.2.4 Operating Models UbiGo – MaaS (Stockholm/Gothenburg, Sweden)

**Table 62 – Value Proposition Canvas UbiGo**

| **VALUE PROPOSITION CANVAS** | |
|---|---|
| | **Customer segments** |
| Customer Jobs | • Commuting to job<br>• Using Mobility for leisure activities<br>• More sustainability travelling/commuting<br>• Mobility costs |
| Pains | • Costs of mobility/own car<br>• Parking costs<br>• More flexible solutions needed that for mobility<br>• Owning a car is not sustainable |
| Gains | • Dense PT system in urban areas<br>• Flexible and efficient solution to every mobility need<br>• No membership fee and monthly subscriptions |
| | **Value proposition** |
| Products & Services | • MaaS app - gathering different mobility needs |
| Pain Relievers | • Cost control of own mobility costs,<br>• One app solves different mobility needs,<br>• Mobility solutions suitable for commuting & free time activities,<br>• More sustainable transport solutions |
| Gain Creators | • No membership/monthly subscription<br>• Discount prices for PT cards<br>• Booking via app for different services<br>• Last mile connectivity |

Not only is owning a car and the maintenance of it expensive other additional costs come with a private car ownership, such as parking costs these are also a nuisance for a lot of people. As a more flexible and efficient mobility solution UbiGo was implemented in Stockholm and Gothenburg. With this service the user always has an overview of the mobility costs, it solves different mobility needs via app for different services wheatear for commuting of leisure activities and is mor sustainable than an own car. Compared to other MaaS services UbiGo has no membership fee or monthly subscription fee, instead only the chosen subscription has to be paid monthly. And it even offers discounts for the dense PT system of Stockholm.

Other important companies and stakeholders are needed for implementing a service such as UbiGo. UbiGo is a service which has no own vehicle fleet or infrastructure, instead they are signing contracts with different mobility operators for their services such as Hertz, Cabonline, PT operator of Stockholm etc. The MaaS operator is as well heavily influenced by investors. For the app and billing system IT operators and billing system providers are needed for the development of the software and transfer of money. And of course, marketing providers are also necessary, whether it be companies specialized in that aspect or public authorities and research institutions mentioning the service in publications.

#### 8.2.2.5 Operating Models whim (international)

**Table 63 – Value Proposition Canvas whim**

<table>
<tr><th colspan="2">VALUE PROPOSITION CANVAS</th></tr>
<tr><td colspan="2">Customer segments</td></tr>
<tr><td>Customer Jobs</td><td>• Costumer:<br>  ○ Commuting to job<br>  ○ Using Mobility for leisure activities<br>  ○ More sustainability travelling/commuting<br>  ○ Mobility costs<br>• Cities: future mobility strategy<br>• Transport providers: connect to multi area system</td></tr>
<tr><td>Pains</td><td>• Multiple contracts and different platforms for various mobility providers<br>• Car traffic overload in cities</td></tr>
<tr><td>Gains</td><td>• All personal mobility data in a single app<br>• All-inclusive plan - your ticket is always at hand<br>• Environmentally friendly mobility systems</td></tr>
<tr><td colspan="2">Value proposition</td></tr>
<tr><td>Products & Services</td><td>• WHIM TO GO: Pay as you go (Starting model for all whim sites)<br>• WHIM URBAN: Unlimited number of public transport tickets, additional taxi, bicycle options<br>• WHIM UNLIMITED: flat rate for all transport needs</td></tr>
<tr><td>Pain Relievers</td><td>• One app for all transport needs (planning, booking, payment)<br>• Combination of different transport means with a single contract and unified and comfortable payment<br>• Clear vision of future mobility for cities</td></tr>
<tr><td>Gain Creators</td><td>• Open MaaS partner platform (“We want to build a global mobility ecosystem together with our partners”)<br>• Substitute for private owned cars</td></tr>
</table>

Before MaaS services were introduced customers had to apply for multiple contracts and platforms of various mobility providers. With whim they can handle their mobility needs in one app starting with the planning process and ending with the payment at international basis. These could lead to more environmentally friendly mobility systems for car traffic overloaded cities all over the world.

The service offers different products according to the customers need. If a user only needs rudimentary a transport service the pay-as-you-go option can be selected but if a customer is travelling often due to e.g. commuting the best option would be the unlimited package with which all services can be used unlimited.

Other important companies and stakeholders are needed for implementing a service such as whim. whim is an international service which has no own vehicle fleet or infrastructure, instead they are signing contracts with different international mobility operators for their services. The MaaS operator is as well heavily influenced by big investors such as BP. For the app and billing system of whim, IT operators and billing system providers are needed for the development of the software and transfer of money. And of course, marketing providers are also necessary, whether it be companies specialized in that aspect or public authorities and research institutions mentioning the service in publications.

## 8.3 User & Role Analysis including user profiles, mobility needs, relative utility

Each MaaS service is used by different users, covers different mobility needs and has its own relative utility.

### 8.3.1 User & Role Analysis Dopravní podnik města Brna (Brno, Czech Republic)

#### 8.3.1.1 User profiles

##### *8.3.1.1.1 Direct Value Chain Participants*

###### 8.3.1.1.1.1 Service operator

8.3.1.1.1.1.1 Statutární města Brno (SMB) Concern

This concern is fully managed by the statutory city of Brno. Beside DPMB other companies are controlled by SMB (see Figure 62):

- Brněnské komunikace a.s. (Brno Communications a.s.)
- Lesy města Brna, a.s. (Forests of Brno, a.s.)
- Pohřební a hřbitovní služby města Brna, a.s. (Funeral and cementry services of the city of Brno, a.s.)
- SAKO Brno, a.s.
- STAREZ – SPORT, a.s.
- Teplárny Brno, a.s. (Heating plants Brno, a.s.)
- Technické sítě Brno, akciová společnost (Technical networks Brno, joint stock company)
- Veletrhy Brno, a.s. (Trade affairs Brno, a.s.)

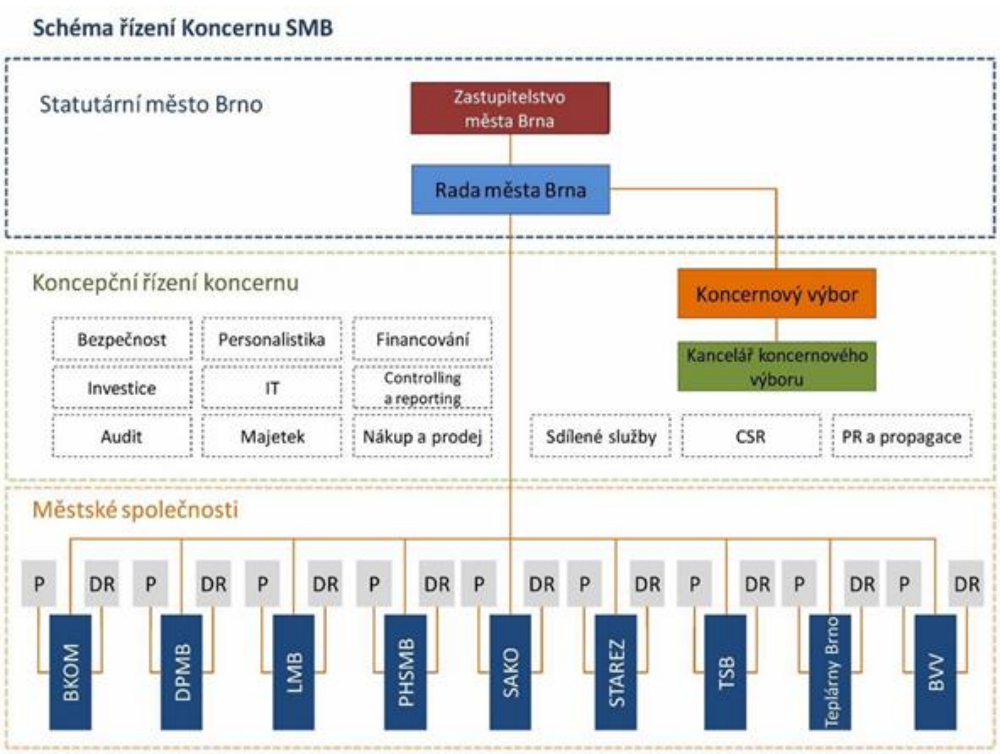



**Figure 62 – Structure of SMB Concern (Source: Statutární mesto Brno, 2020)**

8.3.1.1.1.1.2 Structure of DPMB

DPMB is completely owned by the city of Brno and is structured in the following way:

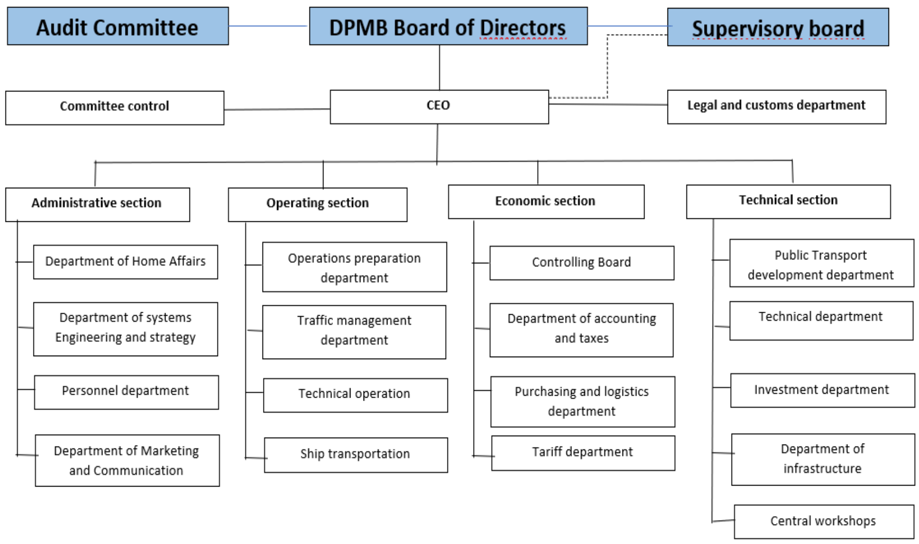



**Figure 63 – Structure of DPMB (Source: DPMB, 2019)**

As can be seen in the figure above (Figure 63) DPMB consist of several sections which are split in four to five departments.

#### 8.3.1.1.1.2 Infrastructure and vehicle provider

The infrastructure of the PT network such as PT stops, tramway tracks and overhead wires is built by different construction companies.

Energy and fuel for the trams, trolleybuses and buses are provided by local energy suppliers.

Vehicle providers are companies such as ČKD Tatra, Škoda, Pragoimex, Iveco Bus, Solaris, etc. The boats of DPMB are provided by Jesko CZ. The vehicle provider for the planned automated driving vehicle service is not fixed yet.

###### 8.3.1.1.1.3 Maintenance operator

For the maintenance of the infrastructure, vehicles and buildings DPMB is most likely responsible itself.

But to do this task equipment and tools are necessary which is provided by hardware stores.

###### 8.3.1.1.1.4 Ticket sale reseller

Tickets for the PT service can be directly bought by DPMB at its sales points or vehicle drivers. But it can also be bought at kiosks.

###### 8.3.1.1.1.5 Billing system operator

For the digital payment of the tickets on the vehicles VISA, MasterCard, Google Pay and Apple Pay can be used. The banks then are responsible for the money transfer.

###### 8.3.1.1.1.6 IT provider

For using the SMS ticketing and the newly installed contactless ticket purchasing machines as well as other technology software is needed. This software was most likely purchased by DPMB from IT companies specialized in programming and not created by themselves. Especially, in the automated driving service area the PT provider is not able to contribute its own software for the future service.

###### 8.3.1.1.1.7 Communication provider

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

###### 8.3.1.1.1.8 Marketing provider

DPMB has its own online shop where it sells merchandise. This merchandise, adds such as billboards and the designs of them were most likely created by advertising companies.

For other advertising reasons such as imprints on vehicles printers are needed.

DPMB is part of the SMB concern, this of course results in the fact that the concern is also advertising its different businesses.

###### 8.3.1.1.1.9 Mobility needs growers

Around or within PT stops there are often businesses and/or restaurants that are profiting of the people using the PT network.

###### 8.3.1.1.1.10 End users

The users of DPMB are the urban citizens of Brno and tourists visiting the city. The modal split of Brno shows that 52 % of the people use the public transportation system as means of transportation (Brno Municipality, 2017).
DPMB transported in the year 2019 around 362 million people, that are one million more than in the year before (361 million people).

Brno plans an automated vehicle service in an area which is poorly served by transportation modes. In this area the focus lies on university students mainly but also on university staff and workers in technological companies.

#### *8.3.1.1.2 Indirect Value Chain Participants*

##### 8.3.1.1.2.1 Safety provider

In case of accidents or other unplanned events insurances are crucial for transportation companies such as DPMB.

##### 8.3.1.1.2.2 Web design providers

DPMB has different linked websites to their official website. These websites often have designs from companies providing certain layouts and programs behind it. Two of these websites are nopCommerce and BootStrapMade.

##### 8.3.1.1.2.3 Mobility needs growers

The brewery Starobrno is providing the Pub tram with three different kinds of beer.

### 8.3.1.2 Mobility needs

#### *8.3.1.2.1 Direct mobility needs*

Public transportation is used to meet all conceivable mobility needs. Whether the services are used for commuting, leisure or business reasons. The frequency of the service adapts to the volume of passengers which changes regularly throughout the day. During rush hours the frequency of the busiest routes is two minutes. Ten minutes is the average frequency and during off peak hours it is 20 minutes. During night operations the frequency is 30 minutes.

The area clustered with technological centers and universities has a high mobility demand but has only one rudimentary transportation service. Therefore, the mobility needs of the students, university staff etc. is high in that area, especially if they need to get in time to an event. To meet these needs, it is planned to install an automated vehicle service which will be a circular service operation at the most frequented places and an on-demand service.

#### *8.3.1.2.2 Indirect mobility needs*

Another need is to remove as much vehicles from the streets as possible to improve air quality and to prevent traffic congestion. Therefore, PTOs have always the task to expand the network according to the demand and find new mobility solutions.

### 8.3.1.3 Relative Utility

The aim of public transportation operators is to provide sustainable public mobility for people. Even though new urban mobility services such as ride-hailing offers like Uber, car-sharing or ridesharing are getting more prominent, these services alone have not the capability or capacity to meet citizens' mobility needs or to solve other problems like the reduction of emissions and traffic congestion. Public transportation is still the backbone to reduce individual transport. (UITP, 2020) Especially people who are not allowed to drive a car are often dependent on public transportation services.

The same applies to DPMB. The company was founded to supply the citizens of Brno with environmentally friendly and cheap mobility within the city. In particular, the planned automated vehicle service in the campus area should increase affordable mobility for students. If successfully implemented time can be saved and happiness can be gained because it is not that stressful to get to the lecture in time anymore as it is by walking.

## 8.3.2 User & Role Analysis ROMA Mobilità (Rome, Italy)

### 8.3.2.1 User profiles

#### *8.3.2.1.1 Direct Value Chain Participants*

##### 8.3.2.1.1.1 Service operator

Roma Mobilità or Roma Servizi per la Mobilità is an instrumental company 100 % owned by Roma Capitale. The company itself has no public entities set up, approved or financed, has no shareholding in companies and has no private law entities in control.

Roma Capitale participates directly or indirectly in a plurality of bodies (Companies, Foundations, Institutions, Associations) and other entities.

The Roma Capitale Group consists of:

- Subsidiaries
- Supervised Public Bodies
- Controlled private Law Entities

These structures operate mainly in the sectors of local public services in the field of water and energy resources, urban hygiene, waste cycle management, mobility and transport. But they are also present in the fields of engineering and territorial development, instrumentation and management of infrastructures, local taxes, culture, social and health assistance and insurance services. The structure of the company can be seen in the following figure (Figure 64).

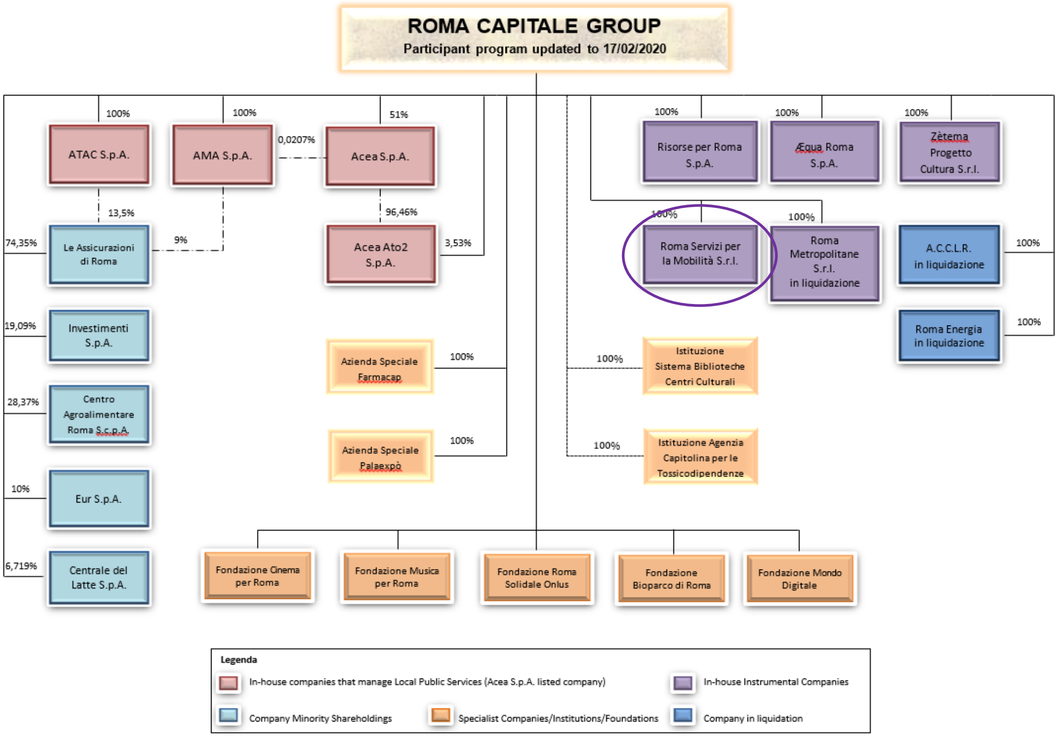



**Figure 64 – Structure of the ROMA Capitale Group (Source: Comune di Roma, 2016)**

#### 8.3.2.1.1.2 Public Transportation operator

ATAC is another ROMA Capitale owned company which is responsible for the PT system in Rome whereas ROMA Mobilità is providing digital maps of the PT network and bicycle lanes on its website. Therefore, they have to work together.
For carsharing it is also important to know where the most frequented PT stations are to relieve the system to a certain extent.

#### 8.3.2.1.1.3 Infrastructure and vehicle provider

The infrastructure, such as the stations of the car-sharing vehicles and charging stations for e-mobility as well as the special infrastructure such as reserved parking lots and taxi/bus lanes are built by construction companies such as ENEL.

The fuel and energy used for the vehicles is provided by local energy suppliers.

The car sharing vehicles are provided by Fiat, Citroen, Nissan and Lancia.

#### 8.3.2.1.1.4 Maintenance operator

For the maintenance of the infrastructure and vehicles different machines, equipment and tools are necessary assuming that services, repairs and technical controls are done by ROMA Mobilità itself.

In case that ROMA Mobilità is not responsible for the maintenance, services, repairs and technical controls of the vehicles itself, external workshops are doing these tasks.

#### 8.3.2.1.1.5 Billing system operator

The car-sharing system works with an app which is used for booking and paying for the service. All the payments are done in digital form and transferred by companies specialized in that aspect such as billing system provider (PayPal). The banks then are responsible for the money transfer.

###### 8.3.2.1.1.6 IT provider

For using the carsharing ROMA Moblitià app as well as other technology software is needed. This software was most likely purchased by ROMA Mobilità from other companies such as Targa Telematics and not created by themselves.

###### 8.3.2.1.1.7 Communication provider

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

###### 8.3.2.1.1.8 Marketing operators

Advertising companies are used for marketing measures such as billboards, flyers, online advertising, etc.

For other advertising reasons such as imprints on vehicles printers are needed.

ROMA Capitale is of course as well doing marketing measures for its services.

###### 8.3.2.1.1.9 End users

The car-sharing system of ROMA Mobilità was created for the inhabitants of Rome. Currently Rome has 616 cars per 1000 inhabitants, which is the second largest amount in Italy after Torino. To reduce the amount of private owned cars especially for citizens living in the inner city the operator provides several car-sharing stations through the city.

##### *8.3.2.1.2 Indirect Value Chain Participants*

###### 8.3.2.1.2.1 Safety provider

In case of accidents or other unplanned events insurances are crucial for car-sharing providers

### 8.3.2.2 Mobility needs

#### *8.3.2.2.1 Direct mobility needs*

Rome is a big city with nearly 2.9 million inhabitants and an average tourist number of about 7 million per year. With that the city has a high demand of mobility services especially in the restricted ZTLs.

Rome citizens living in the inner city have additional vehicle costs due to ZTL restrictions in that areas. Of course, the city center and tourist hotspots of Rome have enough public transportation possibilities to come to any wanted destination in the inner city (Stops per km$^2$: 34.1 (district I) to 13.2 (district VII)). But taking trips to the outer city or outside the city completely can take a lot of time and can be complicated because the density of public transportation possibilities decreases in that areas (Stops per km$^2$: 6 (district XIII) to 3.2 (district XV)) although the districts laying at the borders of the city are mostly the biggest ones. Therefore, other mobility services – such as car-sharing – are a solution to satisfy the need for a car without owning one as well as to have the choice of which mobility possibility is taken.

On the other hand, citizens living in the outer districts of the city (these people most likely have a private owned car) have the possibility to use a car-sharing vehicle for entering the inner city without extra needed ZTL permission for their own car and without searching for a parking lot.

##### *8.3.2.2.2 Indirect mobility needs*

As already mentioned, Rome has the second largest number of cars per 1000 inhabitants in Italy. This results in high traffic volumes and emission production. To reduce the amount of traffic Rome implemented measures like the ZTLs but that is not enough. To motivate inhabitants to sell their cars and with that reduce the traffic volumes and emissions the car-sharing system was implemented.

#### 8.3.2.3 Relative utility

For entering the ZTLs in Rome permissions are necessary for private car owners (even residents living in that areas). And even if cars are allowed to enter, often they are not allowed to park anywhere (especially in the central city area). But the carsharing vehicles owned by ROMA Mobilità are allowed to enter ZTLs and are even allowed to park there. This eliminates the stress of applying for permissions and saves time in looking for a parking spot. The service even offers vehicles for transporting goods which can be practical when transporting something into ZTLs.

Because of this offer residents of the inner city do not need own vehicles when taking trips. ROMA Mobilità has alone 46 car-sharing stations in district I and 36 stations in district II. With that the need for a car can be covered by the service and no own car is needed.

### 8.3.3 User & Role Analysis tim (täglich.intelligent.mobil) (Graz, Austria)

#### 8.3.3.1 User profiles

##### *8.3.3.1.1 Direct Value Chain Participants*

###### 8.3.3.1.1.1 Service operator

Tim itself is part of the Graz Holding with the following structure (Figure 65):

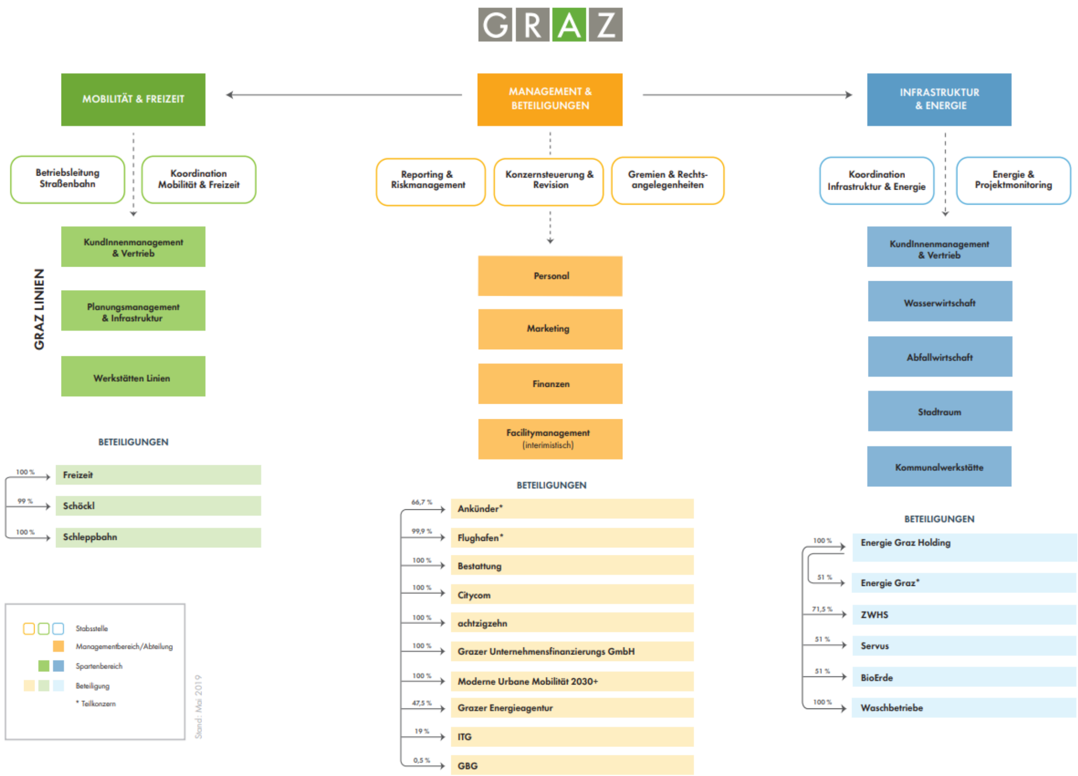



**Figure 65 – Structure of Graz Holding (Source: HOLDING Graz)**

The green part of the structure is called “Mobility & Leisure” of which tim is a part of.

#### 8.3.3.1.1.2 Public Transportation operator

Tim is highly interconnected with the public transportation system in Graz called Graz Linien. Both services are owned by Graz Holding and are as well working together. For example, if a person has a half-year for the PT system in Graz no registration fee for tim has to be paid. With a full-year ticket for the PT system the registration and the monthly subscription fee are saved.

#### 8.3.3.1.1.3 Infrastructure and vehicle provider for car-sharing and rental cars

The infrastructure such as charging stations, bicycle racks, parking spaces for taxis etc. was provided by different construction companies.

Energy and fuel used for the vehicles is provided by local energy suppliers such as Energie Graz.

The vehicles for the car-sharing and rental car service were purchased from VW, Skoda, and Peugeot. If the car rental vehicles offered by tim are not wanted tim-partner Europcar has other vehicles available for tim-customers.

#### 8.3.3.1.1.4 Taxi operator

For the taxi service of tim no own vehicles were purchased instead contracts with a taxi operator (Taxi 878 GmbH & Co KG) were concluded.

#### 8.3.3.1.1.5 Maintenance operator

For the maintenance of the infrastructure and vehicles different machines, equipment and tools are necessary assuming that services, repairs and technical controls are done by tim itself.

In case that tim is not responsible for the maintenance, services, repairs and technical controls of its vehicles itself, external workshops are doing these tasks.

#### 8.3.3.1.1.6 Billing system Operator

The tim system works with an app which is used for booking and paying for the service. All the payments are done in digital form and transferred by companies specialized in that aspect such as PayPal.

The banks then are responsible for the money transfer.

#### 8.3.3.1.1.7 IT provider

For using the tim app as well as other technology software is needed. These software's were most likely purchased by tim from other companies such as and not created by themselves.

