RECIPROCITY

D3.3

Business models report

Project number: 101006576

Duration: 32 months

Project start: 1 February 2021

The RECIPROCITY project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101006576

D3.3 – Business model report	
Deliverable number	D3.3
Responsible partner	G!E
Due date of deliverable	31 July 2023
Actual submission date	31 July 2023
Version	2
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Reviewers	Anne Häner
Work package no.	3
Work package title	ACCELERATE
Work package leader	IAF
Work package participants	IAF, RTECH, ERRIN, G!E, MOV'EO, ZONE Cluster, OKAN, BIZUP, RDA Pilsen, HURC

Dissemination level (please select one)		
CO	Confidential, only for members of the consortium including the Commission Services	
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R	Report	x
D	Demonstrator	
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Publishable summary

RECIPROCITY aims to transform European cities into climate-resilient and connected, multimodal nodes for smart and clean mobility. The project's innovative four-stage replication approach is designed to showcase and disseminate best practices for sustainable urban development and mobility.

As part of this project, the present business model report (D3.3) provides an overview of **innovative urban mobility business models** that could be tailored to cities in the RECIPROCITY replication ecosystem. The work developed was based upon the work carried-out in WP1-2-4, and aimed to collect and derive the business model patterns for urban mobility and propose a business model portfolio that encourage cross-sector collaboration and create an integrated mobility system.

This report is therefore addressed to cities and local authorities that have to meet mobility challenges (i.e. high costs and low margin, broad set of partners, competing with private car) by providing new services to activate and accelerate a sustainable modal shift. It also targets other stakeholders interested in business model concepts applied to cities.

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List of abbreviations

API	Application Programming Interface
BMW	Business Model Workshop
BMC	Business Model Canvas
EC	European Commission
ICT	Information and Communication Technology
MaaS	Mobility-as-a-Service
MSP	Mobility Service Provider
PSP	Payment Service Provider
PTA	Public Transport Agency
PTO	Public Transport Operator
RCP	Reciprocity
SC-BMC	Smart-city business model canvas
SULP	Sustainable Urban Logistic Plans
SUMP	Sustainable Urban Mobility Plans
TOA	Transport Organising Authority
UX	User eXperience

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1. Introduction

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1.1. About RECIPROCITY project

To foster transitions towards sustainability, multimodality and resilience, the outcomes of demonstration and pilot projects need to be applied on a wider scale taking into account historical, spatial, political, social and economic characteristics of each area. This requires collaboration between advanced cities and regions, so-called lighthouse cities that have already implemented and tested innovative mobility solutions, and between those cities that have an unmet mobility need matching these solutions, from hereon-called follower cities. RECIPROCITY assists connect these cities for reciprocal knowledge exchange by creating a replication ecosystem of more than 20 cities and municipalities that vary in size, requirements and level of mobility advancement. Replication ecosystem in this proposal describes a long-term network of different cities and communities, collaborating and exchanging on (urban) mobility practices along the four-staged replication framework. This pool of cities consists of lighthouse cities such as Helsinki (FI), Coventry (UK) or Istanbul (TR) and follower cities such as Pilsen (CZ), Olsztyn (PL) or Liepaja (LV).

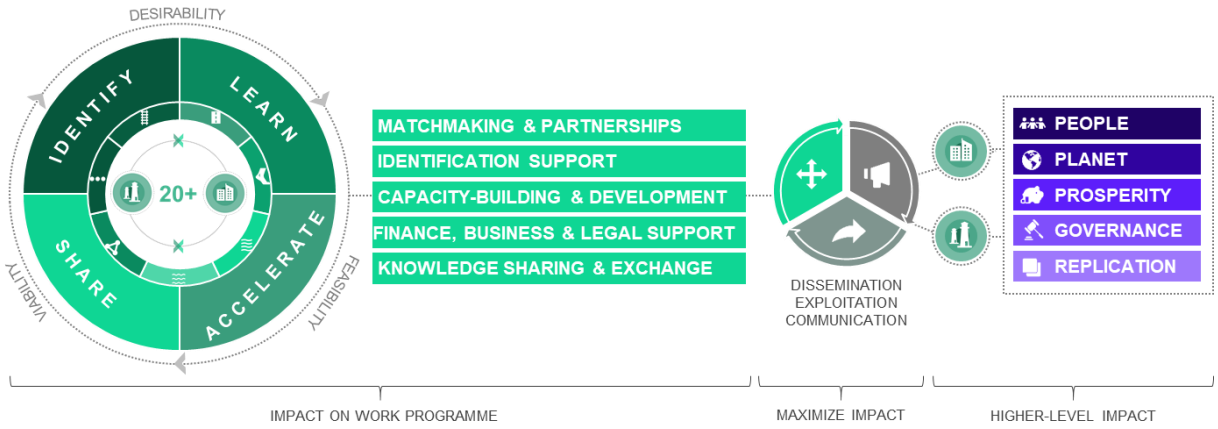

Figure 1 RECIPROCITY concept

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1.2. Why this report and to whom is it addressed?

