SHared automation Operating models for Worldwide adoption

SHOW

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D2.2: Proposed business / operating models & mapping to UCs and Pilot sites

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Executive Summary

D2.2 provides the most recent business models of mobility solutions in and outside of the SHOW project for connected, cooperative autonomous vehicles for public transportation. SHOW is a truly Pan-European effort, bringing together all key stakeholder across 13 EU states, with the vision to support the deployment of shared connected and electrified automation in urban transport chains through demonstration of real-life CCAV scenarios to promote seamless and safe sustainable mobility. Therefore, the building of the business models within D2.2 relies heavily on the feedback of consortium partners that are interested in operating tested services long term.

Four operator models have been identified and are mapped back to every business model and the situation at the pilot site.

All SHOW mega sites have been interviewed, regarding their mobility innovation and underlying mobility plans. With these insights, business models and value propositions have been built, resulting in 10 business model canvas', as well as 10 value proposition canvas for several different user groups.

In addition, D2.2 explores sustainable business schemes and services that are cost efficient and modular; in accordance to the existing/planned infrastructure in SHOW and fleets and each city/region as well as the relevant operational and legal framework.

There are two examples not deriving from a SHOW mega site, namely the initiative of the OEM Volkswagen and the nation Qatar, who plan to install a shuttle mobility service for the FIFA world cup 2022. This approach of sponsoring large scale events, can be of interest for SHOW partners e.g. for the Olympics 2024 in Paris.

Furthermore, the deliverable starts looking into the more technical applications. The authors believe that the Internet of Things (IoT) can enhance the experience of automated transport and make it more secure and safe. The example of an interoperable IoT platform is taken from the former Horizon2020 project AUTOPILOT, in which the communication between different sensors, the vehicles and the interoperability platform were tested. This approach makes sense for SHOW, as it is recommended, to build local mobility platforms, featuring all mobility services of a city/ region.

We consider the four following mentioned business models as completely new for the mobility sector, while anoother six business models have derived from SHOW demonstration sites and are built around the automation of public transport services.

1. Mixed mobility models that combine Mobility as a Service and Logistics as a Service and aim for zero vehicle downtime.
2. Autonomous bus depots that will improve the operation and lower costs drastically for innovative public transport operators.
3. The possibility of funding and marketing autonomous fleets through large scale events like the FIFA world cup 2022 or the Olympic Games in Paris 2024.
4. The interaction of automation and the Internet of Things through interoperable IoT platforms, which can only make autonomous public transport safer, more comfortable and more efficient.

D2.2 will be revisited in D2.3: First version of validated business/operating models, where the successful implementation of the business models will be assessed. D16.3: Final business and economic assessment and exploitation plans will also use the business models to evaluate the sustainability and exploitation plans of the demo site partners.

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Table of Contents

Executive Summary 3

Table of Contents 5

List of Figures 10

List of Tables 11

Abbreviation List 12

Terminology 13

1 Introduction 14

1.1 Purpose and structure of the document 14

1.2 Intended Audience 15

1.3 Interrelations 15

2 Methodological Approach 17

2.1 Initial list of operator/ business models 17

2.2 Basic boundary conditions 18

2.3 Demo Site workshops 18

2.4 Business Model Canvas 18

2.5 Value Proposition Canvas 20

3 Basic research results 22

3.1 Insights on Use Cases and benchmarking results 22

3.2 Existing and new business roles 22

3.3 Online Survey 23

3.4 Reports of Demo Site Interviews 25

3.4.1 Germany 25

3.4.2 Spain 25

3.4.3 France 25

3.4.4 Austria 26

3.4.5 Sweden 26

4 Analysis and building of business models based on the demo site Use Cases 27

4.1 Autonomous PT in combination with on-demand services 27

4.1.1 Fore-sighting and business innovation in Aachen, Germany 27

4.1.2 Business Model Canvas 28

4.1.3 Value Proposition Canvas 29

4.1.4 Success & Failure factors 30

4.1.5 Strengths & Weaknesses compared to traditional public transportation 31
4.1.6 Mapping to UC, demo sites and SHOW KPIs 31
4.1.7 Go-to-market strategies and proposed operator model 31
4.1.8 Summary 32
4.2 Autonomous bus depot management 33
4.2.1 Fore-sighting and business innovation in Madrid, Spain 33
4.2.2 Business Model Canvas 34
4.2.3 Value Proposition Canvas 36
4.2.4 Success & Failure factors for EMT 37
4.2.5 Strengths & Weaknesses compared to traditional public transportation 38
4.2.6 Mapping to UC and SHOW demo sites 39
4.2.7 Go-to-market strategies and proposed operator model 40
4.2.8 Summary 41
4.3 Advanced MaaS in urban environments 41
4.3.1 Fore-sighting and business innovation in Rouen, France 41
4.3.2 Business Model Canvas 43
4.3.3 Value Proposition Canvas 44
4.3.4 Success & Failure factors 45
4.3.5 Strengths & Weaknesses compared to traditional public transportation 46
4.3.6 Mapping to UC and SHOW demo sites 46
4.3.7 Go-to-market strategies and proposed operator model 46
4.3.8 Summary 47
4.4 MaaS and LaaS for hospital/campus operations 48
4.4.1 Fore-sighting and business innovation in Rennes, France 48
4.4.2 Business Model Canvas 49
4.4.3 Value Proposition Canvas 50
4.4.4 Success & Failure factors 51
4.4.5 Strengths & Weaknesses compared to traditional public transportation 52
4.4.6 Mapping to UC and SHOW demo sites 52
4.4.7 Go-to-market strategies and proposed operator model 53
4.4.8 Summary 53

4.5 Peri-urban automated transportation and C-ITS connectivity 53
4.5.1 Fore-sighting and business innovation in Salzburg, Austria..... 53
4.5.2 Business Model Canvas..... 54
4.5.3 Value Proposition Canvas..... 56
4.5.4 Success & failure factors..... 57
4.5.5 Strengths & Weaknesses compared to traditional public transportation 57
4.5.6 Mapping to UC and SHOW demo sites 58
4.5.7 Go-to-market strategies and proposed operator model 58
4.5.8 Summary 58
4.6 Robotaxi services for short distance trips 58
4.6.1 Fore-sighting and business innovation in Graz, Austria..... 58
4.6.2 Business Model Canvas..... 59
4.6.3 Value Proposition Canvas..... 60
4.6.4 Success & Failure factors..... 61
4.6.5 Strengths & Weaknesses compared to traditional public transportation 61
4.6.6 Mapping to UC and SHOW demo sites 62
4.6.7 Go-to-market strategies and proposed operator model 62
4.6.8 Summary 62
4.7 Sustainable autonomous public transportation..... 63
4.7.1 Fore-sighting and business innovation in Linköping, Sweden..... 63
4.7.2 Business Model Canvas..... 63
4.7.3 Value Proposition Canvas..... 65
4.7.4 Success factors & Failure factors..... 66
4.7.5 Strengths & Weaknesses compared to traditional public transportation 66
4.7.6 Mapping to UC and SHOW demo sites 66
4.7.7 Go-to-market strategies and proposed operator model 67
4.7.8 Summary 67
4.8 First/Last mile autonomous transportation to mobility HUBs..... 67
4.8.1 Fore-sighting and business innovation in Kista, Sweden..... 67
4.8.2 Business Model Canvas..... 68
4.8.3 Value Proposition Canvas..... 70
4.8.4 Success& Failure factors..... 71

4.8.5 Strengths & Weaknesses compared to traditional public transportation 71
4.8.6 Mapping to UC and SHOW demo sites 71
4.8.7 Go-to-market strategies and proposed operator model 72
4.8.8 Summary 72
5 Additional analysis and building of future business models 73
5.1 Integrated automated and electric shuttle busses for large scale events ... 73
5.1.1 Fore-sighting and business innovation 73
5.1.2 Business Model Canvas 73
5.1.3 Value Proposition Canvas 75
5.1.4 Success factors & Failure factors 75
5.1.5 Strengths & Weaknesses compared to traditional public transportation 75
5.1.6 Go-to-market strategies and proposed operator model 76
5.1.7 Summary 76
5.2 Interoperable IoT mobility platforms 76
5.2.1 Fore-sighting and business innovation 76
5.2.2 Business Model Canvas 77
5.2.3 Value Proposition Canvas 78
5.2.4 Success factors & Failure factors 79
5.2.5 Strengths & Weaknesses compared to traditional public transportation 79
5.2.6 Go-to-market strategies and proposed operator model 79
5.2.7 Summary 80
6 Mapping of value propositions to SHOW users, type of business, sites and Use Cases 81
6.1 Mapping and summarizing the business models for the demo sites 81
6.2 Discussion on the development of new business models 84
7 Conclusions 86
References 88
Annex 1 - Pilot site interview questionnaire 89
Annex 2 - Business Model Cavas 91
Annex 3 - Value Proposition Canvas 92
Annex 4 – Online survey questionnaire 93
Annex 5 - Mega Site Germany, Aachen - Interview Report 95

Annex 6 - Mega Site Spain, Madrid – Interview Report 98
Annex 7 - Mega Site France, Rouen – Interview Report..... 101
Annex 8 - Mega Site France, Rennes – Interview Report 104
Annex 9 - Mega Site Austria, Salzburg – Interview Report 107
Annex 10 - Mega Site Austria, Graz – Interview Report..... 111
Annex 11 - Mega Site Sweden, Linköping – Interview Report 114
Annex 12 - Mega Site Sweden, Kista – Interview Report..... 117

List of Figures

Figure 1 – Methodology and interrelations of A2.2 16
Figure 2 - Satellite map of demo Aachen..... 27
Figure 3 - Aachen Megasite distribution of SHOW Use Cases 31
Figure 4 - Route followed by the automated passenger vehicles. 33
Figure 5 - Routes followed by the automated passenger vehicles 34
Figure 6 - Madrid Megasite distribution of SHOW Use Cases 39
Figure 7 - Rouen city center Use Case - Robo Taxis..... 42
Figure 8 - Rouen peri-urban Use Case - Bus line 42
Figure 9 - Rouen Megasite distribution of SHOW Use Cases..... 46
Figure 10 - Concept for the CHU future campus..... 49
Figure 11 - Rennes Megasite distribution of SHOW Use Cases 52
Figure 12 - Route of the two scenarios in Salzburg 54
Figure 13 - Salzburg Megasite distribution of SHOW Use Cases 58
Figure 14 - Public Transport HUB Puntingam, Graz 59
Figure 15 - Graz, Route between the station and the shopping center 59
Figure 16 - Graz Megasite distribution of SHOW Use Cases..... 62
Figure 17 - Vehicles used in Linköping..... 63
Figure 18 - Linköping Megasite distribution of SHOW Use Cases 66
Figure 19 - Demo Site map, Kista..... 68
Figure 20 - Kista Megasite distribution of SHOW Use Cases 72
Figure 21 - Interoperable IoT platforms for automated mobility..... 77

List of Tables

Table 1 - Business model Aachen - Autonomous PT in combination with on-demand services 28

Table 2 - Value Proposition Canvas Aachen - Autonomous PT in combination with on-demand services 30

Table 3 - Business Model Madrid - Autonomous Bus Depots 35

Table 4 - Value Proposition Canvas Madrid - Autonomous Bus Depots 36

Table 5 - Business Model Rouen - Advanced MaaS in urban environments 43

Table 6 - Value Proposition Canvas Rouen - Advanced MaaS in urban environments 44

Table 7 - Business Model Rennes - MaaS and LaaS for the hospital campus 49

Table 8 - Value Proposition Canvas Rennes - MaaS and LaaS for the hospital campus 51

Table 9 - Business Model Salzburg - Peri-urban automated transportation and C-ITS connectivity 54

Table 10 - Value Proposition Canvas Salzburg - Peri-urban automated transportation and C-ITS connectivity 56

Table 11 - Business Model Graz – Robotaxi services for short distance trips 59

Table 12 - Value proposition canvas Graz - Robotaxi services for short distance trips 60

Table 13 - Business model Linköping, sustainable autonomous public transportation 63

Table 14 - Value Proposition Canvas Linköping, sustainable autonomous public transportation 65

Table 15 - Business Model Kista, First/Last mile autonomous transportation to mobility HUBs 68

Table 16 - Value proposition canvas Kista, First/Last mile autonomous transportation to mobility HUBs 70

Table 17 - Business Model, Large scale event sponsoring 74

Table 18 - Value proposition canvas, Large scale event sponsoring 75

Table 19 - Business Model, Interoperable IoT platforms 77

Table 20 – Value proposition canvas, Interoperable IoT platforms 78

Table 21 - Mapping of scenarios to SHOW Use Cases 81

Table 22 - Overview of value proposition, users and type of business 82

Abbreviation List

Abbreviation	Definition
ADAS	Advanced Driver Assistance Systems
AV	Automated Vehicle
BMI	Business Model Innovation
CCAV	Connected and Cooperative Automated Vehicles
CNG	Compresses Natural Gas
DRT	Demand Responsive Transport
EMT	Empresa Municipal de Transportes de Madrid
EPoSS	European Platform on Smart Systems Integration
ERTRAC	European Road Transport Research Advisory Council
GDP	Gross Domestic Product
GHG	Green House Gas
KPI	Key Performance Indicator
LaaS	Logistics as a Service
MaaS	Mobility as a Service
MSC	Mobility Service Canvas
OECD	Organisation for Economic Co-Operation and Development
OEM	Original Equipment Manufacturer
PSO	Parts Service Organization (**But in this document:** Public Transport Service Organizations)
PT	Public Transport
PTA	Public Transport Authority
PTO	Public Transport Organization
QoS	Quality of Service
SAE	Society of Automotive Engineers
SPACE	Shared Personalised Automated vEhicles (UITP Project
SULP	Sustainable Urban Logistics Plan
SUMP	Sustainable Urban Mobility Plan
TMC	Traffic Management Centre
UC	Use Case
UITP	Union Internationale des Transports Publics

Terminology

Business model	A simplified illustration done through mapping of various components that can be found in every business/ project. The most known methodology for describing business models is the Business Model Canvas, which describes 9 components.
Business plan	A business plan describes entirety of methods to realize a business/ project. The most important components of a business plan are: strategy, business case, finance and the target-performance comparison in the startup phase. A business plan is not a methodology in the project.
Business case	A business case is a sustainable, up-scaled implementation of the piloted scenarios. It describes the business model (qualitative) and a cost & revenue analysis over a certain time. Business cases in SHOW will be developed within D16.2.
Business Ecosystem	The network of organizations—including suppliers, distributors, customers, competitors, government agencies, and so on—involved in the delivery of a specific product or service through both competition and cooperation.

1 Introduction

1.1 Purpose and structure of the document

The vision of a future one wants to live in includes sustainable places where we love to live and work, and to move between and within them. These headline sits at the heart of most long-term visions for future places, mobility, transport networks and systems.

The SHOW project aims to explore sustainable business schemes that are cost efficient and modular; in accordance to the existing/planned infrastructure and fleets and each city/region as well as the relevant operational and legal framework. Several existing or emerging business/operating models for deployment of CCAV services in Cities will be studied within the project, such as: PTO and non-PTO based shared mobility services (i.e. “combi ticket” between PTO and connected MaaS provider), carsharing (B2C, B2B and PPP), vehicle-based logistics (including LaaS), TMC – based services (i.e. TMC’s acting as MaaS platform operators or “selling” dedicated lanes for AVs), Aggregator based Services and applications (city wide CCAV mobility platforms). As these highly vary across Europe, a one model fits all - best model is not foreseeable.

Therefore, this document gives a detailed status quo & fore sighting (trend) analyses and UCs on different granularity levels (corporate, competition, industry, global eco-system). It will be used as the basis to derive/identify future scenarios as well as business/innovation fields & business opportunities based on the experiences of the SHOW demos. During the project’s proposal phase a provisional list of operator models has been identified, which is now stated in Chapter 2.1. This document will revise those operator models and map them back to the business models which could be identified within and outside of the project.

The document will give an overview of at least five demonstrations with different business models within SHOW and elaborate on two new business models, which will yet have to be conducted under real condition. For these promising business opportunities, alternative business/operating strategies & models will be compared, focusing on assessing which value proposition is covering which need for which type of user (customer). The document will also take into account the influence of environment where the solution is deployed, integrating relevance of geographical diversity as well as influence of the political/legal framework deployed at that location.

Additionally, the definition of a marketing-mix & go-to-market concept for targeted businesses is recommended. Special emphasis in A2.2 will be placed on the potential future role and opportunities for SMEs and Start-ups.

D2.2 is structured according the following approach using the input of all relevant SHOW partners, interview results, workshops, desktop research and selected tools:

- Chapter 2: Describes the methodology used more in depth.
- Chapter 3: Shows the basic results considering the GA, results of D2.1 as well as the results of the interviews/Workshops with the demo sites, as well as the results of the online survey.
- Chapter 4: Focuses on the development of the new extended business models and roles using the results of chapter 3 as well as from the online survey to ensure usability of the results in the demo sites.
- Chapter 5: Focuses on the development of the new business models and roles using the results of chapter 3 as well as from the online survey to offer new opportunities to the demo sites and to fulfil the GA.

- Chapter 6 gives an overview and mapping about the demo sites (mega and satellite sites), the local realized use cases and which business models will be applied during the demonstration.

1.2 Intended Audience

The deliverable will address the relevant project partners within Consortium regarding business and operating models covering development, evaluation/demonstration, deployment and exploitation aspects during the whole duration.

Regarding external audience, the deliverable is interesting for those that are active in the business modelling field of CCAV, either with regard to the research/study part or the deployment part.

1.3 Interrelations

The focus of WP2 is on business and operating models as base for the economic growth of MaaS and business acceptance in modern transportation system. Therefore WP2 is divided in 3 main tasks, starting with A2.1, which provides basic information and approaches for business models, user roles, business analysis of demo sites, success and failure factors, an evaluation of existing business and last but not least by providing a first solution regarding the extension of existing business models and developing new ones. A2.2 uses these results to develop the new business models and roles considering the input of the demo sites, the use cases as well as the first ideas written down in the GA. Finally, A2.3 is responsible for the evaluation of the developed business / operating models to show the progress and success of the development results and also provide recommendations regarding the transferability and scalability of the new business / operating models.

D2.2 with its focus on the development of new business/operating models and roles has refined the business/operating models as well as user roles provided by D2.1, by interviewing/making workshops with the demo sites and using the same tools and methodology like A2.1. These interviews were done to initiate an innovation process within the demo sites, but also to ensure continuity within WP2 work (as the activity bases on the results of A2.1) and also to ensure that the results will be implemented for demonstration phase and therefore be measurable for the business evaluation in A2.3.

This refinement via interviews/workshops were done with the mega sites, because they cover all UC for the whole SHOW project and will be the main data collector during the demonstration, which will support the evaluation in A2.3. It may be mentioned here, that interviewing the satellite sites would not bring further progress for the development of the business models, because they normally do the same things as the mega sites (for example looking the interview in D2.1 regarding Tampere and their view on the MaaS, LaaS and DRT services) and brings additional specific boundary conditions which increases the complexity of the new business models and decreases the usability (transferability and scalability) of them. Additionally, the evaluation in A2.3 as well as the implementation in many of the demo sites and for the impact assessment would be more complex without bringing measurable advantages for the project goals for implementing MaaS in higher speed, higher scope and with higher chances for economic success and impact.

Internal interrelations:

Due to the complexity of internal relations of A2.2 within the SHOW project, we developed the model shown in Figure 1 displaying the input as well as the output of the activity and its deliveries.

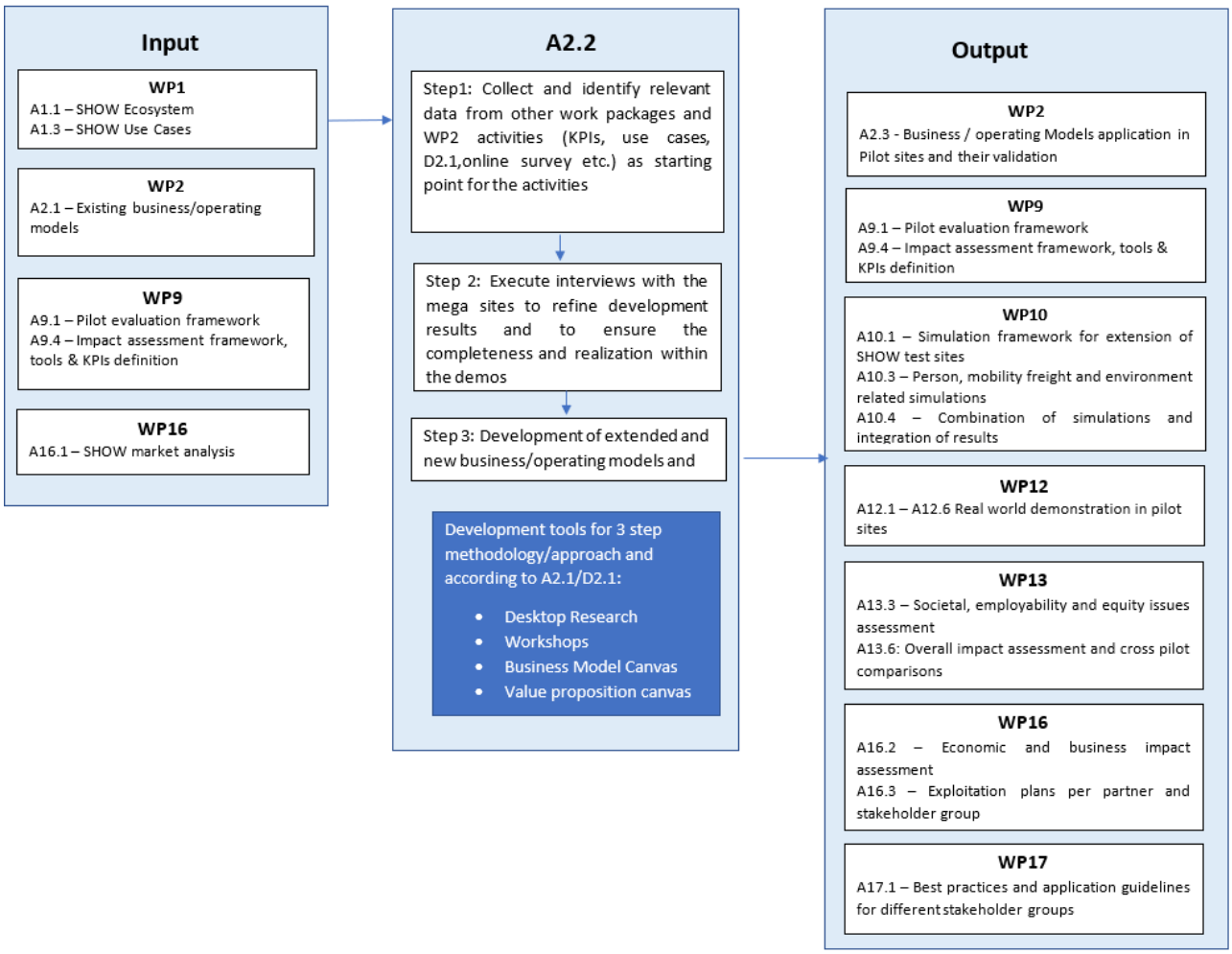

Figure 1 – Methodology and interrelations of A2.2

External interrelations

- External stakeholders working on all fields/types of mobility: Providing on one hand relevant additional input to the existing business models and ecosystem, also beingmultipliers for the results (together with WP15).
- External stakeholders were also included by the executed online survey to collect relevant information about business ecosystems, missing links like user roles or low-level parts of the value chain as well as information about success and failure factors for the introduction of mobility services.

2 Methodological Approach

As a starting point towards building new business models within the SHOW project and the respective demonstration sites the initial business/ operating models of the SHOW proposal phase are being revisited and elaborated and the methodologies for evaluation are explained.

2.1 Initial list of operator/ business models

Within the SHOW GA [1] an initial set of operator models has been identified, which are expected to be implemented withing the project. During the workshops with the demo sites the fitting operator model for each demo has been identified. The models state as follows:

Central model:

A city purchases automated fleets and operates them itself or through concession contract to a specific operator. This model requires higher initial costs but can align the service to the city plan (SUMP, SULP) and integrate it to the local TMC.

Liberal model:

A city allows several operators to provide automated fleet services (multi-vendor approach) either at different locations (neighbourhoods) or service types (one for PT, another for DRT, another for MaaS or LaaS), all following a mutually agreed architecture and specified QoS for its offered service. Competition may offer rich and cost effective services but issues of interoperability and gaps in service provision exist.