#### 8.3.3.1.1.8 Communication provider

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

#### 8.3.3.1.1.9 Marketing provider

Companies such as achtzigzehn are responsible for the graphics & design, brand development, campaigns, classical advertising, media planning, product development or sales support for tim. Achtzigzehn is as well an in-house company of Holding Graz.

For marketing and advertising reasons printers are essential, especially for the imprints on the vehicles.

Public Authorities such as the Federal Ministry of Climate Action, Environment, Energy, Mobility, Innovation and Technology has a marketing impact as well due to mentioning tim in other publications etc.

The same as for the public authorities applies for research facilities such as Grazer Energieagentur, FH Joanneum and TU Graz.

#### 8.3.3.1.1.10 Mobility needs growers

Tim locations are mainly built at high frequented public places where various businesses and restaurants are located.

#### 8.3.3.1.1.11 Support provider

Quintessenz – Organisationsberatung GmbH has a supporting role for tim and is providing e.g. Mobility concepts, etc.

#### 8.3.3.1.1.12 End users

Graz has around 640,000 inhabitants of which 19.8 % are using the public transportation system. tim was created for PT users with additional mobility needs and the general population of Graz for commuting, business and leisure activities. Currently 2,100 people are registered users of which almost all users have a higher educational degree (completed university degree or A-levels) and job. Only very few people working at home or retired people are using the offered services.

##### *8.3.3.1.2 Indirect Value Chain Participants*

###### 8.3.3.1.2.1 Safety provider

In case of accidents or other unplanned events insurances are crucial for car-sharing providers.

###### 8.3.3.1.2.2 Web design providers

tim has its own official website. The website was created by the company En Garde situated in Graz.

#### 8.3.3.2 Mobility needs

##### *8.3.3.2.1 Direct mobility needs*

The PT network within Graz connects all city parts with each other so that people have no problems reaching the intended goal with public transportation. But all places beyond the city limits have only rudimentary PT connections with the city of Graz. Therefore, the people need an alternative to the PT network to reach places outside of Graz because of commuting or leisure reasons. Renting a car or the carsharing system of tim could cover these mobility needs.

##### *8.3.3.2.2 Indirect mobility needs*

Graz has the aim to reduce congestion and emissions in the city. The service of tim can help in reaching these goals.

#### 8.3.3.3 Relative utility

tim is the first MaaS service implemented in Graz and offers several new mobility options at different locations spread through Graz and Linz. These mobility hubs give people the possibility to choose the best mobility option for the current situation they are in while directly interconnected with the most frequented PT stations, so people do not need to search for the service when using the PT. The service even can be a substitute for private owned cars when living in Graz and with that is reducing emissions and the volume of traffic within the city.

### 8.3.4 User & Role Analysis UbiGo – MaaS (Stockholm/Gothenburg, Sweden)

#### 8.3.4.1 User profiles

##### *8.3.4.1.1 Direct Value Chain Participants*

###### 8.3.4.1.1.1 Investors

UbiGo is a private owned company and has several investors such as Via ID and Vinnova – Sweden's Innovation Agency.

##### 8.3.4.1.1.2 Mobility operators

UbiGo is providing the MaaS service but not owning any own fleets or infrastructure. The mobility partners are: SL public transportation, Move about (Car pool), Hertz (car rental), Cabonline (Taxi).

##### 8.3.4.1.1.3 IT provider

For using the UbiGo app as well as other technology software is needed. The technology behind the app comes from Fluidtime Data Services GmbH.

##### 8.3.4.1.1.4 Communication provider

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

##### 8.3.4.1.1.5 Billing system operator

The UbiGo system works with an app which is used for booking and paying for the services offered. All the payments are done in digital form and transferred by companies specialized in that aspect such as PayPal monthly.

The banks then are responsible for the money transfer.

##### 8.3.4.1.1.6 Marketing provider

Advertising companies are used for marketing measures such as billboards, flyers, online advertising, etc.

Public Authorities such as the city of Stockholm has a marketing impact as well due to mentioning UbiGo in publications etc.

The same as for the public authorities applies for research facilities which are using UbiGo regularly in scientific work dealing with new mobility aspects.

##### 8.3.4.1.1.7 End user

UbiGo is a MaaS service created for urban households and businesses of Stockholm and Gothenburg.

#### *8.3.4.1.2 Indirect Value Chain Participants*

##### 8.3.4.1.2.1 Safety provider

In case of accidents or other unplanned events insurances are crucial for MaaS service providers.

### 8.3.4.2 Mobility needs

#### *8.3.4.2.1 Direct mobility needs*

The UbiGo pilot in Gothenburg in 2014 showed that Swedish households are looking for alternative mobility options instead of using a car. Before using UbiGo the participants used to 25 % the private owned car and only to 2 % carsharing systems. During the pilot people used the MaaS service and the travel behaviour changed completely: the usage of the private car decreased about 50 % and the usage of carsharing increased by 200 %. (UITP, 2019a) The people are looking for simple, flexible, reliable and affordable everyday travel services usable in every situation.

##### *8.3.4.2.2 Indirect mobility needs*

As with all other cities Stockholm and Gothenburg want to reduce traffic and with it the amount of emissions emitting and prevent congestion within the cities.

#### 8.3.4.3 Relative utility

UbiGo is the world’s first MaaS app with level 3 integration of transport services. It offers different mobility options at subscription basis that can be selected according to the user’s demand. If the travel behaviour changes over time it is possible to change the subscription or even pause it twice a year. An advantage compared to other MaaS services is, that one UbiGo account can be shared with the whole family without additional costs. Other MaaS services such as tim do not offer such advantages, in contrary, each family member using tim needs to pay an additional monthly fee per member – even if it is reduced.

### 8.3.5 User & Role Analysis whim (international)

#### 8.3.5.1 User profiles

##### *8.3.5.1.1 Direct Value Chain Participants*

###### 8.3.5.1.1.1 Investors

whim is a MaaS service owned by the private company MaaS Global and has several investors such as BP, Toyota, Mitsubishi and Transdev.

###### 8.3.5.1.1.2 Mobility operators

whim is providing the MaaS service but not owning any own fleets or infrastructure. The mobility partners are different local mobility operators such as Hertz (Helsinki), HSL (Helsinki), Wiener Linien (Vienna), TIER (all locations), DTM taxi (Antwerp), National Express West Midlands (West Midlands) etc.

###### 8.3.5.1.1.3 IT provider

For using the whim app as well as other technology software is needed. The technology behind the app comes probably from an IT programming company and was not created by whim itself.

###### 8.3.5.1.1.4 Communication provider

The communication provider plays a big role in the transfer of information like vehicle information and infrastructure information and helps the mobility service operator in the execution of mobility services.

###### 8.3.5.1.1.5 Billing system operator

The UbiGo system works with an app which is used for booking and paying for the services offered. All the payments are done in digital form and transferred by companies specialized in that aspect such as with credit card monthly.

The banks then are responsible for the money transfer.

###### 8.3.5.1.1.6 Marketing provider

Advertising companies are used for marketing measures such as billboards, flyers, online advertising, etc.

Public Authorities such as the city of Helsinki has a marketing impact as well due to mentioning whim in publications etc.

The same as for the public authorities applies for research facilities which are using whim regularly in scientific work dealing with new mobility and MaaS aspects.

##### 8.3.5.1.1.7 End user

The end users of whim are spread all around the world. At the end of 2018 the service had 70,000 registered users in total.

#### *8.3.5.1.2 Indirect Value Chain Participants*

##### 8.3.5.1.2.1 Safety provider

In case of accidents or other unplanned events insurances are crucial for car-sharing providers.

### 8.3.5.2 Mobility needs

#### *8.3.5.2.1 Direct mobility needs*

In big but well-connected cities around the world, people are searching for alternative mobility solutions instead of owning a car. This could have different reasons e.g. Tokyo has one of the highest population densities which means living space is little and expensive at the same time. Owning a car in such an environment is almost impossible. And even if the public transportation system is highly effective, sometimes a car or other transportation modes are necessary for certain situations.
Or when travelling to another country transportation costs can be quite expensive and complicated when using different mobility services. For such situations, whim offers a system already known to the user, costs are always transparent and manageable and no annoying registrations for local mobility services have to be done.

#### *8.3.5.2.2 Indirect mobility needs*

Cities around the world are facing great problems with rising transport emissions and city centres full with cars. International Maas Services such as whim are aiming to reduce such emission and congestion problem by offering different mobility services so that people are more likely willing to reduce the usage of private owned cars.

### 8.3.5.3 Relative utility

Whim is the only international MaaS app available on the market and offers different mobility packages depending on the city the is provided. Up until now whim is offered in five different cities in Europa and it is to be planned to implement it in two Asian cities in the near future. Once registered at the service it can be used in any city the service is available.

## 8.4 Success & Failure factors in the field of CCAM (user, technical and organizational aspects)

### 8.4.1 Success and failure factors Dopravní podnik města Brna (Brno, Czech Republic)

#### 8.4.1.1 Success factors

##### *8.4.1.1.1 Availability of PT provider*

DPMB is an old company with a history of over 100 years and the only PT provider in Brno. The operator is open for MaaS services and is currently working on the implementation of an automated driving service in an area which is poorly served by regular PT services.

##### *8.4.1.1.2 Company and Service image*

DPMB would be one of the first PT operators implementing a MaaS service in its network in the Czech Republic – even a service with automated driving vehicles. This fact is going to create a positive image for the operator and with that gain popularity in the public and a leading role in the Czech MaaS area.

##### *8.4.1.1.3 Future market potential*

According to ABI Research the size of the mobility as a service market will exceed global revenues of 1 trillion US-Dollars by 2030. (Bay, 2020)
With more than 2 million inhabitants in Stockholm, the market potential for UbiGo in the city is estimated at 30 % of the 250,000 households and families.(Fluidtime Data Services GmbH, 2020)

#### 8.4.1.2 Failure factors

##### *8.4.1.2.1 Usability of the mobility service*

With the new automated driving vehicle system DPMB also plans to install a new paying system. For regular users of the system there will be a subscription fee and for customers only using the system occasionally they plan to implement a pay-per-ride system as well as new prices maybe especially for this service. This could lead people not to use the service. Instead they should create an easy usable digital app for all services provided by DPMB with different paying options such as per SMS, PayPal, direct transactions etc.

##### *8.4.1.2.2 MaaS service capacity planning*

As already mentioned, the area where the new automated driving vehicle service is planned only has one rudimentary transportation service. Installing a new one could lead to a demand the service is not possible to cover – especially because the service is a new and innovative concept firstly launched in an area where the interest in such new technology is high (university campus).

##### *8.4.1.2.3 Trust in the service*

Contrary to sub-chapter 8.4.1.2.2 it is also possible that the service fails due to mistrust in the new technology. This could lead in people not using the service and with that additional costs for the operator and not solving the mobility problem.

### 8.4.2 Success and failure factors ROMA Mobilità (Rome, Italy)

#### 8.4.2.1 Success factors

##### *8.4.2.1.1 Future market potential*

According to ABI Research the size of the mobility as a service market will exceed global revenues of 1 trillion US-Dollars by 2030.(Bay, 2020)

##### *8.4.2.1.2 ZTL entrance for ROMA Mobilità owned vehicles*

Without permission private owned cars are not allowed to enter so called ZTLs. The car-sharing vehicles of ROMA Mobilità can enter these zones (except ZTL A1 Trident).

##### *8.4.2.1.3 Reserved parking lots and allowed usage of bus and taxi lanes*

The vehicles owned by ROMA Mobilità are allowed to use the bus/taxi lanes in rome and have reserved parking lots in all parts of the city. With that the user saves time – especially during congestions – and do not need to search that long for parking lots compared to private owned vehicle users.

##### *8.4.2.1.4 Car-sharing system type*

Station-based car sharing is more likely to be used by people who do not want to own a private car. Accordingly, station-based car sharing is rarely used for routine and short trips, but rather serves as a supplement to public transportation. Station-based car sharing thus promotes the change in mobility behaviour more strongly than free-floating systems.(VCÖ - Mobilität mit Zukunft, 2020)

#### 8.4.2.2 Failure factors

##### *8.4.2.2.1 Station-based instead of free-floating car-sharing*

The revenue concerning car-sharing decreased in 2019 compared to the year 2018. Analysing the user behaviour, it can be concluded that the fact that ROMA Mobilità only offers station-based vehicles which decrease the acceptance, whereas other operators (Car2Go, Enjoy, etc.) offers a free-floating service, which is more accepted because of higher comfort.

##### *8.4.2.2.2 Lower customers per vehicle*

An EVA-CS study shows that a station-based car sharing system acquires less customers per vehicle than a free-floating system. For example, the statistical average for Germany as a whole is 45 customers per station-based vehicle and 126 customers per free-floating vehicle at the beginning of 2016.(Bundesverband CarSharing e.V., 2016)

##### *8.4.2.2.3 Desired car not always available*

It is possible that the desired vehicle is not always available. This can turn out to be a restriction of independence and flexibility. In certain situations, early planning and timely reservations of particular car models is necessary.

##### *8.4.2.2.4 Billing system of mobility service*

Not only the rides per use have to be paid, the car-sharing service as well has a monthly fee which is dependent on the contract type (individual, family or company contract).

## 8.4.3 Success and failure factors tim (täglich.intelligent.mobil) (Graz, Austria)

### 8.4.3.1 Success factors

#### *8.4.3.1.1 Including stakeholders into project development and implementation*

Including stakeholders in the development of the concept and the project implementation is important for innovative projects as tim. Stakeholder involvement in other projects entailed multiple coordination processes with entrepreneurs, politicians and experts, but it was precisely this that strengthened the effectiveness of such innovative mobility format.

#### *8.4.3.1.2 Controlled real-time information exchange*

##### 8.4.3.1.2.1 Including traders and local residents at the respective tim-locations

Because local traders and residents are possible customers for the tim-services it was crucial to include them. Through the time of the development up until the openings of tim-locations different measures were created to inform these people of the steps within the project. For example, initial information events on multimodal nodes, status reports per mail if wanted, distributing information flyers about the tim-services that will be offered, etc.

##### 8.4.3.1.2.2 Regular exchange of information

Another important success factor of tim was the information exchange between project members. Various events were developed to ensure a continuous improvement process. For example, an e-Taxi regulars' table was held every six months. There, the operators and drivers of the tim-e-Taxis exchanged experiences and received tips on economical und sustainable driving behaviour in daily operations.

##### 8.4.3.1.2.3 Event triggered information exchange

Information exchange between the different MaaS operators during certain events (such as festivals, concerts, etc.) are important for the services. For example, if a concert ends at a certain time taxi operators can send their fleet to the event location or at PT stations where great streams of people are to be expected. If they communicate with each other at such times the mass of people is more easily controlled and transported and better revenues can be achieved.

#### *8.4.3.1.3 Carsharing system type*

Station-based car sharing is more likely to be used by people who do not want to own a private car. Accordingly, station-based car sharing is rarely used for routine and short trips, but rather serves as a supplement to public transportation. Station-based car sharing thus promotes the change in mobility behaviour more strongly than free-floating systems.(Bundesverband CarSharing e.V., 2016)

#### *8.4.3.1.4 Future market potential*

According to ABI Research the size of the mobility as a service market will exceed global revenues of 1 trillion US-Dollars by 2030. (Bay, 2020)

#### 8.4.3.2 Failure factors

##### *8.4.3.2.1 Station-based instead of free-floating carsharing*

tim offers a station-based instead of a free-floating car sharing service. On long term this could be a reason why car-sharing users switch from tim to other free-floating car-sharing services that could be implemented in the city of Graz. Today, tim is the only car-sharing operator providing the service in Graz but that can change, eventually.

##### *8.4.3.2.2 Operating business and impact decisions*

The first multimodal location of tim was opened at Hasnerplatz in Graz in September 2016. Since then several more locations were opened in Graz und even five in Linz and more are planned. With this the possibility occurs that the operator offers more than the demand requires and that leads to additional costs for the company, especially because the car sharing fleet is owned by tim.

##### *8.4.3.2.3 Billing system of mobility system*

When registering at tim, a sign-up fee of 15 € has to be paid as well as a monthly membership fee of 7 €. These additional costs could lead in people not using tim even though it is a small amount of money.

##### *8.4.3.2.4 Desired car not always available*

It is possible that the desired vehicle is not always available. This can turn out to be a restriction of independence and flexibility. In certain situations, early planning and timely reservations of particular car models is necessary.

### 8.4.4 Success and failure factors UbiGo – MaaS (Stockholm/Gothenburg, Sweden)

#### 8.4.4.1 Success factors

##### *8.4.4.1.1 Future market potential*

According to ABI Research the size of the mobility as a service market will exceed global revenues of 1 trillion US-Dollars by 2030. (Bay, 2020)

##### *8.4.4.1.2 Billing system of mobility service*

Compared to other MaaS services (such as tim) UbiGo has no sign-up or membership fees which need to be paid monthly. It is even possible to book a rental car and taxi via the UbiGo app without an active subscription. Only the subscriptions chosen and potential add-on purchases need to be paid.

The chosen subscription(s) of one account can be used by all family members. With that not every member has to activate their own account instead one account is enough to cover the mobility needs for the whole family – and that without additional costs.

##### *8.4.4.1.3 Car-sharing system type*

Station-based car sharing is more likely to be used by people who do not want to own a private car. Accordingly, station-based car sharing is rarely used for routine and short trips, but rather serves as a supplement to public transportation. Station-based car sharing thus promotes the change in mobility behaviour more strongly than free-floating systems.(VCÖ - Mobilität mit Zukunft, 2020)

#### 8.4.4.2 Failure factors

##### *8.4.4.2.1 Station-based instead of free-floating car-sharing*

UbiGo offers a station-based instead of a free-floating car sharing service. On long term this could be a reason why car-sharing users switch from UbiGo to other free-floating car-sharing services like Car2Go.

##### *8.4.4.2.2 Operating business and impact decisions*

Even though the business shows a revenue growth of 50 % the growth of the costs is even higher (OPEX: +206.16 % (Other external expenses) and +336.58 % (Personnel costs)). This indicates a too fast growing of the business and could have negative effects in the future.

##### *8.4.4.2.3 Dependency on mobility operators*

MaaS operators such as UbiGo has no own vehicle fleets, instead they have contracts with different mobility operators such as Hertz (Car rental), local PT providers (SL), Cabonline (Taxi) and Move about (Car pool). If one of these operators closes, UbiGo is directly affected and loses a contract partner. This situation could lead to different difficulties e.g. not finding a substitute for the lost partner in the region if it was the only mobility provider of this kind.

##### *8.4.4.2.4 Desired car not always available*

It is possible that the desired vehicle is not always available. This can turn out to be a restriction of independence and flexibility. In certain situations, early planning and timely reservations of particular car models is necessary.

### 8.4.5 Success and failure factors whim (international)

#### 8.4.5.1 Success factors

##### *8.4.5.1.1 Market and marketing strategies*

###### 8.4.5.1.1.1 International concept

In comparison with other offered MaaS services whim operation at international level. This fact gives the service the possibility to reach more people at with that more customers can be accumulated and popularity is gained. Of course, the more people know the service the higher is the prominence of it.

###### 8.4.5.1.1.2 Big international industrial investors

whim has international car manufacturers, bus operators, insurance companies and transport providers as investors. With that the networks, experience and customer base can be used in advantage for the company without giving up their independence. Whim is open about taking aboard strong, strategic owners, but not giving any investor a possibility to dictate what whim does or turn it into anything it is not. Both sides know that. These investors are interested in such services because they see the changes in the mobility sector and want a place in it for the future.

##### *8.4.5.1.2 Future market potential*

According to ABI Research the size of the mobility as a service market will exceed global revenues of 1 trillion US-Dollars by 2030.(Bay, 2020)

#### 8.4.5.2 Failure factors

##### *8.4.5.2.1 Possibility of no costumer acceptance of the service in Asian cities/regions*

Whim is an international MaaS service which plans to launch in Tokyo and Singapore in the near future. These locations are the first places located outside of Europe where whim wants to introduce their service. Due to cultural differences or other reasons it is possible that the service will not be used to the extent that it generates positive results in the economic sense.

##### *8.4.5.2.2 Local mobility providers are not willing to integrate their platforms with MaaS*

MaaS operators such as whim have to work with existing providers at the locations the service wants to be established. But some of these providers may not be willing to integrate their platforms with whim. That could be because they already have contracts with other MaaS operators or because the development and interest of MaaS is generally low in the city/region. This could be a great hindrance in installing a worldwide MaaS service.

##### *8.4.5.2.3 Dependency on mobility operators*

MaaS operators such as whim has no own vehicle fleets, instead they have contracts with different mobility operators such as Hertz (Car rental), TIER (E-scooter), local PT providers (HSL), Taksi Helsinki (Taxi), etc. If one of these operators closes, whim is directly affected and loses a contract partner. This situation could lead to different difficulties e.g. not finding a substitute for the lost partner in the region if it was the only mobility provider of this kind.

## 8.5 KPI-related analysis of MaaS including best practices

In this sub-chapter the business KPIs are listed with the results of the chosen MaaS services for the following important KPIs: CAPEX, OPEX, Revenue streams, Pricing strategy, Revenue growth, Return on investment after 3 years, Number and nature of partners, Vehicle utilization rate, Occupancy rate, Vehicle utilization efficiency, and Fleet replacement rate.

### 8.5.1 Dopravní podnik mesta Brna (DPMB)

#### 8.5.1.1 KPI – Cost & revenue structure

**CAPEX (Fixed costs):** Fixed costs consists of different cost categories:

- Cost of vehicle fleet:
  - Bus: 40,258,474.8 € (1,049,491,000 CZK)
  - Trolleybus: 21,664,653.9 € ( 564,772,000 CZK)
  - Tram: 177,087,137.1 € (4,616,453,000 CZK)
  - Boat: 3,653,368.0 € ( 95,239,000 CZK)
  - Total: 242,663,633.8 € (6,325,955,000 CZK)
- Cost of physical infrastructure: 214,873,003 € (5,601,486,000 CZK)
- Costs of digital infrastructure: 4,778,697 € (124,575,000 CZK)
- Machines and equipment: 17,222,757.7 € (448,977,000 CZK)

**OPEX (Variable costs):** Variable costs consist of different cost categories:

- Repairs, Maintenance, Services: 19,603,077 € (512,164,000 CZK) (2019); 15,011,493 € (392,201,000 CZK) (2018) = +30.59%
- Depreciation costs: 22,781,050 € (595,194,000 CZK) (2019); 23,237,326 € (607,115,000 CZK) (2018) = -1.96%
- Personnel costs: 59,749,915 € (1,561,069,000 CZK) (2019); 56,938,809 € (1,487,624,000 CZK) (2018) = +4.94%
- Material consumption: 8,894,612 € (232,387,000 CZK) (2019); 8,201,299 € (214,273,000 CZK) (2018) = +8.45%
- Fuel consumption: 3,987,259 € (104,174,000 CZK) (2019); 4,410,390 € (115,229,000 CZK) (2018) = -9.59 %
- Energy consumption and sewage: 8,639,547 € (225,723,000 CZK) (2019); 8,088,847 € (211,335,000 CZK) (2018) = +6.81%
- Other costs: 2,917,435 € (76,223,000 CZK) (2019); 5,468,464 € (142,873,000 CZK) (2018) = -46.65%

**Revenue streams:** Pay per use (for all services), Subscription fee (for the planned automated driving vehicle service)

**Pricing strategy:**

- One hour: 1 € (25 CZK);
- Yearly ticket: 174 € (4,750 CZK);
- Seniorbus: 2 € (50 CZK);
- Pub tram: 2.3 € (60 CZK) and for Pub-Quiz night 4.6 € (120 CZK)

**Revenue growth:**
The numbers for calculating are from the annual reports of DPMB.

| | |
|---|---|
| Result for the year 2019: | 127,230 € (3,324,316 CZK) |
| Result for the year 2018: | 123,810 € (3,234,957 CZK) |
| Growth in €: | 3,420 € ( 89,359 CZK) |
| Growth in %: | 2,76% |

**Return on investment after 3 years:**
Calculated with the formula: $ROI = \frac{Profit\ of\ the\ year}{Total\ capital} * 100$
The values for the calculation are from the annual reports of DPMB.

2019: ROI = 1.24 %
2018: ROI = 1.53 %
2017: ROI = 1.34 %

Average value: ROI = 1.37 %

#### 8.5.1.2 KPI – Actors in business ecosystem

**Number and nature of partners:** > 8 (best expert guess)

Organizational structure/model: Central model
Business owner: Dopravní podnik mesta Brna (DPMB)

#### 8.5.1.3 KPI - Operational (transport)

**Vehicle utilization rate:**

- Bus: Most of the bus lines start their route around 4:45 and end at around 23:00. This results in a vehicle utilization rate of 76 %.
- Tram: Most of the tram lines start their route around 4:30 and end at around 23:00. This results in a vehicle utilization rate of 77 %.
- Trolleybus: Most of the trolleybus lines start their route around 4:45 and end at around 23:00. This results in a vehicle utilization rate of 76 %.

All values are just according to best expert guess.

**Occupancy rate:** All values below are just best expert guesses

- Bus: 19 % (Umweltbundesamt GmbH, 2020)
- Tram: 19 % (same source as Bus)
- Trolleybus: 19 % (Trolleybuses are considered as line bus as well and therefore has the same occupancy rate as a normal Bus)

**Vehicle utilization efficiency:** Assuming that public transportation services are operating around the clock (0:00 – 24:00) and there is always a passenger in the vehicle (even at night, what is possible in a city like Brno) the vehicle utilization efficiency is 100 % for bus, tram and trolleybus (best expert guess).

**Fleet replacement rate:** the operating life for the different vehicles are:

- Tram: 25 years
- Trolleybus: 20 years
- Omnibus: 9 years

The values are according to the official operating life values determined by law.(Bundesministerium der Finanzen, 2000)

#### 8.5.1.4 KPI - Legal

Subsidies/monetary incentives: There are different subsidies DPMB receives (year 2019):

- Subsidies for the acquisition of fixed assets
  - Subsidies from the SMB budget: 3,594,492 € (93,802,000 CZK)
  - Subsidies from the Slovak Republic and the EU: 10,713,160 € (279,571,000 CZK)
- Operating subsidies from the Slovak Republic and the EU: 701,562 € (18,308,000 CZK)

### 8.5.2 ROMA Mobilità

#### 8.5.2.1 KPI – Cost & revenue structure

**CAPEX (Fixed costs):** Fixed costs consists of different cost categories:

- Numbers for whole business (ROMA Mobilità):
  - Intangible fixed assets:
    - Concessions, licenses, trademarks: 503,164 €
    - Other: 6,597 €

      509,761 €
  - Tangible fixed assets:
    - Systems and machinery: 38,896 €
    - Industrial and commercial equipment: 2,969 €
    - Other goods: 497,023 €

      538,888 €
- Related to car-sharing service only:

- No information only regarding the car-sharing system could be found within the annual report for CAPEX

**OPEX (Variable costs):**

- Numbers for whole business (ROMA Mobilità):
  - Personnel costs: 16,417,473 € (2018); 16,773,549 € (2017) = - 2.1 %
  - Depreciation costs material: 282,108 € (2018); 279,112 € (2017) = +1.07 %
  - Depreciation costs immaterial: 218,482 € (2018); 225,852 € (2017) = - 3.26 %
  - Expenses for services: 13,166,643 € (2018); 12,291,358 € (2017) = 7.12 %
  - Material consumption: 156,828 € (2018); 228,021 € (2017) = - 31.22 %
  - Rent costs: 2,895,592 € (2018); 2,868,692 € (2017) = + 0.94 %
- Numbers for car-sharing service only:
  - Material consumption: 24,864 € (2018); 27,242 € (2017) = -8.73 %
  - Fuel consumption: 94,258 € (2018); 128,590 € (2017) = -26.7 %
  - Rent costs: 610,977 € (2018); 675,215 € (2017) = -9.51 %

**Revenue streams:** Subscription, pay per use

**Pricing strategy:**
Monthly fee depending on contract type:
Individual contract: 14.90 €
Family contract: 19.90 €
Company contract: 59.90 €
Large company contract: Individual price requested by mail

Carsharing depending on distance: 0.49-0.65€/km or 0.33-0.56€/km
Carsharing depending on time: 2.5-3.3€/hour or 1.4-1.7€/hour

**Revenue growth:**
The numbers for calculating are from the annual reports of ROMA Mobilità.
Car sharing:

| | |
|---|---|
| Result for the year 2018: | 603,534 € |
| Result for the year 2017: | 769,160 € |
| Growth in €: | - 165,626 € |
| Growth in %: | - 21.53 % |

**Return on investment after 3 years:** The numbers are calculated for the company ROMA Mobilitá not only for the carsharing service and are available in the annual report of ROMA Mobilità.