The revised guidelines for the Trans-European Transport Network (TEN-T revision) foresees that all major cities ('urban nodes') on that network must develop by 2025 a sustainable urban mobility plan. The new European Urban Mobility Framework outlines a common a list of measures and initiatives for these cities, as well as the remaining cities in the EU, to meet the challenge of making their mobility more sustainable and improving transport and mobility to, in and around cities, as well as improving the efficiency of goods and home deliveries. To successfully change mobility behaviour, innovative mobility solutions have to be largely replicated. As mobility projects are complex, a successful business model, built on specific conditions, may not fit the economic, environmental, technological and social context of different cities, especially given the variations in needs, priorities, costs and requirements among cities.

Based upon the work carried-out in WP1-2-4, the objectives of Task 3.3 'Business model generation' are to collect and derive the business model patterns for urban mobility and propose a business model portfolio that encourage cross-sector collaboration and create an integrated mobility system.

D3.3 provides an overview of **innovative urban mobility business models** that could be tailored to cities in the RECIPROCITY replication ecosystem. The motivations behind this report are to provide fair, sustainable and politically acceptable business models.

This report is therefore addressed to cities and local authorities that have to meet mobility challenges (i.e. high costs and low margin, broad set of partners, competing with private car) by providing new services to activate and accelerate a sustainable modal shift. It also targets other stakeholders interested in business model concepts applied to cities.

While this publication is mainly on the business opportunities behind the various mobility solutions, a set of policy recommendations for the various mobility solutions/categories is currently being drafted and should support cities with focus on regulation.

RCP aims to support cities and municipalities in identifying the most suitable business model and financial scheme for a rapid implementation of smart mobility solutions.

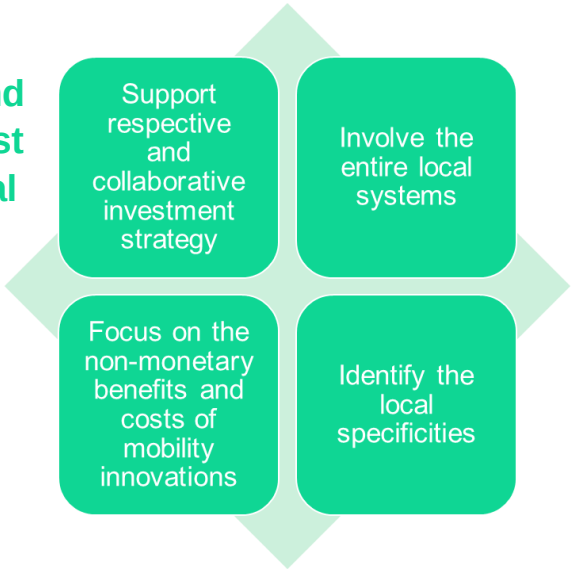

Figure 2 RECIPROCITY Vision of business modelling

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1.3. How is this report structured?

After this general section introducing the report (Section 1), Section 2 introduces the business model definition and provides an overview of the methodological approach developed to generate a portfolio of business model canvas to accelerate the replication of mobility solutions from the RCP portfolio, and matching the interests of the RCP stakeholders.

Section 3 provides an overview of the use cases and solutions that has been analysed to produce this report and Section 4 describes the data collection process.

Section 5 presents the business model patters that have been identified as most relevant to capture the value of the mobility solutions.

Finally, in section 6, business models are generated and supported by lessons learnt and good practices. Cities and municipalities are invited to directly consult this last section.

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2. Business model generation in RECIPROCITY

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2.1. Business model definition

A business model describes how value is created, delivered and captured. A primary component of the business model is the value proposition. This is a description of the goods or services that an organisation offers and why they are desirable to customers or beneficiaries.

The main elements of a business model are synthesised in Figure 3.