AaaS aggregator model:

An aggregator may be selected by a city to provide holistic AaaS across all types of city transport models. This can be a Consortium of private industries or a PPP; pretty much the actors currently developing and operating TMC and traffic infrastructure in several European cities. This actor will undertake the set up and operation of the fleets and infrastructure in the cities, getting a compensation for a certain number of years. This is an innovative concept; not yet applied widely in the automated mobility area is related to the central model; but outsources the responsibility and means from the city to a private or PPP scheme.

Social innovation model:

The city offers the realization of “automated mobility islands” by local operators or communities (University, Hospital, Business areas, etc.), that operate complementary to PT for special purposes (logistics) or user groups. They can also be temporary and utilize leased fleets that migrate from area to area. Specific emphasis will be given towards models that support SMEs / start-ups and are particularly suitable / manageable for them: i.e. without large initial investments and with moderate deployment of personnel. We call this a "delta" or "on-top" approach, i.e. we assume that the necessary major investments have already been made. Whether this approach works for SMEs / start-ups will considerably depend on whether "platform business model conditions" are created, in which they can flourish. Thus, SHOW develops a dashboard and big data platform to promote this concept Europe-wide. [1]

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 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.

2.3 Demo Site workshops

As a starting point of building and implementing every business and operating model within the SHOW project a dedicated demo site workshop has been conducted with the demo site representitives of the SHOW Mega Sites.

We chose to focus on the SHOW Mega Sites, as they cover the whole range of the SHOW demonstrated Use Case on which we build the business models upon. Therefore we ensured to cover a more detailed analysis and have more extensive workshops, rather than covering all SHOW demos only superficially. The methodology and analysis results therefore also apply for the satellite and follower sites of the project.

The A2.2 partners developed a questionnaire template that was used as a guideline for the workshops and can be found in Annex 1. Due to the Covid-19 pandemic, the workshops could not be held at the demo site locations but were held via online meetings. The workshops were around 1 – 2 ½ hours long and were held between September and December 2020, based on the complexity of the developed business model. With some demo sites, multiple follow-up meetings have been scheduled for additional information that could not be covered within the workshop. The workshop itself started with an introduction to the demo site's location, specifics and Use Cases. The involved roles and partners, success and failure factors as well as the (dis)-advantages to traditional public transportation have been discussed. After that the building of the business model via the two canvas' "business model canvas" and "operator model canvas" was done. After the business model was shaped, the workshop assessed which operator models can be build at the demo site and who are the leading forces to implement the business model. A go-to-market strategy is proposed for every business model.

2.4 Business Model Canvas

The concept of business modelling evolved over time and was influenced through various disciplines dealing with technological, organizational or strategic approaches.

In the present, business modelling is mostly used as an instrument to discuss and assess innovation and value creation of an organization. Accordingly, the well-known economists Osterwalder and Pigneur define the term of business models follows: "A business model describes the rationale of how an organization creates, delivers, and captures value." [2] Thus, a business model is a simplified illustration of a business project. The mapping is done through various components, with at least one of them being the main focus. For the workshops in SHOW, the presentation of business models is chosen via the Business Model Canvas (BMC). The BMC includes nine blocks which describe the main parts of a company, allowing a consistent basis for discussion with the shareholders. The BMC is also the most detailed of the more-known models for evaluating and presenting business models. The components of the BMC and the focus are explained in the following [3]. In Annex 2 the reader can see the template of the BMC, which was used in the workshops.

Block 1: Customer segments

The customer is the first and sometimes the most important component of a company. In the block of the customer segments the customers are grouped into clusters according to homogeneous needs, behaviours and characteristics. The targeted division allows to focus on which segment should be served and how.

Block 2: Value Propositions

The block of value propositions gathers the totality of quantitative and qualitative assets, which a business offers to the customer to solve problems or satisfy needs. This variety of services primarily includes products and services as well as the integration of services into customer processes or the project management.

Block 3: Channels

The block channels acts as an interface between the value propositions and the customer segments. The block describes the different communication, distribution and sales channels, through which the offered value is communicated.

Block 4: Customer Relationships

The way a company wants to get in touch with the customer segments is described in the block of customer relationships. Customer relationships have a significant impact on the customer experience and should therefore be tailored to the type of customer segment. In addition, it should be based on the nature of the value offer and its complexity, where less complexity (e.g. consumer goods) implies less interaction.

Block 5: Revenue Streams

The block revenue streams, describes the way in which the monetary values of the business are generated and used. Therefore, the biggest drivers of revenue streams are the customer segments and value propositions as these are generating the revenue. One or more revenue streams can be established for each customer segment. Revenue streams are usually described through one-time or continuous (contract) payments.

Block 6: Key Resources

Key resources are the basis for creating the value to be conveyed. A company needs more than just one key resource to succeed. Resources can be anchored physically, financially, intellectually, personally or as partnerships.

Block 7: Key Activities

Key activities are the success-critical actions of a business. With these activities, the value proposition is created, brokered and opened up the intended market. Another key activity is to establish and maintain customer relationships.

Block 8: Key Partnerships

The network of participants who contribute to the values creation is described under the key partnerships block. Partnerships are critical to success because they are minimizing risks or unlocking key resources that are not owned by the company.

Block 9: Cost Structure

The block cost structure describes the total costs incurred within the business model. The costs should be structured according to their type (CAPEX/ OPEX) and, if possible, assigned to the other blocks [2].

2.5 Value Proposition Canvas

To help focus on the value creation of the Use Case, the Value Proposition Canvas (VPC) will be additionally used for discussion. This canvas uses two of the original nine components to present them in more detail and to address individual issues. The reduction to the two components "customer segments" and "value proposition" makes it possible to better visualize and discuss a possible core focus of the business to be created. In Annex 3 the reader can see the template of the VPC, which was used in the workshops.

Each of the components is divided into three sub-items which are described individually. The explanation is following below:

The component of the customer segments is represented in the "customer profile". This single segment is broken down into:

- customer jobs
- customer pain
- customer gains

When dealing with customer jobs, the business modeller takes the customer perspective into account, and describes which problem, solution or daily task the customer deals with. The problems and risks that hinder the client in completing the jobs are collected in the block of customer pains. Customer gains describe desirable or surprising advantages for the customer that could help him in doing his jobs.

The component of the "value proposition" is described in the "Value Map". This single segment is broken down into:

- products and services
- pain relievers
- gain creators

The value map describes the characteristic of the offered value based on the products and services. These products and services describe the relevant portfolio of a company or a project. In the block of pain relievers it is described how the products and services offered can relieve the pains that occur on the customer segment. There is no need to find a suitable solution for every problem. Rather, it is beneficial for a business model if the value proposition solves a particular problem particularly well. The last block of the VPC is the gain creators. This point describes which of the mentioned customer gains can be generated by the products and services. The gain

creators can also describe profits that go beyond the customer segment. They are important for later upscaling [4].

The two canvases are used as a base for the development of potential business models.

3 Basic research results

Building of the business models within SHOW relies heavily on the feedback of consortium partners that are interested in operating tested services in long term. Therefore, this chapter reports on the relevant discussions and questionnaires that were conducted by other activities than A2.2.

3.1 Insights on Use Cases and benchmarking results

For the evaluation of the demo sites and building of the business models two already existing deliverables have been used as input for the analysis.

D1.2 [5] "SHOW Use Cases" shows the status as of September 2020 of the initiatives around the demo sites, encompassing:

- In depth Use Case descriptions;
- Storyboards;
- First (business) KPI assessments.

D2.1 [6] "Benchmarking of existing business / operating models & best practices" shows the state of art, mobility drivers and business ecosystem around the SHOW Use cases.

- In depths state of the art descriptions with worldwide examples;
- Mapping of Use Cases and state of the art to the SHOW demo sites;
- Initial assessment of business models;
- Overview of ticket prices within the demo regions;
- Benchmarking of different mobility as a service models.

These insights are considered and referenced in the analysis of the business and operating models of the demo sites

3.2 Existing and new business roles

The existing mobility roles important for the SHOW project have been collected within the benchmarking of D2.1, for the detailed explanation of each role, we refer to the document D2.1 [6].

List of business roles identified within D2.1:

- Direct Value Chain Participants
    - Service Operator
    - Infrastructure provider
    - Public Transport operator
    - Vehicle provider
    - Traffic Management Center
    - Maintenance operator
    - Ticket sale reseller
    - Billing system operator
    - IT provider
    - Communication provider
    - Marketing provider
    - End User
- Indirect Value chain providers
    - Safety providers
    - Web design provider

For D2.2 we asked the demo site representitives which business roles could be found locally. We managed to identify new business roles. The results are stated in Chapter 4 and concluded in Chapter 6.

3.3 Online Survey

SHOW WP2 “Business/operating models” conducted an online-survey from 03rd September to 30th September 2020. The survey titles: “Business and operating models for novel mobility services using automated vehicles” and addressed ITS stakeholders within the network of the Consortium partners but not Consortium partners itself (Industry, OEM, supplier, SMEs, Start-up, Research and Academia, Public Authorities).

The survey aimed to assess opinions and insights regarding business models for novel mobility services using CCAVs. The survey is an essential part of the SHOW project. It gathered **assessments, opinions and insights from a wide range of stakeholders** regarding business models for novel mobility services using CCAVs. The survey identified the **important framework conditions** for such business models, and will help to take them into account into the design and setup of the numerous mobility services planned within SHOW. The online survey questionnaire can be seen in Annex 4.

The results presented in this document were essential for starting the discussions during the demo site workshops because they represent basic boundaries that need to be identified for the specific location in order to build sustainable business models.

Regarding the main barriers of integrating Connected and Cooperative Automated Vehicles (CCAVs) into public transport services, 70 of the 88 respondants rated the legal and political pre-conditions with an importance of three or lower (on a scale from one to five with 1 being the most important). The second greatest barrier is the the organizational and operational barriers. Technological barriers are stated as the third greatest barrier, while the business itself and the social acceptance of CCAV solutions are not seen as important barriers.

On the other hand, when asked what the main enablers of integrating Connected and Cooperative Automated Vehicles (CCAVs) into public transport services are, the majority of respondants saw technological development of solutions as the main enabler. This only makes sense as the introduction of CCAVs into Public Transportation relies on a successful technical development. Right after the technological development is the factor business. Successful implementation of technological advancements drive the market and pressure political decision makers to act and apply new laws and regulations, enabling the business. This underlines the importance of assisting the SHOW demo sites in building business models and give strategies for possible go-to-market phases. Social acceptance and organizational enablers are less importants for the respondants. The regulatory and legal factors are not seen as important enablers, as these mostly follow the other points but don’t enable them.

The generation of positive externalities (e.g. greater safety, higher accessibility, attract private investment) and the reduction of investment and operational costs when deploying new services seen as the main advantages of introducing CCAVs in public transportation today. As a third advantage the reduction of car ownership is named.At least the advantages of increasing the number of users for public transportation, as well as raising the social acceptance is pointed out.

Directly linking back to the SHOW mobility services, the respondents were asked to sort the the existing mobility services most suitable for implementing CCAVs in the

short/mid-term. Most of the respondants found Logistics-as-a-Service (LaaS) most suitable for CCAV applications, followed by the traditional PT. The two mobility services are closely followed by mode no.3 – demand responsive transportation. The respondants think that in the short and mid-term car sharing and mobility as a service solutions are the least likely to be implemented.

During the workshops we asked the pilot site, which operating model fits them best. The responsants had to grade the operating models by their likelihood of implementation CCAVs in the short/mid-term. Most responsants chose the social innovation an aggregator model (public private partnerships). This makes sense as it would make the initial financing and implementation of services easier. Next of is the central model, meaning, that the service would be run by one provider holding all assets. At last, the liberal model would be named. Building mobility platforms, ledgers and establishing trusted integrators, which all run under the liberal model, would take more time to implement.

Another important question of the survey regarding the business models was the view of local investors and business regarding the introduction of CCAVs. The median of answers is, that local stakeholders are somewhat positive towards CCAV, but in total 41 respondants, so almost half of them, have not positive view on CCAVs. It is very important to establish demo sites and run live tests. The detailed distribution of answers was als followed:

- Very positively: 11
- Somewhat positively: 37
- No strong opinion: 33
- Somewhat negatively: 7
- Very negatively: 1

In the survey, respondants also were asked a set of questions, where they were free to answer with text. Two of these questions we regard as very important for the building of business models:

Which are the best opportunities for start-ups and SMEs regarding CCAM?

- Mobilities out of big urban cities
- Offering new and convenient services with a personalised and user centric approach.
- Offering soft modes of transport for urban mobility and more environmental friendly
- Leverage from data to offer new services (including maintenance)
- Advertising AV concept, incubation of future providers, much faster developement of hardware and software solution, pressure towards lawmakers
- When the focus is on "access" not only physical mobility (allowing for city planning, 3d printers, telework, etc. to be included in the system)
- Main issues today are technological (sensors,...), societal (acceptability) and technical (AI, algorithm, data management,...). These are the best opportunities now regarding CCAM.
- Data management and combining technologies
- E-mobility services, energy management, flexibility services in target model

Which elements for a successful introduction of CCAV services are currently missing concerning your Business Ecosystem?

- Benchmarks and business model analysis
- Strong involvment of cities and citizens

- Legal framework, technology maturity, economic attractiveness, results and recommendations from case studies about how to deploy AV in order to contribute to accessible, affordable and sustainable cities
- Conflict of technology, costs and ethics: without driver the technologically is not mature; with the driver it is still too expensive
- Public seed financing and risk taking

The set of questions presented in this document are important for the building of the business models, more general results regarding the survey, shall then be published on the homepages of SHOW, but also of UITP and ERTICO, and presented in public workshops.

3.4 Reports of Demo Site Interviews

The following chapters give a quick introduction to the interviews held in October and November 2020 to assess the pre-conditions at the demo sites and build business models about the specific use cases. As a starting point, the A2.2 team interviewed the Mega Sites during the demo site workshops to build sustainable business and operator models with the most mature and commercial potential. All interviews can be found in the Annex and chapter 4 analyses the results in detail. At the end of this document, Mega Sites as well as Satelite Sites will be mapped to the different business models.

3.4.1 Germany

The workshop with the German mega site was held on the 08th October 2020 with the mega site leader DLR, represented by Katharina Karnahl and the ASEAG, PTO of the city of Aachen, represented by Kathrin Driessen. The full interview is documented in Annex 5. The workshop focused on the demo site Aachen, as Mannheim was already discussing leaving the project. The scenario in Aachen is build around the campus of the technical university RWTH. A poepleMover (shuttle) is driving on a regular timetable around the campus-boulevard. Later in the project the scenario is to be adapted to transportation on demand.

3.4.2 Spain

The workshop with the Spanish mega site was held on the 15th October 2020. The demo site consists of the City of Madrid and during the workshop BAX & Company, Empresa Municipal de Transportes de Madrid (EMT), Indra and Datik were present. Madrid actually tests two scenarios. The first scenario is urban driving with automated busses. The second scenario is the autonomous bus operations on the bus depot area. EMT management pointed out that the autonomous bus operation on-site of the depot is of highest importance for them and will be exploitet in the long term. This is why this deliverable focusses on especially this scenario, while urban driving is already analysed with other demo sites.

3.4.3 France

The workshop with the French mega site was held on the 28th October 2020. As the demo site has two separated cities and scenarios, the interview about Rouen was held with Mihai Chirca and Frederic Saffroy from TRANSDEV, while the scenario in Rennes was represented by Isabelle Dussutour (CHU hospital) and Clement Aubourg (Keolis). In Rouen a combined scenario of a coach bus and city-centre robo-taxis was discussed. Rennes has build a scenario around the hospital campus of the CHU. They are building a modular scenario where during the day, patients can use shuttle busses

to move around the campus and during off-peak hours medical goods are transported via these shuttles.

3.4.4 Austria

The workshop with the Austrian mega site was held on the 09th & 10th November 2020. Mega site representitives from Austriatech were Dominik Schallauer and Alexander Fürdos, present during both days. On the first day Markus Karnutch from Salzburg Research was present and during the second day concerning Graz, Joachim Hillebrand from v2c2. The two tested scenarios in both cities are different from each other, while Salzburg is testing a peri-urban connection line with C-ITS added to it and an additional shuttle on a 1.4km long line, Graz is testing Robo-Taxis that are rotating between a station and the local shopping mall.

3.4.5 Sweden

The workshop for the Swedish mega site was also held on two different days. On the 29th October 2020 Anna Anung (VTI), Christian Monstein (Transdev) and Tor Skoglung (RISE) were interviewed, concering the scenario in Linköping. Linköping is building a combustion engine free modern living zone, which features elderly homes and a school for children with special needs. This living area is enhanced with an automated shuttle service, perfectly fitted to the needs of the inhabitants and visitors.

For Kista, the scenario was discussed on the 05th November 2020. Jan Jansson (Keolis), Cili Sobiech & Tor Skoglund (RISE) were present. Kista's scenario is build in the technology/ company area of the city. Right now, workers are heavily commuting to work by car, due to the good connection to the highway and rich parking areas at their work places. To give incentives for commuters to switch to public transportation, a shuttle is established, that rotates between the local train station and within the technology part. Ericsson Sweden is also part of the Consortium partners, which is why the scenario in Kista is tested with different IoT functionalities. During the first year of analysis the scenario Intel Telia, a Swedish telco operator joined the cause and is testing the scenario in cooperation with the Consortium partners.

4 Analysis and building of business models based on the demo site Use Cases

4.1 Autonomous PT in combination with on-demand services

4.1.1 Fore-sighting and business innovation in Aachen, Germany

The test site Aachen “Campus Melaten Nord” , see Figure 2, is a peri-urban environment located close to the borders of both Netherlands and Belgium, easily accessible and fully connected to public transport. The Campus Melaten primarily hosts RWTH institutes. The road network consists of mixed lanes for both PT and regular traffic. There are bicycle lanes on all roads separated from the road through lane markings as defined in the StVO. The traffic density is low to medium, consisting of PT, industrial and private vehicles, pedestrians and bicycles.

The pilot track will be digitally mapped in higher definition. Test vehicles will be equipped with commercially available OBUs (on-board units) to communicate with each other (V2V, vehicle-to-vehicle) using mobile network communication (4G or 5G LTE). A V2I (vehicle-to-infrastructure) communication to RSUs (road-side units) is currently not planned.

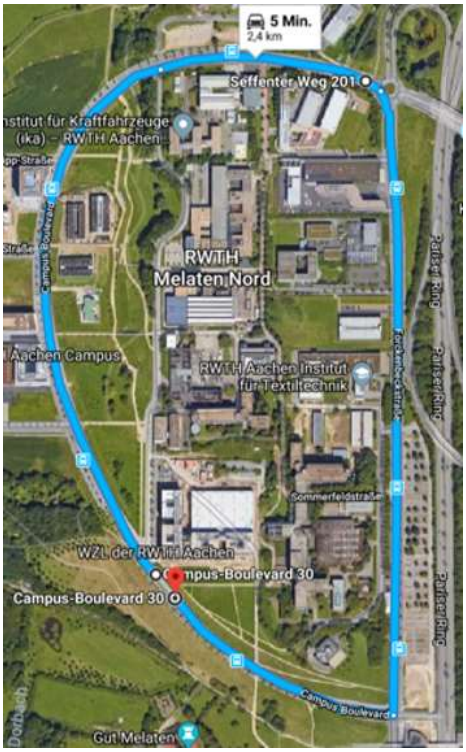

Figure 2 - Satellite map of demo Aachen

During the pilot phase in Aachen, two People Mover vehicles will be operated for a certain duration partially in regular PT mode, partially in DRT (Demand Responsive Transport) mode.

The People Mover is integrated into **the ASEAG MaaS platform movA** via an ASEAG RBL unit and serves the bus stops along the route on Campus Melaten as part of the regular ÖPNV net. The Campus Melaten bus stops are also served by regular ÖPNV lines and serve as hubs for exchanging passengers between regular ÖPNV lines and Campus Melaten People Movers. The People Mover serves the bus stops according

to a regular timetable clockwise along the Campus-Boulevard and the Forckenbeckstrasse.

Due to low passenger amounts outside of main serving times, the PT is reduced to an on-demand service at the fixed bus stops. The DRT application still have to be built, which is the main activity for the demo site partners until the end of 2020.

From a business point of view, ASEAG pointed out that the service of a bus line is unprofitable for them. Reducing the personnel costs, e.g. through autonomous transport would be of interest.

4.1.2 Business Model Canvas

The business model canvas for the solution developed in Aachen is displayed in Table 1.

Table 1 - Business model Aachen - Autonomous PT in combination with on-demand services

BUSINESS MODEL CANVAS	
Value Proposition	• Automated, frequent public transportation around the Rheinisch-Westfälische Technische Hochschule (RWTH) campus • On-Demand service outside of peak hours
Customer Segments	• Students • Commuter/ personnel within the campus area • Visitors
Customer Relationships	• Local news, • Campus information, • Value is distributed over ASEAG movA application
Channels	• The People Mover is integrated into the ASEAG MaaS platform movA via an ASEAG RBL unit
Key Resources	• Strong key partners • Vehicle manufacturer within the demo site consortium • Go-to-market departments/ MaaS department of vehicle manufacturer
Key Activities	• Planning of the demonstration • Preparation of the demonstration
Key Partners	• PTO, PTA • University/ Research, RWTH • Vehicle manufacturer • Software Companies • Engineering companies
Revenue Streams	• Once the solution is supposed to be marketed, tickets can be sold
Cost structure	• High costs for vehicles, ROI not in an adequate timeline, if vehicle price stays the same

The business aspect behind the Use Cases in Aachen is, that off-peak hours are handled with an on-demand service, while at times with a higher passenger volume the automated vehicle runs on-schedule.

ASEAG reports on an unclear situation regarding the current cost structure, due to two reasons:

- Price for technical installation of the solution is not clear (message size / amount of data via V2V, interval of information exchange, bandwidth / QoS for V2V communication, etc.) – all of this will determine the cost for the technical solution.
- Also the amount of energy which can be saved through the collaborative automated driving manoeuvre is not clear.

To give an overview of the ticket prices which would also apply for the ASEAG people mover, the following list states the current prices of 1-way and day tickets of ASEAG [7].

Example of ASEAG ticket prices:

1-way tickets	Zone 1	2,80
	Zone 2	3,70
	Zone 3	5,60
Day-Ticket	Zone 1	7,90
	Zone 2	11,30
	Zone 3	14,80

4.1.3 Value Proposition Canvas

The value proposed through the business model built in Aachen is “Offering autonomous public transportation and additional DRT services”. The service is built around a campus area, with lesser traffic and outside of urban environments. The “customers” most important need is commuting to, from and around the campus. Table 2 shows a number of pains and gains costumer face/ could have from any mobility service that could be built within the area. The left side of the canvas shows the service which is to be deployed. Pain relievers and gain creators explain the points, which the business model can actually fulfill for the customers.

Table 2 - Value Proposition Canvas Aachen - Autonomous PT in combination with on-demand services

Value Proposition Canvas	
Customer Segment	Students Commuter/ personnel within the campus area Visitors
Customer Jobs	• Commuting • Learning/ studying • Working
Customer Pains	• Waiting time for busses outside of peak times • Low frequency • Full public transport during peak hours • No/ not enough public transport during off-peak hours (early& late) • Inflexible hop-in/ drop-off points • No guaranty for space or seating • No information on delays • Delays • Search for parking spaces
Customer Gains	• Connecting the first and last mile • Drop-off for parcels / post • USB charging • Cost effectiveness in comparison to the private car • Comfortable seating
Value Proposition	Automated, frequent public transportation around the RWTH campus, On-Demand service outside of peak hours
Products & Services	• Automated shuttle bus line that connects the different facilities around the campus area • Vehicles: e.Go people mover • Frequency: fixed line, before and after peak = on demand
Pain Relievers	• Cheap on demand transportation or high frequent fixed line during the day • Real-Time information about traffic volume in the area and riders for the shuttle • Pre-booking of tickets and/ or space (seats)
Gain Creators	• Sustainable urban cities • Eliminating mobility gaps • Reduction of private car usage

4.1.4 Success & Failure factors

The demo site in Aachen has a high potential of succeeding with the solution and building a sustainable business model, as the Public Transport Operator ASEAG is a highly innovative public entity with a successfull company and service image. Being a public entity they have a close link to the main decision makers and can bring their demonstration case to the market. Aachen, the cross border region and the campus on which the demonstration is deployed show future market potential.

Nevertheless, there's a huge negative global influence of the COVID-19 pandemic which especially hits the public transportation sector. All PTO's throughout the SHOW

consortium are reporting on less passenger volume, most likely due to work-from-home arrangements by most companies and universities.

On a Use Case level, ASEAG is still inexperienced with the capacity planning of the on-demand service and will therefore need the demonstration time to assess first insights on the passenger peak-times around the campus.

4.1.5 Strengths & Weaknesses compared to traditional public transportation

In the current situation, the people mover is in competition with the normal bus line around the campus MELATEN NORD. The normal PT bus can of course transport more people at the same time and will therefore be essential for the peak hours, especially in the morning and afternoon, the main times for commuting.