2018: ROI = 1.30 %
2017: ROI = - 8.43 %
2016: ROI = - 0.81 %

Average value: ROI = 2.65 %

#### 8.5.2.2 KPI – Actors in business ecosystem

**Number and nature of partners:** > 4 (best expert guess)

Organizational structure/model: Central model, Liberal Model, Aggregator-based services
Business owner: ROMA Capitale

#### 8.5.2.3 KPI - Operational (transport)

**Vehicle utilization rate:** Assuming the service is available from 7:00 to 22:00 and all vehicles are booked, the vehicle utilization rate would be 62.5 % (best expert guess).

**Occupancy rate:** The average number of people using a carsharing vehicle are 2 people. (Bundesministerium für Verkehr und digitale Infrastruktur, 2019) Which would be an occupancy rate of 40 % (best expert guess).

**Vehicle utilization efficiency:** The average vehicle utilization efficiency in Europe is 33 % (best expert guess).

**Fleet replacement rate:** The operating life of the vehicles ROMA Mobilità offers are:
Cars: 6 years
The values are according to the official operating life values determined by law.(Bundesministerium der Finanzen, 2000)

#### 8.5.2.4 1.1.2.4 KPI - Legal

Subsidies/monetary incentives:
Car sharing: Ministry of environment and territorial protection: 559,799 €

### 8.5.3 tim (täglich.immer.mobil)

#### 8.5.3.1 KPI – Cost & revenue structure

**CAPEX (Fixed costs):** Because no tim numbers could be found the following numbers are from the annual report of the HOLDING Graz.

- Intangible fixed assets:
  - Rights: 19,636,170.56 €
  - Value of company: 40,786,385.02 €
  - Prepayments made: 4,641,100.20 €

  65,063,655.78 €
- Tangible fixed assets:
  - Land and buildings: 317,577,733.98 €
  - Technical equipment and machinery: 500,924,929.40 €
  - Other assets: 49,286,169.39 €
  - Prepayments made and assets under construction: 36,060,574.79 €

  903,849,407.56 €

**OPEX (Variable costs):** Because no tim numbers could be found the following numbers are from the annual report of the HOLDING Graz.

- Material consumption: 118,483,456.38 € (2019); 19,508,000 € (2018) = + 507.36 %
- Expenses for services: 40,549,653.73 € (2019); 33,803,000 € (2018) = + 19.66 %
- Personnel costs: 128,447,747.2 € (2019); 124,662,000 € (2018) = + 3.04 %
- Depreciation costs: 85,209,785.09 € (2019); 48,713,000 € (2018) = + 74.92 %

**Revenue streams:** Subscription, Pay per use, Payment transactions, Shareholder contributions

**Pricing strategy:**
Registration fee: 15 €
Membership fee: 7 €/month

**Table 64 – Car sharing prices Graz - Linz**

| Car sharing prices (Graz): | Car sharing prices (Linz): |
|---|---|
| 4€/hour (1st and 2nd hour) | 5€/hour (1st and 2nd hour) |
| 6€/hour (3rd and 4th hour) | 8€/hour (3rd and 4th hour) |
| 9€/hour (5th to 9th hour) | 10€/hour (5th to 9th hour) |
| 77€ (daily rate) | 88€ (daily rate) |

**Revenue growth:** Because no tim numbers could be found the following numbers are from the annual report of the HOLDING Graz.

| | |
|---|---|
| Result for the year 2019: | 25,142,828.29 € |
| Result for the year 2018: | 20,504,000.00 € |
| Growth in €: | 4,638,828.29 € |
| Growth in %: | + 22.62 % |

**Return on investment after 3 years:** Because no tim numbers could be found the following numbers are calculated with the data from the annual reports of the HOLDING Graz with the following formula: $ROI = \frac{Profit\ of\ the\ year}{Total\ capital} * 100$

2019: ROI = - 4.5 %
2018: ROI = - 6.3 %
2017: ROI = - 8.3 %

Average value: ROI = -6.37 %

#### 8.5.3.2 KPI – Actors in business ecosystem

**Number and nature of partners:** > 11 (best expert guess)

Organizational structure/model: Central model
Business owner: Holding Graz – Kommunale Dienstleistungen GmbH/Holding Graz Linien

#### 8.5.3.3 KPI - Operational (transport)

**Vehicle utilization rate:** 65 %

**Occupancy rate:** Value of this KPI is not collected by tim.

**Vehicle utilization efficiency:** 76 %

**Fleet replacement rate:**

Car: 6 years
Bike: 7 years
The values are according to the official operating life values determined by law. (Bundesministerium der Finanzen, 2000)

### 8.5.4 UbiGo - MaaS

#### 8.5.4.1 KPI – Cost & revenue structure

**CAPEX (Fixed costs):**

- Vehicle fleet costs: UbiGo has no own vehicle fleet
- Physical infrastructure costs: UbiGo has no own physical infrastructure
- Other non-current assets: 14,580 € (150 000 SEK)

**OPEX (Variable costs):**

- Personal costs: 286,499 € (2,953,593 SEK) (2019); 65,624 € (676,532 SEK) (2018) = +336.58 %
- Other external expenses: 429,448 € (4,427,302 SEK) (2019); 140,270 € (1,446,080 SEK) (2018) = +206.16 %

**Revenue streams:** Subscription

**Pricing strategy:** The prices are different from service to service and are depending on how long a vehicle or the service is used.

Public transport:

- 10 day tickets – 51 € (5.1 €/ticket); (SEK 525 (SEK 52.50 / ticket))
- 20 day tickets – 82.5 € (4.1 €/ticket); (SEK 850 (SEK 42.50 / ticket))
- 30 day tickets – 117.9 € (3.9 €/ticket); (SEK 1215 (SEK 40.50 / ticket))
- 40 day tickets – 149.4 € (3.7 €/ticket); (SEK 1540 (SEK 38.50 / ticket)

Carpool:

- 3 hours – 32 € (10.7 €/hour); (SEK 330 (SEK 110 / hour))
- 6 hours – 58.2 € (9.7 €/hour); (SEK 600 (SEK 100 / hour))
- 12 hours – 98.9 € (8.2 €/hour); (SEK 1020 (SEK 85 / hour))
- 18 hours – 139.7 € (7.8 €/hour); (SEK 1440 (SEK 80 / hour))
- 24 hours – 174.6 € (7,3 €/hour); (SEK 1800 (SEK 75 / hour))
- 30 hours – 204 € (6.8 €/hour); (SEK 2100 (SEK 70 / hour))

Car rental:

- Small – 81 € (SEK 833)
- Medium – 97 € (SEK 1000)
- Standard – 121 € (SEK 1250)
- Large/Premium – 186 € (SEK 1916)

Taxi:

- Prices according to Cabonline

**Revenue growth:**

The numbers for calculating are from the annual reports of UbiGo.

| | |
|---|---|
| Result for the year 2019: | 178,955 € (1,844,897 SEK) |
| Result for the year 2018: | 119,106 € (1,227,901 SEK) |
| Growth in €: | 59,849 € ( 616,996 SEK) |
| Growth in %: | 50.25 % |

**Return on investment after 3 years:**

Calculated with the formula: $ROI = \frac{Profit\ of\ the\ year}{Total\ capital} * 100$

The values for the calculation are from the annual reports of UbiGo.

2019: ROI = - 175.57 %
2018: ROI = - 27.54 %
2017: ROI = -1.68 %

Average value: ROI = - 68.26 %

#### 8.5.4.2 KPI – Actors in business ecosystem

**Number and nature of partners**: 8

Organizational structure/model: Liberal model

Business owner: UbiGo

#### 8.5.4.3 KPI - Operational (transport)

**Vehicle utilization rate:** UbiGo has no own vehicles/fleets, only contracts with mobility service operators. Therefore, they most likely do not collect such data.

**Occupancy rate:** UbiGo has no own vehicles/fleets, only contracts with mobility service operators. Therefore, they most likely do not collect such data.

**Vehicle utilization efficiency:** UbiGo has no own vehicles/fleets, only contracts with mobility service operators. Therefore, they most likely do not collect such data.

**Fleet replacement rate:** UbiGo has no own vehicles and therefore no own fleet that can be replaced.

### 8.5.5 whim (international)

#### 8.5.5.1 KPI – Cost & revenue structure

**CAPEX (Fixed costs):**

- Vehicle fleet costs: whim has no own vehicle fleet
- Physical infrastructure costs: whim has no own physical infrastructure
- No other CAPEX data publicly available could be found in that aspect. Getting information concerning financial company data additional costs are incurred.

**OPEX (Variable costs):** No publicly available data could be found in that aspect. Getting information concerning financial company data additional costs are incurred.

**Revenue streams:** Subscription, Pay per use, Payment transactions

**Pricing strategy:** whim is offered in several cities around the world. In each city different plans are offered:
Helsinki:
Whim Urban 30: 59.70 €/30 days
Whim Student 30: 32.80 €/30 days
Whim Weekend: 249 €/30 days
Whim Unlimited: 499 €/month

West Midlands:
Whim to Go: Pay as you go

Antwerp:
Whim to Go: Pay as you go

Whim Everyday: 55 €/month

Vienna:
Whim to Go: Pay as you go

Turku:
Whim to Go: Pay as you go

**Revenue growth:**
The numbers for calculating are from the annual reports of whim.

| | |
|---|---|
| Result for the year 2019: | 7,540,000 € |
| Result for the year 2018: | 4,727,000 € |
| Growth in €: | 2,813,000 € |
| Growth in %: | 59.51 % |

**Return on investment after 3 years:** Due to missing information for whim (for calculating ROI the total capital is needed but is not available for public) the EBITDA is considered here.
2019: - 252 %
2018: - 265 %
2017: - 2657.2 %

The EBITDA is an indication of the operating condition of a company, measuring the economic success. The higher the value, the better the company has performed in its operating business. These value – of course – should not be negative. But the results show that there is constant improving of the value over the years.

### 8.5.5.2 KPI – Actors in business ecosystem

**Number and nature of partners:** 23

Organizational structure/model: Liberal Model, Aggregator Model

Business owner: MaaS Global Ltd

### 8.5.5.3 KPI - Operational (transport)

**Vehicle utilization rate:** whim has no own vehicles/fleets, only contracts with mobility service operators. Therefore, they most likely do not collect such data.

**Occupancy rate:** whim has no own vehicles/fleets, only contracts with mobility service operators. Therefore, they most likely do not collect such data.

**Vehicle utilization efficiency:** whim has no own vehicles/fleets, only contracts with mobility service operators. Therefore, they most likely do not collect such data.

**Fleet replacement rate:** whim has no own vehicles and therefore no own fleet that can be replaced.

# 9 Overview and Analysis of existing mobility services of the demo sites

The following chapter describes the state-of-the-art of Mobility as a Service in selected pilot sites. Such combined services are currently under development or already integrated in several demonstration sites of the SHOW project including automated, non-automated and multimodal chains with interfaces to car sharing solutions, e-bike and bike rental, etc.

The selection of demo sites has been made based on availability and quality of demo site data and to cover most relevant MaaS solution and maturity as well as avoiding overlaps within the interviews. Overall 6 semi-structured interviews with the demo site were done (and audio recorded with permission of the participants) between June 2020 and August 2020. Every input in this chapter is based on semi-structured interviews (see chapter 2.3.6 for the guideline) including the audio recording input, workshop result like from the 1st PAN European workshop on 18-September-2020 and with results from the internal research work regarding all listed sub chapters. From WP2 the chapter responsible of chapter (RISE) and chapter 3 (Bax&Company) performed the interviews with Rouen, Madrid, Salzburg, Vienna and Linköping whereas the satellite site coordinator (Sitowise) was responsible for the interview in Tampere. The interviews with Turin, eTrikala and Aachen as well as for the other demo sites will be collected within the A2.2. During the interviews the demo site were normally represented by its leader, a business expert as well as technical experts, which ensures a complete view on the business and operating models covering business, technical and organizational views.

## 9.1 SotA of MaaS in the demo sites

### 9.1.1 Rouen

The Mobility Service Canvas (MSC) gives a fast overview over the project of Transdev located in Rouen.

**Table 65 – Mobility Service Canvas Rouen Normandy Autonomous Lab**

| Mobility Service Canvas | |
|---|---|
| **Name** | Transdev, Autonomous Transport Systems<br>transdev the mobility company |
| **Short description** | Leader in public transport and AV mobility services:<br>• development and supply of ATS (Autonomous Transport System);<br>• operation of AV fleet (+50 experimentations worldwide);<br>• 2 major R&D projects:<br>  ○ RNAL : Rouen Normandy Autonomous Lab ;<br>  ○ Paris-Saclay Autonomous Lab |
| **Website / Reference** | • https://www.transdev.com/en/our-innovations/shared-autonomous-mobility/<br>• https://www.rouennormandyautonomouslab.com |
| **Service Developers** | • RNAL: Transdev, Renault, Matmut, Region Normandie, Rouen Metropole, CDC Region Normandie, Ericsson… |
| **Primary Operator** | • RNAL: Transdev Rouen + Transdev ATS (Autonomous Transport System) |

| Mobility Service Canvas | |
|---|---|
| **Target users and mobility needs** | • Use-case 1 = On-demand transport services for residents, students, commuters, VRU<br>• Use-case 2 = Regular Fixed-route bus services for commuters, residents, students, VRU<br>• Use-case 3 = Robo-taxi in city centre à residents, students, tourists |
| **Mobility Services** | Different use-cases planned:<br>• On-demand autonomous transport services, for last/first mile service to tram station and BRT terminal<br>• Regular fixed-route automated bus services, in order to complement/replace classic bus service<br>• Robo-taxi in city centre;<br>• BRT service on bus dedicated lane. |
| **Related Services** | • Intermodal Hub in city centre;<br>• Mobile app for trip planning and booking;<br>• Fleet supervision for AVs, integrated to PT control centre, in permanent communication with passengers in AVs. |
| **Mobility Service Operators** | • Transdev Rouen;<br>• Transdev ATS (Autonomous Transport Systems) |
| **Access to the Services** | x Public<br>□ Registered users<br>□ Private |
| **Type of environment** | x Urban<br>x Interurban - Suburban<br>□ Highway<br>□ Rural<br>□ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>□ Dedicated lane |
| **Operations Parameters** | • To be defined |
| **Status** | x In development, since 2017;<br>x First trial for on-demand service in area “Le Madrillet” since 2018<br>□ In operation, since… |
| **Areas/routes covered and number of people/amount of goods transported per service** | 2018-2020 :<br>• 10,5 kms (8000 kms reached in autonomous mode)<br>• 2000 people transported |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | • MATMUT, French Insurance company<br>• Renault Nissan Group<br>• ERICSSON<br>• ENEDIS, French electricity network company |

| Mobility Service Canvas | |
|---|---|
| **SME Aspects** | • No available information |
| **Model type (A)** | x PTO (public transport operator)<br>□ non-PTO based shared mobility services<br>□ Carsharing<br>□ Bike sharing<br>□ Vehicle-based logistics<br>□ TMC-based services<br>□ Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal) a **Public Transport Authority regulated model (PSO)**<br>□ Central Model<br>□ Liberal Model<br>□ Aggregator Model<br>□ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2G (government)<br>□ B2C<br>□ B2B<br>□ P2P<br>□ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>• Shared mobility services (shuttles or buses) |
| **Connected Mobility Aspects** | □ V2V<br>x V2I<br>□ V2P<br>□ V2N<br>□ None |
| **Electrified vehicles used per service** | Yes<br>• Number of electric vehicles = ~ 10<br>• Share of electrification: 100 % |
| **Automated vehicles used per service** | Yes<br>• Number of automated vehicles: ~10<br>• SAE level: 4 |
| **Number of vehicles used per service (fleet size)** | Not defined |
| **Vehicle capacity** | • Total capacity for shuttles = 16 passengers max, seated and standing, including 7 seats |

| Mobility Service Canvas | |
|---|---|
| | • Total capacity for robo-taxi = 4 seats |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>□ Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | The services will be integrated in the PT existing mobility tools, such as: passenger info system, trip planner, fare policy and e-ticketing system… |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | The services will be integrated to the public network, in order to complement the existing services; they will be interfaced with the existing regulation tools, such as SAEIV - Passenger Information System… |

The following text gives a more detailed description of the state-of-the-art.

Rouen (population: 111,557) is a city on the River Seine in northern France and capital of the region of Normandy. Wishing to respond to growing and complex mobility needs, the Rouen Normandy Metropolis is committed to the development of an intelligent mobility solution for all, taking the form of an integrated multimodal and carbon-free mobility system deployed on a large scale.

To achieve this ambitious objective, the Metropolis and its industrial partners (CITEOS Rouen, Transdev, Renault, La Poste), in which the poles, sectors and actors of higher education and research, experts in the development of solutions, join forces. innovations for transport, data processing and on-board electronics in particular, plan to work on three axes: increasing the number of transport modes to increase flexibility, connecting the different modes of transport in their dual physical and digital dimension to guarantee continuity and finally offer real-time information on optimized solutions.

In collaboration with the Rouen Normandie Metropolis, Transdev Rouen contributes to the development of the transport offer to support travellers from the Astuce network on all their journeys. Further details of the PT network and about Transdev Autonomous Transport Systems are described in 4.1.1 and 6.1.3 and the latest news can be found on the website: https://www.rouennormandyautonomouslab.com/

The global mobility App in Rouen is called ‘My Astuce” (see Figure 67) and it allow find all the tools and information you need to organize your trips within the Rouen Normandy metropolitan area: routes, timetables, traffic information.

The My Astuce application allows to:

- Buy and validate tickets:
    - Purchase of tickets from the application

  - M-ticket 1h or 24h, booklet of 10 tickets
  - On-board validation via QR code
- Prepare and plan trips:
  - Finding routes by public transport, bicycle, car and, soon, on foot
  - Geolocation of stops, stations, charging, car parks, P+Rs, Cy'clic
  - Schedules and timetables in real time
  - Maps of the public transport network (downloadable/offline)
- Anticipate disruptions:
  - Real-time traffic information on all road or public transport networks
  - Alerts in the event of disruptions on favourite lines and routes
- Personalize trips:
  - Registration of favourite destinations & stations (work, home, gym, etc.)
  - Travel options (reduced mobility, etc.)

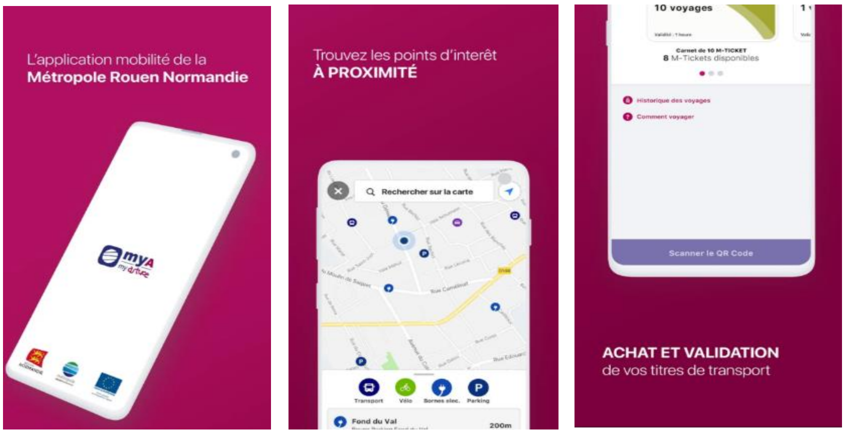



**Figure 67 – Rouen "My Astuce" App (Source: Transdev Rouen)**

Transdev´s motivation to participate in the French SHOW demonstrations are their approach to learn by doing, i.e. perform a lot of experimentation and gather data, to keep close partnership with PTA, Rouen´s diversity of geographic areas and high passenger demand as well as an interesting ecosystem of automation players.

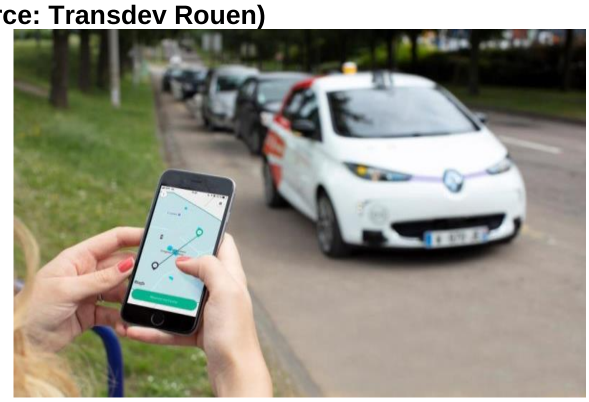


**Figure 66 – Rouen - Autonomous Transport System - On demand app (Source: Transdev Rouen)**

The Autonomous Mobility aspect are not today integrated into the Astuce App but in a complementary App (see Figure 66) and in the future the two apps may fusion once the autonomous shared mobility will scale up.

### 9.1.2 Madrid

The Mobility Service Canvas (MSC) gives a fast overview over the project of EMT located in Madrid.

**Table 66 – Mobility Service Canvas Madrid**

| Mobility Service Canvas | |
|---|---|
| **Name** | **EMT (Empresa Municipal de Transportes de Madrid)** |
| **Short description** | EMT is a public limited company, currently developing MaaS services for Madrid. |
| **Website / Reference** | https://mobilitylabs.emtmadrid.es/ |
| **Service Developers** | • EMT |
| **Primary Operator** | • EMT |
| **Target users and mobility needs** | • Passenger transport for population<br>• Commuting, Business, Leisure |
| **Mobility Services** | MaaS<br>• Carsharing<br>• Taxi<br>• Connection to PT: timetable information, paying tickets<br>• Bikesharing<br>• E-Scooter<br>• Moped-sharing<br>• Charging stations for electric cars<br>• Underground parking |
| **Related Services** | • No information available |
| **Mobility Service Operators** | • PT: EMT Madrid<br>• Carsharing: ShareNow<br>• Bikesharing: BiciMAD, BiciMADGo<br>• Taxi: local taxi operators<br>• Rental Cars: international rental car service provider (Europcar)<br>• E-Scooter: ECooltra |
| **Access to the Services** | □ Public<br>x Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>□ Interurban<br>□ Highway<br>□ Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | • Prices according to Mobility service operators |
| **Status** | □ In development, since …<br>□ Trial, since …<br>x In operation, since |

| Mobility Service Canvas | |
|---|---|
| **Areas/routes covered and number of people/amount of goods transported per service** | • Madrid |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | • PT: EMT Madrid<br>• Carsharing: Car2Go<br>• Bikesharing: BiciMAD, BiciMADGo<br>• Taxi: local taxi operators<br>• Rental Cars: international rental car service provider (Europcar) with discount and E-Scooter: ECooltra |
| **SME Aspects** | • No information available |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>x Carsharing<br>x Bike sharing<br>☐ Vehicle-based logistics<br>☐ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>☐ Liberal Model<br>☐ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>☐ B2B<br>☐ P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>Sharing aspects are:<br>• Public charging infrastructure<br>• Shared-Use Mobility (taxi)<br>• Public Transportation<br>• Carsharing |
| **Connected Mobility Aspects** | ☐ V2V<br>☐ V2I |

| Mobility Service Canvas | |
|---|---|
| | □ V2P<br>□ V2N<br>x None |
| **Electrified vehicles used per service** | • No information available |
| **Automated vehicles used per service** | No |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • No information available |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | Maas: integrated planning, booking, payment |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | EMT itself is a public transportation operator |

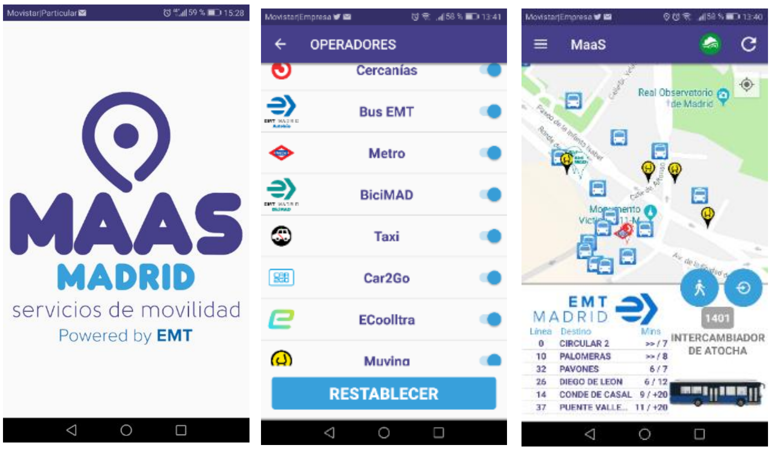
EMT Madrid is developing a MaaS solution for Madrid, capital of Spain with a population of 3.3 million. The Empresa Municipal de Transportes de Madrid (EMT) is a public limited company owned by Madrid City Council. It forms part of the Madrid Regional Transport Consortium, which is the authority commissioned with planning public transport in Madrid (c.f. www.emtmadrid.es).

Some figures about EMT Madrid:

- Runs a fleet of 2,100 buses and 100 mobility aid vehicles
- Operates a network of 213 bus routes
- Operates a 3,564 km-long network containing 10,182 stops
- Covers over 90 million km a year

- Carries 420 million passengers a year (almost 1.6 million/working day)
- Has more than 7000 bus drivers

EMT started as bus operator, since 2013 EMT is adding different mobility services. Today EMT describes itself as a public mobility operator, including services such as managing the public e-bike sharing service, both the station based and a free-floating one (BiciMAD and BiciMADgo) with 208 stations and more than 2,400 e-bikes, underground parking facilities (23 facilities with about 11,000 parking lots), charging infrastructure for electric vehicles (around 100 chargers including 5 fast chargers), and the “Casa de Campo” cable car. The company has an open data policy implemented since 2006 (EMT open data portal available at this link https://opendata.emtmadrid.es/Home). EMT has also launched “Mobility Labs”, which is a platform and a set of APIs that allow mobility developers to have a space to test, develop and publish their systems. It provides data directly connected to the Real Time and planning information systems and offers the information publicly and free of charge. It also allows publishing data to be reused by third parties. It was created in order to foster the deployment of platforms and Apps that promote knowledge of transport for travellers and researchers. There are three main types of users: App developers, researchers, and students (more info at https://mobilitylabs.emtmadrid.es/).




The MaaS solution (see Figure 68) will be available for testing from the fourth quarter of 2020. Aiming at a route

**Figure 68 – Screenshots of MaaS Madrid App (available for Android and iOS) (Source EMT Madrid)**

planner and ticketing system it will enable to combine the different EMT services, like for example a combination of bus, e-bike or parking, with links to further PT lines. The MaaS platform will make it possible to sell trips with other sales commissions and by licensing the use of the platform (defining the price for each hit)

At one of the two demo areas in Madrid, located in Villaverde district, linking La Nave (Madrid City Innovation Hub) with Villaverde Bajo-Cruce Metro Station seamless autonomous transport chains will be demonstrated and integrated to the MaaS platform.

In Madrid exists a long tradition of PT cooperating with the private sector such as with on-demand DR services and other mobility providers. The hub “Madrid in motion” (www.madridinmotion.es) is a collaborative system in which institutions, organizations, leading companies, startups and experts co-create and share knowledge and experiences to create innovations that generate value with real capacity for impact.