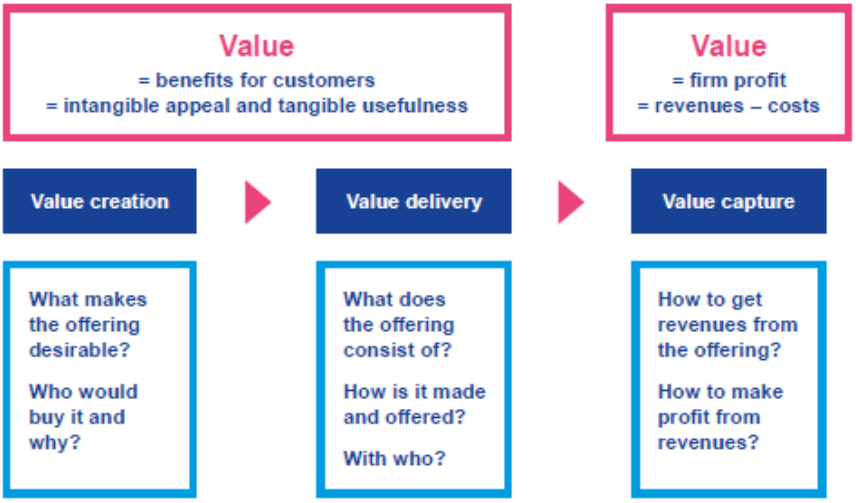

Figure 3 Main elements of a business model (after CIVITAS ECCENTRIC project, Guidelines on How to implement MaaS in local contexts)

A business model allows to uncover new business opportunities and turn customer needs into profitable activities. In a city context, it allows to mobilise resources and minimise the budget needed to solve a problem. Without a viable business model, innovative mobility project will stay at pilot-scales and no real service will be provided.

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2.2. Existing methods to design a business model

Different methods to develop business models, and in particular their value proposition, have been proposed by academics and experts.

To achieve a common understanding of the business model concept itself, several authors have first identified elements belonging to a business model (e.g., Gordijn et al., 2005[1]; Hedman and Kalling, 2003[2]; Johnson, 2010[3]; Osterwalder and Pigneur, 2010[4]). **Probably the most popular example** (according to Spieth et al., 2014[5]) **is the business model canvas (BMC) by Osterwalder and Pigneur (2010)**. Since its inception in 2010, the BMC has indeed been widely used in entrepreneurship programs, start-ups and large companies as a user-friendly approach to business modelling: the BMC is the most widely adopted academic framework for business model innovation both among students and practitioners (Blank, 2013[6]).

When preparing innovative business models for smart cities and peri-urban areas, **the primary objective is not to earn money but to fulfil a mission and to become more resilient to economic, environmental, and social challenges posed by ongoing urbanization**. It is then important to choose the best approach and adapt it to the people applying it, especially to design innovative mobility business models, which can be tailored to the local context by any city/regional authority practitioner.

For RECIPROCITY task 3.3 Business Model Generation, three methods have been explored:

- *The Osterwalder's BMC approach:* BMCs are popular, customer-centered, adequate for innovative solutions and easy to implement with more than 20 years of academic work behind it. However, it is often only used as a checklist without being embedded into the corresponding mobility plan.

[1] Gordijn, J, A Osterwalder and Y Pigneur (2005). Comparing two business model ontologies for designing e-business models and value constellations. In Proceedings of the 18th Bled eConference, Bled, Slovenia, Paper 15.

[2] Hedman, J and T Kalling (2003). The business model concept: Theoretical underpinnings and empirical illustrations. European Journal of Information Systems, 12(1), 49–59.

[3] Johnson, MW (2010). Seizing the White Space: Business Model Innovation for Growth and Renewal. Boston, USA: Harvard Business Press.

[4] Osterwalder, A and Y Pigneur (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Hoboken, USA: Wiley.

[5] Spieth, P, D Schneckenberg and JE Ricart (2014). Business model innovation–state of the art and future challenges for the field. R&D Management, 44(3), 237–247.

[6] Blank, S. (2013), Why the Lean Start-Up Changes Everything, Harvard Business Review, 91(5), 63-72.