During all other times, the people mover will offer more flexibility than any bus. The on demand service will allow the shuttle to be faster, as it won't have to stop at every bus station and can even take shorter routes, if possible. The people mover is also less noisy and produces less CO2 emissions in comparison to the bus. The people mover acts as a door opener for further research and development on the vehicle in this highly innovative campus zone.

4.1.6 Mapping to UC, demo sites and SHOW KPIs

The business Model: "Offering autonomous public transportation and additional DRT services" revolves around the following SHOW Use Cases displayed in Figure 3:

	SHOW Use Cases															
Scenario	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	2.1	2.2	3.1	3.2	3.3	3.4	3.5
Aachen RWTH Campus	☑			☑		☑				☑							

Figure 3 - Aachen Megasite distribution of SHOW Use Cases

For Use Case 1.4: Energy sustainable automated passengers/cargo mobility in Cities:

- Predictive / collaborative driving manoeuvres based on V2V communication at bus stops (flowing traffic merge-out and merge-in), to reduce energy consumption through longitudinal control of multiple vehicles to avoid stationary traffic.

For Use Cases 1.1 Automated passengers/cargo mobility in Cities under normal traffic & environmental conditions, 1.6 Mixed traffic flows & 1.10 Seamless autonomous transport chains of Automated PT, DRT, MaaS, LaaS:

- Ring feeder as on-demand service in a campus environment, based on automated people mover vehicles interfacing PT and interfacing to connected intelligent DRT/MaaS applications in Aachen (Mobility Broker and other DRT systems).

4.1.7 Go-to-market strategies and proposed operator model

As already stated before, ASEAG (Public Transport Operator) as well as e.Go (Vehicle manufacturer) have a department which acts in the field of mobility as a service (operator). Having a prior experience with establishing mobility service on the market

and even owning an established platform, it makes it easy, to integrate future services, like the business model to be built in the project.

Generally speaking, e.Go pointed out, that for liability and technical reasons a vehicle manufacturer won't be able to "just" sell its cars and "leave them alone", like it is usually the case with normal transportation busses.

Another way for this would be leasing models, with regular adjustments on the vehicle and ODDs – Operational Design Domain (Conditions in which the car is allowed to operate in automation).

E.Go is thinking about a go-to-market approach with the Use Case/ a similar Use Case not before 2035-2040, mainly due to technical restrictions. E.Go therefore prefers use cases in a HUB context as these are more viable in the mid-term. Scenarios for a secure HUB context would be gated harbor or airport Use Cases.

Regarding the operator models from the SHOW proposal, the **central model** is preferred for ASEAG, as right now, ASEAG holds all their PTO assets themselves. The DRT planning software is bought and operated by ASEAG.

4.1.8 Summary

The Public Transport Operator, as well as the demo site's vehicle manufacturer have experience in acting as a MaaS operator and have mobility platforms on their own. This is the best pre-condition for a go-to-market approach, as additional services only have to be added to an already existing and established service portfolio. The willingness to use the service by customers would be higher, if they already had experience with other services of the same platform. The demo site partners still see huge technical gaps that need to be tackled before thinking about a go-to-market phase. e.Go goes as far to say, that the technology won't be ready to operate in a profitable way before 2035.

4.2 Autonomous bus depot management

4.2.1 Fore-sighting and business innovation in Madrid, Spain

The demo site of Madrid is led by Empresa Municipal de Transportes (EMT), a public mobility service provider who started as a bus operator but has been slowly increasing services offered since 2003. Nowadays, it is also including a bike-sharing system and 23 underground parking facilities with 11.000 parking slots in total and 100 charging points (5 of them fast-charging). In addition, EMT is currently managing the Casa de Campo cable car destined for leisure trips only.

EMT is owned by the City Council but has a long tradition in cooperating with private companies; partnerships through which, for instance, a demand-responsive bus service has recently been launched. Also, the Spanish ministry and the regional government, as managers of the subway service, as well as other regional bodies and authorities provide funding to the transport operator.

The Madrid Megasite is following the research on two main use case scenarios. From one side, the trial of an automated public transportation for passengers covering a 800m route from “La Nave” innovation hub to the subway station “Villaverde bajo-cruce”. For the deployment, vehicles at SAE L2 and L4 will be deployed in the form of microbuses, Renault Twizzis (robotaxi tests) and a coach bus. The service will be available for users through a MaaS platform or through the EMT App.

This first scenario is implemented in an open environment with real traffic conditions and consists mainly in serving as interchange station communicating the public transport (subway station “Villaverde bajo-cruce”) with the city’s innovation hub (“La Nave”) which englobes numerous start-ups and serves as meeting point.

As for the route, the scenario’s actuation area consists of regular streets including pedestrians and other vehicles but is considered to be a non-dense urban environment, comparable to a sub-urban area type of traffic. There are several spots on the route that can affect the general performance of the system due to traffic rule violations or a lack of clear traffic rules, below is a representation of such.

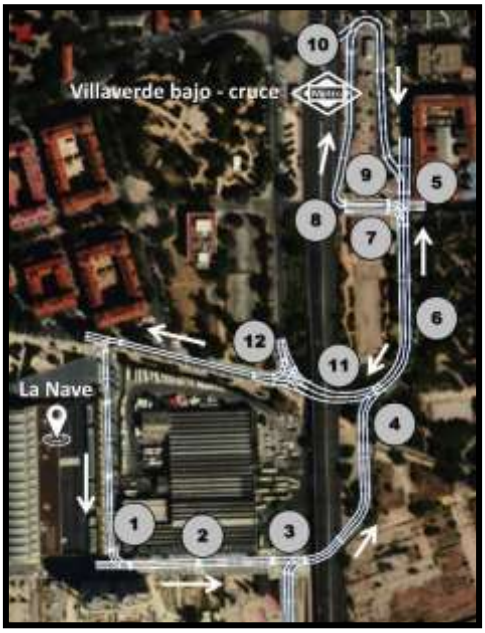

Figure 4 - Route followed by the automated passenger vehicles.

On the other hand, as part of EMT's goal of becoming the state-of-the-art for autonomous bus depot management, the second scenario is based on the optimization of their bus depot operations at the "Carabanchel" bus depot. This case is located in a semi-controlled environment and focuses on auto guided solutions for parking purposes, cleaning, repair area and refuelling mainly, supervised and Teleoperated from a control centre.

The scenario builds on the existing depot management and aims to optimize the aforementioned operations within. The "Carabanchel" bus depot has over 500 buses, including fuel, electric, induction and GNC buses, and the scenario will therefore operate in mixed traffic as there will be other buses and non-autonomous vehicles as well as pedestrians in the form of depot workers and bus drivers.

As a result, the scenario will try to tackle different actions such as the use of platooning for recurrent routes to washing or repair areas and automated parking by the buses once they arrive at the depot, freeing like this a lot of time destined by the pilots to in-depot movements. These requests high levels of automation (SAE 4) and it will ideally all be controlled from the personnel office control centre through teleoperation. Below, an image describing the depot and its areas is presented to better understand the scenario as a whole.

Figure 5 - Routes followed by the automated passenger vehicles

As stated by EMT, this second scenario is the most relevant for their needs and objectives in the long term, therefore, for the upcoming chapter regarding the business model for Madrid, the document will focus on the Bus Depot Management as the most promising scenario for the testing of Business Models, including the SHOW use cases to be piloted in this site (UC1.7, UC1.8, UC3.3 and UC3.5).

4.2.2 Business Model Canvas

The business model for the Madrid demo site is solely built on the scenario of automated bus depots management, as it was stated by the demo site partners during the interview, that this scenario is the one being followed and exploited in the long

term. The specific use case for the urban route between 'La Nave' and 'Villaverde Bajo Cruce' in Madrid doesn't feature values on which a business model could be build, and this is why this chapter will focus on the unique initiative of EMT of automating their bus depot management in the EMT Carabanchel Depot.

Carabanchel's depot business model is focused on optimising operations and reducing costs and the space needed thanks to introducing automation of Bus circulation within the depot, requiring less qualified personnel to manage depot operations and reducing operation times for routineer depot activities like parking, cleaning, charging, etc.

The chosen mobility business model of benchmark (as extensively described in previous SHOW deliverables D2.1 and D16.1), for it's closer relationship, is the LaaS business model concept. As a logistics management concept, the automated depot management of buses and micro-buses within a semi-controlled area, is subject of study from the logistics automation point of view and includes aspects of LaaS, if to be sold as a service to improve logistics of similar operations (looking at a potential replicability of the operational system and related business model to other logistics companies or public transport operators).

Table 3 - Business Model Madrid - Autonomous Bus Depots

BUSINESS MODEL CANVAS	
Value Proposition	• Automated bus depots • Less time consuming • Cost savings • Space saving • Safety increase
Customer Segments	• Public Transport Operators • Public Transport Authorities • Cities/ Municipalities
Customer Relationships	• Licensing • Public-Private Partnerships
Channels	• Public consortium • private public partnership
Key Resources	• Usage of „old" fleet that is upgraded for autonomous vehicle functions • Private Public Partnership to build upon
Key Activities	• Completing the procurement • Homologation, provided by the national traffic authority • Permits/ Regulatory, even when successful – time consuming • Testing
Key Partners	• OEM's and transport operators • Telecom operators, technology providers • Research & academia • Authorities (Municipalities)
Revenue Streams	• OPEX savings

Cost structure	• Technical installation • Initial invest

Based on the EMT annual report, the following figures could be identified:

- CAPEX
  - Bus live cycle between 7-15 years, busses deprivation rate ~10years
  - 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 €

4.2.3 Value Proposition Canvas

As previously seen in the business model canvas, the most relevant features in the value proposition for the bus depot scenario are the cost, time and space saving aspects. These are all related to the successful implementation of the automated buses in the depot and is expected to bring other collateral benefits to the 'Carabanchel' depot. Below the Value Proposition Canvas is presented to clearly illustrate which are the current pains, gains and solutions brought by the automation of the depot operations.

Table 4 - Value Proposition Canvas Madrid - Autonomous Bus Depots

Value Proposition Canvas	
Customer Segment	Public Transport Operators Public Transport Authorities Cities/ Municipalities
Customer Jobs	• Fleet management • Maintenance • Managing pension, fuel, accident claim, etc. • Investments in new fleets and technologies (Wi-Fi, USB charging, …)
Customer Pains	• High personnel cost • Time consuming depot operation+ • Limited space
Customer Gains	• Time savings • More efficient use of space inside the depot area
Value Proposition	Automated bus depots Less time consuming Cost savings Space saving Safety increase
Products & Services	• Development of automated busses for use within the bus depot • Technology • Lidar • Camera • V2X

Value Proposition Canvas	
Pain Relievers	• Lower the personnel cost within the depot due to lesser driver needed • Automated buses will need less space when being parked next to each other • Reduced number of personnel on the lanes walking through the facilities
Gain Creators	• Development of automated busses for use within the bus depot • Boosting innovation • Creating OPEX saving

It can be observed that through the inclusion of new products & services such as the development and implementation of automated buses in the depot together with technology advances and teleoperation for fleet controlling, existing pains can be relieved and associated benefits will flourish too.

Again, most of the pain relievers are related to space, energy and cost saving. Space savings are expected due to the possibility of reducing spaces between vehicles when parking, as there is no need for pilots to access them, and a more fluid traffic circulation thanks to automated functions like platooning, which can additionally reduce energy consumption. On the other hand, high cost savings are expected thanks to lowering the need for personnel to be active on arrival at the depot, low-added value personnel costs can be reduced and result in high OPEX savings through the automation of parking of the vehicles as well as displacements from one work area to another, such as for cleaning, maintenance, charging etc.

Additionally, the fact that a smaller number of drivers will be needed to operate the buses within the depot, a significant reduction of employees walking and moving around the facilities will result in a significant increase in safety the chances of accident will be clearly reduced.

4.2.4 Success & Failure factors for EMT

While the business model and the value propositions associated to the bus depot optimization scenario are quite clear, it is important to understand the actual factors that may trigger, enable or even stop EMT from succeeding.

Positively influencing factors:

- The Depot Centric approach represents a much easier way to set-up and operate automation. On top of that, even if the solutions are being implemented in-house, the fact that EMT is a publicly owned entity serves as a good way to communicate the innovation results to authorities, related impacts and potential replication and scalability of the benefits.

- Also, from an implementation side, the simplicity of the automation needed for a semi-controlled environment, with hardly no traffic, recurrent routes and also applicable through platooning, represent factors that enable the success of EMT in the process.

- Additionally, the vehicles moving through the depot will have no passengers, which is actually a key factor as for simplicity of the testing and reducing the pressure on failure as in most cases a minor crash won't affect any human's

safety (keeping in mind that speed limits inside the depot, due to the location and nature of the place, are considerably low compared to open traffic).

- Although the necessary initial infrastructure investment in technology and depot adaptations (e.g. teleoperation, dedicated lanes, sings), the benefits are expected to be high in the long term thanks to reduction of operational costs and cheaper automation hardware.

Negatively influencing factors:

- Some failure factors can appear through technological limitations. Battery capacity is an example, as throughout the day battery has to remain charged enough in order to be able to operate autonomously once the bus arrives at the depot, for instance.

- Completing the procurement as needed, homologation of the automation solutions through the national traffic authority and meeting the requirements of permits, regulations and similar is highly time consuming and can represent a barrier to successful implementation.

- As major operational benefits are expected to come from reducing the need for drivers to manage vehicles inside the depot, potential resistance from drivers to implementation can be expected. Part of the drivers would need to be re-allocated to other functions or even could not be required anymore.

4.2.5 Strengths & Weaknesses compared to traditional public transportation

In a city like Madrid, where 95% of inhabitants have a bus stop less than 5 minutes away from their homes, automating regular PT services are not really in scope for now, as traditional PT services are really well-rooted and working efficiently. That is why EMT's focus is set on the scenario of the 'Carabanchel' bus depot management, as it serves as a way of improving the existing services with the introduction of automation in a different part of the chain, focused on improving internal operations.

Through the automation included in the bus depot, PT service operations are expected to directly improve for EMT as the depot operator, and that is expected to indirectly impact traditional public transport users positively through increased service reliability, for instance. This scenario will boost innovation in PT while serving as a perfect way to optimize the internal operations of EMT. As a result, a reduction in OPEX can be experimented due to all the aforementioned reasons.

From one side, the actual increase in efficiency of all the operations in the depot, being able to control them in a centralized way from the employee centre through teleoperation. On top of that, drivers that arrive with the buses at the depot after a long working day, will be able to leave the buses on arrival at the depot, where most of the resting operations at depot could be conveniently automated (e.g. parking, charging, driving to cleaning areas…)

Automation of depot operations is also expected to increase security for workers, as previously mentioned through the reduction of accident chances and number of pedestrians in the facilities, and to optimise service operations to improve vehicle utilisation rates and to allow for improved charging and/or maintenance schedules.

As an overarching effect, the reduction of personnel costs due to less time requested per driver, as well as the optimization of space in the depot and time benefits could result in a decrease in PT prizes for the users, or decrease the need for public subventions. Finally reaching then, after all the in-house modifications and optimizations, a real impact on PT service and a comparable difference to traditional PT.

4.2.6 Mapping to UC and SHOW demo sites

The Madrid Megasite touches upon several SHOW Use Cases, 9 in total, distributed throughout both scenarios. Below is a quick presentation of such distribution that serves as a general overview.

Figure 6 - Madrid Megasite distribution of SHOW Use Cases

There is a clear spread as for what UCs are being treated in these scenarios, but some more clarity needs to be presented. From one side, the Madrid Megasite's business model of the automated bus depot in Carabanchel revolves around and includes the following SHOW Use Cases:

For Use Case 1.7: Connection to Operation Centre for tele-operation and remote supervision

- Shuttle teleoperation from the employee centre at Carabanchel depot. The pilot will have a centralized teleoperation centre to manage the AV fleet "remotely".

For Use Case 1.8: Platooning for higher speed connectors in people transport

- Cooperative V2V platooning for electric bus and passenger car. Platooning used in the pilot as an effective way to obtain great results when connecting or moving several vehicles from one space to another, such as parking to cleaning are for instance.

For Use Case 3.3: Automated parking applications

- Shuttle and electric bus automated docking at Carabanchel depot. Parking tasks are common and starting point for the introduction of AV, as a result, for time and space saving (both resulting in cost savings too) the buses at Carabanchel will carry out automated parking applications.

For Use Case 3.5: Depot management of automated buses

- SAE L3-4 automated Depot management, at Carabanchel. UC 3.5 is actually the strict definition of what will be done in the EMT depot, ideally optimizing the depot's operations through the implementation of automated buses.

Additionally, whilst looking into the other scenario for the PT shuttle between Villaverde bajo-cruce and La Nave, the following details on the SHOW UC being considered are presented:

For Use Case 1.1: Automated passengers/cargo mobility in Cities under normal traffic & environmental conditions

- Automated passengers' mobility around La Nave area - normal traffic & environmental conditions.

For Use Case 1.2: Automated passengers/cargo mobility in Cities under complex traffic & environmental conditions

- Automated passengers' mobility around the subway station in Villaverde Bajo-Cruce - complex traffic & environmental conditions.

For Use Case 1.3: Interfacing non automated vehicles and travellers (including VRUs)

- Reliable and safe VRU interfacing at Villaverde Bajo Cruce (subway station).

For Use Case 1.6: Mixed traffic flows

- Villaverde open traffic conditions at several levels.

For Use Case 1.10: Seamless autonomous transport chains of Automated PT, DRT, MaaS, LaaS

- Passenger mobility in SAE L3-4 vehicles in the Villaverde bajo-cruce to La Nave PT shuttle.

4.2.7 Go-to-market strategies and proposed operator model

Having understood the different scenarios and implications each one has, some guidance on the go-to-market strategy can be presented and a suitable operator model can be assigned.

As stated by the pilot representatives during the interviews, the focus of the Automated PT service connection between 'La Nave' innovation hub and the subway station 'Villaverde Bajo-Cruce' will be on understanding the technology and there is no specific business case and exploitation plan behind this Use Case yet. Which shifts the focus once again towards the other scenario: the application of the automated bus depot in Carabanchel, which relies on different steps for its implementation and a clearly distinguished business model associated.

The go-to-market strategy is directly linked to the actual implementation as it is an optimization of internal operations, the first steps are therefore to reach satisfactory results and once the solution is already functioning, market development activities and plans will follow.

Firstly, the actual teleoperation activities will have to be clearly defined and the partners implementing the solution must agree on technology levels and implementation levels, from where to base it to how to do so. Secondly, the software will need to be installed, understood and connected to the new bus fleet as well as giving specific training to those employees in charge of it.

As mentioned, the bus fleet will have to be either substituted or highly adapted to introduce this solution at a large scale, bearing in mind that the 'Carabanchel' depot has over 500 buses. This is something that won't affect the trial period as it can be

tested with only a few vehicles, however, it will have a great impact when it comes to implementing the solution in the depot to work for the complete fleet. Costs of such fleet acquisitions must be taken into consideration during the go-to-market plan, as well as the actual management of the existing fleet.

Additionally, there are important human-resources management issues that will have to be looked into and tackled with a specific plan to ensure a smooth transition from existing employees' tasks, salaries and schedules to a whole new system for EMT drivers.

EMT's required steps towards a successful implementation of the automated bus depot business case are a few still, but it is all part of their ambition of serving the city and the citizens with the best public transport possible and being pioneers in their sector. Through this solution, they move a step closer to their ultimate goal while at the same time, with the help of the Villaverde bajo-cruce to La Nave scenario, they are also involved in innovative solutions related directly with passenger transport, where they feel the need to be closer to, even if this more advanced automation applications do not appear in their short to mid-term plans.

Finally, regarding the possible operator models, EMT usually operates in private-public partnerships and is in close relationship to regional authorities too, through funding and implementation. So many options are open for such scenarios, but they will always be the centre for the operations and the rest of participants will come in mainly as providers of services and capital.

4.2.8 Summary

As a publicly owned transport operator, EMT's mission is to improve the service for the sake of the city and its citizens. Therefore, EMT does not have direct economic interests in implementing automation, they see it however as a great technological advancement through which their operations can be improved and resources optimized, whilst boosting innovation, and all together contributing to providing better services and positive externalities or beneficial side effects to be investigated and concretised through the SHOW piloting activities.

Whilst looking at the proposed scenario in Carabanchel's depot, automation can mean an optimization in personnel costs, fleet parking space, increased safety and operation times, as well as improvements in CAPEX and OPEX over the long run, eventually resulting in benefits both for EMT, it's employees, Madrid citizens and the city as a whole.

The SHOW pilot business model implementation and evaluation will focus on identifying the potential for operational optimisation and related additional benefits associated with the future deployment of automated depot management operations at a large scale in the mid-long term.

4.3 Advanced MaaS in urban environments

4.3.1 Fore-sighting and business innovation in Rouen, France

Rouen has already deployed the first on-demand transport service using autonomous vehicles on open roads in Europe with the Rouen Normandy Autonomous Lab project [8], in various suburban locations. Rouen Normandy Autonomous Lab has allowed Rouen Normandy Metropolis and its partners (Normandy Region, Caisse des Dépôts, Transdev, Renault, Matmut and FEDER / Europe) to gain a valuable experience and know-how from those on-going field operations. This innovative

sustainable transportation service showcases innovative capabilities developed between key actors of tomorrow's mobility.

The next step is opened with SHOW: this new phase consists in the experimentation of 3 autonomous and electric mobility services by Transdev and Renault, such as Collective Public Transport on the territory of the Rouen Normandy Metropolis, committed to the development of intelligent mobility for all, with: autonomous shuttles in urban and peri-urban areas to complement and/or then replace a bus line; on-demand, electric, autonomous and shared cars to serve Rouen city centre, with fixed stops. The two different Use Cases are shown in the following figures.

Figure 7 shows the Rouen city centre with the area for the DRT line and robo-taxis.

Figure 7 - Rouen city center Use Case - Robo Taxis

Figure 8 shows the bus line (coach bus) for the peri-urban area.

Figure 8 - Rouen peri-urban Use Case - Bus line

4.3.2 Business Model Canvas

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.
Table 5 - Business Model Rouen - Advanced MaaS in urban environments shows the built business model for this scenario.

Table 5 - Business Model Rouen - Advanced MaaS in urban environments

BUSINESS MODEL CANVAS	
Value Proposition	• Providing mobility for the City of Rouen/region Rouen Normandy • Experiencing an overall connected transport system
Customer Segments	• Passenger transport for population ranging from urban areas to rural areas (Commuting, Business, Leisure) • 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 • Astuce service centre • Hotline/Mail contact • Customer contract
Channels	• Astuce website • My Astuce app • Rouen Normandy Autonomous Lab
Key Resources	• Vehicles • Supervision centre with fleet control room, smart infrastructure and secure telecommunications networks • Infrastructure for parking/hand-over, charging • Mobility application My Astuce
Key Activities	• Infrastructure setup and maintenance including own vehicles • Supervision centre & fleet control • Enhancement of provided services and future services such as of intelligent communication infrastructure & ITS • Marketing and sales • Real-time monitoring of network status • Management of operational hazards/incidents • Sending instructions to drivers/vehicles
Key Partners	• PTA Rouen Normandie • Renault as provider of vehicles connected to the PT network infrastructure • OEMs • Municipalities of Rouen Normandie metropolis • PT control centre • Insurance companies • Research

Revenue Streams	• Ticketing
	  ○ Subscription (annually, monthly)
	  ○ Pay per use (ticket, SMS ticket)
	• Compensation by PTAs

BUSINESS MODEL CANVAS	
	• Marginal revenue from advertising
Cost structure	• Technical installation • Initial invest

4.3.3 Value Proposition Canvas

The value proposed through the business model build in Rouen is “Advanced automated MaaS in urban environments”. The service is built around the city center of Rouen and one peri-urban bus line leading to the exhibition center of the city. Combining these different lines and approaches leads to enhancing the overall mobility as a Service portfolio of the city, operated by Transdev. First and foremost are the initiatives of reducing the private vehicle usage on and around the city center and making the city more sustainable and friendly for VRUs like pedestrians and bikers.

The interaction between the customer needs and the value that the service can deliver is stated inTable 6.