EMT´s motivation to be part of the Spain Mega site of SHOW are due to EMT´s interest in automation, in improvement of operations, optimization of bus behaviour & driving costs as well as in cooperation with other partners of the consortium.

### 9.1.3 Salzburg

The Mobility Service Canvas (MSC) gives a fast overview over the project Digibus located in Salzburg.

**Table 67 – Mobility Service Canvas Digibus**

| **Mobility Service Canvas** | |
|---|---|
| **Name** | **Digibus® Austria**<br>**Project coordinator:** Salzburg Research<br>**Project Partners:**<br>• Virtual Vehicle Research Center<br>• Universität Salzburg – Center für Human-Computer Interaction<br>• Austrian Institute of Technology<br>• Universität für Bodenkultur – Institut für Verkehrswesen<br>• Factum Chaloupka & Risser OHG<br>• Kapsch TrafficCom AG<br>• PRISMA solutions EDV-Dienstleistungen GmbH<br>• Commend International GmbH<br>• Fluidtime Data Services GmbH<br>• HERRY Consult GmbH<br>• ÖBB-Holding AG<br>• EasyMile SAS<br>**Associated Partners:**<br>• Land Salzburg<br>• Land Niederösterreich<br>• A1 Telekom Austria AG<br>• ÖAMTC Fahrtechnik |
| **Short description** | The Austrian flagship project "Digibus Austria" under the project lead of Salzburg Research aims to research and test methods, technologies and models for proofing a reliable and traffic-safe operation of automated shuttles as part of an intermodal regional mobility system.<br>Digibus Austria addresses the following research fields:<br>1. Semi-automated toolbox for preparing the digital driving environment<br>2. Simulation and road-testing of public transport related driving scenarios<br>3. Interaction with other road users and passengers |

| Mobility Service Canvas | |
|---|---|
| | Results will lay the foundation for an Austrian Reference Model for real-world testing and operation of autonomous shuttles in regional mobility systems.<br> |
| **Website / Reference** | https://www.digibus.at/en/<br>https://www.ait.ac.at/en/research-topics/road-safety-accident-research/projects/digibus-austria/<br>Video:<br>https://youtu.be/wt4djna5Ans |
| **Service Developers** | Project consortium |
| **Primary Operator** | Salzburg Research Forschungsgesellschaft mbH |
| **Target users and mobility needs** | • Commuters<br>• City residents<br>• Day-trippers<br>• Tourists |
| **Mobility Services** | Autonomous bus service with a regularly fixed route connecting PT stations |
| **Related Services** | No related services |
| **Mobility Service Operators** | Koppl, Salzburg:<br>• ÖBB Postbus (3 month demo in 2020) |
| **Access to the Services** | x Public<br>☐ Registered users<br>x Private |
| **Type of environment** | ☐ Urban<br>☐ Interurban<br>☐ Highway<br>x Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | • Service frequency: according to demand; a timetable for the service was established for chosen days in predefined timeslots (2 services/h)<br>• Pooling factor: 6 passengers seated/vehicle plus 1 operator (according to Automat VV)<br>• Price of the service: 0 € (no commercial service allowed according to Automat VV) |

| Mobility Service Canvas | |
|---|---|
| **Status** | ☐ In development, since April 2018 (36 months)<br>x Trials, since 2017…<br>☐ In operation, since …<br>For summer/autumn 2020 a 3-month real-life demonstration with the Easy Mile EZ10 Gen 3 is planned. |
| **Areas/routes covered and number of people/amount of goods transported per service** | Route of the Digibus on the test track in Koppl:<br>The Digibus runs as a feeder between Federal Highway 158 (SVV bus 150 Salzburg- Bad Ischl, stop Koppl-Sperrbrücke) and the municipality center of Koppl (1.4 km) and back (1.4 km)<br><br>Trials:<br>2017 (Navya Shuttle)<br>• Koppl: 240 Test drives, 341 km, 874 passengers<br>• E-Mobility Playdays: 60 Test drives, 120 km, 360 passengers<br>2018 (Easy Mile EZ 10 Gen 1)<br>• Demonstration TRA: 60 Test drives, 48 km, 274 passengers<br>• Koppl: 47 Test drives, 170 km, 146 passengers<br>• Wr. Neustadt: 30 Test drives, 15 km, 90 passengers<br>2019 (Easy Mile EZ 10 Gen 1)<br>• Wr. Neustadt: 939 Test drives, 527 km, 2.228 passengers<br>2019 (Easy Mile EZ 10 Gen 2)<br>• Salzburg Ring: 68 Test drives, 10,5 km, 49 passengers<br>• Koppl: 73 Test drives, 194 km, 191 passengers<br>2020 (EasyMile EZ 10 Gen 3)<br>• Koppl: 3 month demonstration in summer/autumn 2020<br>During the trials and demos a total of 1.517 test drives were carried out. During those test drives 1.425,5 km were covered and 3.972 passengers transported. |
| **Share of trip purpose per service** | The share of the trip purpose was not surveyed. There was no regular service.<br>x Commuting<br>☐ Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | Project Partner:<br>• Virtual Vehicle Research Center (SME)<br>• Universität Salzburg – Center für Human-Computer Interaction (RTO)<br>• Universität für Bodenkultur – Institut für Verkehrswesen (RTO)<br>• Factum Chaloupka & Risser OHG (SME)<br>• Kapsch TrafficCom AG (LE)<br>• PRISMA solutions EDV-Dienstleistungen GmbH (SME) |

| Mobility Service Canvas | |
|---|---|
| | • Commend International GmbH (SME)<br>• Fluidtime Data Services GmbH (SME)<br>• HERRY Consult GmbH (SME)<br>• ÖBB-Holding AG (LE)<br>• EasyMile SAS (vehicle supplier) |
| **SME Aspects** | • None |
| **Model type (A)** | • Not applicable<br>PTO (public transport operator) and non-PTO based shared mobility services:<br> Carsharing<br> Bike sharing<br> Vehicle-based logistics<br> TMC-based services<br>ϒ Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br> Liberal Model<br> Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br> B2B<br> P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>Sharing aspects are:<br>• Public Transportation |
| **Connected Mobility Aspects** | V2V<br>x V2I<br> V2P<br> V2N<br>ϒ None |
| **Electrified vehicles used per service** | Yes<br>• Number of electric vehicles: 1<br>• Share of electrification: 100 % |

| Mobility Service Canvas | |
|---|---|
| **Automated vehicles used per service** | Yes<br>EasyMile EZ10 Gen 1/Gen 2/Gen 3:<br>https://easymile.com/solutions-easymile/ez10-autonomous-shuttle-easymile/<br>• Number of automated vehicles: 1<br>• Gen 1/Gen 2: SAE level 3<br>• Gen 3: SAE level 4 (planned) |
| **Number of vehicles used per service (fleet size)** | 1 vehicle used |
| **Vehicle capacity** | • Total capacity according to Easy Mile: 15 passengers<br>• Seating: 6 passengers; 1 Operator (according to AutomatVV) |
| **Amplitude (Service Period)** | x Daytime<br>☐ Rush hour<br>☐ Off-peak hour<br>☐ Night-time<br>x Weekdays<br>☐ Weekend<br>ϒ Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | Maas: none<br>DRT: planned |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | The test track is ideal for testing automated vehicles in a "first / last mile" scenario in a rural setting in a mixed traffic situation. |

The following text gives a more detailed description of the state-of-the-art.

The Salzburger Verkehrsverbund is the PTA in the State of Salzburg, which includes the City of Salzburg. It is a company that is 100% owned by the State of Salzburg.

Some facts about the Salzburger Verkehrsverbund:

- Manages ca 550 buses, including about 100 trolley buses and
- Manages 5 different train companies from commuter trains to regional trains
- About 189 000 passengers each day, about 69 million passengers per year
- More than 20 operators as partners in the State and City of Salzburg, the State of Upper Austria as well as from Germany/Bavaria

The city of Salzburg is heavily affected by traffic congestion. Every day, 60 000 commuters enter the city centre from the hinterland, a high percentage of private cars. To fight congestion and provide sustainable, it is the aim to implement and test integrated transport, new mobility concepts connecting the hinterland efficiently to the city centre as part of the SHOW project. To bridge first/last mile in PT, automated DRT for connecting peri-urban regions to intermodal mobility hubs are being tested. A MaaS integration is also planned as well as seamless integration with automated and non-automated PT, C-ITS support for higher automation levels.

So far, the Salzburg Verkehr app (see Figure 69) is available that has several MaaS functions:

Functions of the Salzburg Verkehr app:

- Timetable information
- Travel time comparison, car or bus?
- Travel connections with price information and route
- Departure monitor - real-time display of the departure times
- Intelligent map (Mobility Radar)
- Mobile ticket buying

**Figure 69 – Salzburg Verkehr app is comparing routes by PT, bicycle or walking (Source: Salzburg Research Group SFRG)**

Motivation to be part of the SHOW project is to test automated DRT for connecting peri-urban regions to intermodal mobility hubs (bridging first/last miles in PT).

### 9.1.4 Vienna

The Mobility Service Canvas (MSC) gives a fast overview over the project auto.Bus – Seestadt in Vienna.

**Table 68 – Mobility Service Canvas auto.Bus - Seestadt**

| Mobility Service Canvas | |
|---|---|
| Name | **auto.Bus – Seestadt**<br>Mobility provider: Wiener Linien<br>Project Partner: Austrian Institute of Technology (AIT), TÜV Austria, Kuratorium für Verkehrssicherheit (KFV), Siemens Mobility, Navya |

## Mobility Service Canvas

Short description

The research project auto.Bus – Seestadt is being funded by the Federal Ministry for Transport, Innovation and Technology as part of the “Mobility of the Future” scheme. The project aims to enhance the operational quality of future autonomous bus routes by means of planned technological innovations. The goal is to sustainably increase the efficiency and operational safety of autonomous vehicles, with the ultimate goal of operating a bus line in Seestadt under real conditions – with stops, timetables and real passengers.

The first fully autonomous minibus to drive the route will be the "AUTONOM SHUTTLE" produced by NAYVA. It is powered by an electric motor, can take up to 10 passengers and is already navigating various test around the world routes today. The bus travels at speeds of up to 20 km/h and one of the 11 spaces is reserved for the operator, who is responsible for safety onboard.

Website / Reference

https://www.wienerlinien.at/eportal3/ep/contentView.do/pageTypeId/66533/programId/4400867/contentTypeId/1001/channelId/-4400685/contentId/4201540

https://www.ait.ac.at/en/research-topics/integrated-mobility-systems/projects/autobus-seestadt/

Video:
https://youtu.be/EhjSydeVfyM

Service Developers

Project Partner:

- Austrian Institute of Technology (AIT)
- TÜV Austria
- Kuratorium für Verkehrssicherheit (KFV)
- Siemens Mobility
- Navya

Primary Operator

Wiener Linien

Target users and mobility needs

People, who live, work or visit Seestadt, a new urban area in the 22nd district of Vienna.

aspern Seestadt is one of Europe's largest urban development projects. Here in Vienna's fast-growing 22nd district in the north-east of the city, a new urban centre is taking shape – a smart city with a heart, designed to accommodate the whole spectrum of life. A multi-phase development through to 2028 will see the creation of high-quality housing for over 20,000 people and, eventually, an equal number of workplaces. Built on a foundation of innovative concepts and forward-looking ideas, this city-within-a-city combines high quality of life with economic drive and offers something for everyone.

Mobility Services

Two electric buses are running in Seestadt as part of the “auto.Bus - Seestadt” research project. Among other reasons, this is being undertaken to further develop sensors that are important for autonomous driving, to test IT security systems and to see how passengers respond to the buses.

Connection to PT: Connect subway station (U2) to Seestadt residential and business area

Mobility Concept + Modal Split (40 per cent cycling and walking, 40 per cent public transport and just 20 per cent car traffic)

Related Services

Service 1

| | |
|---|---|
| | • Connected PT services as part of the Wiener Linien network, such as subway or bus lines<br><br>Service 2<br><br>• Local businesses, e.g. book store, bike shop, vet, pharmacy |
| Mobility Service Operators | Wiener Linien |
| Access to the Services | x Public<br><br>☐ Registered users<br><br>ϒ Private |
| Type of environment | x Urban<br><br>☐ Interurban<br><br>☐ Highway<br><br>☐ Rural<br><br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| Type of infrastructure used | x Mixed traffic lane<br><br>ϒ Dedicated lane |
| Operations Parameters | • Service frequency: on demand<br>• Vehicle utilisiation rate:<br>• Pooling factor: 10 passengers/veh<br>• Replacement rate:<br>• Expected vehicle milage:<br>• Price of the service: |
| Status | ☐ In development, since …<br><br>☐ Trial, since<br><br>x In operation, since 06.06.2019. |
| Areas/routes covered and number of people/amount of goods transported per service | The 2 busses periodically head for ten stops along the two-kilometers-long circular route. The size of the area covered by the route is approximately 1 $km^2$<br><br> |
| Share of trip purpose per service | x Commuting: N/A<br><br>x Business: N/A<br><br>x Leisure: N/A |
| 3rd Party Suppliers and related company size | Project Partner:<br><br>• Austrian Institute of Technology (AIT), LE<br>• TÜV Austria, LE<br>• Kuratorium für Verkehrssicherheit (KFV), RTO<br>• Siemens Mobility, LE |

| Mobility Service Canvas | |
|---|---|
| | • Navya, ME |
| SME Aspects | • No SMEs/Start-ups involved in this project |
| Model type (A) | PTO (public transport operator) and non-PTO based shared mobility services:<br>□ Carsharing<br>□ Bike sharing<br>x Vehicle-based logistics<br>□ TMC-based services<br>ϒ Aggregator-based services and applications |
| Model type (B) | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>□ Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| Model type (C) | from a targeted client type point of view:<br>x B2C<br>□ B2B<br>□ P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| Shared Mobility Aspects | Yes<br>Sharing aspects are:<br>Public Transportation |
| Connected Mobility Aspects | □ V2V<br>x V2I:<br>○ fleet management for vehicles (Position, Access, fuel/battery level …)<br>○ information to customers<br>○ research data for partners<br>□ V2P<br>□ V2N<br>ϒ None |
| Electrified vehicles used per service | Yes<br>According to the manufacturer, the bus can drive for eleven hours before it needs to return to the charging station. However, its actual running time is also dependent on the current temperature setting, the condition of the road, the weather, and the number of passengers to be transported.<br>Number of electric vehicles: 2/2 (100%) |
| Automated vehicles used per service | Yes<br>NAVYA ARMA: |

| Mobility Service Canvas | |
|---|---|
| | https://navya.tech/wp-content/uploads/2017/09/NAVYA_Brochure_Print_EN_Website.pdf<br><br>SAE: 4 |
| Number of vehicles used per service (fleet size) | 2 |
| Vehicle capacity | • Number of seats per vehicle: 10 passengers +1 baby stroller + 1 operator<br>• Total capacity for 2 vehicles: 20 passengers +2 baby strollers + 2 operators |
| Amplitude (Service Period) | x Daytime: 8 – 12 am<br>□ Rush hour<br>□ Off-peak hour<br>□ Nighttime<br>x Weekdays<br>□ Weekend<br>ϒ Vacation |
| MaaS/LaaS/DRT integration level<br><br>**MaaS - Mobility as a service**<br><br>**Laas - Logistics as a service**<br><br>**DRT - Demand-responsive transport** | During the test period, the use of the service is free of charge for passengers with a valid Wiener Linien public transport ticket or pass. |
| Relation to PT (coordinated by PT)<br><br>**PT – Public transport** | Wiener Linien as the PT operator is one of the key partners in the project. |

The following text gives a more detailed description of the state-of-the-art.

The research project auto.Bus – Seestadt is being funded by the Federal Ministry for Transport, Innovation and Technology as part of the “Mobility of the Future” scheme. The project aims to enhance the operational quality of future autonomous bus routes by means of planned technological innovations. The goal is to sustainably increase the efficiency and operational safety of autonomous vehicles, with the ultimate goal of operating a bus line in Seestadt under real conditions – with stops, timetables and real passengers. The first fully autonomous shuttle to drive the route is a NAYVA/Arma. Wiener Linien´s motivation to participate in SHOW was due to its strategic goal to develop shared on-demand services. Furthermore, as for Wiener Linien and the municipality to make the transport system more environmentally friendly.

### 9.1.5 Linköping

The Mobility Service Canvas (MSC) gives a fast overview over the project Linköping MaaS in Linköping.

**Table 69 – Mobility Service Canvas auto.Bus - Seestadt**

| Mobility Service Canvas | |
|---|---|
| **Name** | **Linköping MaaS** |
| **Short description** | MaaS Service including route planning, booking, ticketing, payment and real-time information for bicycle pooling, car rental, carsharing and public transportation. |
| **Website / Reference** | https://sanktkors.se/vara-projekt/linkoping-maas-mobility-as-a-service/ |
| **Service Developers** | • Sankt Kors, Municipality Linköping, Dukaten, Östgötatrafiken, St.D. Staden, Kyyti Group, Ciao Ciao Carsharing, Science Park Mjärdevi, VTI, Linköping University |
| **Primary Operator** | • Municipality Linköping |
| **Target users and mobility needs** | • Inhabitants of Linköping<br>• Tourists<br>• Commuters |
| **Mobility Services** | • Public transportation<br>• Bicycle pooling<br>• Car rental<br>• Carsharing<br>• Planning, booking, ticketing and payment<br>• Real-time information |
| **Related Services** | • No information available |
| **Mobility Service Operators** | • Östgötatrafiken: PT operator<br>• Ciao Ciao Carsharing: Carsharing |
| **Access to the Services** | □ Public<br>x Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>□ Interurban<br>□ Highway<br>□ Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |
| **Operations Parameters** | • No information available |
| **Status** | □ In development, since …<br>□ Trial, since …<br>x In operation, since 1865 |
| **Areas/routes covered and number of** | Linköping |

| Mobility Service Canvas | |
|---|---|
| **people/amount of goods transported per service** | |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | • Municipality Linköping,<br>• Dukaten,<br>• Östgötatrafiken,<br>• St.D. Staden,<br>• Kyyti Group,<br>• Ciao Ciao Carsharing,<br>• Science Park Mjärdevi,<br>• VTI,<br>• Linköping University<br>• Region Östergötland<br>• Municipality Norrköping<br>• Nira Dynamics<br>• Actia Nordic<br>• Combitech<br>• SICK IVP<br>• Municipality Gävle<br>• Sandbacka Science Park |
| **SME Aspects** | • No information available |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>x Carsharing<br>□ Bike sharing<br>x Vehicle-based logistics<br>□ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>x Central Model<br>□ Liberal Model<br>□ Aggregator Model<br>ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br>□ B2B<br>□ P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>Sharing aspects are: |

| Mobility Service Canvas | |
|---|---|
| | • Public Transportation<br>• Carsharing |
| **Connected Mobility Aspects** | □ V2V<br>□ V2I<br>□ V2P<br>□ V2N<br>x None |
| **Electrified vehicles used per service** | • No information available |
| **Automated vehicles used per service** | • No |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • No information available |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Nighttime<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | Maas: integrated planning, links in app, payment for Linköping |
| **Relation to PT (coordinated by PT)**<br>PT – Public transport | Linköpings main PT provider is Östgötatrafiken |

Linköping with a population of 114,300 is a city in southern Sweden, capital of Östergötland County. Transdev (www.transdev.se) is a bus operator for Östgötatrafiken (PTA), providing express and regional bus traffic in the region Östergötland and also Linköping's city traffic with 94 buses. Every year, more than 19 million people travel with Transdev in Östergötland by bus, train and tram. In Östergötland County a total of 30 million people travel with Östgötatrafiken each year.

The MaaS platform for Linköping aims at increasing sustainable transport options in the whole of the city. The platform is currently developed in Linköping serving the need for new solutions how to get around in the city. The new service will bring together several modes of transport and tailor a trip based on the user's needs.

The app will contain travel planning, booking, ticket, payment and real-time information for, among other things, bicycle pools (LinBike), rental cars, sharing cars, parking app (LinPark) and PT. By making it easier to combine several modes of transport, the city becomes more accessible, resources are used more efficiently while contributing to Linköping's goal of carbon neutrality by 2025.

The MaaS service is currently developed in a research project running until 2021. It was planned to tentatively launch the Maas service in summer 2020. Contributing partner to the MaaS are Linköping municipality, Dukaten, Östgötatrafiken, Stångåstaden, Kyyti Group, Ciao Ciao Carsharing, Mjärdevi Science Park, VTI and Linköping University. Dukaten will operate the MaaS in the long-term and develop the mobility service.

The SHOW demonstration in Linköping is on Campus Area with Linköping University, Ericsson, Combitech and 370 more companies (Mjärdevi Science Park) as well as schools, elderly and child-care centres and residential houses. As part of the demonstration, operation of integrated platform for optimisation of transport systems in Linköping will be interfaced to various MaaS schemes.

### 9.1.6 Tampere

The Mobility Service Canvas (MSC) gives a fast overview over the project Tampere MaaS in Tampere.

**Table 70 – Mobility Service Canvas auto.Bus - Seestadt**

| Mobility Service Canvas | |
|---|---|
| **Name** | **Tampere MaaS** |
| **Short description** | The Tampere MaaS service will provide the following services: route planning, public transportation, information about parking and taxi services |
| **Website / Reference** | http://www.maas4eu.eu/tampere-pilot-project/ |
| **Service Developers** | • Siemens<br>• Tuomi Logistiikka |
| **Primary Operator** | • Tuomi Logistiikka |
| **Target users and mobility needs** | • Inhabitants of Tampere<br>• Tourists<br>• Commuters |
| **Mobility Services** | • Public transportation<br>• Carsharing<br>• Taxi<br>• Bike rental<br>• Parking information<br>• Route planning<br>• Real-time information<br>• DRT services such as PALI and NääSMaaS |
| **Related Services** | • No information available |
| **Mobility Service Operators** | • TKL: PT operator<br>• Parking garages: Finnpark<br>• Taxi: ALUETAKSI<br>• Carsharing: Hertz<br>• Bike rental: Easybike, E.A.T. Tampere, Biking.fi, Pakomatkat |
| **Access to the Services** | □ Public<br>x Registered users<br>ϒ Private |
| **Type of environment** | x Urban<br>□ Interurban<br>□ Highway<br>□ Rural<br>ϒ Restricted access areas (such as industrial areas, university campuses…) |
| **Type of infrastructure used** | x Mixed traffic lane<br>ϒ Dedicated lane |

| Mobility Service Canvas | |
|---|---|
| **Operations Parameters** | • Depending on the service |
| **Status** | **MaaS services:**<br>□ In development, since<br>□ Trial, since …<br>x In operation, since<br>**Pali:**<br>□ In development, since<br>□ Trial, since …<br>x In operation, since 2013<br>**NääSMaaS:**<br>□ In development, since<br>x Trial, since 2020<br>ϒ In operation, since |
| **Areas/routes covered and number of people/amount of goods transported per service** | Tampere |
| **Share of trip purpose per service** | x Commuting<br>x Business<br>x Leisure |
| **3rd Party Suppliers and related company size** | •<br>• TKL: PT operator<br>• Parking garages: Finnpark<br>• Taxi: ALUETAKSI<br>• Carsharing: Hertz<br>• Bike rental: Easybike, E.A.T. Tampere, Biking.fi, Pakomatkat |
| **SME Aspects** | • No information available |
| **Model type (A)** | PTO (public transport operator) and non-PTO based shared mobility services:<br>x Carsharing<br>x Bike sharing<br>x Vehicle-based logistics<br>□ TMC-based services<br>x Aggregator-based services and applications |
| **Model type (B)** | from an organizational point of view (see SHOW proposal):<br>□ Central Model<br>x Liberal Model<br>□ Aggregator Model |

| Mobility Service Canvas | |
|---|---|
| | ϒ Social innovation |
| **Model type (C)** | from a targeted client type point of view:<br>x B2C<br> B2B<br> P2P<br>ϒ C2B (e.g. in case consumers sell their data) |
| **Shared Mobility Aspects** | Yes<br>Sharing aspects are:<br>• Public Transportation<br>• Carsharing<br>• Bikesharing |
| **Connected Mobility Aspects** | V2V<br> V2I<br> V2P<br> V2N<br>x None |
| **Electrified vehicles used per service** | • No information available |
| **Automated vehicles used per service** | • No |
| **Number of vehicles used per service (fleet size)** | • No information available |
| **Vehicle capacity** | • No information available |
| **Amplitude (Service Period)** | x Daytime<br>x Rush hour<br>x Off-peak hour<br>x Night-time<br>x Weekdays<br>x Weekend<br>x Vacation |
| **MaaS/LaaS/DRT integration level**<br>MaaS - Mobility as a service<br>Laas - Logistics as a service<br>DRT - Demand-responsive transport | Maas: integrated planning, links in app, payment for Tampere |

| Mobility Service Canvas | |
|---|---|
| **Relation to PT (coordinated by PT)**<br><br>PT – Public transport | Tamperes main PT provider is TKL |

Tampere is a city in Pirkanmaa, western part of Finland with a population of 230 000 and about 600 000 in the metropolitan area surrounding Tampere. The bus traffic in Tampere is handled by Tampere City Transport (TKL). Tampere Regional Transport offers a complete regional bus services and route network with connections to main national services. In the Tampere region PT is organized jointly between eight municipalities, Tampere, Pirkkala, Nokia, Kangasala, Lempäälä, Ylöjärvi, Vesilahti, Orivesi.

Some facts about the public transport operators in the City of Tampere :

- 70 bus lines,
- one bus line with electric buses & charging stations,
- traffic lights with PT preference,
- feeder parking services
- high-level ITS services

The objective is to improve and integrate mobility system with autonomous feeder buses and shared services as MaaS. MaaS encompassing car sharing, ride-sharing, city bikes etc. will be tested with their operators.

In Tampere, a MaaS architecture/concept is under development which integrates various providers of transport services, initially public transport, taxis, and parking garages, and provides travellers with value-added services, such as multimodal travel information and flexible, use-based reservation and payment options.

Demonstrations are to be carried out in connection with the new automated light rail corridor between Hervanta suburb and TAYS University Hospital Campus area with electrified automated DRT services both in Hervanta and TAYS campus. The developed and tested business model will be public-private partnership with multiple service providers and operators and following purchaser-provider model integrating big data system with open scalable architecture.

The City has several strategies that all are related to Sustainable Urban Mobility Planning (SUMP). The aim of the City of Tampere is to promote low-carbon, energy-efficient transport through various mobility service systems and chains to be implemented during the coming years. The city is planning to increase flexible and environmentally friendly mobility and to offer citizens with mobility alternatives.

Tampere´s motivation to take part in the SHOW project is to develop sustainable processes and also long-term contracts for the business models of CCAM.

## 9.2 Business and operating models using Canvas Methodology

### 9.2.1 Business models of existing mobility services of the demo sites

#### 9.2.1.1 Business model canvas Rouen

**Table 71 – Business Model Canvas Rouen**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | • Providing mobility for the City of Rouen/region Rouen Normandy<br>• Experiencing an overall connected transport system |
| **Customer Segments** | • Passenger transport for population ranging from urban areas to rural areas (Commuting, Business, Leisure)<br>• PT users with additional mobility needs |
| **Customer Relationships** | • Via Astuce Network: Transdev Rouen in collaboration with the Rouen Normandie Metropolis is building a multimodal network<br>• Astuce service centre<br>• Hotline/Mail contact<br>• Customer contract |
| **Channels** | • Astuce website<br>• My Astuce app<br>• Rouen Normandy Autonomous Lab |
| **Key Resources** | • Vehicles<br>• Supervision centre with fleet control room, smart infrastructure and secure telecommunications networks<br>• Infrastructure for parking/hand-over, charging<br>• Mobility application My Astuce |
| **Key Activities** | • Infrastructure setup and maintenance including own vehicles<br>• Supervision centre & fleet control<br>• Enhancement of provided services and future services such as of intelligent communication infrastructure & ITS<br>• Marketing and sales |
| **Key Partners** | • PTA Rouen Normandie<br>• Renault as provider of vehicles connected to the PT network infrastructure<br>• OEMs<br>• Municipalities of Rouen Normandie metropolis<br>• PT control centre<br>• Insurance companies<br>• Research |
| **Revenue Streams** | • Ticketing<br>    ○ Subscription (annually, monthly)<br>    ○ Pay per use (ticket, SMS ticket)<br>• Compensation by PTAs<br>• Marginal revenue from advertising |

The business model for Rouen encompasses the mobility App ‘My Astuce” recently launched that provides various MaaS functions for the Rouen Normandy metropolitan area. Autonomous mobility aspects are not yet included.