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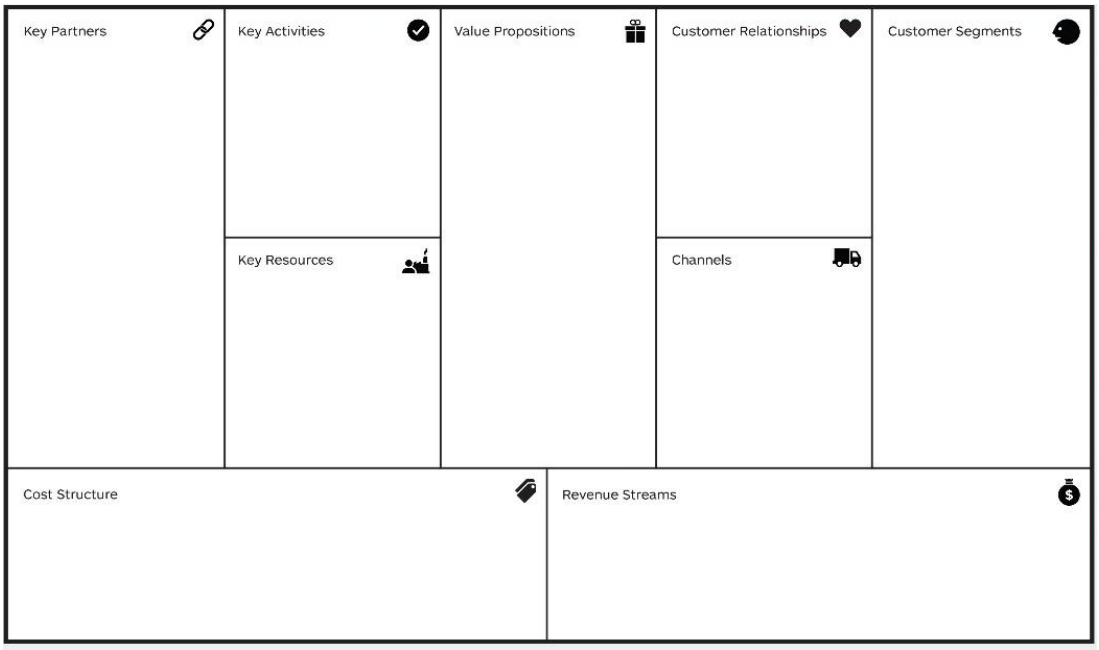

Figure 4 Business Model Canvas from Osterwalder

- *The Smart City BMC, proposed by Giourka et al (2019):* The Smart City Business Model Canvas (SC-BMC) intends to help cities design business models by adapting components of the BMC and adding new ones that operationalise the smart city dimensions. The SC-BMC presents a holistic approach for presenting all network actors' contributions in the generation of value and can be a complementary framework for facilitating replication of smart city solutions in different contexts. However, such canvas are quite heavy to present and implement.

- *Business model patterns:* Learning from existing solutions is often an efficient option for business model innovation. This approach facilitates group interaction, promotes creativity by thinking in analogies and is adequate for innovative solutions. This tool is customer-centered as well as quite popular and easy to implement thanks to the Business Model Navigator from St Gallen (2014)[7], describing 55 patterns, and the Business model pattern database from the University of Göttingen[8] (Remane et al., 2017), structuring 182 patterns along several dimensions to facilitate the navigation to the relevant set of patterns for a specific impact on an organization's business model.

As presented in the table below, the BMC/SC-BMC and Business model patterns approaches show various similarities in the way they are structured, although the value proposition design process itself is slightly different: the BM Navigator highlights the importance of the use of the patterns (Ideation), while BMC/SC-BMC Value Proposition Design puts emphasis on answering the customer needs ("problem-solution fit"). The latter also focusses on being distinctive from the competition or, in a city context, ensuring that network of actors creates and delivers the value and not the city alone (i.e. including partners, suppliers, beneficiaries, buy-in support, etc.). Osterwalder however highlights the need to first design several (bold) prototypes before focusing on one

[7] Gassmann, O., Frankenberger, K., & Csik, M. (2014). The business model navigator: 55 models that will revolutionise your business (1st ed.).

[8] Remane, G, Hanelt, A, Tesch, J, Kolbe, L, M. (2017). The business model pattern database — a tool for systematic business model innovation. International Journal of Innovation Management 2017 21:01. https://doi.org/10.1142/S1363919617500049

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in particular. In that sense, the BM patterns could be useful to provide 'food for thought' when developing these prototypes, i.e. they can be used as a basis to create various options to be investigated.

Table 1 Comparison of the Business model canvas and Business model patterns approaches

Osterwalder (BMC) / Giourka (SC-BMC)	St. Gallen (Business Model patterns)
Understand: analyse the environment	**Initiation**: analyse the ecosystem
Design: develop and select prototypes	**Ideation**: adapt the patterns
Design: adjust the value proposition and detail the business model	**Integration**: detail the business model
Implement: test, validate, adapt	**Implementation**: test, adapt
Manage: monitor and improve	

To summarise, the Business model canvas and Business model patterns approaches are complementary rather than mutually exclusive and can be used in combination so as to make the most of their respective strengths and propose a practical tool for cities aiming to implement innovative mobility solutions. Based on these findings, we therefore propose to follow a combined approach making the most of existing methods.