Table 6 - Value Proposition Canvas Rouen - Advanced MaaS in urban environments

Value Proposition Canvas	
Customer Segment	Passenger transport for population ranging from urban areas to rural areas (Commuting, Business, Leisure) PT users with additional mobility needs
Customer Jobs	• Commuting • Shopping • Groceries • Leisure Trips • Tourism
Customer Pains	• Congested city centres • Danger for VRUs • No locals: not knowing which line to take, confusing public transport situation • Inflexible hop-in/ drop-off points • No guaranty for space or seating • No information on delays • Delays • Search for parking spaces
Customer Gains	• Coordinating multiple lines • Drop-off for parcels / post • USB charging in vehicles • Cost effectiveness in comparison to the private car • Ease of use in comparison to private car • Comfortable seating
Value Proposition	Providing mobility for the City of Rouen/region Rouen Normandy Experiencing an overall connected transport system
Products & Services	• **Shuttle i-Cristal**: Max: 30 km/h • **Robo-taxi Renault Zoe**: Max: 30 km/h • Advanced tests on private tests trucks with higher speeds • A regular bus line enforced with i-Cristal autonomous shuttles • An on-demand Transport service in dense city-centre of Rouen in Renault ZOE

Pain Relievers	• Easy to use and understand mobility as a service application • All city's mobility services on one app • Real-Time information about traffic volume in the area and riders for the shuttle • On demand transportation, flexibility • Pre-booking of tickets and/ or space (seats)
Gain Creators	• City ticket with easy pricing – e.g. flat rate being able to use multiple mobility services • Sustainable urban cities • Safer cities for VRUs and other vehicle (drivers) • Reduction of private car usage in urban areas

4.3.4 Success & Failure factors

Success Factors:

- **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. Transdev is extremely active in researching suitable infrastructure add-ons for the Use Case, where needed. 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, but also willingness to use the service.
- **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.

Failure factors:

- **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.

4.3.5 Strengths & Weaknesses compared to traditional public transportation

With the Use Cases tested in SHOW, Transdev wants to enhance their portfolio and move from providing public transportation to providing mobility as a service solutions.

For them, this is a huge boost for the competitiveness of the company, but also the inhabitants of Rouen and the city itself will be positively effected by the MaaS development of Transdev. Transdev will be able to provide more flexible, urban transportation which is aiming to reduce the private car usage within the city center. The city will become less dense (vehicle wise), and more sustainable, due to lower emissions (CO2 and noise). When automated services are in place, the rural and peri-urban routes could be offered at a lower price.

But the technological development is also the biggest challenge for enabling the business model of automated MaaS services. While, according to Transdev, it won't be able to be tackled short or mid-term.

4.3.6 Mapping to UC and SHOW demo sites

The business Model: “Advanced MaaS in urban environments” revolves around the following SHOW Use Cases displayed in Figure 9:

	SHOW Use Cases																
Scenario	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	2.1	2.2	3.1	3.2	3.3	3.4	3.5
Rouen	☑	☑	☑	☑	☑	☑	☑			☑			☑			☑	

Figure 9 - Rouen Megasite distribution of SHOW Use Cases

- UC 1.1: Automated passengers mobility in cities under normal traffic & environmental conditions;
- UC 1.2: Automated passengers mobility in cities under complex traffic & environmental conditions;
- UC 1.3: Interfacing non automated vehicles/ travellers (VRU);
- UC 1.4: Energy sustainable automated passengers/cargo mobility in Cities;
- UC 1.5: Actual integration to city Public Transport Control Centre;
- UC 1.6: Mixed traffic flows;
- UC 1.7: Connection to Operation Centre for remote supervision;
- UC 1.10: Seamless autonomous transport chains of Automated PT, DRT, MaaS;
- UC 3.1: Self-learning Demand Response Passengers mobility;
- UC 3.4: Big data/AI based added value services for Passengers mobility.

4.3.7 Go-to-market strategies and proposed operator model

As a pioneer in the automated mobility related topic, 2001 Transdev started to operate a L2 automated buses with optical guidance in Rouen. Since 2017 created a whole ecosystem is built around AVs with the Rouen Normandy Autonomous Lab. SHOW is now part of it and while the initial project lifetime of Rouen Normandy Autonomous Lab

is officially over, the development of the technical specification and building of business models lives on within SHOW.

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. Transdev is very much interested in taking the Use Cases to the market and has a strong business model to support these initiatives. For them the collaboration with SMEs and start-ups is crucial.

Additionally, Transdev is running studies on the acceptance of their automated vehicles and have already asked around 300 people to evaluate the SHOW Use Case [9].

Transdev already gathered 5,000 hours of video material to monitor behavior of other drivers, to feed their autonomous cars information and make their system more secure and safe.

According to them, a positive effect is, that level 5 automation is not needed to operate within Public Transport solutions. The condition in which the vehicle moves autonomously will cover 95% of the situations within the city center (Overtaking, Intersections, etc.). For unpredictable incidents, Transdev would either need a safety operator within the car, or is really interested in tele-operation.

Transdev ambition is to go beyond experimentation and to apply their understanding of the needs of each region to the gradual and successful integration of these technologies into public transport networks.

For Transdev multiple operator models are possible. They hold most of their assets themselves (within the MaaS) but are open for cooperation with other SMEs (Private Public Partnership), etc. For an integrator model, Transdev would want to act as the integrator themselves.

4.3.8 Summary

In Rouen a strategy exists for the next 12 years, with the objective to reduce modal share of private car (currently 67%) and pollution as part of the Sustainable Urban Mobility Plan (SUMP) goals achievement. Integration of electric vehicles and citizens shouldwork in co-creationprocesses. Transdev is in charge of the autonomous services axis.

Transdev firmly believes that shared autonomous transport is set to radically change the way to travel and, on a broader scale, the way to live (through flexible, personalised and accessible services, more stops and more regular services, reduced noise and air pollution…). This represents an excellent opportunity for local authority transport networks due to the fact that shared autonomous mobility services will be rolled out before personal autonomous vehicles.

Rouen has already deployed the first on-demand transport service using autonomous vehicles on open roads in Europe with the Rouen Normandy Autonomous Lab project, in various suburban locations. Rouen Normandy Autonomous Lab has allowed Rouen Normandy Metropolis and its partners (Normandy Region, Caisse des Dépôts, Transdev, Renault, Matmut and FEDER / Europe) to gain a valuable experience and know-how from those on-going field operations. This innovative sustainable transportation service showcases innovative capabilities developed between key actors of tomorrow’s mobility.

Normandy Metropolis is committed to the development of intelligent mobility for all, encompassing: autonomous shuttles in urban and peri-urban areas to complement

and/or then replace a bus line; on-demand, electric, autonomous and shared cars to serve Rouen city centre, with fixed stops.

At this stage Transdev and their partners are still in the phase where they are massively investing in the technologies in order to achieve the minimum required level that allows to create a real service. The decision makers should understand that the gap between experimentation and real service is big and the need massive financial support.

Transdev´s motivation to participate in the French SHOW demonstrations is 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.

Transdev is on a great way to market the solutions, once technologically developed, with a great consortium of partners (local and international).

4.4 MaaS and LaaS for hospital/campus operations

4.4.1 Fore-sighting and business innovation in Rennes, France

The SHOW demo site in Rennes is the hospital campus of the CHU (Centre Hospitalier Universitaire de Rennes, trans. Medical University Hospital). Behind the Use Case is a greater mobility plan of the hospital administration, to create a car free, sustainable and overall enjoyable campus for people that have to stay at the hospital and their visitors. A concept of this can be seen in Figure 10 - Concept for the CHU future campus.

The service itself handles two very interested approaches at the same time:

- Transport of persons: Visitors, medical staff, logistic staff, students, VRUs
- Transport of goods: Medical equipment, blood, small laundry

The use case will be to offer mobility both to the passengers on the CHU site (patient, doctors, visitors) and evaluate which segment if the most appropriate to the use of automated shuttles and when.

The shuttles will also transport light material when there are no passengers to move (night), the security and safety requirements for this material transport will be analysed and new services and equipment will be developed (GRUAU third party).

Figure 10 - Concept for the CHU future campus

4.4.2 Business Model Canvas

The CHU Rennes has the interest to become one of the first car free and environmentally friendly hospital campuses. Therefore, they joined the SHOW project, backing up their Use Cases with a bigger plan than “just” technical development. This builds a great foundation for go-to-market activities. Table 7 shows the business model that has been developed with the demo site.

Additional to the Use Case specifications, it has to be stated that around the campus there is a metro stration and bike sharing - provided by the local PTO STAR, which is not part of the demo site consortium – and parking. The campus consists of multiple facilities and it either takes long walks to the different facilities or the car, to go to the according parking space.

Table 7 - Business Model Rennes - MaaS and LaaS for the hospital campus

BUSINESS MODEL CANVAS	
Value Proposition	• One of the first car free and environmentally friendly hospital campuses • Train station, metro station, bike sharing, parking – near and • Cars can be used on campus from building to building • Bus line on the campus from train station • Medical equipment delivered at night
Customer Segments	• Patients of CHU, visitors, doctors and medical personnel. • Hospital stations and management
Customer Relationships	• passenger information on the stations, flyers in the hospital, website etc.

BUSINESS MODEL CANVAS	
Channels	• Information around and on the hospital campus • Planned: Application, integration to PTO
Key Resources	• Campus plan of CHU “vehicle free campus” • Strong partners on demo site • Strong business model (passengers as well as logistics) • Financial support
Key Activities	• Planning of demonstration with special regards to the COVID-19 situation because of the hospital area • Planning of the services and interior design of the vehicles
Key Partners	• Shuttle and its driver • PT operator KEOLIS • passengers • ESI group for acceptability survey • GRUAU. Start up cooperation for reservation, cooperation for customer surveys • CHU hospital administration
Revenue Streams	• Generating money is not the focus of the Use Case, the Use case mainly wants to support the initiative of CHUs plans to transform the campus to a vehicle free area. • Less noise, less emission, more safety, more space • If the Use Case get’s integrated into the existing public transportation of the area, then the same ticket prices would apply
Cost structure	CAPEX: • Vehicle • Interior building • Technical installation OPEX: • Personnel • Maintenance • Swapping interior

4.4.3 Value Proposition Canvas

The value proposed through the business model built in Rennes is “MaaS and LaaS for the hospital campus”. The service is built around the sustainable concept plan of the CHU itself, combining passenger transport and transport of medical goods.

On the one hand, an upscaled business model of this concept, would be addressed to other campus-like locations, but to explain the value proposition better, this document

focuses on the customer segment of the passengers and hospital workers, as end-users of the service. The value proposition canvas states as follows:

Table 8 - Value Proposition Canvas Rennes - MaaS and LaaS for the hospital campus

Value Proposition Canvas	
Customer Segment	Patients of CHU, visitors, doctors and medical personnel. Hospital stations and management
Customer Jobs	• Urgent trips to the hospital • Visiting family members/ friends in the hospital • Day-Care trips for treatments, e.g. chemo therapy, dialysis • Transporting medical goods • Moving around the campus • Special needs with regards to mobility • slow, visually deficient, mentally deficient
Customer Pains	• Long foot walks to the facilities from the parking/ metro station • Not enough overview of the campus area and where to go • Immobility or reduced mobility (e.g. broken bones, wheelchair) • A lot of individual traffic
Customer Gains	• Information of the campus area • Information on the way around the campus • Reliable way to move from and to facilities • Information on the hospital
Value Proposition	One of the first car free and environmentally friendly hospital campuses Train station, metro station, bike sharing, parking – near and Cars can be used on campus from building to building Bus line on the campus from train station Medical equipment delivered at night
Products & Services	• 6 shuttles dedicated to passengers and freight • Navya and Easymile • 5-10 km/h • On board sensors, HD-mapping • On-site intelligent signs and totem for passengers (use of ITS, 5G networks)
Pain Relievers	• Secure and safe transportation around the campus • Comfortability • Vehicles addressing the needs of hospitalized people and day care cases
Gain Creators	• Building of a hospital campus information system • Integrated into the local transportation (app and transport)

4.4.4 Success & Failure factors

Success:

- **Infrastructure-Environment:** The campus itself is a great area for the use case, as there is no complex urban traffic situations with falsely parked cars, intersections, etc.
- **Vehicle type:** The Keolis vehicle which is used in Rennes is built for two different solutions – passenger transport and transportation of medical goods. Right now, Keolis and CHU are working on the interior design for the secure transport of fragile and expensive medical supply.
- **Ecosystem for SMEs/start-ups**: According to CHU, Rennes offers a rich ecosystem for SMEs and start-ups for collaboration.
- **Overall campus**-plan: The CHU administration developed a future concept for the campus, including the mobility solutions tested within SHOW. Having such a backup, covers the demonstration and business model not only financially, but gives it the needed local support

Failure:

- **COVID-19:** Is the hardest challenge for the demonstration and successful uptake of the business model right now. The CHU is at the heart of the pandemic. Demonstrations can't run as planned and all activities are pushed back, as handling the situation is the top priority now.
- **Costs:** Driver transformation will represent an added cost at the beginning. Software licenses are also a big part of the costs.

4.4.5 Strengths & Weaknesses compared to traditional public transportation

At this point there is no public transportation available on the campus, except for shared services, like bikes and taxis. The ways around the campus are quite complex and with the future campus concept and mobility services on campus the look and experienced moving around it will improve.

Visitors will have it easier to go from facility to facility and compared to loud, inflexible coach busses, the little shuttles will take less space and integrate nicely into the concept.

4.4.6 Mapping to UC and SHOW demo sites

The business Model: "MaaS and LaaS for the hospital campus" revolves around the following SHOW Use Cases:

	SHOW Use Cases																
Scenario	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	2.1	2.2	3.1	3.2	3.3	3.4	3.5
Rennes CHU Hospital		☑	☑	☑						☑		☑					

Figure 11 - Rennes Megasite distribution of SHOW Use Cases

- **For Use Cases 1.1 & 2.2:** Providing a safe, acceptable and efficient mixed transport service for all the CHU users.
- **For Use Case 1.3:** Improving the interface between the shuttles and the vulnerable users in the CHU (slow, visually deficient, mentally deficient etc.) for 100% safety.
- **For Use Case 1.4:** Developing a management system for combining the needs of charging and the requirement of the service via optimisation tools.
- **For Use Case 1.10:** Integrating the automated shuttle service into the automated transport offer in Rennes (metro).

4.4.7 Go-to-market strategies and proposed operator model

No experimentation at the CHU campus has been done yet and is likely to be postponed further because of the COVID-19 impact on the hospital. The innovation that the demo site focuses on, will be in building added-value services and adaptation of the interior design of shuttles.

Regarding the go-to-market phase, the business model is backed up with the overall campus concept for the CHU. The most important point now is, to integrate the PTO of Rennes into the demonstration and inspire him for the solution. The CHU itself or partners like Keolis could operate such a service, if we're thinking about the operator model "Private Public Partnership" or in the case of CHU "social innovation model". But the most profitable way would be to integrate the solution into the PTO's systems.

- **For Use Case 1.10:** Integrating the automated shuttle service into the automated transport offer in Rennes (metro).

4.4.8 Summary

The demo site Rennes is built on the campus of the university hospital (CHU) and backed up with an excellent future-campus-concept of the administration of the hospital. This not only secures the financing of the pilot but will also enhance the uptake of the business model and the whole go-to-market phase.

But with all these positives effects around the demo site, the COVID-19 pandemic might be endangering the demonstrations most at this specific place, as the hospital is at the heart of the pandemic.

Meanwhile, Keolis and their demo site partners are working on simulations and the interior capabilities of the vehicles for the transportation of medical supplies, as well as getting the local public transport operator on board.

4.5 Peri-urban automated transportation and C-ITS connectivity

4.5.1 Fore-sighting and business innovation in Salzburg, Austria

The demo site in Salzburg is built upon two scenarios.

Scenario 1 will be realized in the municipality of Koppl. The municipality is located in the peri-urban area of the City of Salzburg. The route links the centre of Koppl municipality to the "Sperrbrücke" bus stop, which is situated on the main road to Salzburg city centre. "Sperrbrücke" bus stop is a stop of the public bus line no. 150 connecting the peri-urban areas to the city centre. Therefore, "Koppl Sperrbrücke" acts as an intermodal interchange where passengers are able to change from the automated shuttle bus to the public bus line. The bus stop has been equipped with an area for safely turning the automated shuttle. The length of the autonomous shuttle route is approximately 1.4 km one-way.

Scenario 2 focuses on the public bus corridor between "Koppl Sperrbrücke" and the City of Salzburg. The public bus line 150 connects the peri-urban area Koppl with the city centre on an arterial, rural road. The length of the route is approximately 7.9 km one-way, the maximum speed limit is 80 km/h. It is a partly curvy asphalt road with separate driving lanes bridging nearly 300 meters height difference between the starting point in Koppl and the arrival point in the city of Salzburg. There are eleven bus stops in each direction on this route.

Figure 12 shows the route of the two above explained scenarios. The green route shows the autonomous sub-urban connection to regional Line 150, which is supposed to be operated as an on-demand service long term, but for this demonstration still running on a fixed schedule. The purple route shows the demo for the C-ITS enhanced public bus connecting efficiently intermodal mobility HUB to the city centre.

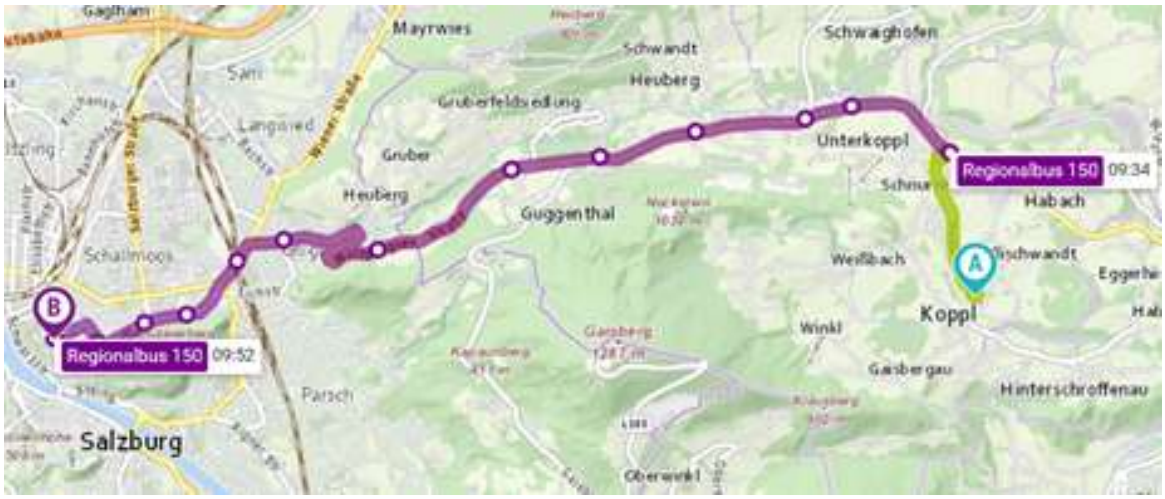

Figure 12 - Route of the two scenarios in Salzburg

4.5.2 Business Model Canvas

The autonomous shuttle used for the first mile to the peri-urban bus line 150 was already tested in another project and is already established in the region. The demographic of users is wide, ranging from young people to elderly. Table 9 shows the business model build in Salzburg.

Table 9 - Business Model Salzburg - Peri-urban automated transportation and C-ITS connectivity

BUSINESS MODEL CANVAS	

Value Proposition	• (On demand) Connection of the sub-urban area in Koppl to the well-established regional bus lines
	• Benefitting from C-ITS cooperative traffic management e.g.
	  ○ In-vehicle speed limits, including dynamic speed limits
	  ○ Emergency electronic braking light
	  ○ Road works warning
	  ○ Weather conditions
	  ○ Intersection safety

Customer Segments	• Passenger transport for population at urban and peri-urban areas (Commuting, Business, Leisure) • PT users with additional mobility needs
Customer Relationships	• Salzburger Verkehrsverbund service centre • Hotline/Mail contact • Customer contract • Positive feedback regarding usefulness and comfort • High acceptance

BUSINESS MODEL CANVAS	
Channels	• Website (www.salzburg-verkehr.at) • Salzburg Verkehr app with intelligent map (mobility radar) with real-time information and routing function • Interactive map • Free audio guide for tourists on bus line 150 • Local newspapers, flyers • TV • The use case itself is not yet integrated in existing mobility solutions
Key Resources	• 4 stations along the automated shuttle path • HD Mapping • 5 RSU by Kapsch • Strong partners e.g. relations with Easymile • Strong partner consortium • Region and municipality are experienced in testing autonomous vehicles • Acceptance of inhabitants • Buses, including trolley buses • Salzburg Verkehr app with intelligent map (mobility radar) with real-time information and routing function
Key Activities	• Running Pre-Demo SHOW early 2021 • On-Going validation and testing • Cooperation with PTO Salzburg Verkehr about sustainability of the project results, possible operator model • Infrastructure setup and maintenance including own vehicles • Enhancement of provided services and future services such as of intelligent communication infrastructure & ITS • Marketing and sales • Real-time monitoring of network status • Management of operational hazards/incidents • Sending instructions to drivers/vehicles
Key Partners	• Municipalities, urban areas and local communities • Salzburg Research • Austria Tech • Salzburger Verkehrsverbund GmbH
Revenue Streams	• Soft factors are most important for the region: • Connecting people to the regional bus line: 150. • Possible ticketing: Pay as you go or integration into current Salzburg Verkehr pricing strategy ○ Total revenue/traffic division Salzburg AG: 62.035.169 € (2019)

BUSINESS MODEL CANVAS	
	○ 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
Cost structure	• Technical installation • Investment in Infrastructure • Personnel • Investments in machines and equipment/traffic division Salzburg AG: 15,300,000 € (2019)

4.5.3 Value Proposition Canvas

The value proposed in the business model built with the pilot site Salzburg is "Peri-urban automated transportation and C-ITS connectivity. The business model canvas can be seen in the following table:

Table 10 - Value Proposition Canvas Salzburg - Peri-urban automated transportation and C-ITS connectivity

Value Proposition Canvas	
Customer Segment	Passenger transport for population at urban and peri-urban areas (Commuting, Business, Leisure) PT users with additional mobility needs
Customer Jobs	• Commuting • Leisure trips • Tourism trips
Customer Pains	• No information on delays, traffic situation • Longer waiting times due to the lack of bus priority on the road • Hilly area, hard to walk for some pedestrians, especially elderly
Customer Gains	• Higher flexibility = on demand automated shuttles • Higher frequencies • Electrified buses boosting sustainability
Value Proposition	(On demand) Connection of the sub-urban area in Koppl to the well-established regional bus lines Benefitting from C-ITS cooperative traffic management e.g. In-vehicle speed limits, including dynamic speed limits Emergency electronic braking light

Value Proposition Canvas	
	Road works warning Weather conditions Intersection safety
Products & Services	• C-ITS cooperative traffic management • Shuttle bus in municipality with direct connection to big bus lane • Autonomous bus for 8 people
Pain Relievers	• Real-time information on the road condition through C-ITS • Real-time information on delays • Priority to the bus
Gain Creators	• Connection to the sub-urban areas around the city of Salzburg is needed but only a small number of buses with long pauses in between the scheduled trips are available • Walking trips around 1-2km to the next PT line with higher frequencies • Comfort of PT • Sustainability of private car usage

4.5.4 Success & failure factors

Success:

In 2016 Salzburg started the initiative “Digibus Austria” in which the autonomous shuttle was first introduced. Since then it has been greatly accepted by the political decision makers and the users. The demo site will continuously be used for tests.

The demo site is considering the integration of on-demand services for the shuttle, especially, because there is a need for seat management (booking a ride on the shuttle). Often times, passengers have to wait for another cycle of the shuttle, because it often is full. This on the other hand, shows the great acceptance at an early stage.

Failure:

The vehicle(s) are not resilient, robust, reliable as needed to be operated in a save, viable and profitable after-project lifetime. Salzburg research is in close contact with the vehicle manufacturer to continually work on the improvement of the vehicle.

The pandemic influence on public transportation services is especially hard on the small shuttles, as they already transport only 8 people, which is not reduced to even less.

CCAV applications are not possible with shuttles as they can only read/ receive information but not yet send to infrastructure.

4.5.5 Strengths & Weaknesses compared to traditional public transportation

The route for the autonomous shuttle is only 1,4 km, approximately the length of the municipality. Therefore, a normal coach bus wouldn’t be feasible. The smaller, more flexible shuttle busses are a better fit. The C-ITS connection in the non-automated bus allows for in-vehicle (dynamic) speed limits and emergency electronic braking lights as well as road works warning.

For the alpine area of Salzburg the regular updates on weather conditions are a huge plase and last but not least the overall traffic safety is enhanced through C-ITS.

The Weakness compared to a normal system is mainly the costs and initial investment in the infrastructure.

4.5.6 Mapping to UC and SHOW demo sites

The Pilot site Salzburg envisages the implementation of two scenarios (scenario 1 and scenario 2). With these scenarios, the pilot site will be able to cover the following UCs: 1.2, 1.3, 1.6 and 3.1.