#### 9.2.1.2 Business model canvas Madrid

**Table 72 – Business Model Canvas Madrid**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | • Providing mobility for Madrid<br>• EMT - to be the reference operator for Urban Mobility in Madrid |
| **Customer Segments** | • Passenger transport for population in urban area (Commuting, Business, Leisure)<br>• PT users with additional mobility needs |
| **Customer Relationships** | • EMT Service centre<br>• Hotline/Mail contact<br>• Customer contract |
| **Channels** | • Website (www.emtmadrid.es)<br>• Interactive map of Madrid<br>• EMT Madrid App<br>• Supporting Opendata Madrid |
| **Key Resources** | • Buses<br>• Infrastructure for underground parking/charging (about 100 charging points/5 fast chargers)<br>• Public bike charging service (207 bike stations)<br>• MaaS platform (available from last quarter 2020) |
| **Key Activities** | • PT provider<br>• Infrastructure setup and maintenance including own vehicles<br>• Enhancement of provided services<br>• Marketing and sales |
| **Key Partners** | • EMT is ownedby Madrid City Council<br>• Part of Madrid Regional Transport Consortium (authority commissioned with planning public transport in Madrid)<br>• Different on-demand mobility providers with e-bikes, e-scooters, etc.<br>• Metro de Madrid (PT)<br>• Madrid in motion – innovation hub collaborative system |
| **Revenue Streams** | • Subscription<br>• Pay per use<br>• Shareholder contributions (Regional transport Authority CRTM) |

The business model for Madrid encompasses the mobility app EMT Madrid which is launched in September 2020 and provides various MaaS functions for the Madrid metropolitan area. It is combining EMT services with other operators in Madrid and in the next years also the autonomous transport chains in Villaverde district. As a publicly owned public transport operator our mission is to improve the service for the sake of the city and its citizens. Therefore, EMT does not have economic interest as such on automation (from the point of view of business opportunities) but as a tool to improve operations, optimize resources and boost innovation to provide the best services. At one hand, for instance, for the demo to be deployed in Villaverde area (service under real traffic conditions), the use of automation will imply improvements in accessibility and inter-modality, as well as increasing the occupancy rate, the vehicle utilisation efficiency and rate, and optimization of duration/length/number of trips, increasing inclusiveness at the same time.

At the other hand, at the Carabanchel area (service within the bus depot), automation can mean an optimization in parking and charging time, as well as improvements in CAPEX and OPEX.

### 9.2.1.3 Business model canvas Salzburg

**Table 73 – Business Model Canvas Salzburg**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | • Providing different modes of transport for the City and State of Salzburg |
| **Customer Segments** | • Passenger transport for population at urban and peri-urban areas (Commuting, Business, Leisure)<br>• PT users with additional mobility needs |
| **Customer Relationships** | • Salzburger Verkehrsverbund service centre<br>• Hotline/Mail contact<br>• Customer contract |
| **Channels** | • Website (www.salzburg-verkehr.at)<br>• Salzburg Verkehr app with intelligent map (mobility radar) with real-time information and routing function<br>• Interactive map<br>• Free audioguide for tourists on bus line 150 |
| **Key Resources** | • Buses, including trolley buses<br>• Infrastructure for parking<br>• Salzburg Verkehr app with intelligent map (mobility radar) with real-time information and routing function |
| **Key Activities** | • PT provider<br>• Infrastructure setup and maintenance including own vehicles<br>• Enhancement of provided services<br>• Marketing and sales |
| **Key Partners** | • About 20 different bus and train operators<br>• Municipalities, urban areas and local communities |
| **Revenue Streams** | • Subscription<br>• Pay per use<br>• Shareholder contributions |

The business model for Salzburg includes the mobility app Salzburg Verkehr and provides various MaaS functions for the State and City of Salzburg. It is connecting many different operators, routes and modes in Salzburg and the neighbouring counties. Growing focus is on peri-urban regions and autonomy/e-mobility.

### 9.2.1.4 Business model Vienna

**Table 74 – Business Model Canvas Vienna (auto.Bus – Seestadt)**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | • Fully automated public bus service<br>• Shortened walking distances<br>• PT stops closer to origins/destinations<br>• Access to a shared motorized transport service<br>• New, comfortable and accessible transport solutions<br>• Cost-effective transport alternatives |
| **Customer Segments** | • Passenger transport for population at urban areas (Commuting, Business, Leisure) |
| **Customer Relationships** | • WienMobil centre<br>• Hotline/Mail contact<br>• Customer contract |
| **Channels** | • WienMobil App<br>• Internet platform (www.wienerlinien.at) |

| BUSINESS MODEL CANVAS | |
|---|---|
| | • PT promotion platform |
| **Key Resources** | • Autonomous PT service in operation<br>• WienMobil app for route planning, ticketing and connected mobility offers |
| **Key Activities** | • Successful pilot period |
| **Key Partners** | • Austrian Institute of Technology (AIT)<br>• TÜV Austria<br>• Kuratorium für Verkehrssicherheit (KFV)<br>• Siemens Mobility<br>• Navya |
| **Revenue Streams** | • Subscription (via Wiener Linien)<br>• Pay per use (via Wiener Linien)<br>• Research fund |

The research project auto.Bus – Seestadt is being funded by the Federal Ministry for Transport, Innovation and Technology as part of the "Mobility of the Future" scheme. The project aims to enhance the operational quality of future autonomous bus routes by means of planned technological innovations. The goal is to sustainably increase the efficiency and operational safety of autonomous vehicles, with the ultimate goal of operating a bus line in Seestadt under real conditions – with stops, timetables and real passengers. The first fully autonomous shuttle to drive the route is a NAYVA/Arma.

### 9.2.1.5 Business model Linköping

**Table 75 – Business Model Canvas Linköping**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | • Providing different modes of transport for Linköping<br>• Long-term partnerships with transport authorities and companies |
| **Customer Segments** | • Passenger transport for population at urban and rural areas (Commuting, Business, Leisure)<br>• PT users with additional mobility needs |
| **Customer Relationships** | • Via Östgötatrafiken, Transdev as operator in city of Linköping and Östergötaland County<br>• Östgötatrafiken service centre<br>• Customer contract<br>• Hotline/Mail contact |
| **Channels** | • Östgötatrafiken website<br>• Östgötatrafiken app<br>• Östgötatrafiken interactive map |
| **Key Resources** | • Vehicles<br>• Infrastructure for parking/hand-over, charging<br>• LinBike<br>• rental cars & sharing cars<br>• parking app (LinPark) |
| **Key Activities** | • Marketing and sales<br>• Infrastructure setup and maintenance including own vehicles<br>• Enhancement of provided services<br>• R&D on new mobility solutions |
| **Key Partners** | • PTA Östgötatrafiken<br>• OEMs<br>• Bike & Car rental |

| BUSINESS MODEL CANVAS | |
|---|---|
| | • Municipality of Linköping<br>• Research (University)<br>• Akademiska Hus (real estate company)<br>• Dukaten (parking) |
| **Revenue Streams** | • Subscription<br>• Pay per use |

The business model for Linköping is focused on providing different modes of transport in urban and peri-urban areas. A MaaS solution is currently under development, to be launched mid-2021, to enhance mobility solutions and decrease car dependency, initiated by the municipality together with new partners.

#### 9.2.1.6 Business model Tampere

**Table 76 – Business Model Canvas Tampere**

| BUSINESS MODEL CANVAS | |
|---|---|
| **Value Proposition** | • Providing different modes of transport for Tampere<br>• Promote low-carbon, energy-efficient transport through various mobility service systems and chains |
| **Customer Segments** | • Passenger transport for population at urban/sub-urban areas (Commuting, Business, Leisure)<br>• PT users with additional mobility needs |
| **Customer Relationships** | • Tampere public transport customer service centre<br>• Customer contract<br>• Hotline/mail contact<br>• Nello Online Service (24/7) |
| **Channels** | • PT promotion platform<br>• Internet platform (www.joukkoliikenne.tampere.fi)<br>• Nysse Mobiili App |
| **Key Resources** | • Vehicles<br>• Infrastructure for parking/hand-over |
| **Key Activities** | • Marketing and sales<br>• Infrastructure setup and maintenance including vehicles<br>• Enhancement of provided services |
| **Key Partners** | • PT provider<br>• Municipalities, urban areas and local communities |
| **Revenue Streams** | • Subscription<br>• Pay per use<br>• Shareholder contributions |

The business model of Tampere encompasses different transport operators aiming at decreasing car-dependency in the city/region of Tampere. Together with a MaaS under development Tampere is putting growing importance to low-carbon, energy-efficient transport through various mobility service systems and chains.

### 9.2.2 Operating models of existing mobility services of the demo sites

#### 9.2.2.1 Operating model Rouen

**Table 77 – Value Proposition Canvas Rouen**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Commuting to job<br>• Using Mobility for leisure activities |

| VALUE PROPOSITION CANVAS | |
|---|---|
| | • More sustainable commuting/traveling<br>• Mobility costs |
| Pains | • Car-dependency<br>• Combining different transport modes/first-last mile<br>• Multiple contracts and different platforms for various mobility providers<br>• Interoperability of different IT-systems and interfaces |
| Gains | • Single contract, cashless payment with a single account (Astuce app/Astuce card) covering all services<br>• Better access to e-mobility & AV (Renault/Transdev)<br>• Reduction of car traffic for a more sustainable mobility |
| **Value proposition** | |
| Products & Services | • My Astuce app integrating PT network infrastructure |
| Pain Relievers | • Single app for planning, reservation and using different mobility services |
| Gain Creators | • Bring more mobility options for a regular PT user<br>• Substitute for private owned cars |

The operating model for Rouen focusses on more sustainable ways for commuting to increase first/last mile and decrease car dependency in the Rouen Normandy metropolitan area. Autonomous mobility and e-mobility aspects are of growing importance.

#### 9.2.2.2 Operating model Madrid

**Table 78 – Value Proposition Canvas Madrid**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Commuting to job<br>• Using Mobility for leisure activities<br>• More sustainable commuting/traveling<br>• Mobility costs |
| Pains | •<br>• Efficiency & reliability of the PT system<br>• Combining different transport modes/first-last mile when commuting<br>• Multiple contracts and different platforms for various mobility providers<br>• Interoperability of different IT-systems and interfaces |
| Gains | • Better access to e-mobility & more flexible on demand services<br>• Single contract, cashless payment with a single account covering more services<br>• Real-time information available<br>• Reduction of car traffic for a more sustainable mobility |
| **Value proposition** | |
| Products & Services | • MaaS combining EMTs mobility options & PT<br>• E-mobility & on-demand solutions<br>• Public charging/ Parking app |
| Pain Relievers | • Simple portal and app for planning, reservation and using different mobility services<br>• More on-demand services increasing reliability/efficiency |
| Gain Creators | • Bring more mobility options for a regular PT user<br>• Increase efficiency of PT<br>• Substitute for privately owned cars |

The operating model for Madrid includes MaaS, e-mobility and on-demand solutions to allow for better access, efficiency and reliability of the PT system in Madrid metropolitan area.

### 9.2.2.3 Operating model Salzburg

**Table 79 – Value Proposition Canvas Salzburg**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Commuting to job<br>• Using Mobility for leisure activities<br>• More sustainable commuting/traveling<br>• Mobility costs |
| Pains | • Connection of peri-urban regions to PT<br>• Car-dependency and traffic congestion in the city of Salzburg<br>• Multiple contracts and different platforms for various mobility provider<br>• Interoperability of different IT-systems and interfaces |
| Gains | • Better access to e-mobility, on demand services & mobility hubs<br>• Reduction of car traffic for a more sustainable mobility<br>• Single contract, cashless payment with a single account covering more services |
| **Value proposition** | |
| Products & Services | • Salzburg Verkehr app<br>• myRegio annual ticket<br>• Park & Ride |
| Pain Relievers | • Simple portal and app for planning and using PT<br>• Overall connected transport system fully implemented to better connect peri-urban regions |
| Gain Creators | • Bring more flexible mobility options for a regular PT user<br>• Substitute for private owned cars, especially for commuters from the peri-urban regions to the City of Salzburg |

The operating model for Salzburg puts growing effort onto the connection to peri-urban regions in the State of Salzburg to decrease car-dependency in these regions and to provide access to PT for further developing areas in the surroundings of the City of Salzburg.

### 9.2.2.4 Operating model Vienna

**Table 80 – Value Proposition Canvas Vienna auto.Bus - Seestadt**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Fully automated public bus service<br>• Shortened walking distances<br>• PT stops closer to origins/destinations<br>• Access to a shared motorized transport service<br>• New, comfortable and accessible transport solutions<br>• Cost-effective transport alternatives |
| Pains | • Expanding PT with demand responsive transport solutions<br>• Network extensions and connection of peri-urban regions to PT |
| Gains | • Access to e-mobility and first/last mile solutions<br>• reduction of car traffic and emissions in Vienna |
| **Value proposition** | |
| Products & Services | • Pilot demonstration Auto-Seestadt |
| Pain Relievers | • First/last mile transport solution |
| Gain Creators | • Bring more mobility options for a regular PT user<br>• Substitute for private owned cars |

The research project auto.Bus – Seestadt is being funded by the Federal Ministry for Transport, Innovation and Technology as part of the "Mobility of the Future" scheme. The project aims to enhance the operational quality of future autonomous bus routes by means of planned technological innovations. The goal is to sustainably increase the efficiency and operational safety of autonomous vehicles, with the ultimate goal of operating a bus line in Seestadt under real conditions – with stops, timetables and real passengers. The first fully autonomous shuttle to drive the route is a NAYVA/Arma.

#### 9.2.2.5 Operating model Linköping

**Table 81 – Value Proposition Canvas Linköping**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Commuting to job<br>• Using Mobility for leisure activities<br>• More sustainable commuting/traveling<br>• Mobility costs |
| Pains | • Multiple contracts and different platforms for various mobility provider<br>• Car-dependencies in Linköping<br>• Availability & comfort of PT in Linköping<br>• Interoperability of different IT-systems and interfaces |
| Gains | • Better access to e-mobility, on demand services<br>• Reduction of car traffic for a more sustainable mobility<br>• Single contract, cashless payment with a single account covering more services<br>• climate protection goals |
| **Value proposition** | |
| Products & Services | • PT with various modes of transport in parallel |
| Pain Relievers | • Overall connected transport system fully implemented<br>• MaaS combining electric/automated vehicles with PT network<br>• Single app for planning, reservation and using different mobility services |
| Gain Creators | • Bring more mobility options for a regular PT user<br>• Substitute for privately owned cars |

The operating model for Linköping encompasses multiple contracts and operators to increase sustainable ways for commuting and to lower car dependency in the Linköping region. This is also the aim of the MaaS solution currently under development.

#### 9.2.2.6 Operating model Tampere

**Table 82 – Value Proposition Canvas Tampere**

| VALUE PROPOSITION CANVAS | |
|---|---|
| **Customer segments** | |
| Customer Jobs | • Commuting to job<br>• Using Mobility for leisure activities<br>• More sustainable commuting/traveling<br>• Mobility costs |
| Pains | • Car-dependencies<br>• Combining different transport modes/first-last mile<br>• Multiple contracts and different platforms for various regional providers |
| Gains | • More flexible and environmentally friendly mobility<br>• Mobility alternatives to the car<br>• Testing measures to see the efficiency such as testing of city bikes, e-bikes, parking norms + shared cars, school mobility plans, commuter parking, MaaS services |

| VALUE PROPOSITION CANVAS | |
|---|---|
| | • Reduction of car traffic for a more sustainable mobility |
| **Value proposition** | |
| Products & Services | • Travelcard<br>• Journey planner (webservice)<br>• Nysse Mobiili (app) |
| Pain Relievers | • Nysse Mobiili for administration and payment tasks<br>• Simple portal and app for planning and using the vehicle<br>• Overall connected transport system fully implemented based on tested measures |
| Gain Creators | • Testing different measure to see their efficiency<br>• Bring more mobility options for a regular PT user<br>• Substitute for private owned cars |

The operating model for Tampere reflects growing efforts to improve and integrate the mobility system with autonomous, demand-responsive and shared services as well as a MaaS solution which is under development currently.

## 9.3 User & Role Analysis including user profiles, mobility needs, relative utility

### 9.3.1 User and Role analysis Rouen

#### 9.3.1.1 User profiles

Rouen has a diversity of geographic areas from historic centre to rural areas, with differences in the passenger demand. Whereas the city of Rouen itself has about 111.000 inhabitants, there are in total nearly 500.000 in the metropolitan area. Many parts can be described as car-dependent. 10% of trips are made with PT, whereas 32% of trips in the city of Rouen is un-motorized and 63% motorized either with own car or as car passenger.

**Roles in the MaaS solution:**

- Service operator (MaaS operator)
- Infrastructure & vehicle provider such as e.g. Renault and PT
- Other mobility option providers/operators (auto-shuttles and auto-buses)
- Maintenance operator
- PT control centre
- Ticket sale reseller
- Billing system operator
- IT provider
- Communication provider
- Marketing provider
- End users

#### 9.3.1.2 Mobility needs

In Rouen exists a strategy for the next 12 years, with objectives to reduce modal share of private car (currently 67%) and pollution as part of the SUMP goals achievement. Integration of electric vehicles and citizens should work in co-creation processes. Transdev is in charge of the autonomous services axis. The area for the AV testing will take place in the heart of Le Madrillet one of the most dynamic areas in Rouen Metropolis, in a strategic point in the south entrance in Rouen.

### 9.3.1.3 Relative utility

Aim of the MaaS and autonomous solutions in Rouen is to offer several new mobility options at different locations, which can act as a substitute for private owned cars and reduce emissions and the volume of traffic within the city.

## 9.3.2 User and Role analysis Madrid

### 9.3.2.1 User profiles

More than half of the 3.3 million inhabitants of Madrid use the public transport as their common way of transport including the metro, the commuter trains and the EMT buses. Every day, around 2.3 million people use the metro which spans the entire city with its 302 stations. EMT supplying buses has 1.6 million passengers on a working day. 7% of Madrid´s inhabitants use PT not at all.

Usage of PT is more frequent in the centre of Madrid than in the surrounding metropolitan area. About 45% of the people living in the centre of Madrid use private cars regularly, in comparison to 50% in the metropolitan area.

**Roles in the MaaS solution:**

- MaaS operator/Service operator EMT
- Infrastructure & vehicle provider EMT
- Other mobility option providers/operators (car, e-moped)
- Other PT such as Metro de Madrid
- Maintenance operator EMT
- Ticket sale reseller
- Billing system operator
- IT provider
- Communication provider
- Marketing provider
- End users

### 9.3.2.2 Mobility needs

Madrid is the third Functional Urban Area in Europe. It provides an interlinked PT system with an extensive metro system, buses, commuter trains, additional services such as e-bike-sharing and many other shared mobility services (e-carsharing, e-scooters sharing, e-motorcycles sharing services). Large investments to the PT have been made, the city is on a mission to reduce pollution levels and is actively encouraging more people to use public transport.

To react to user discontent regarding public bus service in terms of punctuality and frequency, EMT developed also interactive maps with service information helping customers to plan their trips more efficiently, encouraging a more intensive use of public transport. PT providers provide open data for 3rd party developers on an open-data portal since 2011 for further app development.

User acceptance of new mobility services/sharing thus is good such as of full-electric motorcycles, scooters, bikes and cars.

### 9.3.2.3 Relative utility

Despite Madrid´s extensive PT system indicated users that they would use the PT more if further adapted to their needs. Passengers do not see the PT as a time efficient way to commute and see improvements that could be made in terms of density and reliability of the PT system.

Usage of private cars is often due to a lack of a nearby PT station or due to the long-time of commuting with PT. People living in the surrounding metropolitan area using private cars would like to change to PT once arriving in the central area.

### 9.3.3 User and Role analysis Salzburg

#### 9.3.3.1 User profiles

Salzburg as a city has about 155,000 inhabitants, the State of Salzburg in total has 554,211 inhabitants. Modal share in the city is different to the state. In the city 15% of trips is made with PT, 20% with bicycle and another 20% by foot, 44% of trips are made with own car or as car passenger. In the State of Salzburg, an average of 58% of trips is made with own car or as car passenger. Only an average of 12% of trips are made with PT, whereas 28% of trips in average are un-motorised.

**Roles in the MaaS solution:**

- Service operator Salzburger Verkehrsverbund (MaaS operator)
- Infrastructure & vehicle provider
- Other mobility option providers/operators (trolleybuses, commuter trains)
- Maintenance operator
- Ticket sale reseller
- Billing system operator
- IT provider
- Communication provider
- Marketing provider
- End users

#### 9.3.3.2 Mobility needs

The City of Salzburg is heavily affected by traffic congestion. Every day, 60 000 commuters enter the city centre from the hinterland, a high percentage of private cars. Furthermore, The State of Salzburg is one of the most tourism-intensive regions in Austria. Due to large ski areas in the southern districts, the state is in the winter months dominated by tourist traffic in the Alps, especially on the weekends traffic congestions occur.

To fight congestion and provide sustainable, it is the aim to implement and test integrated transport, new mobility concepts connecting the hinterland efficiently to the city centre. To bridge first/last mile in PT, automated DRT for connecting peri-urban regions to intermodal mobility hubs are being tested. A MaaS integration is also planned as well as seamless integration with automated and non-automated PT, C-ITS support for higher automation levels.

#### 9.3.3.3 Relative utility

One of the main challenges in the PT system is the connection of the hinterland to the city. In recent years, the accessibility of none of the municipalities in the state could be improved. Travel time in average has increased, despite frequency, due to high traffic volumes and changes such as new speed limits or roundabouts. The programme Salzburg Molil 2025 foresees necessary improvements thus in the accessibility, improvements for pedestrians and cyclists, in barrier-free mobility and connectivity of the PT system.

Since 2017 user surveys are performed regarding autonomous shuttles. Focus here is on acceptance, safety and security. The answers are good, passengers feel safe and willing to use it as integrated in PT services. Data might be biased due to safety operator always on-board and might be different if no safety operator were present. Passengers are curious to know how the new shuttle service is working but it has to fulfil the purpose of the passenger - if automated or not (reliability, safety and comfort).

### 9.3.4 User and Role analysis Vienna

#### 9.3.4.1 User profile

Vienna has 1.9 million inhabitants and in total 2.6 million in the metropolitan area. It attracts about 7 million tourists each year. On average, about 2.6 million passengers per day use the Wiener Linien network. In total, about 961 million passengers used the Wiener Linien network in 2019.

With 38% of all passenger trips in Vienna made using public transport, PT has a substantially higher share of passenger traffic than cars. Walking (28%) has replaced the car (27%) in second place. The number of holders of a Wiener Linien annual pass (852,000) surpasses the number of registered vehicles in Vienna (by 143,000 in 2019).

**Roles in MaaS solution:**

- MaaS operator/Service operator Wiener Linien
- Infrastructure & vehicle provider (PT)
- Other mobility option providers/operators (car rental, car sharing, e-scooters, etc. )
- Maintenance operator Wiener Linien
- Ticket sale reseller
- Billing system operator
- IT provider
- Communication provider
- Marketing provider
- End users

#### 9.3.4.2 Mobility needs

PT in Vienna is seen as of a high standard, following a consistent strategy and significant investment with regard to e.g. network extensions, adding new mobility services, scheduling/timetables and real-time traffic information. Still further advancements are to be made in terms of automation and barrier free mobility. Furthermore, with regard to expanding PT with private initiatives and commercial mobility providers as well as infrastructure to access mobility information.

Public acceptance of sharing solutions is great. Bike-sharing is already available for 10 years with more than 100 stations and very low access fee. Car-sharing providers widely available, same as for Scooter and kick-scooter sharing providers recently. There are only few complaints from users about shared services, besides visual impact and space occupation by kick-scooters.

The MaaS platform is also used by more than 100,000 users, yet it is not always 100% integrated but with links to the operators. Automation is in introductory phase, yet the automated shuttles have a great acceptance so far on a fixed route of 2 km.

#### 9.3.4.3 Relative utility

Wiener Linien gets very good ratings from users especially for intervals, reliability and price-performance ratio. About 98% of PT users are pleased with the services and offers of Wiener Linien. The two best rated quality features are the frequent intervals on the subway and the well-developed public transport network. In terms of capacity indeed more than 260,000 passengers can ride about 1,000 vehicles at a time.

Users recognize also that the network is constantly being expanded, the intervals are improved and new, state-of-the-art vehicles are acquired. Further positive aspects rated by users are security, cleanness, reliability, and punctuality, furthermore friendliness of staff and space inside the vehicles.

### 9.3.5 User and Role analysis Linköping

#### 9.3.5.1 User profiles

Linköping aims to achieve carbon-neutrality by 2025. As part of this, a substantial decrease of motorised individual transport (55%) will be needed. In terms of active transport, the city aims to increase the share of bike trips in the modal split from 27% to 40% by 2030. This will be supported by e.g. the bike link between Linköping centre and the outer districts and the introduction of an electric bike pool. 10% of passenger trips in Linköping are by public transport.

The SHOW demonstration site at Mjärdevi Science Park has an even higher percentage of motorised individual transport. Mjärdevi Science Park is a workplace for over 7000 people. About 58% of these arrive by private car. Large car-parking spaces and retracted office blocks define the area – together with split functionalities and a heavy reliance on private motorised vehicles. Vallastaden, the neighbouring residential area has a residential for elderly people and a school for children with disabilities.

**Roles in the MaaS solution:**

- Service operator (MaaS operator Dukaten from mid-2021)
- Infrastructure & vehicle provider such as e.g. Transdev and PT
- Other mobility option providers (e.g. LinBike)
- Maintenance operator
- Ticket sale reseller
- Billing system operator
- IT provider
- Communication provider
- Marketing provider
- End users

#### 9.3.5.2 Mobility needs

The science park currently hosts a large amount of free car parking spaces and is conveniently connected to larger regional roads. A desired shift towards more environmentally-friendly behaviour requires the introduction of different, more sustainable transport options. As part of this, city planning needs to be rethought in order to accommodate and enable the use of these transport options. Formerly un- or underused spaces can be repurposed to support such a transition. In Mjärdevi this is realised by enabling more sustainable transport options.

The MaaS platform is another measure to increase sustainable transport options in the whole of Linköping. A MaaS platform is currently developed in Linköping serving the need for new solutions how to get around in the city. The new service will bring together several modes of transport and tailor a trip based on the user's needs.

#### 9.3.5.3 Relative utility

Every year, more than 19 million people travel with Transdev in Östergötland by bus, train and tram. In Östergötland County a total of 30 million people travel with Östgötatrafiken each year. Whereas the traffic in the countryside counts only for 3% of this per year, in comparison to 30% in Linköping area, which has steadily increased in the last years.

Due to the increasing number of passengers, especially in the city of Linköping, there have been complaints about a lack of space in the most popular bus lines. According to a new arrangement, the supply has been increased by about 28% in Linköping in form of e.g. 17 new electric buses. The number of passengers in the countryside of Östergötland County has though slightly decreased in the last year.