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2.3. Methodological approach developed in RECIPROCITY

In order to provide a robust methodology, two well-known approaches (the Business Model Canvas/ Value Proposition Design and the Business Model patterns) have been combined to generate business models for mobility solutions.

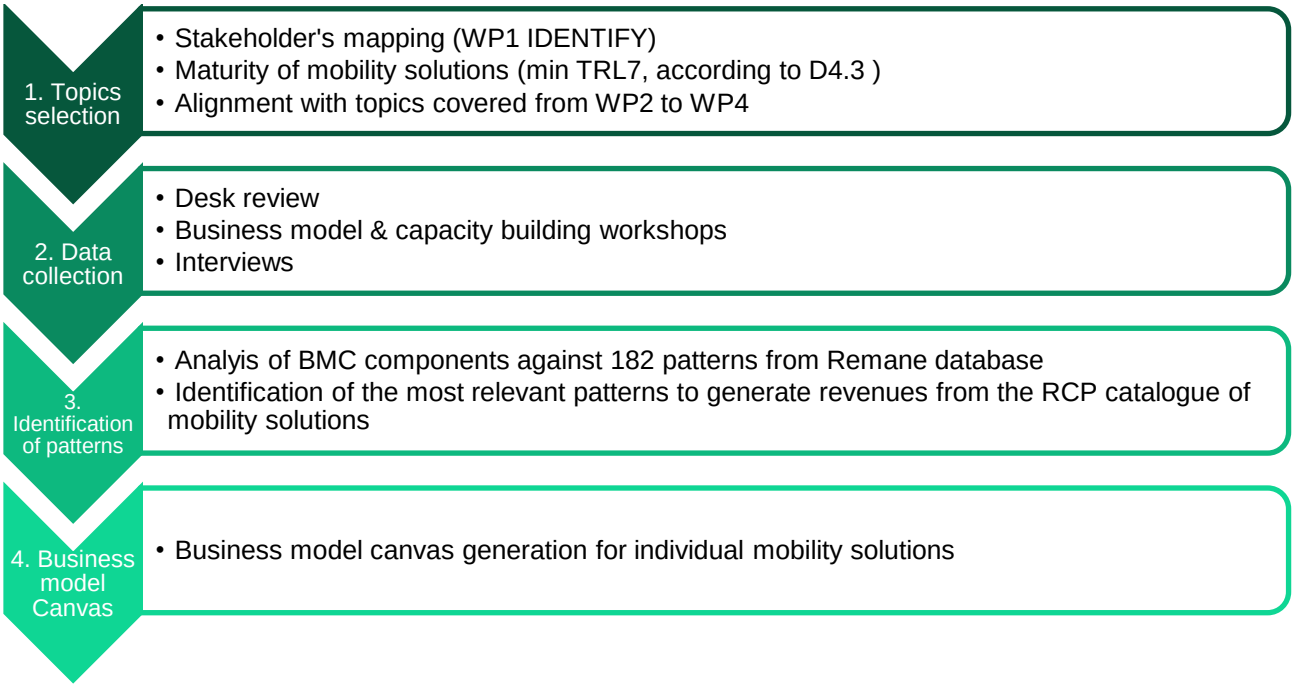

Figure 5 Methodological approach developed in RCP for business model generation

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2.4. RECIPROCITY Business Model Canvas

For reasons of readability and to provide a methodology easy to implement by cities/local authorities, Osterwalder's BMC has been chosen as the reference canvas, but with an 'add-on' taking into account the operating factors of the smart cities (and therefore the questions underlying the SC-BMC).

An adaptation of the BMC, the RCP-BMC, is therefore proposed, and will be used from now on to synthesise the business models presented in this deliverable.

<table>
<tr><th>Key actors, offerings and co-creation</th><th>Key activities</th><th>Value Proposition (for Customers)</th><th>Actor Relationships</th><th>Network Beneficiaries</th></tr>
<tr><td rowspan="3"></td><td rowspan="3">

Key resources & infrastructure</td><td rowspan="3"></td><td>Customer relationship
Actor relationship</td><td rowspan="3">Geographical segmentation
Professional segmentation

Segmentation by "restricted route"

Occasional</td></tr>
<tr><td>Deployment Channels</td></tr>
<tr><td></td></tr>
<tr><th colspan="3">Budget Costs</th><th colspan="2">Revenue Streams</th></tr>
<tr><td colspan="3">Investments
Operation & Maintenance
Scale-up</td><td colspan="2"></td></tr>
<tr><th colspan="3">Environmental Impacts: costs and benefits</th><th colspan="2">Social Impact: Values and Costs</th></tr>
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Figure 6 Proposed RCP Business model Canvas