	SHOW Use Cases															
Scenario	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	2.1	2.2	3.1	3.2	3.3	3.4	3.5
Salzburg		☑	☑			☑							☑				

Figure 13 - Salzburg Megasite distribution of SHOW Use Cases

Scenario 1: Testing automated demand responsive transport (DRT) for connecting a peri-urban area to a city centre via an intermodal mobility hub. Demand-responsive automated shuttles are used to bridge the first/last mile.

Scenario 2: Testing of a C-ITS enabled bus corridor, connecting an intermodal mobility hub to the city centre at high efficiency. It is planned that the buses will be equipped with OBU's and that RSU's connected to the TMC of Salzburg will be installed.

4.5.7 Go-to-market strategies and proposed operator model

With regards to marketing and establishing the service at the demo sites for the user, Salzburg is ahead of all demo sites within SHOW. For their specific business model, it is now important to follow up on this. The PTO of Salzburg called "Salzburg Verkehr" is an associated partner of the pilot site. Discussion for an integration to the already existing public transport services are on-going. If Salzburg Verkehr decides to bring the solution to the market themselves, they act within the central model. During the interview it was also stated, that cooperating with SMEs would be possible. Therefore, the operator model "liberal" model would be possible, as well.

4.5.8 Summary

The demo site's services are integrated and feeding into the timetables of Salzburg Verkehr's bus lines. One bus line is being equipped with C-ITS technology. The automated shuttle bus is already established within the region and the demo site has a great opportunity of taking their services to the market.

Salzburg Verkehr would also be the partner to buy and operate such lines, the scope is not yet set but they are involved in ongoing discussions continuing next year

4.6 Robotaxi services for short distance trips

4.6.1 Fore-sighting and business innovation in Graz, Austria

An existing public transport terminal "Puntingam" (bus, tram, train) will be extended with automated shuttles that provide rides to a shopping center. In this urban scenario the automated shuttles will stop at the terminal, pick up people and drive through the public stops where there are many pedestrians. The main goal will be the development of automated driving functions for the vehicle with support of infrastructure at the

terminal. Close to the terminal is the shopping center “center west” to which the automated route will be going.

Figure 14 - Public Transport HUB Puntingam, Graz

Figure 15 - Graz, Route between the station and the shopping center

4.6.2 Business Model Canvas

The demo site in Graz has a great opportunity to build a sustainable business model, as there is a big demand of transportation from the train station to the centre west. The shopping mall has a public bus stop, but the bus itself drives a longer route after the shopping centre, often times quite empty. An additional shuttle, or robo-taxi, could be an addition to the existing bus line and only circulate within the 1km route. The business model itself is described in the following table.

Table 11 - Business Model Graz – Robotaxi services for short distance trips

BUSINESS MODEL CANVAS

Value Proposition	• Flexible, fast connection to the shopping centre “centre west” • Robo Taxi service • Automated trunk opening
Customer Segments	• Passenger transport to and from the shopping centre • Especially interesting for: PT users with additional mobility needs
Customer Relationships	• Tests with real “inexperienced” passengers are planned • Long term: Integration with public transport operator possible
Channels	• Information in center west and at the station • Flyers, local news • No integration in any app yet
Key Resources	• Research orientated demo site partners • Route without interference with private cars or VRUs (only busses) • Vehicles used (normal private cars) cheaper than shuttle busses • “Robo Taxis”
Key Activities	• Installation of infrastructure along the route and at the station • Preparing the demo in 2021 • Cost evaluation
Key Partners	• Center West • Virtual vehicle
Revenue Streams	• Ticket sales
Cost structure	• Technical installation • Investment in Infrastructure • Personnel

4.6.3 Value Proposition Canvas

The value proposition for the service at the demo site Graz is “Robotaxi services for short distance trips”. The route from the bus station to the shopping mall is only 1km but busses don’t drive often. Possible passengers have to walk the last mile, if they didn’t catch the bus. The service tested in SHOW can eliminate this problem. The whole value proposition canvas is explained in the following table.

Table 12 - Value proposition canvas Graz - Robotaxi services for short distance trips

Value Proposition Canvas	
Customer Segment	Passenger transport to and from the shopping centre Especially interesting for: PT users with additional mobility needs
Customer Jobs	• Leisure trips • Commuting • Shopping trips
Customer Pains	• Long waiting times for a bus that drives to the centre

	• A lot of empty trips on the route after the Center bus stop • Busses are often complicated to board for people with special mobility needs
Customer Gains	• Higher frequencies • Electrified taxis boosting sustainability
Value Proposition	Flexible, fast connection to the shopping centre “centre west” Robo Taxi service Automated trunk opening
Products & Services	• Additional infrastructure at the station (sensors) • Robo-Taxis (normal passenger cars) • 1km route with no other privately used vehicles (PT only)
Pain Relievers	• Higher frequencies due to trips only in between the station and the centre
Gain Creators	• More comfort than normal buses • More sustainable than private car usage

4.6.4 Success & Failure factors

Success:

In Graz and especially the little area of the demo site, a need for more transportation is given, that is better handled by autonomous shared services. Once the trails have been successful Graz should build upon this and plan to market the solution with the local PTO.

Failure:

But until now, the pilot site didn’t really consider and see their business potential, the business model remained unclear. The document and the according WP2 partners are helping with the building of business models on the pilot site.

The demo site has no prior experience with the setup of autonomous cars in that area, which can delay the demonstrations and other activities.

4.6.5 Strengths & Weaknesses compared to traditional public transportation

As already mentioned within the business model, the route to the center is only 1km and the public bus only drivers there approx.. every 15 to 20min. For a lot of visitors, a foot walk is faster.

An automated robo-taxi could quickly make the rounds in between the center and the bus station, in a more cost-efficient way, then adding another bus to the line.

This would completely eliminate waiting times

The demo site partners think of an add-on: payment with barcodes/ QR Codes within the car.

A weakness compared to the normal bus, is the amount of people transported. The robo taxi can only take 3 additional people on the trip, which might not be enough to handle the demand peaks.

4.6.6 Mapping to UC and SHOW demo sites

In the pilot site of Graz the following SHOW Use Cases are going to be covered: UC1.2; UC1.3; UC3.4.

There are no differences for the implementation of UCs in Graz. There is one common implementation, where an automated shuttle drives along a route (UC1.2), detects VRUs (UC1.3) and serves a bus stop (UC3.4).

	SHOW Use Cases																
Scenario	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	2.1	2.2	3.1	3.2	3.3	3.4	3.5
Graz		☑	☑													☑	

Figure 16 - Graz Megasite distribution of SHOW Use Cases

4.6.7 Go-to-market strategies and proposed operator model

The Use Case was handled very technically up until this point and solely technical feasibility tests are being done. Once the initial technical set-up has been done, tests on willingness to use and other user tests should be done. On the example of other sites, it was found out that the go-to-market phase can be easier, if the local PTO is on-board. The demo site lead partner v2c2 should involve Graz PTO and see, if they are willing to operate a robo-taxi service for the specific route tested within the Use Case. The Use Case has a big potential because mobility services in cooperation with HUBs are a huge opportunity.

4.6.8 Summary

Graz' business model resolves around the 1km route between the PT station "Puntingam" and the shopping mall "centre west". This route is a perfect testing ground for not only the technological challenges of the uptake of autonomous vehicles, but can also show the uptake of new mobility business models. The demand for mobility services has already been identified by the demo site partners. For a go-to-market phase they have to build up on that and get the local PTO involved.

4.7 Sustainable autonomous public transportation

4.7.1 Fore-sighting and business innovation in Linköping, Sweden

The demo site in Linköping aims to show how autonomous buses work within a future, sustainable, urban living space and shows why urban mobility is needed there.

The implementation of the Use Case is done in two phases, as there are two major conditions along the route:

Phase 1 is the implementation on an existing street and the interaction with mixed traffic situations. A red light prioritization assistance will be added for the shuttles.

Phase 2 is the implementations of the Use case in a new area. The city wants to build a sustainable exhibition living area, with no cars allowed. Only shared solutions can be used within this sustainable urban living space. Another speciality is, that there is a special school for children with special needs. During the morning and afternoon there is approx. 22 taxis for these kids that need assistance to get from the train stations to the school, as a foot walk wouldn't be possible for them. The automated solution could be built for their needs. The taxis should be replaced in the long term by automated last mile PT in shuttles.

Figure 17 - Vehicles used in Linköping

4.7.2 Business Model Canvas

Table 13 - Business model Linköping, sustainable autonomous public transportation

BUSINESS MODEL CANVAS	
Value Proposition	• Offer autonomous public transportation for future, car-free urban living space • Improve the user experience which is why the aim is for elderly and children • Door to Door perspective, services for "special" needs: blind, limited mobility
Customer Segments	• Passenger transport for population at urban and rural areas (Commuting, Business, Leisure) • PT users with additional mobility needs
Customer Relationships	• Planned: Application development • Later an integration to: Östgötatrafiken (PTO), Transdev as operator in city of Linköping and Östergötaland County
Channels	• Östgötatrafiken website • Östgötatrafiken app • Östgötatrafiken interactive map
Key Resources	• Sustainable concept for future urban living spaces • Vehicles • Infrastructure for parking/hand-over, charging • LinBike • rental cars & sharing cars • parking app (LinPark)
Key Activities	• Marketing and sales • Infrastructure setup and maintenance including own vehicles • Enhancement of provided services • R&D on new mobility solutions
Key Partners	• PTA Östgötatrafiken • OEMs • Bike & Car rental • Municipality of Linköping • Research (University) • Akademiska Hus (real estate company) • Dukaten (parking)

Revenue Streams	• Ticket Sales:
	  • Subscription
	  • Pay per use
	• Value increase in the land
	• Sustainability

Cost factors	• Initial investment in the fleet • Technical installation • Infrastructure • Personnel • Maintenance

These figures are taken from the annual report of Östgötatrafiken:

- 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).

Tickets:

- 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.

4.7.3 Value Proposition Canvas

Table 14 - Value Proposition Canvas Linköping, sustainable autonomous public transportation

Value Proposition Canvas	
Customer Segment	Passenger transport for population at urban and rural areas (Commuting, Business, Leisure) PT users with additional mobility needs
Customer Jobs	• Sustainable city management • Sustainable urban areas: elderly, children • Commuting • Trips to and from school
Customer Pains	• Long connection to trunk line, • Special needs in mobility (reduced mobility), • High costs for last mile transportation (e.g. taxis for the children to school)
Customer Gains	• Connecting the last mile, • Raising value of the property • Continuous development and research, “Best practice area”
Value Proposition	Offer autonomous public transportation for future, car-free urban living spce Improve the user experience which is why the aim is for elderly and children Door to Door perspective, services for “special” needs: blind, limited mobility

Products & Services	• Two shuttles (Navya, Easymile)
	• Two different road types
	  ○ Complex mixed traffic
	  ○ Extra road for only shared mobility solutions

Pain Relievers	• A feeder for the first/ last mile is set in place • The autonomous shuttle are specialized for the needs of the school kids with reduced mobility and elderly people living in the area

Value Proposition Canvas	
Gain Creators	• More comfort than normal buses • More sustainable than private car usage • Raining the value of the property

4.7.4 Success factors & Failure factors

VTI, the demo site leader in Linköping reports on a successful history of public private partnerships in Sweden for new businesses. This would for them be a way to bring the solution to the market.

Unlike most PTO's in Europe, Swedish public transportation has lesser profitability gaps in their network which would encourage a PTO to invest in new technologies.

A downside of the Use Case in Limköping is the technical complexity. Before thinking about the go-to-market phase, the technical issues have to be resolved.

4.7.5 Strengths & Weaknesses compared to traditional public transportation

The autonomous public transport service planned in Linköping is part of the urban, sustainable living concept which is planned to be built in the area. The Use Case fits perfect in the concept, with autonomous and electrified, shared transportation services.

The technical development is yet still at an early stage and there has been no prior project in the area with autonomous vehicles. Therefore, there is no information available on the acceptance of the service yet.

4.7.6 Mapping to UC and SHOW demo sites

In the pilot site of Linköping the following SHOW Use Cases are going to be covered: UC1.1; UC1.3; UC1.6; UC1.7; UC3.1, 3.2 and 3.4.

	SHOW Use Cases																
Scenario	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	2.1	2.2	3.1	3.2	3.3	3.4	3.5
Linköping	☑		☑			☑	☑						☑	☑		☑	

Figure 18 - Linköping Megasite distribution of SHOW Use Cases

- UC1.1: Automated passengers/cargo mobility in Cities under normal traffic & environmental conditions
  - → **Title: First & Last mile public transportation in mixed traffic**
- UC1.3: Interfacing non automated vehicles/ travellers (VRU)
  - → **Title: First & Last mile public transportation at shared space with VRU**
- UC1.6: Mixed traffic flows
  - → **Title: First & Last mile public transportation in mixed traffic**
- UC1.7: Connection to Operation Centre for tele-operation and remote supervision
  - → **Title: Elin operational Dashboard**
- UC3.4: Automated services at bus stops
  - → **Title: On-demand stop signal at bus stops**
- UC3.1: Self-learning Demand Response Passengers/Cargo mobility
  - → **Title: Route optimisation based on passenger counting**.

- UC3.2: Big data/AI based added value services for Passengers/ Cargo mobility
  - → **Title: Personalised route (on & off) suggestions**

4.7.7 Go-to-market strategies and proposed operator model

As mentioned in the success factors, for Swedish startups and initiatives it is common to start a go-to-market approach with an aggregator model like private public partnerships.

Transdev states, they are more than happy to introduce user stories and business cases developed throughout the project with automated public transportation to their own portfolio in Sweden, as the capabilities are there, but Transdev Sweden doesn't have best practises in Sweden yet. The possibility for Transdev to follow a central model and become the operator themselves is another likely option.

4.7.8 Summary

Summarizing it can be said that Linköping is off to a good start for the development of the Use Case. If technological barriers are overcome, realizing the business model seems to be possible, as there is a concept to back it up. The Use Case is very challenging as it combines multiple street types and a lot of the defined SHOW Use case levels.

4.8 First/Last mile autonomous transportation to mobility HUBs

4.8.1 Fore-sighting and business innovation in Kista, Sweden

The Kista site is an urban area, Stockholm´s leading ICT centre with 40 000 commuting every day to Ericsson, Stockholm University and Royal Institute of Technology and approx. 1000 other companies. 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, 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. Today, more than 50% commuting take their own car despite a well functional public transports with metro, commuter rail and buses.

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. Today there are no AV operations in the area. The area type is urban with mainly business/commercial character with the Kista Fair and the shopping centre Kista Galleria.

The route for the demonstration in Kista is shown in the figure below:

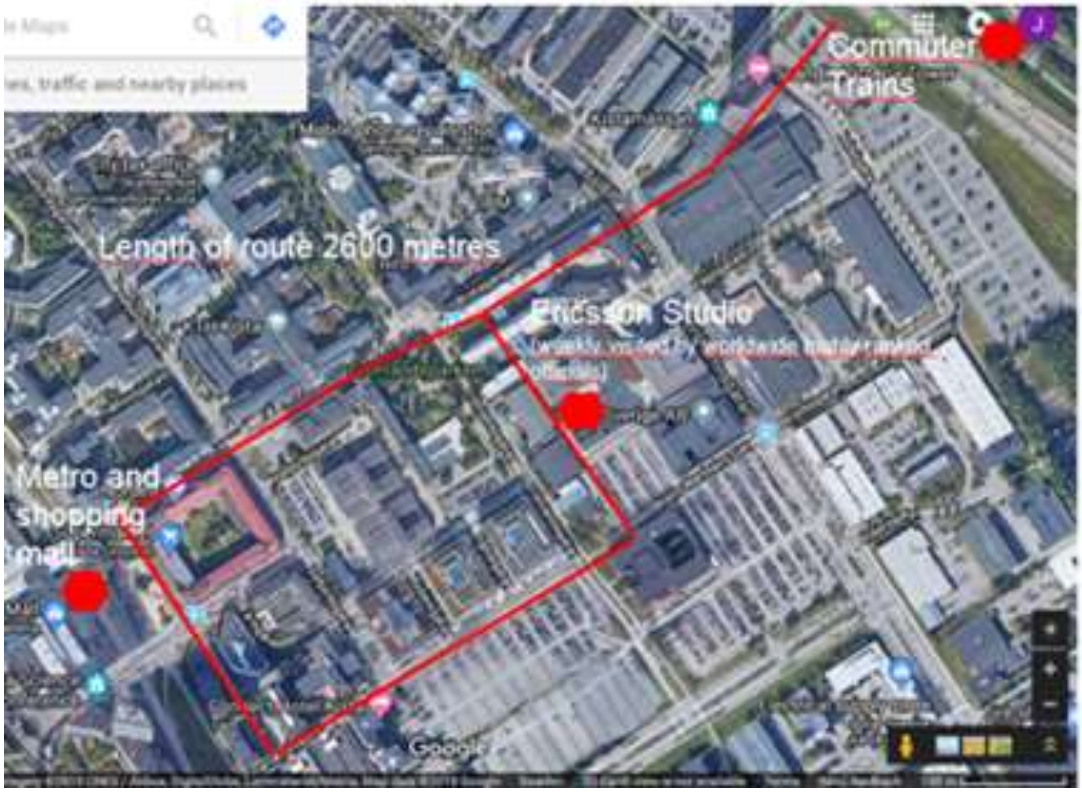

Figure 19 - Demo Site map, Kista

- 2km per trip
- Connect the train station in the North and the Subway station in the South
- 5G connection through Ericsson and Telia

Technological:

- 5G for communication as well as positioning
- On street units
- Work with Start-Ups: T-Engineering – Tech-integrator is working with Keolis in cooperation with Intel and Telia

There have been pre-trials in other areas of Stockholm by Keolis & partners:

In the “5G-Ride” project in the area of Stockholm/Djurgården, T-engineering`s autonomous connected vehicles were tested in a public manner for about 100 riders in Sept-Oct 2020. The aim of 5G-Ride is to test how a system for remotely monitored 5G-connected vehicles can facilitate the introduction of self-driving, electric vehicles in cities in a safe way. The project is coordinated by Urban ICT Arena, which is part of Kista Science City AB. Project participants are Intel, Ericsson, Keolis, T-Engineering and Telia. As outcome and future improvement, video streaming should be used in a limited extend and 99% independence would be good for the vehicles with on stream sensors. IoT application by Ericsson could be added to the use case, which has so far focussed on monitoring level, geofencing etc. For the future, a connection to cell phones and smart devices, etc. could be aimed for.

4.8.2 Business Model Canvas

Table 15 - Business Model Kista, First/Last mile autonomous transportation to mobility HUBs

BUSINESS MODEL CANVAS	
Value Proposition	• New/ Better/ more comfortable Commuting • Reduce individual traffic • Reduce emission in the area • Put the driver outside of the vehicle (tele-operation in focus)
Customer Segments	• Commuters, • Kista fair visitors, • passengers visiting Kista Galleria/mall, • VRU
Customer Relationships	• Partnership in the area, Kista science city is promoting the trials to the company and landlords in the area, this is how Telia and Intel joined the trial • For the future: integration to existing network
Channels	• Demo will start 2021 • For the future the PTA wants to integrate the road in their network • Vehicle is completely connected to the control tower already
Key Resources	• Former trials pushed the acceptance for following demos • Strong partnerships, High-Tech area and organizations • Not much Mobility as a service infrastructure in the area (very traditional)
Key Activities	• Start the trial in Kista • Promotion to local firms • 10-15 Use cases being testes • Find cheaper vehicle to use, so that 2 cars can be used • Add pedestrians, other vehicles, bikes and connect them for the trial
Key Partners	• Intel Telia joined the trials • T- Engineering as a sub-contractor • Demo Site partners • All organizations within the High-Tech Area and their employees • Landlords •
Revenue Streams	• Important KPIs • Number of carried out Use Cases • Ridership/ Passengers • Raising the value of the properties within the area • Change modal split in Kista (+ less emissions, etc.)
Cost factors	• CAPEX: • 300k autonomous vehicle • 150k vast technical setup cost

The business model focuses on first/last mile automated transport from/to mobility hubs, such as the commuting train and metro train station, to reduce individual traffic, parking spaces and emissions in the business area of Kista. The vehicles will be connected and operated by Ericsson´s 5G Control Tower. A strong partnership between Keolis, Ericsson, Intel, Telia and T-engineering has been established to achieve this. Future integration to the SL public network needs to be further elaborated.

The ticket prices from AB Stockholms Lokaltrafik (SL):

- Annual pass/whole region: 961,90 € (9770 SEK)
- Monthly pass/whole region: 91,50 € (930 SEK)
- Day pass/whole region: 15,25 € (155 SEK)
- Single ticket/75 minutes: 3,60 € (37 SEK)

4.8.3 Value Proposition Canvas

Table 16 - Value proposition canvas Kista, First/Last mile autonomous transportation to mobility HUBs

Value Proposition Canvas	
Customer Segment	Commuters, Kista fair visitors, Passengers visiting Kista Galleria/mall, VRU
Customer Jobs	• Commuting • Groceries • Leisure trips
Customer Pains	• No coordinated public transport lines, waiting time in between stops • Low frequency • Full public transport during peak hours • No/ not enough public transport during off-peak hours (early&late) • Inflexible hop-in/ drop-off points • No guaranty for space or seating • No information on delays • Delays
Customer Gains	• Connecting the first and last mile • Raising value of the property • Drop-off for parcels / post • USB charging • Cost effectiveness in comparison to the private car
Value Proposition	New/ Better/ more comfortable Commuting Reduce individual traffic Reduce emission in the area Put the driver outside of the vehicle (tele-operation in focus)
Products & Services	• A first/last mile automated shuttle bus line that connects the different mobility HUBs around the area • Vehicles: • Frequent
Pain Relievers	• Coordination between shuttle and fixed line to eliminate long waiting times at mobility HUBs

Value Proposition Canvas	
	• Real-Time information about traffic volume in the area and riders for the shuttle • Pre-booking of tickets and/ or space (seats
Gain Creators	• Sustainable urban cities • Eliminating mobility gaps • Reduction of private car usage

4.8.4 Success& Failure factors

Success:

The pilot site in Kista is the only pilot site in SHOW with big potential for IoT connection, due to Ericsson's Control Tower. Ericsson´s global HQ is located here and has already equipped the area for 5G.

The QoS of 5G connectivity together with the Control Tower, that monitor and supervise the autonomous vehicles, enable a safe removal of the operator in the vehicle and can reduce operational costs of autonomous vehicles.

High acceptance of autonomous and connected mobility can be expected in the high tech area of Kista, as a leading ICT innovation eco system.

Less commuters and visitors using their own car can lead to value creation and business model potential for the real-estate organizations if parking areas are removed and replaced by shops, further buildings, etc.

Long-term replacements of some full-size buses (i.e. winning new vehicle tenders) will ensure longer financial stability and lower costs.

Failure

A best case would be needed to become profitable, a fully "gated" area, separated bus lanes etc., then the safety operator is not needed, and operation can easily generate a ROI. Safety operator is main issue in terms of OPEX in this use case.

4.8.5 Strengths & Weaknesses compared to traditional public transportation

The small area (~2km per trip) does not need full-size buses but gives opportunities to more flexible little shuttles for the connection to outside parking and metro/commuter train station.

4.8.6 Mapping to UC and SHOW demo sites

Business Model: "First/Last Mile transportation to mobility HUBs build in Kista revolves around the following SHOW Use Cases:

	SHOW Use Cases																
Scenario	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	2.1	2.2	3.1	3.2	3.3	3.4	3.5
Kista	☑	☑	☑			☑	☑									☑	

Figure 20 - Kista Megasite distribution of SHOW Use Cases

UC1: Automated mobility in cities:

- UC1.1 Automated passengers' mobility in cities under normal traffic & environmental conditions
- UC1.2 Automated passengers' mobility in cities under complex traffic & environmental conditions
- UC1.3 Interfacing non automated vehicles/travellers (VRU)
- UC1.6 Automated passengers' mobility in cities in mixed traffic flows
- UC1.7 Connection to operation centre for tele-operation and remote supervision

UC3: Added Value services for Cooperative and Connected Automated mobility in cities

- UC3.4 Automated service at bus stop

4.8.7 Go-to-market strategies and proposed operator model

The Integration of SMEs is an important point for the demo site, in Kista´s case T-Engineering developed the vehicle for teleoperation for Keolis, in partnership with Intel, Telia and Ericsson. Kista Science City has played an important role for promotion to everyone in the area. This already made other interested partners join the demo and opened up other trials in further areas of Stockholm (5G-Ride).

For a go-to-market strategy it is of high importance to involve the landlords of the area to promote more sustainable mobility. The city district is further identified by City of Stockholm as 1 of 8 areas needing special attention for “smart choice measures”, investment in services, infrastructure, and digital communications to make commuting easier and opens up new possibilities. Kista city 2030 ambition is a fossil free and smart city with an attractive public transport with much less cars.