### 9.3.6 User and Role analysis Tampere

#### 9.3.6.1 User profiles

Tampere aims at carbon-neutrality by 2030. On a working day about 46% are using privately owned cars, about 13% PT, 9% the bike and about 31% are walking. The aim is to reduce the percentage of cars by 15% in 2030 by increasing usage of PT (to 19%/modal share), bike (to 15%) and walking (to 34%) according to the SUMP of the City of Tampere.

**Roles in the MaaS solution:**

- Service operator
- Infrastructure & vehicle provider
- Maintenance operator
- Ticket sale reseller
- Billing system operator
- IT provider
- Communication provider
- Marketing provider
- End users

#### 9.3.6.2 Mobility needs

The aim of the City of Tampere is to reduce car dependency mainly by increasing flexible and environmentally friendly mobility and by offering citizens with mobility alternatives. In order to develop guidelines how to reduce car-dependency and react to mobility needs, Tampere assumes that testing the measures is very important to see the effectiveness. Due to this, many pilots exist in Tampere that serve different needs such as testing of city bikes, e-bikes, parking norms + shared cars, school mobility plans, commuter parking, MaaS services, 30 km/h areas, winter maintenance.

The City of Tampere is investing in multiple different projects, which include the tramway with feeder transport, multi-purpose arena with high level intelligent services, new intelligent city centre, etc. These smart city development projects and new infrastructure will create a testing platform for smart mobility including autonomous feeder transport services integrated with the whole transport system.

#### 9.3.6.3 Relative utility

Tampere is a student city and the young people are very keen on using and testing new technologies. There are not too many shared services in Tampere so far. However, the current acceptance is rather good. The tests and pilots of autonomous services so far have raised a lot of positive interest. Yet, the majority of population is still unaware of automated driving, but a publicity campaigns, pilots and different media channels have increased awareness. Public transport is becoming increasingly popular, including shared services. There is strong political will to develop shared services.

## 9.4 Success & Failure factors in the field of CCAM

### 9.4.1 Rouen

#### 9.4.1.1 Success factors Rouen

**Infrastructure-Environment:** Infrastructure allows higher safety at higher speeds. There is a relationship between service provision and infrastructure required. Different environments also determine the level of infrastructure required. Low density areas call for less infrastructure while dense areas with huge fleets can highly benefit from huge infrastructure investments. Furthermore, investment in the infrastructure can be seen as a trigger for other additional automation/5G activities.
**Vehicle type:** Transdev is testing different kinds of vehicles, with more or less sensors, shared or not with the infrastructure which has a high impact on the business case.
**Data from demonstrations:** Currently Transdev is acquiring and analysing a lot of data from infrastructure for optimisations, e.g. in regarding sensor placing.
**Relationship technology-service:** Transdev is also testing different hypothesis to connect technologies available with the potential business models to be designed. Moving from tailor made use cases to plug-and-play systems able to be more replicable (increase investments/profit ratio).
**Ecosystem for SMEs/start-ups**: According to Transdev, Rouen offers a rich ecosystem for SMEs and start-ups for collaboration. The target is to source start-ups in the mobility field, not only in automated vehicle technologies.
**Open Innovation:** Approach through open innovation and connecting to other economic domains such as tourism. Now performed through online events and pitch sessions, such as needs-solution meetings and events.

#### 9.4.1.2 Failure factors Rouen

**Business model**: From Transdev´s point of view it would be ideal to integrate the service into the PTO portfolio, e.g. in the regular contract meeting regular expectations. Adapt what is available already for buses to automated services in a competitive price scheme & connected to public funding.
**Improving service:** Development of new services can according to Transdev attract more users and increase revenue by e.g. optimising transit time, offering animation and entertainment services in collaboration with other companies and transforming the driver role into a new role for potentially offering novel services on-board the vehicles.
**Costs:** Transdev foresees at least for the beginning of operations increasing charges for trips as investments will be high. Driver transformation will also represent an added cost at the beginning. Software licenses are also a big part of the costs.

**User acceptance:** Creating the safety feeling for the passengers is very important with functionalities like video feedback where you can see the supervisor or an enabled communications system.

### 9.4.2 Madrid

#### 9.4.2.1 Success factors Madrid

**User acceptance:** EMT´s opinion is that user acceptance is key to success also in the field of CCAV. In Madrid user acceptance of new mobility services/sharing is good such as of full-electric motorcycles, scooters, bikes and cars. Yet CCAV is still too far away from people´s daily routines. Negative news from US might have had a negative impact on people´s view of AV in Spain.

**Public-private partnerships:** In Madrid exists a long tradition of PT cooperating with the private sector such as with on-demand DR services and other mobility providers. The hub "Madrid in motion" is a collaborative system for institutions, organisations, leading companies, start-ups and experts create PT innovations. Madrid has quite a big start-ups ecosystem.

**Communication:** Specially to involve start-ups EMT counts on communication.

**Communication infrastructure:** Not necessarily 5G is needed in EMT´s opinion but other communication infrastructure is important. In addition to this on-board equipment, physical infrastructure such as barriers on the road are needed.

**Open data platform**: EMT sees open data platforms as a great advantage for 3rd party developers to develop app/services that feed upon data. Further usage according to EMT is bi-directional: registered users can up/download data/information to link expected AT & real AT.

**Demonstration:** From EMT´s point of view it would be a success if they would manage to launch a service that is used by a reasonable number of users without access limitations (people with reduce mobility/ areas underserved, etc.)). And SHOW demonstrations can help to push this development forward. Especially as not many references exist today to assess CCAV success and failures. For PTA it is difficult to assess, that is why EMT is involved in these types of demonstrations to see if difficulties can be overcome. According to EMT another relevant aim is to use AV in bus depots, saving human resources, time & space for parking.

**Policy/Politics:** City council of Madrid is pushing for a sustainable, smart, safe mobility plan for Madrid that will be launched soon, yet often in PT there is more a daily base thinking or even conditioned by political cycles, according to EMT.

#### 9.4.2.2 Failure factors Madrid

**Acceptance/skills of employees:** Drivers need to be involved in the tests and developments to see the advantages rather than just seeing it as a risk for unemployment. Necessary skills are needed to maintain CCAV in EMT´s opinion as well as that intelligence will need to remain on the bus to prevent accidents.

**Costs:** Costs for the PT relies on providers such as Navya or Easymile. Especially when it comes to scaling up a pilot/going beyond pilot stage as EMT cannot renew its fleet in a short time yet need to retrofit the fleet. Maintenance and insurance costs are also an important factor for EMT. Questions that are of further importance for EMT are e.g. how much does it cost to have conventional bus in turn to AV? Projects such as SHOW can help making those calculations. Other factors should also be taken into account such social aspects, acceptance, or vandalism for example.

**Uncertainty of AV behaviour:** EMT stresses that it is also important to reduce the uncertainty of AV behaviour to increase the acceptance of the users and society as a whole.
**Reduced capacity of AV:** Now AV have a reduced capacity from EMT´s point of view, as in the city centre more capacity is needed such as e.g. 12m buses. Outskirts are more feasible for AV´s reduced capacity nowadays.
**On-demand services:** CCAV can play a relevant role as on-demand services, especially in areas with lower density, at certain times of the day, yet the ideal location is important for now. AV can also reduce the number of rolling stocks in streets, as an optimised way with less limitations on continuous basis.

### 9.4.3 Salzburg

#### 9.4.3.1 Success factors Salzburg

**Innovation climate:** Innovative municipality is very supportive according to Salzburg research.

#### 9.4.3.2 Failure factors Salzburg

**Maturity:** According to Salzburg Research maturity of the current ecosystem has to be increased, now in research state using vehicle prototypes. Furthermore, if moving from pilot to implementation some value chain restructuring will need to happen. Shuttles are not able to work completely autonomously for the moment. When this happens, the PTO could perhaps take over all operations.

**Innovation climate:** Innovative municipality is very supportive according to Salzburg research.

**Positive CCAV business case:** From Salzburg research point of view, there are the following requirements for CCAVs, namely traffic modelling capabilities, traffic digital maps, ITS-G5, ITS wireless technologies. Nice to have: Roadside units and on-board units in the shuttle. There are also quite few constrains like the need for 2 lane roads (no possible with just one lane), slope no more than 10% (now is 8% and already quite challenging), no icy road but slightly wet ones. No able to drive on heavy rain and snowfall. Also, vegetation in the road is an obstacle, road needs to be clean from vegetation, especially critical in rural areas. Some vegetation also private. Need for very good internet connection and GPS signal, challenging in rural areas. The shuttle should be able to adapt to any environment and now it is still not the case.

### 9.4.4 Vienna

#### 9.4.4.1 Success factors Vienna

**Customer acceptance:** A key aspect when introducing a new technology is the user acceptance. To achieve a pleasant driving experience and to strengthen confidence in the driving skills of the autonomous vehicle, in case of an autonomous minibus, passengers and other road users have to be addressed as well. Tools for conveying autonomous driving decisions and context information of the vehicle for the passengers were developed by Wiener Linien.

**Concept and planning:** The concept and planning of the PT stops was converted to the special requirements of the vehicle (10-20 people and full autonomy of the vehicle). In particular, the development of solutions for barrier-free access is discussed. For this purpose, a computer-aid planning tool for evaluating vehicle interior and PT stop design for performance, comfort and safety is being further developed.

**Traffic safety:** During the implementation of a new mobility service, Wiener Linien takes the aspects of traffic safety into account. The results are used to reduce conflicts with automated vehicles and thus increase traffic safety. For this purpose, an intersection in the test area was observed for several days.

**Problem Resolution Management (PRM) process:** the creation and implementation of a project-specific problem resolution management process based on ASPICE was carried out by Wiener Linien regarding occurring problem cases and situations. The process regulates the processes and responsibilities in the event of problems with the vehicles (e.g. technical problems, accidents, malfunctions, etc.).

**Infrastructure/Data:** Wiener Linien points out the importance of infrastructure and data available such as vehicle-infrastructure communications and fleet management, fuel and battery level information, information for customers and data collection platform for researchers.

**Modelling:** Wiener Linien regards micro- and macro-modelling as a necessary tool to assess the relevance of investing in CCAVs. It is positive if cities have already models available, yet a lot of data is needed, including stated preference and revealed preference surveys, pricing strategies can be included as well. On macro-level the complete traffic network can be analysed (e.g. extending the metro line, building a dedicated lane, sharing solutions, park and ride schemes, implementation of on-demand services with huge fleets…).

#### 9.4.4.2 Failure factors Vienna

**Upscaling/Costs:** Wiener Linien stresses that new business partnerships need to be established towards future upscaling and to achieve a sustainable financial structure. In-depth analysis of APEX and CAPEX, identify hidden costs in the cost structure in order to design the pricing and revenue structure. It is also important to have a good operational model looking at safety, accessibility, financially sustainable and quality standards of Wiener Linen.

**Policy/Politics:** Strategic goals defined in the SUMPs need to be fulfilled by the research projects, according to Wiener Linien to push the public transport system towards achieving modal split and $CO_2$ emissions targets and reducing the total energy use in the transport system.

**Integration:** According to Wiener Linien, integration into to the system is the most important, independently on the vehicle. If the research is successful the consideration of innovative revenue scheme is foreseen, e.g. time-based pricing more analogous to car-sharing type of pricing strategies.

### 9.4.5 Linköping

#### 9.4.5.1 Success factors Linköping

**Regulation & Policy:** According to Transdev policy and regulations should stimulate innovation and development such as by policy labs for testing in secure conditions. Improved and ensured policies can lead to better agreement between stakeholders (public and private ones).

**Sales:** Following the legal changes until 2012 in Sweden, new possibilities opened up for market initiatives by private operators, e.g. for deregulated services to fill gaps in the network. Although in practice the public transport network is so extensive already in most regions that profitable gaps in this network are very few.

#### 9.4.5.2 Failure factors Linköping

**Business model:** Transdev as an operator sees a need to better mix how the public and the private actors have responsibility and blend this together – especially for first/last mile. There is a gap how the business model should look (b2b, b2c, mobility package for employees, etc) that could be further investigated. After much attention has been given to the technical development, more attention should be given now to business model development. These can lead from this phase of feasibility studies and pilots towards a long-term strategy and a landscape of running operations (business model as a catalyst to move from prototypes into live usage).

**Sharing culture:** Transdev sees that there is a need to learn more about the Swedish culture and sharing in small vehicles (the smaller the vehicle, the more intimate). There are two trends towards individuality and towards sharing solutions. Willingness to pay is also necessary to be successful.

**Operational capabilities in vehicles**: It would be important according to Transdev to look more at the man-machine relationship, to solve issues such as how acceptable is it to have errors?

**Organisational:** There is an expectation towards PTA to handle everything that is connected to mobility (new micro mobility excluded). It can be a failure from Transdev´s point of view that PTA should have the responsibility for everything.

**Technical capability:** Overall technical capability is improved, such as speed and intuitively acting to other road users, which is a success according to Transdev. Yet, technical maturity of autonomous solutions is sometimes overestimated at first hand and then passengers regard the speed of AV as slow. Furthermore, complexity increases as for example the higher the speed, the better the safety standards need to be.

**Costs:** Costs of the vehicles, backoffice costs and high software costs in comparison to hardware costs are an important factor in Transdev´s view. Furthermore, the revenue structure is very static today. This could be changed by a more hybrid public-private structure and that not all revenue is coming from PTA. 9.3User & Role Analysis including user profiles, mobility needs, relative utility.

### 9.4.6 Tampere

#### 9.4.6.1 Success factors Tampere

- user acceptance,
- proper functional and technical operation,
- co-operation between the involved actors and stakeholder works,
- successful integration with the existing PT services,
- reliable and secure communication networks are used,
- proper business models have been tested and developed

#### 9.4.6.2 Failure factors Tampere

- user do not use & accept the services
- technical and functional elements do not work properly,
- isolated & stand-alone service,
- poor communication solutions,
- no proper business model,

- emerging risks and threat, caused by external factors (for instance COVID-19)

## 9.5 KPI-related analysis of CCAV/MaaS within demo sites including best practices

D2.1 will give a qualitative benchmarking focusing on the success and failure factors of the identified business models, enhanced with quantitative measures within the next deliverables of WP2 and WP16. Yet, in this chapter first business KPIs are listed for the chosen MaaS solutions:

- CAPEX
- OPEX
- Revenue streams
- Pricing strategy
- Revenue growth
- Return on investment after 3 years
- Number and nature of partners
- Vehicle utilization rate
- Occupancy rate
- Vehicle utilization efficiency
- Fleet replacement rate

In the next deliverable D2.2. the quantitative factors will be further collected by interviews, questionnaires and the building of business models in which these information will be collect

### 9.5.1 Madrid

Figures for a KPI-related analysis of Madrid MaaS are not available as the MaaS platform is just launched in September 2020. The figures are taken from the annual report of EMT for 2018 (Empresa Municipal de Transportes de Madrid, 2018).

- **CAPEX**
  - Cost of vehicle fleet: 500,857,473 €
- **OPEX**
  - Repairs, maintenance, services: 7,203,232 €
  - Depreciation costs: 49,689,424 €
  - Personnel costs: 453,463,282 €
  - Material consumption: 6,745,736 €
    - Of which fuel consumption: 637,468 €

- **Revenue streams**: Subscription, pay per use, shareholder contributions

- **Pricing strategy** (not available for MaaS until now):
  - Annual pass/interzonal: € 895
  - Monthly pass/interzonal: € 89,50
  - EMT single ticket: € 1,50

- **Revenue growth:**
  - Result for the year 2018: 600,259,000 €
  - Result for the year 2017: 566,712,000 €
  - Growth in %: 5,92

- **Number and nature of partners:** >5 partners

- **Fleet replacement rate:** 7 years

### 9.5.2 Salzburg

Salzburger Verkehrsverbund is the PTA in the State of Salzburg, which includes the City of Salzburg. The company is 100% owned by the State of Salzburg and has about 20 different mobility providers (cf 9.1.3). Salzburg is aiming to implement and test integrated transport, in particular new mobility concepts efficiently connecting the hinterland to the city centre.

Figures for a KPI-related analysis of Salzburg MaaS are not available as the MaaS integration is planned/under development. So far, the Salzburg Verkehr app is available that has several MaaS functions with much potential to business model enhancement.

Salzburg AG is the biggest mobility provider in Salzburg according to the annual report 2019 (Salzburg AG, 2019). Yet, there are only limited figures available specifically on the public transport, such as from the annual report of Salzburg AG, which comprises sections/subsidiaries such as energy/network, water/heating supply, telecommunications and mobility.

The traffic division will be detached from Salzburg AG, based on a decision taken in 2020, and will be operated in an own company owned by the City and State of Salzburg. For the ongoing re-organisation no figures are available.

Some basic figures showing the potential:

- Salzburger Verkehrsverbund has about 189,000 passengers each day, about 69 million passengers per year including tourists. Salzburg AG had about 49 million passengers/2019 without tourists.

- **Total revenue/traffic division Salzburg AG:** 62.035.169 € (2019)

- **CAPEX (Fixed costs):** Investments in machines and equipment/traffic division Salzburg AG: 15,300,000 € (2019)

- **Revenue Growth/Passengers revenue/Salzburg AG**: 52,200,000 € (+2% in relation to 2018)

- **Revenue streams/Salzburger Verkehrsverbund**: Subscription, pay per use, shareholder contributions

- **Pricing strategy/Salzburger Verkehrsverbund**:
  - myRegion annual pass/all regions: € 595.00
  - myRegion monthly pass/all regions: € 99.00
  - Day pass/all regions: € 37.00
  - Single ticket: from € 1.90/pre-ordered in package of 5 tickets

- **Number and nature of partners**: +20 partners in Salzburger Verkehrsverbund

- **Fleet replacement rate**: 6-9 years/depending on type of vehicle, for rail vehicle 25 years.

### 9.5.3 Vienna

The below provided figures represent the results of the auto.Bus - Seestadt project. auto.bus – Seestadt project was launched in 2019 with a goal to test two autonomous shuttles in a real operation environment. The project is ongoing until the mid of 2021. These figures do not represent the overall MaaS ecosystem of Vienna.

**CAPEX (Fixed costs):** Fixed costs consists of different cost categories:

- Cost of vehicle fleet: vehicles are rented
- Costs of digital infrastructure: 15,000 €

**OPEX (Variable costs):** Variable costs consist of different cost categories:

- Repairs, Maintenance, Services: 7,000 € per month
- Fuel consumption: No costs because Wiener Linien produces the energy used by the vehicles through solar panels
- Other costs: rent of the vehicles: 19,000 € per month including 3,500 € service maintenance cost per vehicle

**Revenue streams:** The auto.Bus – Seestadt research project is being funded by the Federal Ministry for Transport, Innovation and Technology as part of the "Mobility of the Future" scheme.

Future revenues – after implementing the project into a regular service – will be gained through pay per use.

**Pricing strategy:** the use of the service is free. After implementing the service in the regular PT operation the prices will be most likely the same as for the other services of Wiener Linien.

### 9.5.4 Linköping

Figures for a KPI-related analysis of Linköping MaaS are not available as the MaaS integration is planned/under development. Currently, the business model & ecosystem of the MaaS is defined. For example, the price strategy capping.

So far, available figures of the PTA Östgötatrafiken (Östgötatrafiken, 2019) are taken to show the business potential of mobility services. Especially for Linköping it can be stated that 2% of its metropolitan GDP have been and will be spent on operating public transport.

- **CAPEX (fixed costs)**
  - Cost of vehicle fleet: 142,105,730 € (1,478,354,000 SEK)
  - Other external costs: 7,946,691 € (82,671,000 SEK)
- **OPEX (variable costs)**
  - Depreciation costs: 7,715,416 € (80,265,000 SEK)
  - Personnel costs: 9,530,723 € (99,150,000 SEK)
  - Costs of operating public transport (using PT operating cost per PKT as a factor) are cheaper in Sweden than in Europe and compared to the global average, for Linköping 24 cents/passenger kilometre (Kenworthy, 2020).

- **Revenue streams**
    - Pay per use
    - Subscription fee
    - Shareholder contributions
    - Research fund
    - Average PT farebox revenue per PKT (passenger kilotmetre) - measures revenue based on how far people travel on public transport – is about 9 cents.

- **Pricing strategy**
    - Annual pass/whole region: 994.90 € (10350 SEK)
    - Monthly pass/whole region: 110,50 € (1150 SEK)
    - Day pass/whole region: 14,40 € (150 SEK)
    - Single ticket/whole region: 7,20 € (75 SEK)
    - Linköping recovers 41% of its transport operating costs from the farebox.

- **Revenue growth:**
    - Result for the year 2019: 165,039,256 €
    - Result for the year 2018: 153,596,043 €
    - Growth in €: 11,443,213 €

- **Number and nature of partners Östgötatrafiken:** 5 partners as operators (such as Arriva, Transdev, SJ, etc.)

- **Occupancy rate:**
    - PT vehicle occupancy 14.4 pers/unit
    - PT seat occupancy 19%

- **Vehicle utilization efficiency:**
    - Linköping spends 2% of its metropolitan GDP on operating public transport, which shows the growth rate for public transport

- **Fleet replacement rate:** 5-7 years

### 9.5.5 Tampere

The bus traffic in Tampere is handled by Tampere CityRegional Transport (https://joukkoliikenne.tampere.fi/en/frontpage.html), offering a complete city and regional bus services and route network with connections to main national services. In the Tampere region a MaaS encompassing car sharing, ride-sharing, city bikes etc. is under development and will be tested with their operators, thus no figures are available for the MaaS/CCAM yet.

For the Tampere City Transport the following figures are available from the annual report of 2019 (TKL, 2019):

- **<u>OPEX (variable costs)</u>**
    - Cost of materials & services: 7,508,776 €
    - Depreciation costs: 2,446,619 €
    - Personnel costs: 17,806,472 €

- **<u>Revenue streams:</u>**
    - Pay per use
    - Subscription fee

- **<u>Pricing strategy:</u>**
    - Annual pass/whole region: 860 €
    - Monthly pass/whole region: 115 €
    - Day pass/whole region: 15,00 €
    - Single ticket/whole region: 7,20 €

- **<u>Revenue growth:</u>**
    - 2019: 29,191,152 €
    - 2018: 28,540,291 €
    - Growth in €: 650 861

- **<u>Number and nature of partners</u>**: 5 operators in Tampere

- **<u>Fleet replacement rate</u>**: 7 years (bus)

# 10 Benchmarking of existing mobility services

The goal of this chapter is to conclude the different examples of mobility services and business models that were thoroughly built in the previous chapters. The business models will be analysed for their type of business model based and each key component and mobility service.

For future use of the document and maybe further adaptions with results from interviews and questionnaires also the following business KPIs are important for a quantitative analysis but will be extended with a second benchmarking table that focuses on the following quantitative details and support the development of the new business models A2.2:

- CAPEX
- OPEC
- Revenue streams
- Pricing strategy
- Estimated revenue growth
- Return on investment after 3 years
- Number and nature of partners
- Vehicle utilization rate
- Occupancy rate
- Vehicle utilization efficiency
- Fleet replacement rate

The benchmarking of D2.1 focuses mainly on the **Mobility Service Canvas** and clusters the different mobility services. Each mobility service builds the baseline for the development of business models in the business model canvas of D2.2 which is why the results of this benchmarking are crucial for continuing the project work.

## 10.1 Identified business models

Business models describe or prescribe more specifically how resources are combined and transformed in order to generate value for customers and other stakeholders, and how a value generating company will be rewarded by its exchange partners that receive value from it.

In this deliverable the identified business models of the Mobility Service Canvas are reported with their according roles and mobility needs. The in-depth business modelling and comparison of business models will the done in deliverable D2.2.

The following business models could be identified:

<u>Cluster: Traditional Public Transportation (10)</u>

- Bus
- Bus Rapid Transit
- Coach bus
- Tram
- Rail
- Metro
- Ferry
- Shuttles
- Taxi
- Bike Sharing/ E-Scooter

Public Transportation services (5)

- Parking
- Digital services (online tickets, routing)
- Car sharing
- Car rental
- Paratransit & Ambulance services

Logistics (1)

- Logistics as a Service

Demand Responsive Transport (4)

- Digital DRT service for low density area (Grenoble Metropole, Rouen Autonomous Lab)
- Transit services (PTFlex services)
- On demand ferry's
- Fixed Line Demand Responsive Transportation

Car Sharing (1)

- (Automated) car sharing services

Mobility as a Service (5)

Mobility as a services describes the shift away from personally-owned modes and is often defined by mobility platforms that combines public transportation offers of a certain area. As traditional public transportation is usually included within these service packages, the report on mobility as a service evaluates the five different service platforms reported in a mobility service canvas.

- ROMA Mobilita
- tim (täglich. intelligent. mobil)
- UbiGo MaaS
- Whim
- Dopravní podnik města Brna

In the following, these business models are analysed regarding their mobility drivers and involved roles.

### 10.1.1 User, Roles and mobility drivers per business model

For the success of building a business (model) it is important to analyse the eco-system in which the business model is to be built. Therefore Table 83 gives an in depths view of the user, roles and stakeholders involved in every identified business model.

For further development of the business models and the business development it is important to closely monitor the stakeholders involved in the models and identify if they are of supportive or defensive nature. The marketing mix and go-to-market activities need to always be re-iterated to include the according mobility needs.

**Table 83 – Roles and mobility drivers per business model**

| | Business Model | Roles/ Stakeholders | Mobility Needs |
|---|---|---|---|
| **Traditional Public Transportation** | Bus | Public Transport Operator<br>Public Transport Authority<br>(Public Transport) OEM | • Transportation in urban, suburban and rural areas<br>• Development towards sustainability (electrification) and automation |
| | Tram | | |
| | Passenger Rail | | |
| | BRT | | |
| | Coach | | |
| | Metro | | |
| | Ferry | | |
| | Parking | | |
| | Car-Sharing | | |
| | Bike-Sharing | | |
| | Taxi | | |
| | Digital Services | | |
| | Shuttles | | |
| | Paratransit& Ambulance Services | | |
| **Logistics** | LaaS | Shippers<br>Transportation companies (truck, rail, ocean, air)<br>Public authority<br>Traffic management<br>Fleet owners | • Transport of goods<br>• Cost intensive last mile transport |
| | **Business Model** | **Roles/ Stakeholders** | **Mobility needs** |
| **Demand Responsive Transportation** | Digital DRT service for low density area (Grenoble Metropole, Rouen Autonomous Lab) | Population in rural areas<br>Public Authorities,<br>PTA<br>Traffic Management<br>PTO | • Offering flexible transportation in an efficient manner for low density area<br>• Improve the quality of service and passenger experience<br>• Decrease the costs of transportation |
| | Transit services (PTFlex services) | | • Provide public transit authorities with on demand mobility solutions tailored to local needs; |

| | | | |
|---|---|---|---|
| | | | • Reduce the cost per passenger-kilometers for transit authorities in low-density areas<br>• Guarantee seamless trips. |
| | On demand ferry's (Sydney) | Public Authority (Port, City, Transport)<br>Traffic Management | • Extend the ferry mobility service to un-serviced bay area;<br>• Operate the services as a complementary and integrated part of the mass transit mix;<br>• Provide customers with a service as fast, reliable, and convenient as a private car. |
| | Fixed Line Demand Responsive | Public Authorities,<br>PTA<br>Traffic Management<br>PTO | • Connecting a low-density neighborhood in rural or suburban areas with the broader PT system or with;<br>• Connecting business park with the rest of the PT network;<br>• Providing night services;<br>• Providing point to point mobility services to disabled or elderly people. |
| **Car Sharing Services** | (Automated) Car Sharing services | Car Sharing Operators,<br>PTO<br>Public Authority<br>Urban citizens | • Reducing the number of individual cars<br>• Offering individual mobility when needed |
| | **Business Model** | **Roles/ Stakeholders** | **Mobility needs** |
| **Mobility as a Service** | ROMA Mobilita<br>tim (täglich. intelligent. mobil)<br>UbiGo MaaS<br>Whim<br>Dopravní podnik města Brna | PTO<br>PTA | • MaaS services are more focused on the needs and values of costumers than the traditional transportation system. With that customer-centric behavior the customer is given higher preferences.<br>• MaaS is much more efficient for the entire transportation system than the present mode of transportation.<br>• MaaS services integrate different types of transportation options under one roof. With that the customer can always access a transportation service if needed. |

### 10.1.2 Success & Failure factors in the field of CCAM (user, technical and organizational aspects)

Public transportation is essential to all our lives. The economy depends upon the capacity to get to and from work. Freight is moved around countries via different logistics services. More and more countries competitiveness is judged using the quality and sustainability of its transport systems. But the believe that many cities have a transportation problem is well established. For the successful building of business models Table 84 therefore takes a look at the different success and failures factors reported for each business model cluster.