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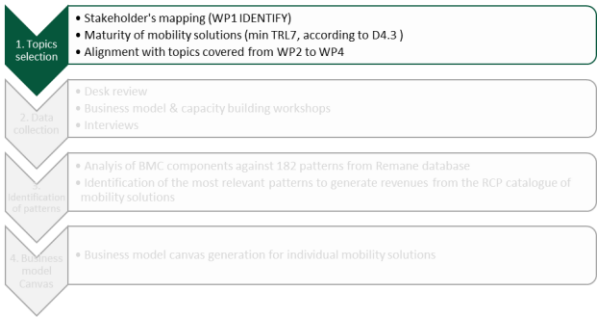
3. Topics selection



In order to provide a business models portfolio meeting the needs of RCP stakeholders, the present report provides business models for mobility solutions that emerged throughout the RECIPROCITY project, i.e. from the IDENTIFY work package, identifying the RCP stakeholders' needs (D1.2) and proposing a Replication roadmap, to the LEARN work package, providing among others a catalogue of best practices and lessons learnt. The studied mobility solutions have been clustered into four main thematic groups, as proposed in the Catalogue of mobility best practices (D4.3):

- *Multimodal Digital Mobility Services:*
  - *Mobility as a Service*
  - *Shared mobility (bike, e-scooter, car)*
  - *Multimodal Mobility and Shared Mobility*
  - *On-Demand Public transport*
- *Connected, Cooperative and Autonomous Mobility:*
  - *Autonomous Shuttles for Passengers*
  - *Automated deliveries/logistics*
- *Electric and hydrogen vehicles*
  - *EV charging stations*
  - *Fuel Cell Bus and Hydrogen Refuelling stations*

The present analysis focuses on mobility solutions from the RECIPROCITY catalogue that have demonstrated effectiveness in real environment (minimum Technology Readiness Level 7). This approach aims to refine the value propositions, provide reliable information on funding and financing mechanisms, and establish structured revenue models.

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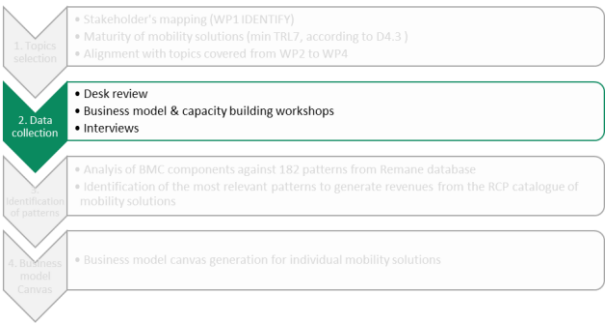
4. Data collection and business model workshops



The business models presented in the next sections have been elaborated thanks to data collected through both qualitative and quantitative methods:

- an initial desk review on the RCP use cases and current mobility business modelling practices was conducted to propose a design experiment;
- relevant insights and recommendations were gained from stakeholders in dedicated business model workshops (WP3), workshops and trainings sessions (WP2) or interviews (as part of T4.3).