For the PTO within the area it is out of scope to join or operate the trials, meanwhile Keolis and other PTOs like Transdev can strategically think about operating this first/last mile transportation services (~5 years). This situation would most likely be described within the liberal model, with a multi-vendor-approach in the area, where different operators co-exist.

4.8.8 Summary

The business model is focussed on first/last mile automated transport from/to mobility hubs, such as the commuting train and metro train station, to reduce individual traffic, parking spaces and emissions in the business area of Kista. Despite the existence of a well-functioning PT, significant portions of the working population commute by private vehicle, creating congestion issues and using valuable land resources for parking that would otherwise go into denser commercial or residential development. The vehicles of the Kista demo site will be connected and operated by Ericsson´s 5G Control Tower with further potential for IoT connection.

5 Additional analysis and building of future business models

5.1 Integrated automated and electric shuttle busses for large scale events

A new, additional business model for the use of MaaS-based passenger transport results from the changing event landscape. Events have the character that in a relatively short time, a large number of people for very different reasons have to be transported to and from the venue.

The well-known services of public transport companies in the context of large events today consist of connecting bus lines between large parking lots or multi-storage car parks with the entrance areas of the event location. This includes, for example, regular sporting events, trade fairs and concerts. In addition, so-called VIP services provide individual transport for a few people between hotels and the event location.

An example that the deliverable wants to put emphasis on, is an announcement of the Volkswagen group which plans to sponsor the FIFA football world cup in 2022.

CEO Herbert Diess and QIA boss Mansur bin Ibrahim Al- Mahmud signed a corresponding contract in the Qatar capital Doha. The aim of the “Qatar Mobility” project is to convert traffic in the Middle East metropolis into a sustainable and at the same time economic model, the fund said. The concept should also survive the planned soccer World Cup in Qatar at the end of 2022. Volkswagen wants to build a fleet of self-driving electric buses together with the Gulf Emirate's State [10].

Such an integration of OEM based vehicles into the large-scale even organization of e.g. world cups is considered the first step for an integrated public transport operation for the future, as there are big funding possibilities.

5.1.1 Fore-sighting and business innovation

Volkswagen wants to provide a fleet of self-driving electric busses for Qatar. The objective is to have around 150 electric self-driving busses to host the visitors of the soccer world cup. The challenge is to have the busses driving in an urban environment linked to the event and local traffic management, it is of utmost importance to include external sensors in the strategy. It is a good example that business ownership, in this case the state of Qatar being in charge of the world cup with Volkswagen as a vehicle sponsor has to be fulfilled to have a clear business model and additional Return-of-Invest considerations.

It should also be mentioned that the soccer world cup can be considered as a first ad initial starting event before handing over the operation to a public transport operator of the state of Qatar. Also, the vehicle fleet of Volkswagen is planned to be used after the event by mobility service providers like MOIA in Germany in the following years 2023/ 2024. This means sponsorships of the mobility services and fleets can be considered as a key element to bring SHOW services to the European market.

5.1.2 Business Model Canvas

The service concept can be considered as a business model for several of the services planned in SHOW.

The business model is to have an initial investment phase for the technology of the automated vehicles invested by the event vehicle sponsor.

A business model for approaching large-scale events from a project perspective is outlined in Table 17.

Table 17 - Business Model, Large scale event sponsoring

BUSINESS MODEL CANVAS	
Value Proposition	• Bringing autonomous public transportation onto the market • Cooperation between large scale events and the automotive industry
Customer Segments	• Large Scale events • Event visitors • Inhabitants • Passengers
Customer Relationships	• Partnership between the automotive sector and associations of large-scale events like world cups, Olympics, etc.
Channels	• Demonstrations • News (TV, newspaper, etc.) • Marketing in general • On-site during the event • Smartphone application, mobility/ event
Key Resources	• Large scale events • Automotive partners • Strong projects • Demonstrations
Key Activities	• Get in touch with the automotive sector • Identify feasible large-scale events in Europe • Apply as a sponsor/ partner
Key Partners	• Automotive • Assoziation • ITS provider • Infrastructure providers • Telcos • SME/ start ups
Revenue Streams	• Marketing • Tickets
Cost factors	• Technological costs • Sponsoring

5.1.3 Value Proposition Canvas

In addition to the business model for large scale events, Table 18 shows an example of a value proposition canvas for the cooperation between projects and associations/ committees of large scale events.

Table 18 - Value proposition canvas, Large scale event sponsoring

Value Proposition Canvas	
Customer Segment	Large Scale event committees, Municipalities, Cities, nations, as well as all possible passengers during the event
Customer Jobs	• Providing safe and numerous transportation possibilities for visitors of the event • Accessibility • Considering language barriers
Customer Pains	• Handling the mass of visitors • Coordination
Customer Gains	• Content visitors • Image • Marketing
Value Proposition	Bringing autonomous public transportation onto the market Cooperation between large scale events and the automotive industry
Products & Services	• Partnerships/ cooperation for large scale events such as world cups and Olympic games • Autonomous public transportation fleets • Infotainment systems • Visitor information
Pain Relievers	• Mobility services available for all common languages • Information on the city and the event • Accessibility through developed vehicles
Gain Creators	• Creating a great image to show around the whole world • Placing at the top regarding technology

5.1.4 Success factors & Failure factors

On one hand, the success for marketing a mobility solution with the sponsoring of large-scale events is great. But on the other hand, it takes a huge investment that only big cooperations are able to provide.

5.1.5 Strengths & Weaknesses compared to traditional public transportation

For foreigner's public transportation in unknown countries/ areas are often times very confusing as there often is no overview of the lines of information on next stops. Autonomous and in general services with a high technology degree usually work with

applications showing all necessary information in multiple languages. The marketing effect for sponsoring large scale events is great, as the event is broadcasted world wide.

5.1.6 Go-to-market strategies and proposed operator model

For SHOW the business case can be linked to the automated vehicle fleet during upcoming large-scale events in Europe. A special business opportunity identified, can be the Olympic games in Paris 2024. It is recommended that the French automotive industry targets to present French automobile industry as vehicle sponsor for the Olympic Games. The business model already outlined in the project AUTOPILOT should target a number of services already foreseen in SHOW by the different French pilot site partners.

Based on the mobility clusters available in France, where French automotive industry already takes part, e.g., cooperation for autonomous vehicles of PSA and Vedecom, lays the baseline for a successful go-to-market setup.

5.1.7 Summary

In conclusion, the sponsoring of a large-scale event is a great but costly plan for automotive players. Only big corporations would be able to pay the needed sum to be able to be the main sponsor of such a project. Nevertheless, one should think of similar go-to-market approaches, even as a project consortium.

There might be interesting events and conferences, where the project could be present, marketing their developed solutions.

5.2 Interoperable IoT mobility platforms

5.2.1 Fore-sighting and business innovation

Interoperable automated driving platforms are needed for any go-to-market strategy linked with automated driving and all its complex sensor hardware. Given the many actors involved in automated driving it becomes clear, that it is necessary to integrate as many different IoT platforms and sensors as possible.

An automated vehicle can only “see” as far with its on board sensors, a connected city would make the applied vehicle “see around corners” and already predict situation and enhance the overall driving experience, e.g. no harsh braking.

To explain the concept of interoperable IoT platforms for automated mobility, the example of the project AUTOPILOT is used [11].

AUTOPILOT is the acronym for the project name AUTOmated driving Progressed by Internet Of Things. During the project lifetime (2016-2019) several players of the automotive, ITS and telco sectors came together, to build an interoperable platform for automated mobility. AUTOPILOT itself targeted private vehicles, but the architecture of the platform itself could easily integrate public transportation and other MaaS services.

Figure 21 shows the architecture of the project. The centre of it all is the interoperable IoT platform oneM2M. It is connected to multiple sensors, ranging from the vehicles over road side units and even drones. The oneM2M platform is then connected to different platforms that could represent the vehicle back-end of cars or in the SHOW

case: automated buses. The platforms exchange their sensor data and inform the whole system about the traffic situation and possible hazards.

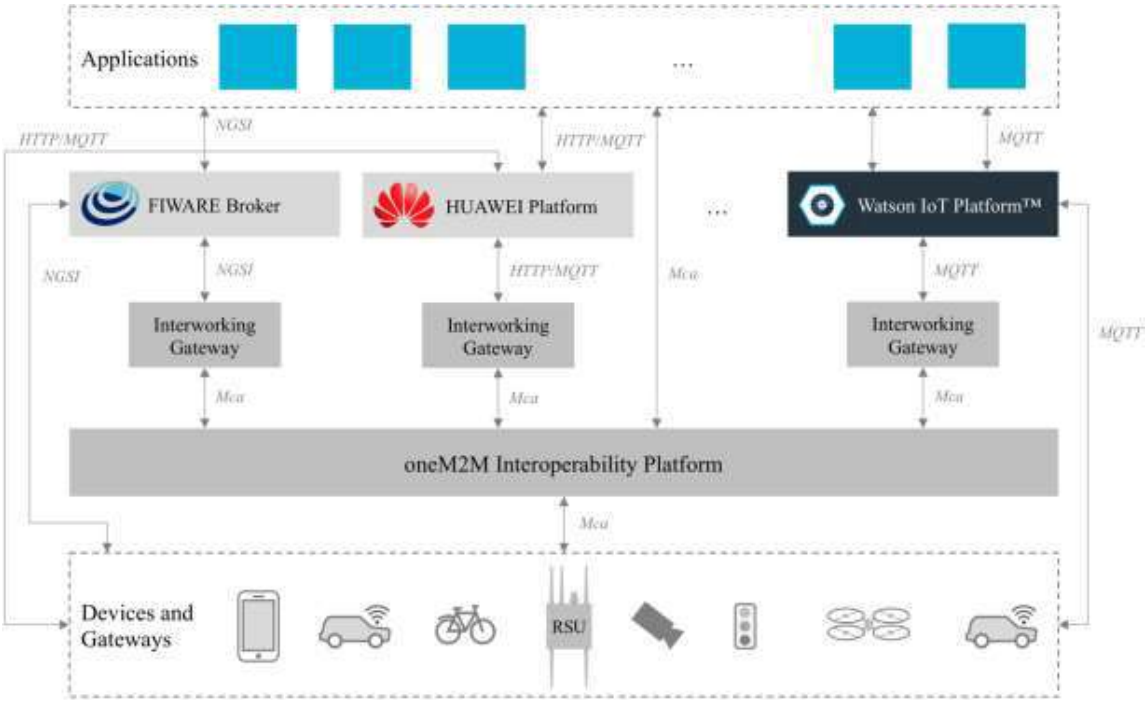

Figure 21 - Interoperable IoT platforms for automated mobility

5.2.2 Business Model Canvas

The concept of interoperability platforms for automated mobility can also be applied for automated public transportation within the SHOW project. A business model canvas is drafted in Table 19.

Table 19 - Business Model, Interoperable IoT platforms

BUSINESS MODEL CANVAS	
Value Proposition	• Connecting automated vehicles to the traffic environment outside of the cars • Expanding the field of view of the vehicle by combining in-vehicle sensors and road-side units, traffic lights, smart devices, cameras, etc. • Increasing traffic safety • Supporting the decision making of the automated vehicle
Customer Segments	• Automtive industry • Public transport operators • Public transport authorities
Customer Relationships	• Partnerships between interoperability platform providers and vehicle manufacturers/ public authorities
Channels	• Demonstrations • Marketing in general

BUSINESS MODEL CANVAS	
	• Platform service
Key Resources	• Fleets of vehicles • IoT compatible platforms • Interoperability platform • ITS providers • Telco companies • Strong projects • Demonstrations
Key Activities	• Get in touch with the automotive sector • Build and connect different kinds of platforms • Identify feasible • Build demonstrators
Key Partners	• Automotive • Assoziations • Public transportation • ITS provider • Infrastructure providers • Telcos • SME/ start ups
Revenue Streams	• Marketing • Tickets • Platform service • Data in general
Cost factors	• Technological costs • Implementation • Maintanance

5.2.3 Value Proposition Canvas

In addition to the business model for interoperable IoT platforms, Table 20 shows an example of a value proposition canvas for the cooperation between the platform provider and a public transport operator with its own cloud solution which will be connected to the interoperability system.

Table 20 – Value proposition canvas, Interoperable IoT platforms

Value Proposition Canvas	
Customer Segment	Public transportation (authorities and operators)
Customer Jobs	• Providing safe and numerous transportation possibilities • Availability and accessibility • Providing fair ticket prices • Punctioality

Customer Pains	• Expensive techonology to automate the fleets • No “one size fits all” solution • No comparibality to other manufacturers • Aging infrastructure • Limited space for infrastructure • Expensinve in-vehicle sensors
Customer Gains	• Easy to use introduction to automation of fleets • Cost effective introduction of new technologies • User acceptance • Higher passenger number
Value Proposition	Interoperable IoT platforms for connected and automated public transportation
Products & Services	• Interoperability platform that can connect to different vehicle back-ends • Long lasting partnerships
Pain Relievers	• Easy connections of own vehicle information and sensor data to the platforms • Marketplace solutions allow to only pay what is used
Gain Creators	• Connecting the fleets to a pre-build, easy to modify platforms

5.2.4 Success factors & Failure factors

The greatest success factor of this concept is the interoperability itself. When the ITS provider develops an interoperability platform and integrates more and more mobility service data, the automated driving functions become more safe and robust, as there is more reliable data. The concept can be enhanced through many other IT technologies, e.g. blockchain.

Nevertheless, connecting many automated services makes the system vulnerable for security breachings. IT-security is the greatest failure factor such a concept can have.

5.2.5 Strengths & Weaknesses compared to traditional public transportation

The benefit of integrating interoperable IoT platforms into the development of automated public transport fleets is that the vehicle has access to a wider range of sensor information than if it would use in-vehicle sensors only. This enhances the traffic safety as well as the driving comfort, as harsh-braking can be reduced, due to the wider field of vision of the automation technology. Threats can be identified earlier and the vehicle can act accordingly. The weakness compared to the traditional way of public transportation is the openness of the concept. As all information will be shared on the platform, a security breach would harm the city. The concept doesn’t enable automated driving, fleet managers will still have to automate their fleets and do the initial investments, before they can interact and engange with interoperability platforms.

5.2.6 Go-to-market strategies and proposed operator model

There are two ways the concept could be introduced to a market. First is, that a consortium of partners develops, demonstrates and analyses the importance of interoperability for automated public transportation preferably in a funded environment,

ensuring that all results are targeted internationally to benefit the numerous public transport organizations, as well as cities and work towards the goal of a sustainable future. Great market barriers deriving from the unknown of new business fields will slowly but steadily eliminated, opening the market to a wide range of businesses, allowing new partnerships to build and competition to rise.

If this concept is not researched openly, only a few big organizations will have the resources to find the needed partners and funds to realize such solutions. Partnerships between big platform providers like Amazon and vehicle manufacturers like Daimler could be possible, leading to a monopoly. The technology will be available for a few fleets, most likely at a high price and the market barriers will remain high, until other companies invest in own research, funds and gain experience in this field of business.

5.2.7 Summary

In conclusion, interoperable IoT platforms will play a major role in the field of CCAM, due to the many benefits. Most of the failure factors of interoperable IoT platforms also apply for the automation of fleets itself. Therefore, it can be assumed that solutions to mitigate these factors have already been found, once the interoperability plays a role in the enhancement of automated driving in urban environments. Even if interoperability for automated driving is a future concept, fleet managers, OEMs and authorities need to assess the value it could bring for their operations. These values can best be identified in (follow-up) projects for the automation of public transportation.

6 Mapping of value propositions to SHOW users, type of business, sites and Use Cases

6.1 Mapping and summarizing the business models for the demo sites

Several value propositions have been developed in A2.2 and are reported in the current deliverable.

To give an overview of all the developed values within SHOW and beyond, Table 21 shows the overview of the interviewed demo sites and the SHOW use cases. Table 22 shows all value propositions of this document, which type of user it addresses, in which type of business it acts and for which Mega and Satellite site they are applicable.

	SHOW Use Cases															
Scenario	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.10	2.1	2.2	3.1	3.2	3.3	3.4	3.5
Aachen, RWTH Campus	☑			☑		☑				☑							
Madrid, Carabanchel Depot							☑	☑							☑		☑
Madrid, Villaverde – La Nave PT	☑	☑	☑			☑				☑							
Rouen, Urban City Centre	☑	☑	☑	☑	☑	☑	☑			☑			☑			☑	
Rennes, CHU Campus		☑	☑	☑						☑		☑					
Salzburg, Peri-urban C-ITS		☑	☑			☑							☑				
Graz, Short distance robo-taxis		☑	☑													☑	
Linköping, Sustainable mobility	☑		☑			☑	☑						☑	☑		☑	
Kista, First/Last mile to HUBs	☑	☑	☑			☑	☑									☑	

Table 21 - Mapping of scenarios to SHOW Use Cases

Through the workshops two new business models have been identified. But within the workshop and especially for the demo site in Sweden Kista, topics that are not directly considered within the SHOW project have been added to the discussion. With Ericsson and Deutsche Telekom as experienced technology partners within the Consortium, the use of IoT for the automation of public transportation fleets is being explored. This deliverable connects the results of a former project (AUTOPILOT) and applies them for public transportation. Another example is taken with the partnership between the Volkswagen group and the state of Qatar, which develops automated shuttles for the FIFA world cup 2021. The overview above shows all types of user groups are addressed within the different business models identified in SHOW, other business, public, as well as end-consumers (passengers). What can be said about the mapping from a demo perspective is, that the implementation of the use cases is highly dependent on the fact, that some demos do follow-ups on already existing technologies from prior projects, while other demos start from scratch. This mix of knowledge and expertise within the partners is a great starting point for implementation, as knowledge can be shared.

Table 22 - Overview of value proposition, users and type of business

Value Proposition	Existing/ New	Type of user	Type of Business	Mega & Satellite Sites	Comments
Autonomous PT in combination with additional on-demand services	Existing (new for Tampere and Trikala)	Students, Commuters	Business-to-Consumer	Germany Tampere/Finland, Trikala/Greece	
Autonomous Bus Depots	New	Public Transport operators and authorities	Business-to-Business or Business-to-Public	Spain	
Advanced MaaS in urban environments	Existing	Inhabitants, Tourists	Business-to-Consumer	France Turin/Italy	
Combined MaaS and LaaS (for the hospital campus)	New	Visitors, In-hopitalized, Commuters, Hospitals	Business-to-Public Business-to-Business Business-to-Consumer	France Turin/Italy	Transportation of people and medical goods. Turin has been added to this category, however their pilot does not involve any logistics element (LaaS). Still, it includes MaaS for hospital operations, because it is dealing with demand-responsive transport of patients to a hospital.
Peri-urban automated transportation and C-ITS connectivity	Existing (new for Trikala)	Inhabitants of sub-urban areas, Tourists	Business-to-Consumer	Austria Trikala/Greece Brainport/ Netherlands	In Trikala this needs to be confirmed according to the new legal framework that they are expecting to be voted this year and if the peri-urban autonomous transportation in mixed-traffic will be

Value Proposition	Existing/ New	Type of user	Type of Business	Mega & Satellite Sites	Comments
					permitted and under which circumstances.
Robotaxi services for short distance trips	Existing (new for Trikala)	Inhabitants, visitors of malls, commuters	Business-to-Consumer	Austria Trikala/Greece	In Trikala robotaxis will operate as complementary to autonomous shuttles according to the demand in the fixed line and will probably operate in platooning for short distance trips in the area.
Sustainable living areas with autonomous public transportation	Existing (new for Tampere)	Inhabitants, landlords	Business-to-Consumer Business-to-Public	Sweden Tampere/Finland, Brno/Czechia, Copenhagen/Denmark	Car free combustion engine zone, schools for children with specials needs, elderly
First/Last mile autonomous transportation to mobility HUBs	Existing (new for Tampere and Trikala)	Commuters, visitors	Business-to-Consumer	Sweden Tampere/Finland, Copenhagen/Denmark, Trikala/Greece	In Trikala robotaxis will serve this according to the framework mentioned above and the mobility HUB will be the intercity bus station and central square of specific villages around.
Integrated automated and electric shuttle busses for large scale events	New	Visitors of the event, event companies, hotels	Business-to-Consumer Business-to-Business	n.a. Opportunity for France, Olympic Games 2024	
Interoperable IoT platforms for automated mobility	New	Cities, Mobility providers, manufacturers	Business-to-Business Business-to-Public	n.a. Sweden is testing IoT compatibility for autonomous driving	

6.2 Discussion on the development of new business models

The already existing models for “Transport-on-Demand” are able to supplement the existing public transport offers massively. Using the example of MOIA from Volkswagen AG, which is mainly known from its operations in Hamburg and Hanover (Germany), it can be seen that on-demand offers are already being successfully offered and used.

Actually it can be seen that the demand for the use of MOIA is falling. The decline can currently be explained by a lack of transparency and the lack of integration to the public transport offer, as well as a very low number of vehicles.

An essential factor for future success and increasing acceptance therefore is the full integration into the existing public transport network, (initially i.e. without the transfer of ownership), e.g. use of a traffic app for the city of Hamburg (or other cities). The complete overview of the - at all times - current and available transport infrastructure is essential for this: common tariff structures and regulations, clear entry and exit concept, full integraton of on-demand offers with public transport.

Even if applications and system solutions are mentioned again and again in the context of the MaaS discussions, the need for a vehicle with or without a driver to take over the journey remains. The so-called last mile can be ensured quite easily with an on-demand offer or autonomous shuttles. For this it is necessary that approved providers are integrated into the transport association and billed in an integrated manner.

For permanent acceptance and the associated use, however, it is important to know a common, comprehensible tariff. It is conceivable that the journey (regardless of the means of transport) from a main train station to a district by underground, tram, bus (public transport) and then - an on-demand service or autonomous shuttle with one tariff and billed in one payment process.

This means also for the earlier mentionend service for concerts, fairs or other events with a high numer of visitors.

Requirements:

- Complete integration of the mobility provider to the local PTO
- Exclusivity of the offer within the district with appropriate vehicles / drivers (incl. night drives, patient trips, student collection services ...)
- Complete integration of the services in timetables and tariff system
- Booking via the local transport app
- Billing / charging via public transport providers

Benefits:

- Relief of the last mile
- Securing pedestrians, children, people with restricted mobility
- CO_2 pollution can be reduced
- Easy entry for e-mobility
- Additional income for low-income residents
- Integration into the event management of a district
- Supplementing school bus services

Disadvantages:

- Limited parking space within the district
- Utilization and associated environmental pollution cannot be planned
- Possibly obsolete vehicles

- Increased complexity in billing
- Limited transport volume per shuttle

Revenue generation:

- Additional new service
- Billing via the tariff system of the local PTO
- Alternatively, the billing could also be done via the app or telecommunications service provider (analogous to roaming)
- Distribution of costs and refinancing through technology providers

Additional incentives:

- Benefits with e-mobility or other environmentally friendly drive concepts
- Benefits for services (training, fees, maintenance, booking systems)
- Reservation of parking spaces at the stops and within the district
- Access to shopping services in addition to delivery services
- Benefits with e-mobility or other environmentally friendly drive concepts
- Benefits for services (training, fees, maintenance, booking systems)
- Reservation of parking spaces at the stops and within the event area

7 Conclusions

The main goal of D2.2 has been to build future business and operating models about new mobility services covering different types of services within SHOW (e.g. PT, MaaS, LaaS and DRT) at the different pilot sites of SHOW. D2.2 takes the five Mega Sites for a first assessment and builds 8 business models which are directly linked to the mega and satellite demo sites and their use cases and proposes two additional models, based on similar initiatives of important ITS players, that are also mapped to them and of high importance for the overall SHOW project.

After a thorough analysis of each of these business models proposed, a mapping is done, comparing the value propositions, user types, types of business and if the business models are already existing or new – to further describe the future mobility services that can be implemented at each demo site and the view on the business and operating models as well as relevant user/operating roles within each specific business ecosystem as well as the success and failure factors which influence the deployment of the services during its lifetime.

Based on the building of the different business models the following conclusions can be made:

- Most business models are built while being supported by a sustainable mobility plan, with the support of local decision makers. This support of a strong Consortium of partners will be needed to develop and finance the solutions that are to be build successfully.
- Business models for automated public transportation services are addressing all types of users, regardless of age or mobility need. The ultimate goal is to offer the most personalized mobility mix as possible, when needed and where needed.
- If a private and flexible trip is inevitable, autonomous shared cars will be one of the most important players in the future of urban areas and will co-exist and even mix with the rest of existing trends and mobility solutions such as PT, DRT, LaaS and micro-mobility. The timely-uptake of robo-taxis is still unclear, with special regards to the development of the Use Cases at the demo sites, but we expect them to have a high market impact and especially cover user needs at the very last, or first mile of trips.
- The internet of things plays an important role for the successful uptake of automated mobility services. Strong ITS players should be involved during the development of such services.
- Regarding the costs for establishing an autonomous transport solutions, partners are waiting for the vehicle prices to drop by at least 15-20%, before considering a commercial uptake with new shuttles.
- All pilot sites reported that eliminating the cost factor of a driver/ security driver within vehicles would already make for a profitable business model. The uptake of tele-operations becomes even more important.