**Table 84 – Success and failure factors in the field of CCAM**

| | Success Factors | Failure Factors |
|---|---|---|
| **Traditional Public Transport services** | • Responding to local challenges at the lowest cost<br>Cost control<br>• Meeting all needs of our customers, whether they are passengers, mobility authorities or businesses;<br>• Focusing on operational excellence in order to provide the best possible service at any times and at the lowest cost;<br>• Developing new solutions for future needs and markets;<br>• Safety above all;<br>• Customer acceptance;<br>• Test and learn approach / progressive approach;<br>• REX: regular return of experience and feed-back from all parties, passengers and partners;<br>• Level of cooperation between all partners of the projects: creation of an ecosystem, with public/private actors, industrial, academic, large group, start-ups etc... | • Environmental risks<br>• Safety and security risks<br>• Limits in technology, slowed development<br>• Ability of the public sector to invest in new technologies<br>• Uncertainty on Life Cycle Cost (LCC), providers, monopolistic or competitive markets |
| **(Automated) Logistics** | • Supply Chain optimization<br>• Process improvement<br>• Targeted procurement<br>• Mode shift<br>• Shipper collaboration | • Insufficient degree of innovation in the implementation of digital technologies<br>• Excessive bureaucratization in procedures<br>• Too many empty return journeys<br>• Long waiting times for loading and unloading of goods<br>• Insufficient implementation of platooning |
| **Demand Responsive Transportation** | • Service Design: Finding the right proposition of service to meet the demand for mobility in a cost effective manner<br>• Building a cost effective production<br>• Deployment: Fostering rider ship and service through communication, digital marketing and field presence<br>• Operations and continuous improvement<br>• Technology: Computational capabilities and digital services support enhanced customer experience (plan book pay), service productivity and quality (algorithm for routing and grouping optimization). But they are not at the forefront of what passengers are expecting from the service. They are just tools supporting a mobility service<br>• Deployment: fostering ridership and service use through communication, digital marketing, and on-the-field presence.<br>• Operations and continuous improvement: reaching targeted level of service and quality engagement in day-to-day operations with continuous improvement effort. | • Increasing costs per passenger<br>• Poor understanding of new skill acquisition<br>• Small fleets |
| **Car Sharing Services** | • After a big hype of higher level (SAE Lvl. 4 and 5) car sharing in 2018/ 2019, a lot of services have been put into service but high level of automation still waits for the solving of technical issues | • Missing and limited connected infrastructure for communication of the vehicle<br>• Unresolved regulatory issues |

| | Success Factors | Failure Factors |
|---|---|---|
| | • General strategies are used by car sharing companies to maximize their market penetration and success<br>• Moving towards sharing economy | |
| **Mobility as a service applications** | • Reduced sensor complexity and sinking hardware costs<br>• Demonstration data, Research<br>• Optimization of travel models, overall service<br>• Ecosystem for SMEs/ startups<br>• Open innovation<br>• Building of private/ public partnerships<br>• Open data platforms and interoperability<br>• Increasing majority of technology<br>• Integration of existing public transportation<br>• Shift towards “sharing culture”<br>• Reliable and secure communication networks are used,<br>• Proper business models have been tested and developed | • Missing & Limited infrastructure environment<br>• For the beginning of operation partners foresee increasing costs per trip and high investment sums<br>• Missing user acceptance/ adaption<br>• Current uncertainty of AV behavior<br>• Reduced capacity of AV<br>• Policy and politics<br>• Isolated and stand-alone services<br>• Poor communication solutions |

## 10.2 Benchmarking of well introduced market MaaS Business models / operating models

After identifying the roles/ stakeholders, mobility needs as well as success and failure factors, this deliverable takes a closer look at the most ambitious business models for mobility as a service. MaaS is identified as the most ambitious Use case as it combines multiple other use cases in one interoperable platform and is expected to reshape the mobility as we know it.

Table 85 shows the main findings of five mobility as a service approached that were found in and around the SHOW demo sites. Apart from the defined benchmarking criteria which can be found on the left side of the benchmarking table, a first insight about the business modelling process is given in the bottom part of the benchmarking table, as a preparation for D2.2 which will give further insights on the development of SHOW business models.

**Table 85 – Benchmarking MaaS**

| **Name** | UbiGo - MaaS | whim (MaaS Global Ltd) | tim (täglich.intelligent.mobil) | Dopravní podnik mesta Brna (DPMB) | Roma Mobilitá |
|---|---|---|---|---|---|
| **Primary Operator** | UbiGo | MaaS operator: MaaS Global Ltd | Holding Graz – Kommunale Dienstleistungen GmbH / Holding Graz Linien (PT operator) | Dopravní podnik mesta Brna (DPMB) | Roma Capitale |
| **Target users and mobility needs** | Urban citizens | Urban citizens | Urban citizens | Urban citizens<br>Tourists within the City | Urban Citizens<br>Tourists within the City |
| **Mobility Services** | Mobility Service 1: Public Transport (e.g. SL in Stockholm)<br>Mobility Service 2: Car Sharing(Move about)<br>Mobility Service 3: Car Rental (Hertz)<br>Mobility Service 4: Taxi (Cabonline) | Mobility Service 1: Public Transport<br>Mobility Service 2: City bike<br>Mobility Service 3: Taxi<br>Mobility Service 4: Car Rental<br>Mobility Service 5: E-Scooter | Mobility Service 1: Car sharing<br>Mobility Service 2: Ride sharing<br>Mobility Service 3: Taxi<br>Mobility Service 4: Car Rental<br>Mobility Service 5: Connectivity Service<br>Background Service 1: Billing platform<br>Background Service 2: Public charging | Mobility Service 1: Public Transport<br>Mobility Service 2: "Seniorbus" | Mobility Service 1: Car sharing<br>Mobility Service 2: Bike sharing<br>Mobility Service 3: Taxi<br>Background Service 1: Billing platform<br>Background Service 2: Connectivity Service<br>Background Service 3: Public charging |
| **Related Services** | None | Service 1: Maas open ecosystem for Businesses<br>Service 2: Innovation platform for new breed of digital services | **Indirect via Shareholder Holding Graz/LINZ AG:**<br>Service 1: Energy (Gas, Electric Power, Heating)<br>Service 2: Municipal services | Service 1: Ticket sale<br>Service 2: On-board information and advertisements in paper and digital form<br>Service 3: "Pub tram"<br>Service 4: Boat rides for tourists | Service 1: Roma public transport services<br>Service 2: Roma information system |

| Name | UbiGo - MaaS | whim (MaaS Global Ltd) | tim (täglich.intelligent.mobil) | Dopravní podnik mesta Brna (DPMB) | Roma Mobilitá |
|---|---|---|---|---|---|
| **Mobility Service Operators** | Operator 1: SL in Stockholm (PT provider)<br>Operator 2: Move about (Carpool)<br>Operator 3: Hertz (Car rental)<br>Operator 4: Cabonline (Taxi) | **Different operators for provided services in different areas/cities:**<br>Operator 1: e.g. HSL in Helsinki, Wiener Linien in Vienna (Local PT provider)<br>Operator 2: e.g. TOYOTA, Hertz, SIXT (Car rental)<br>Operator 3: e.g. TIER (E-Scooter sharing)<br>Operator 4: e.g. ALD Sharing (Carsharing)<br>Operator 5: City Bike sharing (Bike sharing) | Operator 1: "tim" (Carpool)<br>Operator 2: "tim card" service (billing platform for e-taxis)<br>Operator 3: Several local e-taxi service providers with "tim" contract (E-taxi in Graz)<br>Operator 4: Anruf-Sammel-Taxi AST (Ride sharing in Linz)<br>Operator 5: Europcar (Car rental)<br>Operator 6: Energie Graz (Public charging) | Operator 1: Dopravní podnik mesta Brna (Local PT provider) | Operator 1: Roma Mobilità (Carsharing, Bike sharing, billing platform "Bus Multi Entry Card", platform for information, platform for calling taxi, infrastructures for electric cars) |
| **Access to the Services** | Registered Users | Registered Users | Registered Users | Public | Registered Users |
| **Type of environment** | Urban | Urban<br>Interurban | Urban | Urban<br>Interurban | Urban |
| **Type of infrastructure used** | Mixed traffic lane | None | Mixed traffic lane | Mixed traffic lane<br>Dedicated lane | Mixed traffic lane |
| **Operation parameters** | Subscription is done via UbiGo app<br><br>Car rental and taxi can be booked without a subscription (via app)<br><br>No membership fee<br><br>Subscriptions can be paused or changed each month<br><br>If SL public transit causes a delay of more than 20 minutes a taxi can be booked for free between the two intended stations/stops | Different Plans whim offers (depending on location):<br><br>Whim to Go (Pay as you go)<br><br>Whim Urban 30 (PT 30 days ticket, limited use of Taxis/city bikes/E-shooters, reduced rate for Rental car)<br><br>Whim Weekend (Urban 30 + Rental car on weekend)<br><br>Whim Unlimited (Mobility flat rate) | Operation time: 24x7 Service<br><br>Car sharing prices (Graz):<br>4€/hour (1st and 2nd hour)<br>6€/hour (3rd and 4th hour)<br>9€/hour (5th to 9th hour)<br>77€ (daily rate)<br><br>Car sharing prices (Linz):<br>5€/hour (1st and 2nd hour)<br>8€/hour (3rd and 4th hour)<br>10€/hour (5th to 9th hour)<br>88€ (daily rate) | Passengers transported in 2018:<br>360,883,000<br><br>Passenger kilometres in 2018:<br>39,263,000<br><br>Operation time: 24x7<br><br>Frequency's:<br>Frequency during rush hours: two minutes<br>Average frequency: ten minutes<br>Frequency during off peak: 20 minutes<br>Frequency during night: 30 minutes<br><br>Price of service:<br>One hour: 25 CZK<br>Yearly ticket: 4,750 CZK<br>Seniorbus: 50 CZK | Operation time: 24h<br><br>On demand service<br><br>Price of service:<br>Carsharing depending on distance: 0.49-0.65€/km or 0.33-0.56€/km<br>Carsharing depending on time: 2.5-3.3€/hour or 1.4-1.7€/hour |
| **Status** | Service in trial, since 2014 in Gothenburg | In operation, since October 2016 in Helsinki | In operation, since 2016 in Graz and since 2018 in Linz | In operation, since 1869 | In operation, since 2009 |

| Name | UbiGo - MaaS | whim (MaaS Global Ltd) | tim (täglich.intelligent.mobil) | Dopravní podnik mesta Brna (DPMB) | Roma Mobilitá |
|---|---|---|---|---|---|
| | Service in operation, since February 2019 in Stockholm | **Rollout:**<br>Birmingham: pilot since 15-12-2016, in operation since March 2018<br>Antwerp: pilot since 30-09-2017, in operation since March 2018<br>Vienna: in operation since October 2019<br>Greater Tokyo: pilot starting soon<br>Singapore: pilot starting soon | For the Styria central area the start is scheduled for 2020 | | |
| **Areas/routes covered and number of people/goods transported per service** | Covered areas:<br>Gothenburg<br>Stockholm | Covered areas:<br>Full service in designated areas | Covered areas:<br>Graz: 15 tim sites, no restrictions on routes areas<br>Linz: 5 tim sites (mid 2020)<br><br>Vehicles available: e-Golf, Skoda Fabia combi, Peugot Transporter | Covered areas:<br>approximately 230 km2<br>Bus routes: 40<br>Tram routes: 11<br>Trolleybus routes: 13<br>Boat routes: 1<br><br>Number of people transported per year:<br>Buses: 123,431,000<br>Trams: 191,714,000<br>Trolleybuses: 45,504,00<br>Boats: 234,000 | Covered areas:<br>Rome Capital areas |
| **Share of trip purpose per service** | Commuting<br>Leisure | No Information | No Information | Commuting: 45 %<br>Business: 30 %<br>Leisure: 25 % | Commuting<br>Business<br>Leisure |
| **3rd Party Suppliers and related company size** | None | Vehicle providers (LE) and PT provider | Public entities, Companies, PT operator | None | PT provider<br>Mobility service provider |
| **SME Aspects** | None | None (but open to any company) | None | None | None |
| **Model Type (A)** | PTO and non PTO based shared mobility services<br>Carsharing | Carsharing<br>Bike sharing<br>Aggregator-based services and applications | Carsharing | Vehicle-based logistics | Carsharing<br>Bike sharing<br>Vehicle-based logistics<br>TMC-based services<br>Aggregator-based |

| Name | UbiGo - MaaS | whim (MaaS Global Ltd) | tim (täglich.intelligent.mobil) | Dopravní podnik mesta Brna (DPMB) | Roma Mobilitá |
|---|---|---|---|---|---|
| | | | | | services and applications |
| **Model Type (B)** | Liberal Model | Liberal Model<br>Aggregator Model | Central Model | Central Model | Central Model<br>Liberal Model<br>Aggregator Model |
| **Model Type (C)** | B2C | B2C<br>B2B<br>P2P | B2C | B2C | B2C |
| **Shared Mobility Aspects** | Yes,<br>Public transportation<br>Carpool | Yes,<br>Public transportation<br>Carsharing<br>Shared-Use Mobility (Taxi)<br>Fixed-route system<br>Private shuttles | Yes,<br>Public Transportation<br>Carsharing<br>Ridesharing (Linz)<br>Shared-Use Mobility (Taxi)<br>Public charging infrastructure | Yes,<br>all services provided by DPMB are shared services | Yes,<br>Public Transportation<br>Carsharing<br>Ridesharing<br>Shared-Use Mobility (Taxi)<br>Private Shuttles<br>Demand response system<br>Fixed routes<br>Cargo delivers by carsharing<br>Public charging infrastructure |
| **Connected Mobility Aspects** | None | V2P | V2I | V2N | V21 |
| **Electrified vehicles used per service** | Yes, Carpool 100 % electrified | Yes | yes, 17 of 45 vehicles are electrified | Yes, trams, trolleybuses and boats are to 100 % electrified | Yes |
| **Automated vehicles used per service** | None | None | None | None | None |
| **Number of vehicles used per service (fleet size)** | More than 100 vehicles in carpool | According to mobility partner | Graz: 45 vehicles<br>Linz: | 322 buses<br>317 trams<br>156 trolleybuses<br>20 minivans<br>6 boats | None |
| **Vehicle capacity (seats per vehicle)** | Depending on service | According to mobility partner | Up to 5 people | Bus: 40 seats<br>Long bus: 70 seats<br>Trolleybus: 40 seats<br>Minivan: 15 seats<br>Tram: 40 seats<br>Boat: 100 seats | Two to Four seats/vehicle |
| **Amplitutde (Service Period)** | Daytime<br>Rush hour | Daytime<br>Rush hour | Daytime<br>Rush hour | Daytime<br>Rush hour | Daytime<br>Rush hour |

| Name | UbiGo - MaaS | whim (MaaS Global Ltd) | tim (täglich.intelligent.mobil) | Dopravní podnik mesta Brna (DPMB) | Roma Mobilitá |
|---|---|---|---|---|---|
| | Off-peak hour<br>Night time<br>Weekdays<br>Weekend<br>Vacation | Off-peak hour<br>Night time<br>Weekdays<br>Weekend<br>Vacation | Off-peak hour<br>Night time<br>Weekdays<br>Weekend<br>Vacation | Off-peak hour<br>Night time<br>Weekdays<br>Weekend<br>Vacation | Off-peak hour<br>Night time<br>Weekdays<br>Weekend<br>Vacation |

| BUSINESS MODELLING | | | | | |
|---|---|---|---|---|---|
| **Revenue Streams (main business model approach)** | Subscription (no membership fees) | Subscription<br>Pay per use<br>Payment transactions | Subscription<br>Pay per use<br>Payment transactions<br>Shareholder contributions | Subscription fee<br>Pay per use | Pay per use |
| **Value Proposition** | Value 1: Gathering mobility needs and solves them<br>Value 2: Cost control and overview for costumer & comfortable payment<br>Value 3: Sustainable transport solution<br>Value 4: Substitute for private car | Value 1: Gathering mobility needs and solves them<br>Value 2: Cost control and overview for costumer & comfortable payment<br>Value 3: Sustainable transport solution<br>Value 4: Substitute for private car | Value 1: Gathering mobility needs and solves them<br>Value 2: Cost control and overview for costumer & comfortable payment<br>Value 3: Sustainable transport solution<br>Value 4: Substitute for private car | Value 1: Providing mobility in a place that is poorly served by transportation modes<br>Value 2: Sustainable transport solution | Value 1: Rented and shared cars are allowed to enter ZTL |
| **Customer relationships** | App users (UbiGo)<br>PT users (SL)<br>Car rental/carpool | App users (Whim App)<br>Partner platforms<br>Partner networks | Tim service centre<br>Customer contract<br>Hotline | Service routes | Rome's Citizen |
| **Channels** | Channel 1: UbiGo App<br>Channel 2: SL cards | Channel 1: Whim App<br>Channel 2: Transport providers<br>Channel 3: Innovative Businesses<br>Channel 4: Cities | Channel 1: Tim app<br>Channel 2: PT promotion platform<br>Channel 3: Internet platform (www.tim.at) | Channel 1: App | Channel 1: App (Mobile phones) |
| **Key Resources** | Resource 1: PT network<br>Resource 2: Carpool<br>Resource 3: App service<br>Resource 4: Customer service | Resource 1: App service (booking and payment platform)<br>Resource 2: Contracts to Transport providers<br>Resource 3: Data (customers, trips, services) | Resource 1: PT connected locations<br>Resource 2: Infrastructure for parking/hand-over and charging<br>Resource 3: IT-platforms and contracts<br>Resource 4: Vehicles | Resource 1: Autonomous vehicle<br>Resource 2: App (booking application) | Resource 1: Vehicles<br>Resource 2: App |

| Name | UbiGo - MaaS | whim (MaaS Global Ltd) | tim (täglich.intelligent.mobil) | Dopravní podnik mesta Brna (DPMB) | Roma Mobilitá |
|---|---|---|---|---|---|
| **Key Activities** | Activity 1: Partner network<br>Activity 2: Finding investors<br>Activity 3: Pilot for testing and adapting services<br>Activity 4: (Getting) support from municipalities and PT<br>Activity 5: (Have) knowledge on customer group and experience | Activity 1: Managing and operating services<br>Activity 2: Attracting customers and partners<br>Activity 3: Expand the network | Activity 1: Marketing and sales<br>Activity 2: Infrastructure setup and maintenance<br>Activity 3: Enhancement of provided services | Activity 1: Marketing<br>Activity 2: Analysis of travellers' behaviour | Activity 1: Car sharing |
| **Key Partners** | Partner 1: Volvo<br>Partner 2: City of Gothenburg/Stockholm<br>Partner 3: Via-ID (investor)<br>Partner 4: Regional PTA (SL/Västtrafik)<br>Partner 5: Carpool (Move about)<br>Partner 6: Car rental (Hertz)<br>Partner 7: Taxi (Cabonline)<br>Partner 8: Research (e.g. RISE, Chalmers) | Partner 1: PT Provider<br>Partner 2: Transport provider<br>Partner 3: Municipalities and local communities | Partner 1: PT Provider<br>Partner 2: Municipalities and local communities | Partner 1: Automated vehicle developers | Partner 1: Vehicle provider (Fiat)<br>Partner 2: Rome municipality |
| **Costumers Jobs** | Job 1: Commuting to job<br>Job 2: Using Mobility for leisure activities<br>Job 3: More sustainable commuting/travelling<br>Job 4: Mobility costs | Job 1: Commuting to job<br>Job 2: Using Mobility for leisure activities<br>Job 3: More sustainable commuting/travelling<br>Job 4: Mobility costs | Job 1: Commuting to job<br>Job 2: Using Mobility for leisure activities<br>Job 3: More sustainable commuting/travelling<br>Job 4: Mobility costs | Job 1: Getting to the event<br>Job 2: Mobility Costs | Job 1: Commuting to job<br>Job 2: More sustainable commuting/travelling<br>Job 3: Mobility costs |
| **Pains** | Pain 1: Costs of mobility/own car<br>Pain 2: Parking costs<br>Pain 3: Flexible solutions needed for mobility<br>Pain 4: Owning a car is not sustainable | Pain 1: Multiple contracts and platforms for various mobility providers<br>Pain 2: Car traffic overload in urban areas | Pain 1: Multiple contracts and platforms for various mobility providers<br>Pain 2: Car traffic overload in urban areas | Pain 1: Limited available time<br>Pain 2: Walking long distances | Pain 1: No entrance zones (ZTL) and private car use in central areas |
| **Gains** | Gain 1: Dense PT system in urban areas<br>Gain 2: Flexible solution for mobility needs<br>Gain 3: No membership fee and monthly subscriptions | Gain 1: All personal mobility data in one app<br>Gain 2: Ticket always at hand<br>Gain 3: Sustainable mobility | Gain 1: All personal mobility data in one app<br>Gain 2: Access to e-mobility<br>Gain 3: Sustainable mobility<br>Gain 4: Single contract, cashless payment | Gain 1: Time savings<br>Gain 2: Getting to the event in time<br>Gain 3: Sustainable mobility | Gain 1: Allowed to enter ZTL |

## 10.3 Benchmarking of all identified business models / operating models

Mobility as a Service (MaaS) explains the notion of shifting the transportation services and solutions to an on-demand service. In place of the individuals owning and operating their vehicles, MaaS benefactors offer a wide range of transport options when and where the user requires them. Rideshare apps (Uber) and peer-to-peer rental services (GoGet, Flexicar) and micro-mobility services (Lime Scooters, Jump Bike) are the well-established examples of MaaS services. Within our benchmarking we could identify five Mobility as a Service examples with the scope of public transportation. The global mobility as a service market can be categorized based on vehicle type, service, application type, business model, enterprise size, end-use industry, and region. All of these factors can be found in Table 29.

This specific sub-chapter is going to summarize the findings of the Mobility as a Service benchmarking.

The following similarities could be identified as a result of the benchmarking:

- All MaaS models feature electrified fleets
- All MaaS models includes shared fleets
- All MaaS models have a subscription fee or/and pay as you use features
- No SMEs are involved in the current state of art of the MaaS models, partners had divided opinion about their integration. Some partners were very open for the entrance of SMEs, for other partners it was out of scope.

These key factors are the defining parameters of future and successful Mobility as a service models.

Apart from these important similarities, the benchmarking showed the approaches of the different MaaS applications regarding the mobility needs of their users. It can be summarized as the following:

- Public transportation is used to meet all conceivable mobility needs. Whether the services are used for commuting, leisure or business reasons
- High mobility demand but has only one rudimentary transportation service. Therefore, the mobility needs of the students, university staff etc. is high in that area, especially if they need to get in time to an event.
- Therefore, other mobility services – such as car-sharing – are a solution to satisfy the need for a car without owning one as well as to have the choice of which mobility possibility is taken
- Simple, flexible, reliable and affordable everyday travel services usable in every situation.
- MaaS covers the very individual mobility need of citizens
- MaaS eases the process of ticketing and make it accessible for foreign tourists

Two very important indirect mobility needs that were found were, that MaaS

- lessens private cars on the streets and
- reduces congestion and emissions in the city.

Public authorities and transportation operators face the struggle with urban planning and congested/ polluted cities every day. MaaS will not only renew their business models and make their organizations more efficient, it will also reduce long term goals from which the inhabitants and decision makers of the area will benefit.

At the end, chapter 10 is supposed to build the baseline and create a base-template of the mobility service canvas for the following deliverables which take a closer look at the business models build by consortium partners and build within the SHOW project. Such deliverables can be identified as e.g. D2.2 and D16.2 whereas the mobility service canvas will also be of interest for several other work packages within the project, that are not directly related to building business models, economics and market deployment/ exploitation like the demo sites or dissemination activities.

## 10.4 Seven proposal for new or extended business models

At last, within this chapter the 7 most promising business and operating models approaches were identified and updated with the feedback of the online survey considering all the information and trends regarding new ideas and extensions of business models and lay a solid base for the further business modelling within D2.2 including the feedback of the pilot sites (done via workshop).

In the following chapters, the business model canvasses contains only the main changes and new aspects not a fully developed business model. This will be done in A2.2.

### 10.4.1 Public Transportation: auto.Bus – Seestadt in Vienna

The identified business model for the use case of public transportation was found in Vienna. It is a fully automated public bus services that fulfils the objective of shortening the walking distances from PT stops closer to destinations. The auto.Bus Seestadt presents itself as a new, comfortable and accessible transport solution that is more cost-effective than other modes of travels. The full business canvas to the auto.Bus Seestadt Vienna can be found in Chapter 4.2.1.3.

The business model addresses people working in Seestadt a city district of Vienna, searching for transport options between their home, workplace or other non-hyper urban areas, eliminating the “last mile” problem as walking ways to the next subway station are rather long.

Solving the problem of the “last mile” is still an open point which is why new business models addressing this are needed.

Figure 70 shows the preliminary business model canvas of auto.Bus Seestadt.

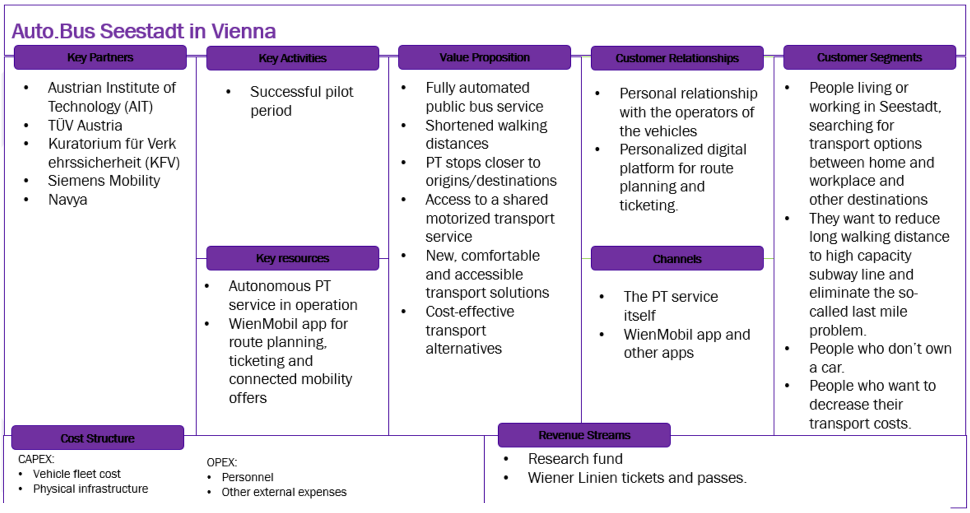



**Figure 70 – Preliminary business model auto.Bus - Seestadt Vienna (Source: SHOW internal)**

## 10.4.2 Logistics-as-a-Service

### 10.4.2.1 Freelway

The first identified business model for LaaS is called "Freelway" and located in Sweden. Freelway is a service app to coordinate and organize transport deliveries in urban areas. The piloting phase is running since 2018 and covers:

- Delivery of groceries, medicine or post (mail)
- Delivery from restaurants of cafes
- Deliveries from private person to friends
- Customer to customer services

Freelway has three main objectives:

- Build freight coordination services to coordinate common resources and transport needs
- Reduce costs and climate impact of transportation by coordinating and sharing vacancies
- Automatization for last mile transport in rural areas

The full description of Freelway can be found in chapter 5.2.1.1 while Figure 71 shows the preliminary business model canvas of the service.