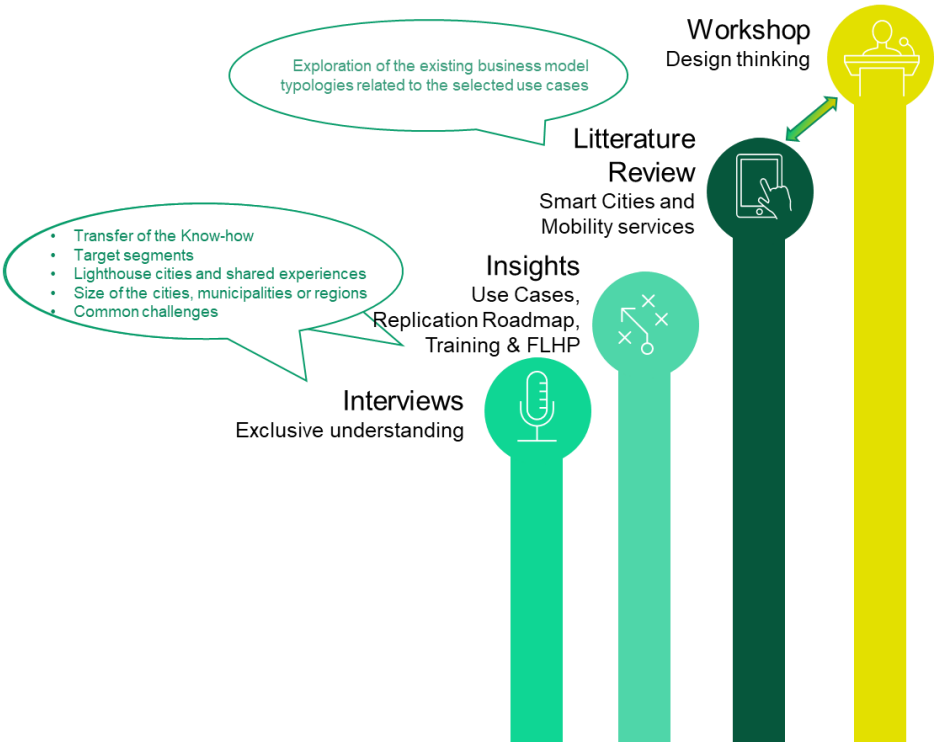


Figure 7 Data collection process for business model generation

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The RECIPROCTY Use Cases studied:

Seamless multimodal mobility REGIOMOVE (GE), DOMINOS MaaS (AT), SOFTLY MOBILE TOURISM MOBILITY (AT), EARL (GE) Use Case #47, ZISteM project (GE), DUCKT/ACTON smart infrastructures (TK), On-demand Public Transport in Pilsen (PL), Issy-les-Moulineaux eVs charging, Coventry eVs charging stations.

Business model workshops (BMW) have been conducted during RECIPROCITY's Mobility Assemblies and Mobility Missions to understand the local specific conditions that affect and influence the business model success and the investment strategy. In other words, the business model workshops have been elaborated to identify the external factors influencing the business model, in particular the value delivery and value creation:

- *Who are the key partners in cities local ecosystems?*
- *What should be (better) satisfied from the end-user point of view?*
- *What are the most important costs?*
- *How the project/solution has been funded?*
- *How are the data managed?*

Topics of the BMWs have been selected among the mobility solutions ranked in WP1 "Identify" and interest from the Missions/Assemblies attendees carried out by the project:

- *Paris Mobility Mission: Infrastructures to support the roll-out of alternative-fuel vehicles (H_2 and eVs): how can we work together?*

Date	*Number of participants*	*Approach used*	*Animators/Partners involved*
22-24.06.2022	*15*	*Canva*	*DOWEL, ZONE*

- *Barcelona Mobility Assembly: Mobility as a service and shared-mobility*

Date	*Number of participants*	*Approach used*	*Animators/Partners involved*
15-17.11.2022	*32*	*Canva / working group meeting*	*DOWEL, IAF*

- *Linz Mission: Autonomous Mobility as a service, toward an integrated model*

Date	*Number of participants*	*Approach used*	*Animators/Partners involved*
28-31.03.2023	*17*	*LEGO Serious play*	*BIZUP, DOWEL*

After the BMWs, complementary information has been collected either from the literature, during the post-mission webinars (WP2) or by interviewing use-case providers (from both lighthouse and follower cities) in the framework of T4.2, to adequately complete the business model canvas.

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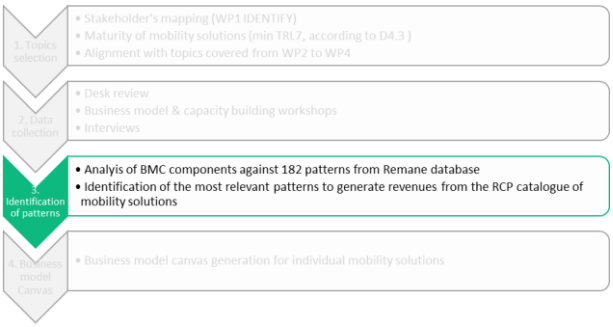
5. Identification of most relevant business model patterns



Business model patterns can be used to generate ideas for the different parts of the business model:

- *Value Proposition itself (WHAT)*
- *Customer relationships / channels (WHO)*
- *Key activities/ resources/ partners (HOW)*
- *Cost structure and revenue streams (WHY)*

In this report, the "ideation" step focussed on the value capture part of the Business Model Canvas, i.e. the "WHY".

In this step, the following approach has been implemented:

- ***Review of the patterns already identified in the literature***

  Source: « integrated list of business model patterns » (Remane et al., 2017), as this is a very recent and peer-reviewed reference, presenting an exhaustive review of the research carried out so far on the topic of BM patterns (with a synthesis into a matrix with 182 patterns)

- ***Selection of those applicable to the individual mobility solutions studied in RECIPROCITY to propose revenue models***

The selected patterns are presented in Table 2. Good practices or lessons learnt from RECIPROCITY cases or other projects are provided for each of these patterns, when available.