For the project itself the following conclusions can be made:

All the conclusions about the business models for “Connected and Cooperative Automated Public Transportation Services” together with the examples shown outside of the SHOW context are helping to support the building of the ecosystem, especially considering the SHOW approach which focuses on SME, start-ups and new entrants, as well as the integration of local PTOs (and do not cannibalize them).

D2.2 will be the base for the work done in D2.3. D2.3 is to assess and help with the successful implementation of the business models developed in D2.2. Furthermore,

D16.3 will use the business models to evaluate the sustainability and exploitation plans of the demo site partners and check back with D2.3 on the implementation of these business models.

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Annex 1 - Pilot site interview questionnaire

Interview Guideline Pilot Site Interview of D2.2 Business Modelling and mapping to pilot sites Document Responsible: Romina Quaranta (T-Systems): Romina.quaranta@t-systems.com	
Date of Interview:	
Mega Site:	
Participants:	
Notes:	
Use Case description:	In preparation for the interviews note a few points of the Use Case, to discuss it with the demo site partners What are the innovative aspects of the Use Case? How will the development continue?
Success & Failure Factors:	Success& Failure Factors of the Use Case, also available in D2.1
Business Model Canvas:	From experience the online interview is not the perfect medium to focus on building the business model with the demo site partners, in comparison to the previously planned demo site workshops, were all partners would see a live-demo and focus solely on the business modelling afterwards. For the interview we encourage you to focus more on specific key points of the business model and put them together in a model afterwards. E.g. • What is the value the Use Case is creating at your specific location? • Which customer segment is the Use Case addressing? • On which channels are the customers addressed? • How are the customers addressed? • What are the resources, the Use Case is built on? • What are the main activities right now? • Which partners are involved in the Use Case? Do you plan on involving other partners? • How will the Use Case generate money? (Additional ticket sales, cost *savings,…)* • What is the current cost structure of the Use Case, how will the cost structure change during the next years?
Value Proposition Canvas:	The Value Proposition Canvas is supposed to give a closer look in the two factors customer segments and the value proposition of the Use Case. *For the Customer Segments please explain what "jobs"* the customer has to do *on a regular basis (e.g. commuting), what "pains" he faces during these activities (e.g. no synchronized connections, long waiting times), what "gains"* the customer expects and needs or what would delight his experience For the Value *Proposition please explain the Use Case in "products& solutions", describe how the Use Case can eliminate some of the pains in "pain relievers" and what value the use case can create in "value creators"*

Strengths& Weaknesses compared to traditional public transportation:	Why is the automated Use Case better fitting than traditional mobility solutions?
Go to market strategies and operator models:	What go-to-market strategies are the demo site partners following and did they already think about possible operator models? Who wants to continue developing and operating the Use Case?

Annex 2 - Business Model Cavas

Name	How to fill out the table
Customer segments	Please all customer segments which are relevant for the business model
Value propositions	Please give a summery from the related VPC
Channels (communication, distribution)	Please describe all channels which are relevant addressing the customer segments
Customer Relationships (per customer segment)	Please describe how the customer and the service are related within the business model
Revenue Streams	Please list here all relevant revenue streams (names) and give quantifications (if possible)
Key Resources	Please describe all resources which are relevant for the business model
Key Activities	Please describe all activities which are relevant for the business model
Key Partnerships	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
Cost structure	Please list here all relevant cost categories and give quantifications (if possible)

Annex 3 - Value Proposition Canvas

Name	How to fill out the table
Customer Segment	Please list all customers (segments) which are involved
Customer Pains	Please list all factors which prevents customers from using/implementing the service
Customer Gains	Please list all factors which produces gains
Customer Jobs	Please list all possible customer jobs in relation to the services listed in the MSC and if possible, user roles
Value Proposition	Please list relevant value propositions, USP or any other business advantages for the busines model
Pain Relievers	Please list all relevant factors which can be used to reduce the impact of the pain factors
Gain Creators	Please list all relevant factors offering the chance to create gains
Products & Services	Please list all relevant products and services for the value proposition and the related business model

Annex 4 – Online survey questionnaire

1) What do you believe are the main barriers when trying to integrate Connected and Cooperative Automated Vehicles (CCAVs) into public transport services?

Please grade them in order of importance (1-most important to 5-least important)

Technological / Technical	(1…5)
Legal / Political	(1…5)
Organizational / Operational	(1…5)
Business / Economical	(1…5)
Social acceptance / User acceptance	(1…5)

2) What do you believe are the main enablers when trying to integrate CCAVs into public transport services?

Technological / Technical	(1…5)
Legal / Political	(1…5)
Organizational / Operational	(1…5)
Business / Economical	(1…5)
Social acceptance / User acceptance	(1…5)

3) What do you think are the main advantages of introducing CCAVs in PT services today?

Reducing car ownership	(1…5)
Increasing the number of users	(1…5)
Reducing investment and operational costs when deploying new services	(1…5)
Generation of positive externalities (e.g. greater safety, higher accessibility, attract private investment…)	(1…5)
Social acceptance / User acceptance	(1…5)

4) Which of the existing mobility business models do you think is the most suitable for implementing CCAVs in the short/mid-term?

In Public Transport operations	(1…5)
Car-sharing and ride-sharing services	(1…5)
Demand responsive transport (DRT)	(1…5)
Mobility-as-a-Service (MaaS)	(1…5)
Logistics-as-a-Service (LaaS)	(1…5)

5) Which of the existing business governance models do you think is the most suitable for implementing CCAVs in the short/mid-term?

Central model	(1…5)
Liberal model	(1…5)
Analytics as a Service aggregator model	(1…5)
Social innovation model	(1…5)
Other (please specify)	(1…5)

6) How is the general users' acceptance of shared transport services in your region?

Very positively
Somewhat positively
No strong opinion
Somewhat negatively
Very negatively

7) How do local businesses and investors in your region view the introduction of CCAVs?

Very positively
Somewhat positively
No strong opinion
Somewhat negatively
Very negatively

8) 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?

Through feasibility studies	(1…5)
Learning from others	(1…5)
Through real-life pilots	(1…5)
Through impact assessment studies	(1…5)
Through forecasting and scenario studies	(1…5)

9) Which measures of evaluation should be applied to define what has been a successful CCAV business model? and particularly for an SME or a start-up/ new entrant?

A positive Business Case for the company	(1…5)
A positive Business Case for the ecosystem	(1…5)
Generating positive impacts for the regional environment	(1…5)
Through reducing costs thanks to operational performance	(1…5)
Through increasing the revenue streams thanks to new services	(1…5)

10) Which organization type do you think should take the main orchestrator role in a multi-actor Connected and Cooperative Automated Mobility (CCAMs) business ecosystem?

Public Transport authorities or Public Transport Operators
Independent MaaS aggregators
Road or traffic management operators
ITS infrastructure operators
Autonomous vehicle providers
Municipal and Urban planning authorities
Other (Please specify)

11) What is the importance of the service providers in your CCAM ecosystem?

Traffic/Road authorities	(1…6)
Vehicle providers	(1…6)
Infrastructure providers	(1…6)
Data providers	(1…6)
Software-based service providers	(1…6)
Other (Please specify)	(1…6)

12) Which are the most critical operations within your CCAM ecosystem?

Traffic management	(1…6)
Fleet management	(1…6)
Infrastructure management	(1…6)
Data management	(1…6)
Access rights management	(1…6)
Other (Please specify)	(1…6)

13) What is the importance of the cost items when operating CCAVs in cooperation with PT services?

Vehicle maintenance	(1…5)
Vehicle use	(1…5)
Infrastructure maintenance	(1…5)
Infrastructure use	(1…5)
Other (Please specify)	(1…5)

14) Which are the best opportunities for start-ups and SMEs regarding CCAM?
Which are the most favourable ecosystems for SMEs and start-ups to flourish?
15) Which elements for a successful introduction of CCAV services are currently missing concerning your Business Ecosystem?

16) What do you feel are the minimum infrastructure/technological requirements needed to have a positive CCAVs business case during the transition period?

17) If one now considers the degree of vehicle electrification (none up to full electrification, be it battery electric or fuel cell electric):

- To what extent does this influence your answers given above?

To what extent would possible business models change / work better or worse?

Annex 5 - Mega Site Germany, Aachen - Interview Report

Pilot Site Interview of D2.2 Business Modelling and mapping to pilot sites Document Responsible: Romina Quaranta (T-Systems): Romina.quaranta@t-systems.com	
Date of Interview:	08th October 2020
Mega Site:	Germany, Aachen
Participants:	DLR (Katharina Karnahl), TSY (Romina Quaranta, Klaus Grabert), ASEAG (Kathrin Driessen)
Notes:	Aachen's PTO ASEAG aims at integrating autonomous people movers into regular transport.

Use Case description:	**Full Use Case description (October 2020) available in D1.2**
	• Peri-urban:
	  ◦ Autonomous traffic in real city environment demo (UC1, UC2)
	  ◦ Integrated automated PT with automated DRT and automated MaaS demo (UC3)
	  ◦ Robust operation of automated shuttles in peri-urban scenarios with remote supervision
	• Aachen: Passenger cars, 2 shuttles (e.GO Mover Shuttle), 30km/h, SAE lvl 4
	• The People Mover serves the bus stops according to a regular timetable clockwise along the Campus-Boulevard and the Forckenbeckstrasse.
	• Entering a bus stop, if: a stop is triggered by an on-board passenger, or if potential passengers are waiting at the bus stop

Success & Failure Factors:	Success: • Innovation of PT provider • Company and service image • Future market potential Failure: • Global influence of COVID-19 on PTO's • DRT service capacity planning

Business Model Canvas:	• What is the value the Use Case is creating?
	  ◦ Automated. Fruequent public transportation around the RWTH campus
	• Which customer segment is the Use Case addressing?
	  ◦ Students, Commuter/ personell within the campus area, visitors
	• On which channels are the customers addressed?
	  ◦ The People Mover is integrated into the ASEAG MaaS platform movA via an ASEAG RBL unit and serves the bus stops along the route on Campus Melaten as part of the regular ÖPNV net.
	• How are the customers addressed?
	  ◦ Local news, campus informations, value is distributed over ASEAF movA application
	• What are the resources, the Use Case is built on?
	  ◦ Strong key partners
	  ◦ Vehicle manufacturer within the demo site consortium
	  ◦ Go-to-market departments/ MaaS department of vehicle manufacturer
	  ◦ High-innovation zone where demo is located
	  ◦ Funding for go-to-market preparation

	• What are the main activities right now?
	  ○ Planning of the demonstration
	  ○ Preparation of the demonstration
	• Which partners are involved in the Use Case? Do you plan on involving other partners?
	  ○ PTO, PTA,
	  ○ University/ Research
	  ○ Vehicle manufacturer
	  ○ Software Companies
	  ○ Engineering companies
	• How will the Use Case generate money? (Additional ticket sales, cost *savings,…)*
	  ○ Once the Use Case is supposed to be marketed, tickets can be sold
	• What is the current cost structure of the Use Case, how will the cost structure change during the next years?
	  ○ High costs for vehicles, ROI not in an adequate timeline, if vehicle price stays the same

Value Proposition Canvas:	• **Jobs:**
	  ○ Commuting
	  ○ Learning/ studying
	• **Pain:**
	  ○ Waiting time for busses outside of peak tims
	  ○ Low frequency
	  ○ Full public transport during peak hours
	  ○ No/ not enough public transport during off-peak hours (early&late)
	  ○ Unflexlible hop-in/ drop-off points
	  ○ No guaranty for space or seating
	  ○ No information on delays
	  ○ Delays
	  ○ Search for parking spaces
	• **Gains:**
	  ○ Connecting the first and last mile
	  ○ Drop-off for parcels / post
	  ○ USB charging
	  ○ Cost effectiveness in comparison to the private car
	  ○ Comfortable seating
	• **Service:**
	  ○ automated shuttle bus line that connects the different facilities around the campus area
	  ○ Vehicles: e.Go people mover
	  ○ Frequency: fixed line, before and after peak = on demand
	• **Pain Relievers:**
	  ○ Cheap on demand transportation or high frequent fixed line during the day
	  ○ Real-Time information about traffic volume in the area and riders for the shuttle
	  ○ Pre-booking of tickets and/ or space (seats)
	• **Gain Creators:**
	  ○ Sustainable urban cities
	  ○ Eliminating mobility gaps
	  ○ Reduction of private car usage

Strengths& Weaknesses compared to traditional public transportation:	Why is the automated Use Case better fitting than traditional mobility solutions? As the campus Melaten is an area with several facilities of the RWTH, the automated people mover of e.Go will make commuting around the campus easier and more enjoyable for students, teachers and visitors. • More flexibility • Less noise and CO2 emissions • Door opener for research and development on the vehicle

Go to market strategies and operator models:	What go-to-market strategies are the demo site partners following and did they already think about possible operator models? Who wants to continue developing and operating the Use Case? e.Go as the vehicle manufacturer has multiple departments which concern different fields of business • e.GO Moove (vehicle manufacturer) • e.GO mobile AG/ e.to go (Mobilty as a service provider) For liability and technical reasons a vehicle manufacturer won't be able to "just" sell its cars and leave them alone. In the future teh manufacturer will sell ist vehicles, as well as service contracts for regular updates and checkings Another way for this woule be leasing models, with regular adjustments on the vehicle and ODDs – Operational Design Domain (Conditions in which the car is allowed to operate in automation) E.Go is thinking about a go-to-market approach not before 2035-2040 E.Go also prefers Use Cases in HUB context as these are more viable in the mid-term. For: ASEAG: • Central model is preferred for ASEAG, right now ASEAG holds all their PTO assets themselves, also DRT software is bought and operated by ASEAG • Liberal model: Multi- Vendor approach • AaaS: Aggregator (PPP), innovation banks, innovationfonds • Social innovation model: University, Hospital, start up cluster

Annex 6 - Mega Site Spain, Madrid – Interview Report

Date of Interview:	15th October 2020
Mega Site:	Spain, Madrid
Participants:	(T-SYS) Romina Quaranta, (BAX) Albert Serra, Ignacio Magallón, Nacho Sarrió Mercadé (EMT) Sergio Fernández Balaguer, César Omar Chacón (Indra) Martin Rivas Caneiro
Notes:	• EMT Started as Bus operators but slowly increasing services offered since 2003. Now operating also bike-sharing system and some underground parking facilities (23 facilities, 11.000 parking slots and providing also 100 charging points, 5 of them Fast-charging). Managing also the casa de campo cable car for leisure trips. • Two possible BM at this moment for the MaaS approach. First: Act like commercials selling trips. Second: License the use of their MaaS platforms (three available: route planner, ID manager and X) • They are owned by the City Council (100% Public) but also long tradition of cooperation with Private companies. Yesterday they launched a demand-responsive bus service. • Spanish ministry and regional government (subway managers) and other regional authorities provide funding.
Use Case description:	**Full Use Case description (October 2020) available in D1.2** • Two different business models: o Real traffic condition, interchange station with subway with connection of Public Transport to innovation HUB of the city (start-ups, meeting point); Regular Streets, pedestrians, etc. – Urban environment but not dense, sub-urban area type.; Microbus and coach bus, testing robo taxis with Twizzis o 5 bus depots connection, bus depot with over 500 busses, test automation for improving own operation, HUB centric, o Washing to parking, mixed traffic in a controlled environment,
Success & Failure Factors:	Success factor: • Hub Centric approach is easier to install and operate • Cost savings through less drivers, less skilled drivers • Publicly owned PTO, easier communication • Battery lifespan, battery vs. speed Failure factor: • Completing the procurement • Homologation, provided by the national traffic authority • Permits/ Regulatory, even when successful – time consuming
Business Model Canvas:	• What is the value the Use Case is creating? o Optimization of own operation: automated bus depots (less time for the human operation, cost savings, space saving) • Which customer segment is the Use Case addressing? o Public Transport Operators and Authorities, Cities • On which channels are the customers addressed? o Public consortium with top state of the art knowledge in automation and optimization for PTO operation, private public partnership • How are the customers addressed? o Licensing o Public, Private Partnerships • What are the resources, the Use Case is built on?

	○ Old fleet that has been renewed is used for testing ○ Private Public Partnership Completing the procurement • What are the main activities right now? ○ Completing the procurement ○ Homologation, provided by the national traffic authority ○ Permits/ Regulatory, even when successful – time consuming ○ Testing • Which partners are involved in the Use Case? Do you plan on involving other partners? ○ EMT, Indra, Irizar, Tecnalia • How will the Use Case generate money? (Additional ticket sales, cost *savings,…)* ○ Savings (personnel, operational) • What is the current cost structure of the Use Case, how will the cost structure change during the next years? ○ Hardware costs expected to go down or at least be exponentially more powerful for the same costs, ○ Right now old infrastructure, old batteries
Value Proposition Canvas:	• **Customer Jobs:** ○ Fleet management ○ Maintenance ○ Managing pension, fuel, accident claim, etc. ○ Investments in new fleets and technologies (Wi-Fi, USB charging, …) • **Gains:** ○ Time savings ○ More efficient use of space inside the depot area • **Pains:** ○ High personnel cost ○ Time consuming depot operation+ ○ Limited space • **Service:** ○ Development of automated busses for use within the bus depot ○ Lidar ○ Camera ○ V2X • **Gain Creators:** ○ Development of automated busses for use within the bus depot ○ Boosting innovation ○ Creating OPEX savings • **Pain Relievers:** ○ Lower the personnel cost within the depot due to lesser driver needed ○ Automated buses will need less space when being parked next to each other
Strengths& Weaknesses compared to traditional public transportation:	Strenghts: • Optimize operation (vehicle utilization rate, number of trips, …) • Efficient use of space • Efficient use of old fleet Weaknesses: • Flexibility remains unclear • High technical development to be done
Go to market strategies and operator models:	What go-to-market strategies are the demo site partners following and did they already think about possible operator models? Who wants to continue developing and operating the Use Case? • Becoming the provider of top of state of the art • Private Public Partnership main goal for development and promotion of development and research, deployment of the city • Less ambition to becoming a MaaS provider, but a provider of MaaS application for EMT and partners,

	• Turning conventional vehicles into automated ones, • Bus live cycle between 7-15 years, busses deprivation rate ~10years

Annex 7 - Mega Site France, Rouen – Interview Report

Date of Interview:	28th October 2020
Mega Site:	France, Rouen
Participants:	(TSY) Romina Quaranta, Klaus Grabert (TRANSDEV) Mihai Chirca, Frederic Saffroy

Notes:	• Bus line: Mainly commuters, students
	• Robot taxis in city center: eider tourists, commuters, residents, scholars, VRUs
	  ○ On demand Robo taxis downtown, enforce network there, connect main hubs
	  ○ 10k people per day on the HUB
	  ○ Historical heart – tourism as a driver
	  ○ Services are 100% integrated in the PT network
	  ○ Embed commuter and any other passengers
	• Autonomous shuttles
	  ○ Line 34 on blue route, first regular line 100% automated
	  ○ Former industrial area, now connection
	• AV strategy:
	  ○ Robo taxi and on-demand services
	  ○ Two steps to automated shuttles. Operate shuttles under normal conditions, then automate in a high expansion zone: Laboratories,
	  ○ BRT service

Use Case description:	In preparation for the interviews note a few points of the Use Case, to discuss it with the demo site partners **Full Use Case description (October 2020) available in D1.2** • A regular bus line enforced with i-Cristal autonomous shuttles; • An on-demand Transport service in dense urban heart of Rouen in Renault ZOE; A private test track area and circuit for advanced tests**.** There are two area to be covered from the scenario point of view: the technological and the service aspects: From a technical point of view, the focus is on the ability of the vehicle to travel in automated mode from an origin to a destination while deserving several point/stops From a service point of view, in this project we have: - A regular bus line enforced with i-Cristal autonomous shuttles; - An on-demand transport service in dense urban heart of Rouen in Renault ZOE.
Success & Failure Factors:	Succes: • Infrastructure-Environment • Vehicle type • Data from demonstrations • Relationship technology-service • Ecosystem for SMEs/start-ups • Open Innovation Failure: • Business model • Improving service

	• Costs • User acceptance

Business Model Canvas:	• What is the value the Use Case is creating?
	  o Providing mobility for the City of Rouen/region Rouen Normandy
	  o Experiencing an overall connected transport system
	• Which customer segment is the Use Case addressing?
	  o Commuters, tourists, residents, scholars, vulnerable road users and persons with disabilities (wheel chaired users can board on the automated shuttle)
	• On which channels are the customers addressed?
	  o Astuce website
	  o My Astuce app
	  o Rouen Normandy Autonomous Lab
	• How are the customers addressed?
	  o Via Astuce Network: Transdev Rouen in collaboration with the Rouen Normandie Metropolis is building a multimodal network
	  o Astuce service centre
	  o Hotline/Mail contact
	• What are the resources, the Use Case is built on?
	  o Vehicles
	  o Supervision centre with fleet control room, smart infrastructure and secure telecommunications networks
	  o Infrastructure for parking/hand-over, charging
	  o Mobility application My Astuce
	• What are the main activities right now?
	  o Real-time monitoring of network status
	  o Management of operational hazards/incidents
	  o Sending instructions to drivers/vehicles
	• Which partners are involved in the Use Case? Do you plan on involving other partners?
	  o PTA Rouen Normandie
	  o Renault as provider of vehicles connected to the PT network infrastructure
	  o OEMs
	  o Municipalities of Rouen Normandie metropolis
	  o PT control centre
	  o Insurance companies
	  o Research
	• How will the Use Case generate money? (Additional ticket sales, cost *savings,…)*
	  o Ticketing
	  o Subscription (annually, monthly)
	  o Pay per use (ticket, SMS ticket)
	  o Compensation by PTAs
	  o Marginal revenue from advertising
	• What is the current cost structure of the Use Case, how will the cost structure change during the next years?
	  o CAPEX:
	  o Vehicle
	  o Interior building
	  o Technical installation
	  o OPEX:
	  o Personnel
	  o Maintenance
	  o Swapping interior

Value Proposition Canvas:	Customer Jobs: • Commuting • Shopping • Groceries • Leisure Trips • Tourism Gains: • Coordinating multiple lines • Drop-off for parcels / post • USB charging in vehicles • Cost effectiveness in comparison to the private car

	• Ease of use in comparison to private car • Comfortable seating Pains: • Congested city centers • Danger for VRUs • No locals: not knowing which line to take, confusing public transport situation • Inflexible hop-in/ drop-off points • No guaranty for space or seating • No information on delays • Delays • Search for parking spaces Service: • **Shuttle i-Cristal**: Min: 0 km/h; Max: 30 km/h (TBC) • **Robo-taxi Renault Zoe**: Min: 0 km/h; Max: 30 km/h (TBC) • Advanced tests may be performed on private tests trucks with higher speeds; • A regular bus line enforced with i-Cristal autonomous shuttles; • An on-demand Transport service in dense urban heart of Rouen in Renault ZOE; Gain Creators: • City ticket with easy pricing – e.g. flatrate being able to use multiple mobility services • Sustainable urban cities • Safer cities for VRUs and other vehicle (drivers) • Reduction of private car usage in urban areas Pain Relievers: • Easy to use and understand mobility as a service application • All city's mobility services on one app • Real-Time information about traffic volume in the area and riders for the shuttle • On demand transportation, flexibility • Pre-booking of tickets and/ or space (seats)
Strengths& Weaknesses compared to traditional public transportation:	Why is the automated Use Case better fitting than traditional mobility solutions? • Many parts can be described as car-dependent. • 10% of trips are made with PT, • 32% of trips in the city of Rouen is un-motorized • 63% motorized either with own car or as car passenger.
Go to market strategies and operator models:	What go-to-market strategies are the demo site partners following and did they already think about possible operator models? Who wants to continue developing and operating the Use Case. • autonomous transport is set to radically change the way of travel, the way of life • through flexible, personalised and accessible services, more stops and more regular services, reduced noise and air pollution…). • opportunity for local authority transport networks due to the fact that shared autonomous mobility services will be rolled out before personal autonomous vehicles. • go beyond experimentation and to apply understanding of the needs of each region to the gradual and successful integration of these technologies into public transport networks.