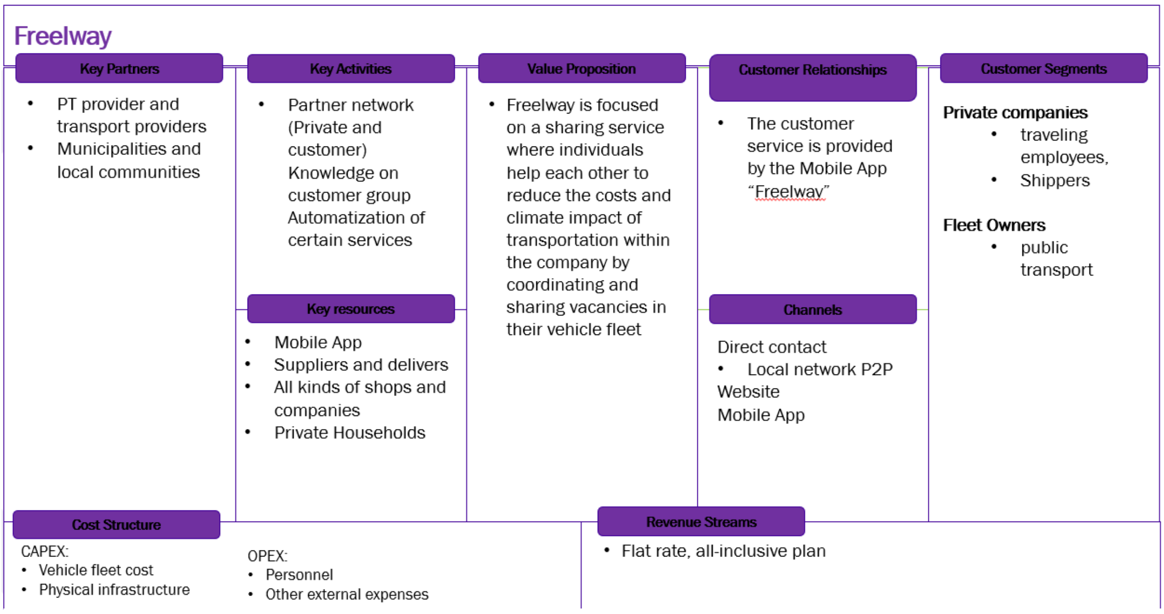



**Figure 71 – Preliminary business model Freelway, Sweden (Source: SHOW internal)**

### 10.4.2.2 EURIDICE

The second business model of logistics as a service evolves from a project named EURIDICE. The main objective of the project is to provide an information services platform with the focus on individual cargo items, their interactions with the surroundings and the stakeholders. EURIDICE therefore provides a fixed and mobile web services infrastructure, for enabling real-time access to cargo information, if needed, to private and public stakeholders along the transportation chain, supporting information retrieval related to the cargo for back-offices and field staff. Information on

EURIDICE can be found in Chapter 5 and the following Figure 72 shows the preliminary business model canvas.

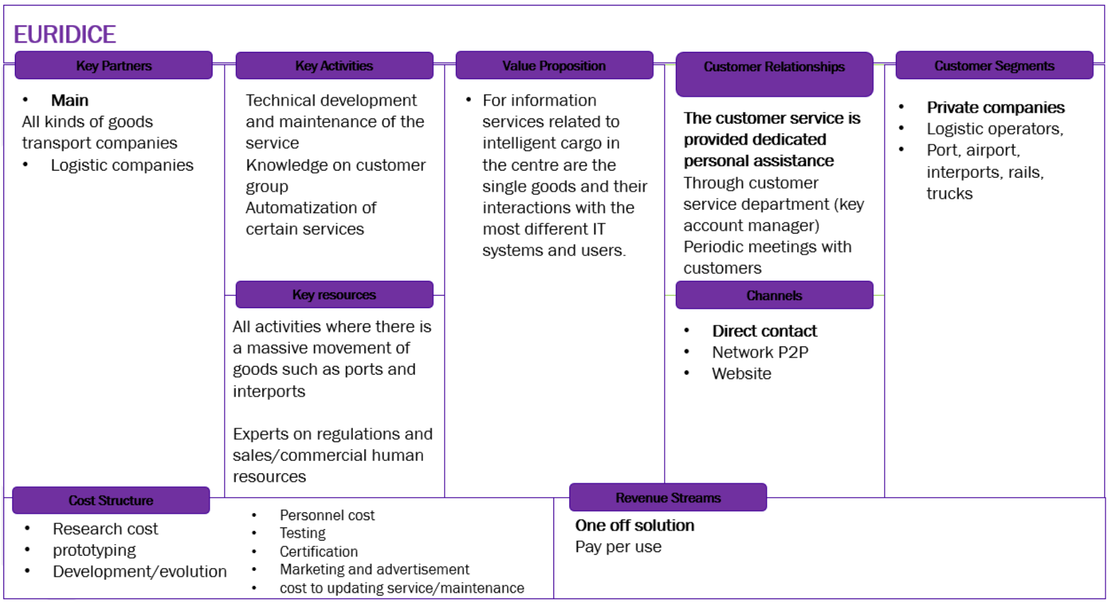



**Figure 72 – Preliminary business model EURIDICE (Source: SHOW internal)**

### 10.4.3 Demand Responsive Transportation: Fully Outsourced

The identified business model for demand responsive transportation is located in Lyon and has the objective to connect the industrial area to the transport network, speaking for the first and last mile. The developed business model canvas is displayed in Figure 73 and further described in chapter 6.1.2.3.

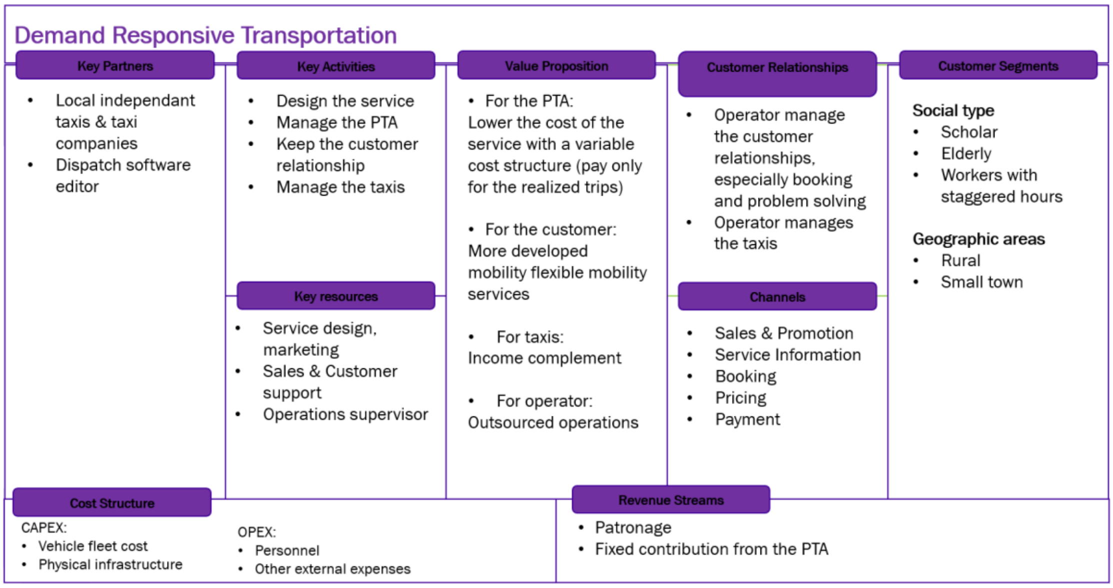



**Figure 73 – Preliminary business model DRT (Source: SHOW internal)**

## 10.4.4 Mobility as a Service

### 10.4.4.1 tim (täglich.intelligent.mobil), Graz, Austria

The identified business models for mobility of a service can cover the other models of transportation and their business models, but combine them for more efficiency.

tim is an innovative mobility model operated by a sub-division of the PTO Graz Linien. It was the frame of a research project in 2018 and is operated now in the city of Graz as well as in Linz.

Figure 74 shows the developed business model canvas. More information on tim can be found in Chapter 8.1.3.

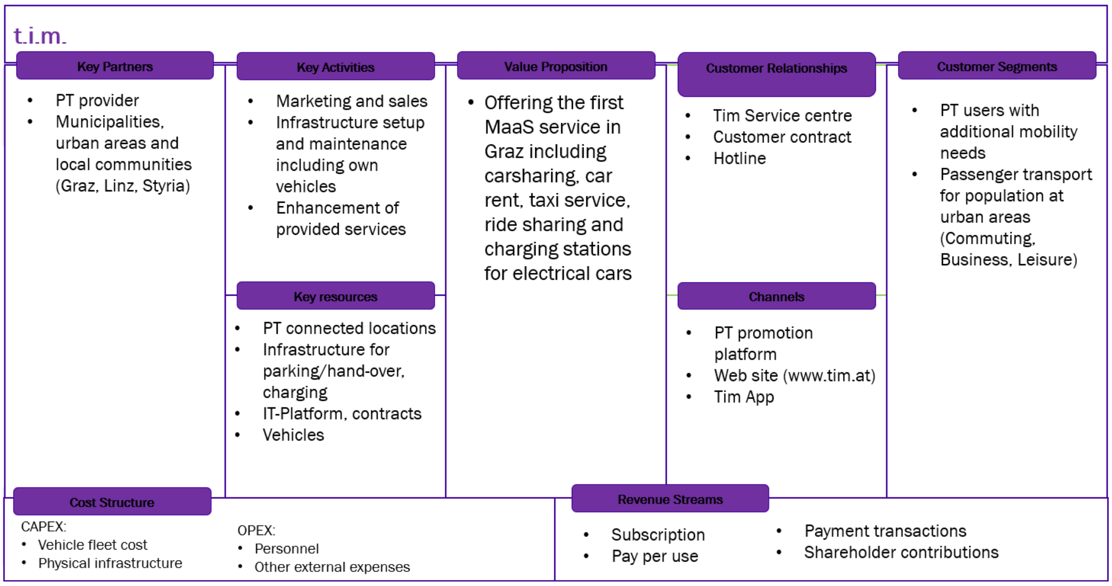



**Figure 74 – Preliminary business model tim, Graz, Austria (Source: SHOW internal)**

### 10.4.4.2 whim

whim is a platform 2.0 solution that includes all possible mobility solutions across Europe and is operated by MaaS Gobal Ltd since 2016.

The special business model of whim is the connection of multiple independent services on one platform under one subscription.

More information about whim can be found in chapter 8.1.5. Figure 75 displays the business model of whim.

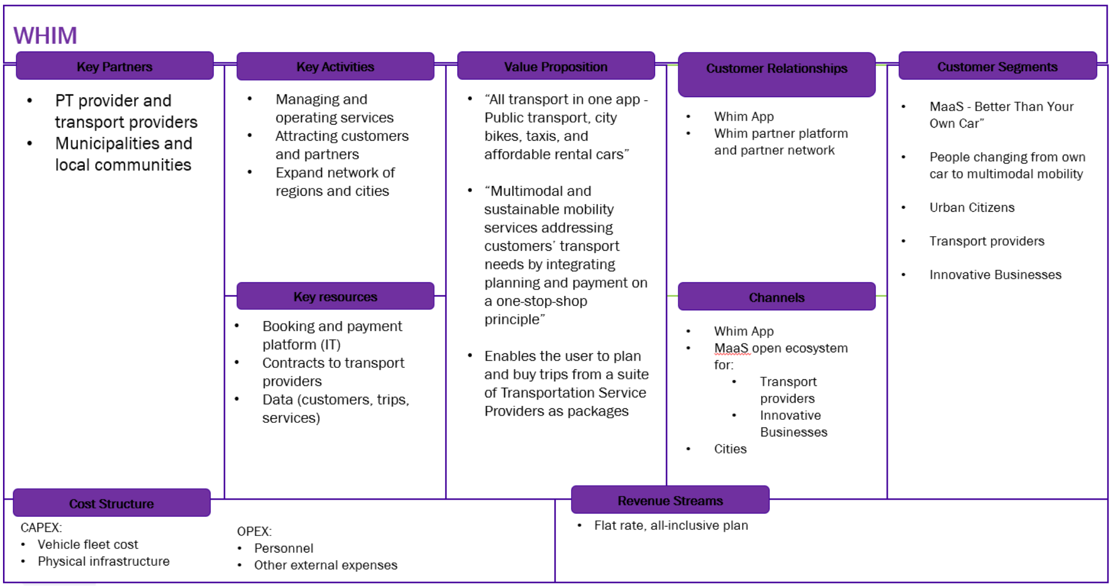



**Figure 75 – Preliminary business model whim (Source: SHOW internal)**

### 10.4.5 Mixed mobility service models

Mixed mobility models are not particularly results that were found during the benchmarking phase of the pilot sites and partners but rather a new business model which will enter the market and reform a lot of traditional business models.

A mixed business model means, that a service combines two different approaches, e.g. the comfortable flexible transportation of DRT as well as parcel delivery, like the mentioned "Freelway" service.

An example of such a future service is shown in Figure 76.

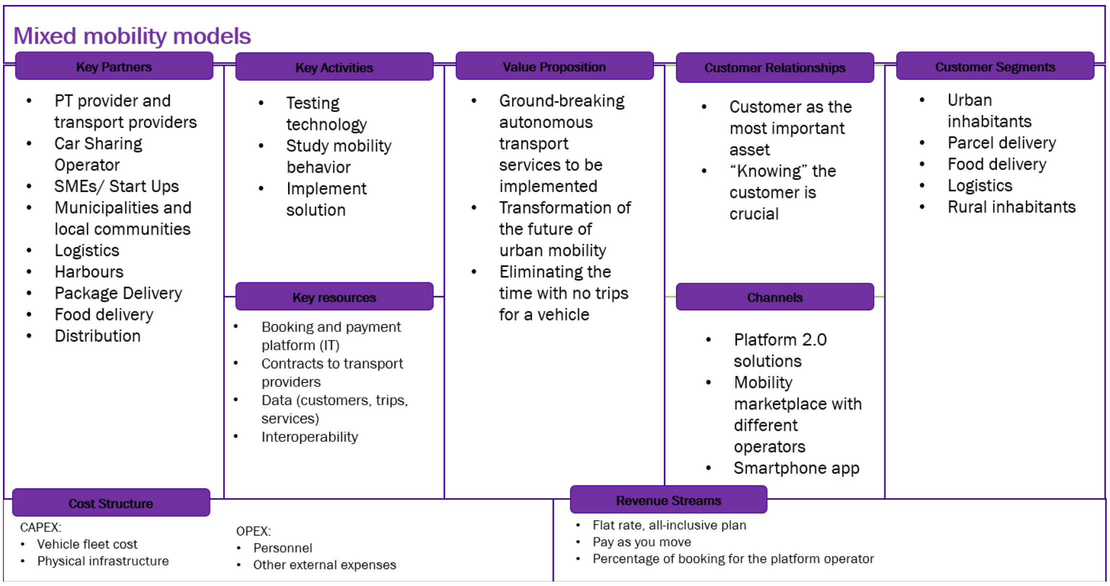



**Figure 76 – Preliminary business model for mixed mobility services (Source: SHOW internal)**

# 11 Conclusions

The main goals of D2.1 are to provide an overview of business and operating models about existing mobility services covering different types of services (MaaS, LaaS and DRT) and to benchmark them to identify relevant potentials for new business and operating models.

The results of D2.1 content the mobility canvas, the business model canvas and value proposition canvas to describe a mobility services and its view on the business and operating models as well as relevant user/operating roles within the business ecosystem and success and failure factors which influences the development of the services during its lifetime.

Based on the benchmarking of the mobility services the following conclusions can be made:

- CAPEX and OPEX are the main barriers for earning money, but OPEX could offer business chances by extending the value chain for the mobility service itself by opening it to new participants.
- Parking vehicles and therefore not used services do not earn money, so it is quite important to maximize the utilization. So considering a mixed mobility services approach (MaaS, LaaS and DRT) could open the way to new business models or to extend existing established business.
- Consideration of the whole business ecosystem including all sub-systems (analysing the second and third line within the mobility service) and all user and operating roles is very important to generate an adequate view with all chances, costs and revenue streams to get a complete picture and to identify business potentials for cost reduction or increased business success
- We have identified relevant success and failure factors which have to be considered like
    - The stakeholders need deep and actual knowledge about you're their business ecosystem and especially about its changes or trends
    - It is important to find the right time, speed and strategy for the expansion of the business
    - The mobility service must cover the different local boundary conditions (customers and their mobility needs, legal restrictions) and must integrate/interact with different other business sectors like tourism, culture or regional specialities to extend the existing business ecosystems and maximize the impact of the mobility service.
- The presented best practice business and operating models show the potential for extending existing models optimizing the cost structure by detailing the value chain and covering this business aspects by new entries, especially by SME and Start-ups to benefit from their flexibility and innovation potential.
- The benchmarking results also shows that there is room for new business and operating models focussing for example on a mixed service approach integrating and combining all relevant strengths of MaaS, LaaS and DRT services to overcome the disadvantages of a single operated mobility services

All the conclusions together with the boundary conditions, the benchmarking and the valuable starting points from the proposal build the "development ecosystem" for the new business and operating models developed in WP2 (A2.2) especially considering the SHOW approach which focuses on SME, start-ups and new entrants, integrate PTO (and do not cannibalize them) and consciously disregarding the basic investments (which is a major barrier for any business especially for a new one). As one a first activity of A2.2,  an online survey will help understand external stakeholders' perception and understanding of success and failure factors, user and roles within the business ecosystem of a mobility services and opportunities to integrate SME/Start-ups/new market entrants in current business. The findings will support the development of novel business and operating models, which will be presented in D2.2.

The results of D2.1 will also be a input source for the evaluation activities within SHOW, to be precise for the evaluation methodology in A2.3 as well as for the business impact assessment methodology in A16.2 were the results will be used to define the evaluation environment as well as specific boundary conditions, e.g. influence from the market entry of SME/start-ups/new entrants in the field of OPEX (A2.3) or effects of new or extended mobility service portfolio for specific stakeholder groups (IT service provider, marketing provider, municipalities…)

Last but not least, the results of D2.1 will be used within WP16 and the D16.1 to identify relevant market competitors for the market analysis in A16.1.

Finally, it can be concluded, that the results of D2.1 including the demo sites interview and workshop will lay a solid base for the business and operating activities within the different WPs of SHOW.

# References

Bay, O. (2020, September 12). ABI Research Forecasts Global Mobility as a Service Revenues to Exceed $1 Trillion by 2030. https://www.abiresearch.com/press/abi-research-forecasts-global-mobility-service-rev/

Brno Municipality. (2017). Modal Split in Brno. https://data.brno.cz/en/graf/delba-prepravni-prace/

Bundesministerium der Finanzen. (2000). AfA-Tabelle für die allgemein verwendbaren *Anlagegüter (‘AV’)*. https://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Steuern/Weitere_Steuerthemen/Betriebspruefung/AfA-Tabellen/Ergaenzende-AfA-Tabellen/AfA-Tabelle_AV.pdf?__blob=publicationFile&v=3

Bundesministerium für Verkehr und digitale Infrastruktur. (2019). Verlagerungswirkungen und Umwelteffekte veränderter Mobilitätskonzepte im Personenverkehr. https://www.bmvi.de/SharedDocs/DE/Anlage/G/MKS/studie-verlagerungswirkungen-umwelteffekte-mobilitaetskonzepte.pdf?__blob=publicationFile

Bundesverband CarSharing e.V. (2016, June). Wirkung verschiedener Carsharing-Varianten auf Verkehr und Mobiläts-Verhalten. https://carsharing.de/alles-ueber-carsharing/umweltbilanz/wirkung-verschiedener-carsharing-varianten-auf-verkehr

Collins, S. (2010, May 7). *Rome: How to use the city’s bike share program*. https://www.eurocheapo.com/blog/rome-atacs-bikesharing-progam.html

Comune di Roma. (2016). Gruppo Roma Capitale. https://www.comune.roma.it/resources/cms/documents/parteciprogrammaint_Lug2016.pdf

Comune di Roma. (2020). Roma e le fasce di salvaguardia ambientale. https://www.comune.roma.it/PCR/resources/cms/documents/Fasce_di_salvaguardia_ambientale_2006.pdf

Demil, B., Warnier, V., & Lecocq, X. (2018). *‘Business model thinking’, business* ecosystems and platforms: The new perspective on the environment of the organization. https://www.researchgate.net/publication/330442460_Business_model_thinking_business_ecosystems_and_platforms_The_new_perspective_on_the_environment_of_the_organization

DPMB. (2019). Annual report of DPMB - Year 2019. https://www.dpmb.cz/cs/firma-vyrocni-zpravy

DPMB. (2020). Pípni a Jed—Bezkontaktní platba za jízdenku—Bez papíru, bez registrace, bez starostí! https://pipniajed.cz/

Empresa Municipal de Transportes de Madrid. (2018). Cuentas Anuales e Informes de Gestión. Informes anuales. https://www.emtmadrid.es/Elementos-Cabecera/Enlaces-Pie-vertical/EMPRESA/Somos/Cuentas-Anuales-e-Informes-de-Gestion.aspx?lang=es-ES

Fluidtime Data Services GmbH. (2020). UbiGo und Fluidtime machen Haushalte in Stockholm und Göteborg unabhängig von Autos. https://www.fluidtime.com/ubigo/

Freelway. (2020). Ett ecosystem av hallbarare mobilitetstjänster. https://www.freelway.com/sidor/usp1-3/ett-ecosystem-av-haallbarare-mobilitetstjaenster

Google Maps. (2020). Map of Kista. https://www.google.de/maps/place/Kista,+Stockholm,+Schweden/@59.4028122,17.9078838,13z/data=!3m1!4b1!4m5!3m4!1s0x465f9e8955005cc9:0xffbb795f2bd6d2cf!8m2!3d59.4024341!4d17.9464824

Graz HOLDING. (2020). tim—Täglich.intelligent.mobil. https://www.tim-oesterreich.at/graz/wp-content/uploads/sites/2/2020/03/tim_produktfolder_februar_2020.pdf

H2020 STARS. (2020). H2020 STARS Website. http://stars-h2020.eu/

Hofmann, F. (2019, January 24). Business Model Scalability: Internal vs External. https://bmilab.com/blog/2019/1/10/business-model-scalability-internal-vs-external#:~:text=Internal%20scalability%20describes%20how%20capable,customer%20base%20and%20increase%20sales.

Kenworthy, J. R. (2020). Sustainable Mobility in Ten Swedish Cities. http://www.k2centrum.se/sites/default/files/fields/field_uppladdad_rapport/working_paper_2020_8_0.pdf

Lee, K.-F. (2018). AI Superpowers: China, Silicon Valley, and the new World Order. Houghton Mifflin Harcourt.

Lubello, V., & Bousse, Y. (2020). Review of new mobility services and technologies and set-up of knowledge. http://h2020-gecko.eu/fileadmin/user_upload/publications/GECKO_D1.1_Review_of_new_mobility_services_and_technologies_and_set-up_of_knowledge_v1.0.pdf

MaaS Global Oy. (2020). whim—All transport in one app. https://whimapp.com/

Merge Greenwich. (2020). Customer attitudes to Autonmous Vehicles and Ride-sharing. https://mergegreenwich.com/wp-content/uploads/sites/13/2018/04/MERGE-Greenwich-Consumer-attitudes-to-AV-ride-sharing-3.pdf

Modulushca. (2020a). M-box prototype design. https://encrypted-tbn0.gstatic.com/images?q=tbn%3AANd9GcQMdqCqUG5g5si2UdH2EeaXqkh3_mVI3NjxZg&usqp=CAU

Modulushca. (2020b). Second M-box prototype. https://encrypted-tbn0.gstatic.com/images?q=tbn%3AANd9GcSpuVPicwmaN-BGtWLc-4V5KisgFEIeYMbaRw&usqp=CAU

Osterwalder, A. (2004). The Business Model Ontology—A Proposition in a Design Science Approach. http://www.hec.unil.ch/aosterwa/PhD/Osterwalder_PhD_BM_Ontology.pdf

Östgötatrafiken. (2019). Arsredovisningar. https://www.ostgotatrafiken.se/info/vi-och-vart-uppdrag/styrelsen/arsredovisningar/

ResearchGate. (2020). First phyical M-box prototype. https://www.researchgate.net/figure/Physical-prototype-of-the-small-M-box-of-the-Modulushca-project_fig9_332111237

Réseau astuce Les Transports en Commun de la Métropole. (2020). City Plan Rouen-France. https://reseau-astuce.fr/ftp/document/pdfplans/plangen2020.pdf

RS Web Solutions. (2020, January 29). A complete Guide on Mobility as a Service (MaaS). https://www.rswebsols.com/tutorials/technology/mobility-as-a-service-maas

Salzburg AG. (2019). Annual Report 2019—Facts. Figures. Data. https://www.salzburg-ag.at/content/dam/web18/dokumente/unternehmen/annual-report.pdf

ShareNorth. (2020). ShareNorth Website. https://share-north.eu/

Statutární mesto Brno. (2020). Spolecny koncernovy zájem. https://www.brno.cz/koncern/

Stockholm Discovery AB. (n.d.). Kista Science City. Retrieved 29 September 2020, from https://www.stockholmdiscovery.se/business-visits-lectures/2019/3/1/kista-science-city

TKL. (2019). Tampereen Kaupunkiliikenne Liikelaitos—Kertomus vuoden 2019 toiminnasta. https://www.tampere.fi/tkl/tk2019.pdf

Transdev Group. (2019). Final Report 2019. https://cdn.transdev.com/wp-content/uploads/2020/03/transdev-group-financial-report-2019.pdf

UbiGo Innovation AB. (2020). Resetjänster för dig och din familjs vardagsresande. https://www.ubigo.me/

UITP. (2019a). Report—Mobility as a Service. https://www.metropolis.org/sites/default/files/resources/Report_MaaS_final.pdf

UITP. (2019b). Ready for MaaS? - Easier Mobility for Citizens and better Data for Cities. https://cms.uitp.org/wp/wp-content/uploads/2020/07/Policy-Brief_MaaS_V3_final_web_0.pdf

UITP. (2020). Public Transport at the Heart of the integrated Urban Mobility Solution. https://efa.greens-efa.eu/legacy/fileadmin/dam/Documents/Events/2016_05_04_shared_mobility_in_rural_areas/2_UITP.pdf

Umweltbundesamt GmbH. (2020). Treibhausgas-Emissionen und Auslastung des Personenverkehrs 2018 nach Verkehrsmitteln. https://www.umweltbundesamt.de/sites/default/files/medien/384/bilder/dateien/10_tab_thg-emi-auslast-pv-2018-verkehrsmitteln_2020-06-08.pdf

VCÖ - Mobilität mit Zukunft. (2020). Carsharing-Systeme im Vergleich. https://www.vcoe.at/carsharing

Wiener Linien. (2020a). WienMobil: Mit einer App die Stadt im Griff. https://www.wienerlinien.at/eportal3/ep/channelView.do/pageTypeId/66526/channelId/-3600060

Wiener Linien. (2020b). WienMobil Stationen. https://www.wienerlinien.at/eportal3/ep/programView.do/pageTypeId/66526/programId/4401236/channelId/-4400944

Wiener Stadtwerke GmbH. (2020, June 22). Geschäftsbericht der Wiener Stadtwerke 2019. https://issuu.com/wstw/docs/gb2019_wrstwerke_gesamt_262113f7894d9b