Annex 8 - Mega Site France, Rennes – Interview Report

Date of Interview:	28th October 2020
Mega Site:	France, Rennes
Participants:	(TSY) Romina Quaranta, Klaus Grabert (CHU) Isabelle Dussutour (Keolis) Clement Aubourg
Notes:	• Hospital area • 50% of cases are handled as day care only • Transport of persons: Visitors, medical staff, logistic staff, students, VRUs • Transport of goods: Medical equipment, blood, small laundry
Use Case description:	**Full Use Case description (October 2020) available in D1.2** The use case will be to offer mobility both to the passengers on the CHU site (patient, doctors, visitors) and evaluate which segment if the most appropriate to the use of automated shuttles and when. The shuttles will also transport light material when there are no passengers to move (night), the security and safety requirements for this material transport will be analysed and new services and equipment will be developed (GRUAU third party).
Success & Failure Factors:	Success: • Infrastructure-Environment • Vehicle type • Data from demonstrations • Relationship technology-service • Ecosystem for SMEs/start-ups • Open Innovation Failure: • Business model • Improving service • Costs • User acceptance • COVID19

Business Model Canvas:	• What is the value the Use Case is creating?
	  ○ One of the first car free and environmentally friendly hospital campuses
	  ○ Train station, metro station, bike sharing, parking – near and
	  ○ Cars can be used on campus from building to building
	  ○ Bus line on the campus from train station
	  ○ Medical equipment delivered at night
	• Which customer segment is the Use Case addressing?
	  ○ Patients of CHU, visitors, doctors and medical personnel.
	  ○ Hospital stations and management
	• On which channels are the customers addressed?
	  ○ Information around and on the hospital campus
	  ○ Planned: Application, integration to PTO
	• How are the customers addressed?
	  ○ passenger information on the stations, flyers in the hospital, website etc.
	• What are the resources, the Use Case is built on?
	  ○ Campus plan of CHU “vehicle free campus”
	  ○ Strong partners on demo site
	  ○ Strong business model (passengers as well as logistics)
	• What are the main activities right now?

	○ Planning of demonstration with special regards to the COVID-19 situation because of the hospital area ○ Planning of the services and interior design of the vehicles • Which partners are involved in the Use Case? Do you plan on involving other partners? ○ shuttle and its driver; PT operator KEOLIS, passengers, ESI group (SC) for acceptability, GRUAU. Start up cooperation for reservation, cooperations for customer surveys • How will the Use Case generate money? (Additional ticket sales, cost *savings,…)* ○ Generating money is not the focus of the Use Case, the Use case mainly wants to support the initiative of CHUs plans to transform the campus to a vehicle free area. ○ Less noise, less emission, more safety, more space ○ If the Use Case get's integrated into the existing public transportation of the area, then the same ticket prices would apply • What is the current cost structure of the Use Case, how will the cost structure change during the next years? ○ Right now: Several parking spaces at different facilities and one metro line towards the hospital campus. On the campus there is bike sharing by the PTO STAR. ○ The cost structure is completely new CAPEX: - Vehicle - Interior building - Technical installation OPEX: - Personnel - Maintenance - Swapping interior
Value Proposition Canvas:	Customer Jobs: • Urgent trips to the hospital • Visiting family members/ friends in the hospital • Day-Care trips for treatments, e.g. chemo therapy, dialysis • Transporting medical goods • Moving around the campus • Special needs with regards to mobility • slow, visually deficient, mentally deficient Gains: • Information of the campus area • Information on the way around the campus • Reliable way to mov • e from and to facilities • Information on the hospital Pains: • Long foot walks to the facilities from the parking/ metro station • Not enough overview of the campus area and where to go • Immobility or reduced mobility (e.g. broken bones, wheelchair) • A lot of individual traffic Service: • 6 shuttles dedicated to passengers and freight • Navya and Easymile • 5-10 km/h • On board sensors, HD-mapping • On-site intelligent signs and totem for passengers (use of ITS, 5G networks) Gain Creators: • Building of a hospital campus information system • Integrated into the local transportation (app and transport) Pain Relievers: • Secure and safe transportation around the campus

	• Comfortability • Vehicles addressing the needs of hospitalized people and day care cases
Strengths& Weaknesses compared to traditional public transportation:	Why is the automated Use Case better fitting than traditional mobility solutions? • Traditional public transport compared unflexible, loud, takes much space. Busses will often drive empty, busses are hard to board for passengers with special needs (wheelchair, broken leg, etc.)
Go to market strategies and operator models:	What go-to-market strategies are the demo site partners following and did they already think about possible operator models? Who wants to continue developing and operating the Use Case? • No experimentation in CHU of all automated transport is made at this stage, the innovation will be in services, adaptation of the interior design of shuttles. • CHALLENGE: Peak hours for modal shift and visitation hours • IDEA OWNER: • Hospital asked the CHU, Keolis etc.

Annex 9 - Mega Site Austria, Salzburg – Interview Report

Interview Guideline Pilot Site Interview of D2.2 Business Modelling and mapping to pilot sites Document Responsible: Romina Quaranta (T-Systems): Romina.quaranta@t-systems.com	
Date of Interview:	09.11.2020
Mega Site:	Salzburg, Austria
Participants:	Markus Karnutsch <markus.karnutsch@salzburgresearch.at>; Dominik.schallauer@austriatech.at; Grabert, Klaus Klaus.Grabert@t-systems.com; Romina Quaranta romina.quaranta@t-systems.com; Fürdös Alexander Alexander.Fuerdoes@austriatech.at
Notes:	Operation runs in between 09:00 – 15:00h with 1 vehicle Specialty of this Use Case is the route - Sub-urban: Geo-scans of the surrounding tend to derive from the real situation (grass not cut, bushes hanging on the street more than on the scans, etc.) - Mountain/ Hill area: Hight difference of approx. 400m between the highest point (intermodal station Koppl/ line 150) and the city center of Salzburg - Vehicle used: 1 Easymile Shuttle which officially runs under SAE L4, still faces some technical issues
Use Case description:	Scenario 1 will be realized in the municipality of Koppl. The municipality is located in the peri-urban area of the City of Salzburg. The route links the centre of Koppl municipality to the “Sperrbrücke” bus stop, which is situated on the main road to Salzburg city centre. “Sperrbrücke” bus stop is a stop of the public bus line no. 150 connecting the peri-urban areas to the city centre. Therefore, “Koppl Sperrbrücke” acts as an intermodal interchange where passengers are able to change from the automated shuttle bus to the public bus line. The bus stop has been equipped with an area for safely turning the automated shuttle. The length of the autonomous shuttle route is approximately 1.4 km one-way. It is a slightly curved asphalt road with a maximum of 8 percent incline (equivalent to 65 m height difference). The whole route has driving lanes for both directions. Including start and terminus stops, the route serves four bus stops in each direction. The whole route is fully equipped with ETSI ITS-G5-enabled Roadside Stations (5). Also, a HD map of the whole route has been created. The rural location of this route presents a number of challenges (e.g. partly lacking points of reference such as buildings or road markings for the reliable positioning of the vehicle), poor GNSS signal quality, and rudimentary road infrastructure without signalized intersections, as well as the maximal road gradient of 8%. Scenario 2 focuses on the public bus corridor between “Koppl Sperrbrücke” and the City of Salzburg. The public bus line 150 connects the peri-urban area Koppl with the city centre on an arterial, rural road. The length of the route is approximately 7.9 km one-way, the maximum speed limit is 80 km/h. It is a partly curvy asphalt road with separate driving lanes bridging nearly 300 meters height difference between the starting point in Koppl and the arrival point in the city of Salzburg. There are eleven bus stops in each direction on this route.
Success & Failure Factors:	Success& Failure Factors of the Use Case, also available in D2.1

	Success: • Austrian Mission statement 2016: Digibus Austria, since then there are continuous tests on this route • High acceptance within the region by inhabitants and politic decision makers Failure: • Vehicle is not resilitent/ robust/ reliable as needed to be operated in a save, viable and profitable after-project lifetime • Integration of on demand services needed, seat management needed • Pandemic influence on PT and especially small busses • CCAV not possible with shuttles as they can only read/ receive information but not yet send to infrastructure

Business Model Canvas:	What is the value the Use Case is creating?
	
	• (On demand) Connection of the sub-urban area in Koppl to the well-established regional bus lines
	• Benefitting from C-ITS cooperative traffic management e.g.
	  ○ In-vehicle speed limits, including dynamic speed limits –
	  ○ Emergency electronic braking light –
	  ○ Road works warning –
	  ○ Weather conditions,
	  ○ if linked to dynamic in-vehicle speed limits –
	  ○ Intersection safety
	
	Which customer segment is the Use Case addressing?
	
	• The two scenarios in Salzburg are aimed at the user groups of commuters and residents, day-trippers and tourists.
	• Most important for PT: Transportation of elderly
	• Tests showed the wide demographic of passengers
	
	On which channels are the customers addressed?
	
	• Local newspapers, flyers
	• TV
	• The use case itself is not yet integrated in existing mobility solutions
	
	How are the customers addressed?
	
	• See channels
	• Positive feedback regarding usefulness and comfort
	• High acceptance
	
	What are the resources, the Use Case is built on?
	
	• 4 stations along the automated shuttle path
	• HD Mapping
	• 5 RSU by Kapsch
	• Strong partners e.g. relations with Easymile
	
	What are the main activities right now?
	
	• Running Pre-Demo SHOW early 2021
	• On-Going validation and testing
	• Cooperation with PTO Salzburg Verkehr about sustainability of the project results, possible operator model
	
	Which partners are involved in the Use Case? Do you plan on involving other partners?
	
	How will the Use Case generate money? (Additional ticket sales, cost *savings,…)*
	
	• Soft factors are most important for the region:
	• Connecting people to the regional bus line: 150.

	• Possible ticketing: Pay as you go or integration into current Salzburg Verkehr pricing strategy • • Total revenue/traffic division Salzburg AG: 62.035.169 € (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 What is the current cost structure of the Use Case, how will the cost structure change during the next years? • CAPEX (Fixed costs): Investments in machines and equipment/traffic division Salzburg AG: 15,300,000 € (2019)
Value Proposition Canvas:	Jobs: • Commuting • Leisure trips • Tourism trips Pains: • Connection to the sub-urban areas around the city of Salzburg is needed but only a small number of buses with long pauses in between the scheduled trips are available • Walking trips around 1-2km to the next PT line with higher frequencies • Comfort of PT • Sustainability of private car usage Gains: • Higher flexibility = on demand automated shuttles • Higher frequencies • Electrified buses boosting sustainability Service: • C-ITS cooperative traffic management • Shuttle bus in municipality with direct connection to big bus lane • Autonomous bus for 8 people Pain Relivers: • Real-time information on the road condition through C-ITS • Real-time information on delays • Priority to the bus Gain Creators: • Connection to the sub-urban areas around the city of Salzburg is needed but only a small number of buses with long pauses in between the scheduled trips are available • Walking trips around 1-2km to the next PT line with higher frequencies • Comfort of PT • Sustainability of private car usage
Strengths& Weaknesses compared to traditional public transportation:	Why is the automated Use Case better fitting than traditional mobility solutions? The route for the autonomous shuttle is only 1,4 km, approximately the length of the municipality. Therefore, a normal coach bus wouldn't be feasible. The smaller, more flexible shuttle busses are a better fit. The C-ITS connection in the non-automated bus allows for in-vehicle (dynamic) speed limits and emergency electronic braking lights as well as road works warning.

	For the alpine area of Salzburg the regular updates on weather conditions are a huge plase and last but not least the overall traffic safety is enhanced through C-ITS. The Weakness compared to a normal system is mainly the costs and initial investment in the infrastructure
Fore Sighting and business innovation:	What are the innovative aspects of the Use Case? How will the development continue? The demo site's services are integrated and feeding into the timetables of Salzburg Verkehr's bus lines. One bus line is being equipped with C-ITS technology. The automated shuttle bus is already established within the region and the demo site has a great opportunity of taking their services to the market.
Go to market strategies and operator models:	What go-to-market strategies are the demo site partners following and did they already think about possible operator models? Who wants to continue developing and operating the Use Case? Integration of timetables, Integration of PTO, giving him the license to operate, Salzburg Verkehr is already involved. Marketing

Annex 10 - Mega Site Austria, Graz – Interview Report

Interview Guideline Pilot Site Interview of D2.2 Business Modelling and mapping to pilot sites Document Responsible: Romina Quaranta (T-Systems): Romina.quaranta@t-systems.com	
Date of Interview:	10th November 2020
Mega Site:	Austria, Graz
Participants:	(Austriatech) Dominik.schallauer, Fürdös Alexander (v2c2) Joachim Hillebrand (TSY) Klaus Grabert, Romina Quaranta
Notes:	
Use Case description:	In preparation for the interviews note a few points of the Use Case, to discuss it with the demo site partners **Full Use Case description (October 2020) available in D1.2** Automated shuttle route between the PT HUB “Puntigam” and the shopping center “center west” 2-3 stops at other shopping points like IKEA etc. Kameras an der Haltestelle, um freie Parkbuchten zu detektieren C-ITS for traffic light communication on street
Success & Failure Factors:	Success& Failure Factors of the Use Case, also available in D2.1 Success: - Integration of local PTO - Dedicated lane Failure: - Business potential rather small - Lack of experience
Business Model Canvas:	From experience the online interview is not the perfect medium to focus on building the business model with the demo site partners, in comparison to the previously planned demo site workshops, were all partners would see a live-demo and focus solely on the business modelling afterwards. For the interview we encourage you to focus more on specific key points of the business model and put them together in a model afterwards. E.g. What is the value the Use Case is creating? • Flexible, fast connection to the shopping centre “centre west” • Robo Taxi service • Automated trunk opening

	Which customer segment is the Use Case addressing? • Passenger transport to and from the shopping centre • Especially interesting for: PT users with additional mobility needs On which channels are the customers addressed? • Information in center west and at the station • Flyers, local news • No integration in any app yet How are the customers addressed? • Tests with real “inexperienced” passengers are planned • Long term: Integration with public transport operator possible What are the resources, the Use Case is built on? • Research orientated demo site partners • Route without interference with private cars or VRUs (only busses) • Vehicles used (normal private cars) cheaper than shuttle busses • “Robo Taxis” What are the main activities right now? • Installation of infrastructure along the route and at the station • Preparing the demo in 2021 • Cost evaluation Which partners are involved in the Use Case? Do you plan on involving other partners? • Center West • Virtual vehicle *How will the Use Case generate money? (Additional ticket sales, cost savings,…)* • Ticket sales What is the current cost structure of the Use Case, how will the cost structure change during the next years? • Technical installation • Investment in Infrastructure • Personnel
Value Proposition Canvas:	Jobs: • Leisure trips • Commuting • Shopping trips
	Pains: • Long waiting times for a bus that drives to the centre • A lot of empty trips on the route after the Center bus stop • Busses are often complicated to board for people with special mobility needs
	Gains: • Higher frequencies • Electrified taxis boosting sustainability
	Service: • Additional infrastructure at the station (sensors) • Robo-Taxis (normal passenger cars) • 1km route with no other privately used vehicles (PT only)
	Pain reliever: • Higher frequencies due to trips only in between the station and the centre
	Gain creator: • More comfort than normal buses • More sustainable than private car usage

Strengths& Weaknesses compared to traditional public transportation:	Why is the automated Use Case better fitting than traditional mobility solutions? • Robo-taxi is faster than the current bus line and more comfortable than walking (1km) • Completely eliminating waiting times Weakness: • Compared to a bus, the robo taxi can only fot 3-4 passengers
Fore Sighting and business innovation:	What are the innovative aspects of the Use Case? How will the development continue? • Rather technical approach, business needs to get more in focus
Go to market strategies and operator models:	What go-to-market strategies are the demo site partners following and did they already think about possible operator models? Who wants to continue developing and operating the Use Case? • Tests on willingness to user, acceptance etc. are needed • Integrate with the local PTO • Marketing via shopping mall, incentives

Annex 11 - Mega Site Sweden, Linköping – Interview Report

Interview Guideline Pilot Site Interview of D2.2 Business Modelling and mapping to pilot sites Document Responsible: Romina Quaranta (T-Systems): Romina.quaranta@t-systems.com	
Date of Interview:	29th October 2020
Mega Site:	Sweden, Linköping
Participants:	Anna Anung (VTI), Christian Monstein (Transdev), Tor Skoglung (RISE), Klaus Grabert, Romina Quaranta (TSystems)
Notes:	
Use Case description:	• Site aims to show how autonomous buses work within in area where its needed • Develop an open platform for studies and research • In 2 phases: • Phase 1: rather complex: First Stop at VTI, then goes on a public road, then campus area, only for pedestrians, • Phase 2: New area, sustainable exhibition living area, no car area, shared solution for transportation (electrification, car sharing, autonomous transportation) ~ 22 taxis for the kids with special needs every morning because it's too far from school to trunk line • Taxis should be replaced in the long term by automated last mile PT • Improve the user experience which is why the aim is for elderly and children • Door to Door perspective, services for "special" needs: blind, limited mobility
Success & Failure Factors:	Success: • Continuously run trials, Area for research of integration of automated PT in different environments Failure • Public fundings are mostly spend on clusters of transportation and not research and not the capillaries of the network (first and last mile) • Hybrid solutions needed • Willingness to pay (for the solution for stakeholders)

Business Model Canvas:	• What is the value the Use Case is creating?
	  ○ Improve the user experience which is why the aim is for elderly and children
	  ○ Door to Door perspective, services for "special" needs: blind, limited mobility
	• Which customer segment is the Use Case addressing?
	  ○ Elderly, children
	  ○ blind, limited mobility
	• On which channels are the customers addressed?
	  ○ Right now: Fixed lines
	  ○ Later: Technology is prepared for being embedded in the MaaS solution, MaaS solution will integrate the pilot
	  ○ Negotiations ongoing for developing on MaaS platform
	• How are the customers addressed?
	  ○ MaaS app,

	• What are the resources, the Use Case is built on?
	  ○ Sustainable urban space “plan”
	  ○
	• What are the main activities right now?
	  ○ Evaluate the user experience,
	  ○ Implement the Use Cases
	  ○ Implement on demand services through integration in MaaS application
	• Which partners are involved in the Use Case? Do you plan on involving other partners?
	  ○ Research and academia
	  ○ PTO
	  ○ PTA, City/ Municipality
	  ○ Start Ups
	  ○ MaaS operators
	• How will the Use Case generate money? (Additional ticket sales, cost *savings,…)*
	  ○ Soft values: Value increase for land, sustainability,
	  ○ Hard values: Tickets sales according to transports already established network, reduction of personnel costs of PT
	• What is the current cost structure of the Use Case, how will the cost structure change during the next years?
	  ○ Initial investment in the fleet
	  ○ Technical installation
	  ○ Infrastructure
	  ○ Personnel
	  ○ Maintenance

Value Proposition Canvas:	Jobs: • Sustainable city management • Sustainable urban areas: elderly, children Pain: • Long connection to trunk line, special needs, high costs for last mile transportation (e.g. taxis for the children to school) Gains: • Connecting the last mile, raising value of the property • Continous development and research, “Best practice area” Service • Two shuttles (Navya, Easymile) • Two different road types • Complex mixed traffic • Extra road for only shared mobility solutions Pain Relivers: • A feeder for the first/ last mile is set in place • The autonomous shuttle are specialized for the needs of the school kids with reduced mobility and elderly people living in the area Gain Creators: • More comfort than normal buses • More sustainable than private car usage • Raining the value of the property
Strengths& Weaknesses compared to traditional public transportation:	The autonomous public transport service planned in Linköping is part of the urban, sustainable living concept which is planned to be built in the area. The Use Case fits perfect in the concept, with autonomous and electrified, shared transportation services.

	The technical development is yet still at an early stage and there has been no prior project in the area with autonomous vehicles. Therefore, there is no information available on the acceptance of the service yet.
Fore Sighting and business innovation:	VTI, the demo site leader in Linköping reports on a successful history of public private partnerships in Sweden for new businesses. This would for them be a way to bring the solution to the market
Go to market strategies and operator models:	• Private Public Partnerships for deployment of new technologies are successful in Sweden • Transdev is more than happy to introduce user stories and business cases with automated public transportation to their portfolio in Sweden, as the capabilities are there

Annex 12 - Mega Site Sweden, Kista – Interview Report

Date of Interview:	05.11.2020
Mega Site:	Sweden, Kista
Participants:	Jan Jansson (Keolis), Romina Quaranta & Klaus Grabert (TSYS), Cili Sobiech & Tor Skoglund (RISE),
Notes:	• 2km per trip • Connect the train station in the North and the Subway station in the South • High-Tech area plus some real-estate • A lot of parking spaces within the area, because ~70% of workers commute with private car • 5G connection through Ericson and Telia (Swedisch Telco) • 5G for communication as well as positioning • On street units • Work with Start-Ups: T-Engineering – Tech-integrator is working with Keolis in cooperation with Intel and Telia • 6k new apartments until 2024
Use Case description:	Pre-Trial • "5G-Ride" project, that Kista tried their cars and connection in a public manner for ~100 riders, 2 weeks ago • Result: Video Streaming • 99% independence is wanted for Keolis for the cars with on stream sensors IOT by Ericosson vehicle team: • Started on a monitoring level, geo fencing etc. • For future, connect to cell phones, smart devices etc. Integration of SMEs – T-Engeneering
Success & Failure Factors:	Success: • Only pilot Site with such big potential for IoT connection • High tech area highly accepting the technology • Value creation and business model potential for the real-estate organizations if parking's are removed and replaced by shops etc. Failure: • Best Case Needed: A fully "gated" area, separated bus lanes etc., then the operator is not needed, and operation can easily generate a ROI
Business Model Canvas:	What is the value the Use Case is creating? • New/ Better/ more comfortable Commuting • Reduce individual traffic • Reduce emission in the area • Put the driver outside of the vehicle (tele-operation in focus) Which customer segment is the Use Case addressing?

	• Commuters, organizations within the area, (shop owners, landlords) On which channels are the customers addressed? • Demo will start 2021 • For the future the PTA wants to integrate the road in their network • Vehicle is completely connected to the control tower already How are the customers addressed? • Partnership in the area, Kista science city is promoting the trials to the company and landlords in the area, this is how Telia and Intel orsc the trial • For the future: integration to existing network What are the resources, the Use Case is built on? • Former trials pushed the acceptance for following demos • Strong partnerships, High-Tech area and organizations • Not much Mobility as a service infrastructure in the area (very traditional) What are the main activities right now? • Start the trial in Kista • Promotion to local firms • 10-15 Use cases being testes • Find cheaper vehicle to use, so that 2 cars can be used • Add pedestrians, other vehicles, bikes and connect them for the trial Which partners are involved in the Use Case? Do you plan on involving other partners? • Intel Telia joined the trials • T-Engeneering as a sub-contractor • Demo Site partners • All organizations within the High-Tech Area and their employees *How will the Use Case generate money? (Additional ticket sales, cost savings,…)* • Important KPIs • Number of carried out Use Cases • Ridership/ Passengers • Local mobility like this is supposed to be pushed by the landlords, restructure the Tech-area with smart mobility there, this will raise the value of the properties within the area • Change modal split in Kista (+ less emissions, etc.) • 3-5 min waiting time for bus otherwise you will prefer other modes of transport What is the current cost structure of the Use Case, how will the cost structure change during the next years? • 300k for the vehicle • Vast set up costs 150k just for the technical part • Safety driver cost!!
Value Proposition Canvas:	Jobs: • Commuting • Groceries • Leisure trips Pain: • No coordinated public transport lines, waiting time in between stops • Low frequency • Full public transport during peak hours • No/ not enough public transport during off-peak hours (early&late) • Inflexible hop-in/ drop-off points • No guaranty for space or seating

	• No information on delays • Delays Gains: • Connecting the first and last mile • Raising value of the property • Drop-off for parcels / post • USB charging • Cost effectiveness in comparison to the private car Service • A first/last mile automated shuttle bus line that connects the different mobility HUBs around the area • Vehicles: • Frequent Pain Relivers: • Coordination between shuttle and fixed line to eliminate long waiting times at mobility HUBs • Real-Time information about traffic volume in the area and riders for the shuttle • Pre-booking of tickets and/ or space (seats) Gain Creators: • Sustainable urban cities • Eliminating mobility gaps • Reduction of private car usage
Strengths& Weaknesses compared to traditional public transportation:	Small area ~2km per trip doesn't need a small number of big busses but better with a lot more flexible little vehicles for the connection to outside parking and subway/ train station
Fore Sighting and business innovation:	Tele Operation from Control tower Geo Fencing Vehicle IoT
Go to market strategies and operator models:	Promotion to everyone in the area through Kista science city, already made other interested partners join the demo and opened up other trials. For a go-to-market strategy it is of high importance to involve the landlords of the area For the PTO within the area it is out of scope to join or operate the trials, meanwhile Keolis and other PTOs like Transdev can strategically think about operating this first/last mile transportation services (~5 years)