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Table 2: Description of selected patterns, which can be used to develop revenue models

Patterns	Who pays?	Adapted Description for mobility solutions	Good practices from RECIPROCITY cases
Affiliation (prospect fees) (Gassman et al., 2014)	MSPs	The focus lies in supporting MSP to successfully sell mobility services and directly benefit from successful transactions. The MSP is able to reach more diverse potential customer, without additional active sales or marketing efforts, and increase the activity of its services. He can also outsource certain charges to the MaaS operator (customer relations, transaction and billing fees, etc.) for services purchased via the MaaS application. Affiliates usually profit from some kind of pay-per-sale or pay-per-display compensation /commission and the MaaS operator from the provision and maintenance of its service.	
Banner advertising (Hanson, 2000)	Private local companies	Provide a product or service and mix it with advertising messages (online or physical banner). Revenues from advertising are generated from the pay-per-click.	• Advertisement fees of some specific private local companies such as hotels in the area. • Example of JC Decaux, advertising company that deploys bike-sharing services in exchange for advertising space in the city[9] • Donau Donkeys/Feine Fracht load bicycles and heavy load bicycles rent out the vehicle surfaces to regional companies as advertising space.[10]
Efficiency-based (Chatterjee 2013)	PTOs	Use capital resources efficiently to produce commonalities while allowing savings. On-demand public transport itself allows cost recovery by offering solutions for low density areas, first mile/last mile services with improved customer service levels.	On-demand public transport Pilsen: savings resulting from implementing the first phase of on-demand public transport solution (with a call phone line and web form) were up to 70% of compensation payments
Fixed flat-rate (Gassman et al, 2014)	End-users (commuters, everyday mobility...etc)	In this model, a single fixed fee for the service (e.g. use of ta MaaS app, use of shared mobility) is charged, regardless of actual usage or time restrictions on it. The user benefits from a simple cost structure while the company benefits from a constant revenue stream.	• RegioMove: Changed from a revenue-based model to a fixed flat rate model for MaaS • E-scooter: see https://emmy-sharing.de/en/plans/

[9] *JCDeaux. (2021). Supplyingself-servicebikes. Retrieved 29-04-2021, from https://www.jcdecaux.com/partners/supplying-self-service-bikes*

[10] https://www.feine-fracht.de/

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Freemium (free trial) (Johnson, 2009)	End-users (commuters, everyday mobility..etc)	Offer basic services for free, while charging a premium for advanced or special features	Example of Kolumbus service in the City of Stavanger, Norway: you can buy a public transport ticket and you get 1 hour free for your bike. The booking system is built on a first here first served- based or you pay a little fee to have your bike for one hour or several hours a day.
Flexible pricing (Tuff and Wunker, 2010)	End-users (commuters, everyday mobility..etc)	In this case, rental prices of mopeds or e-scooter vary for an offering based on demand. Prices in areas with low demand are lower than prices in areas with high demand. This way, the company tries to match the demand and supply across areas better to reduce the need for relocation of scooters and increase revenue at the same time.	https://felyx.com/nl/
Leverage customer data (Gassman et al, 2014)	PTOs, TOA/Authorities MSPs & MaaS operator	New value is created by collecting customer data and preparing it in beneficial ways for internal usage or interested third-parties (e.g. other MSPs). Revenues are generated by either selling this data directly to others or leveraging it for own purposes, i.e., to better relocate and redistribute the fleet or to increase the effectiveness of advertising. For instance, MaaS constitutes an opportunity to collect more accurate data on mobility practices, which can contribute to better planning and adaptation to the needs of transport organisation.	• Example of the MaaS WienMobil service in Vienna: a subsidiary company of two public entities has developed an open platform into which data from the various mobility services are integrated. MaaS operators then use this platform to build their MaaS solution, allowing competition between different MaaS services [11]. • Algorithms can also display advertisements based on users location and time
Membership (Tuff and Wunker, 2010)	End users / Local businesses	Charge a time-based payment to allow access to locations, offerings, or services that non-members do not have. Memberships offer customers the opportunity to utilise scooters at a discounted rate, aiming to foster loyalty towards a particular operator. Additionally, extended rental periods are made available to enhance the customer experience.	https://felyx.com/fr/company/partners/ Special packages are offered to company: number of minutes; exclusive booking of a fixed number of e-scooters, etc.
Pay-per-use (Johnson, 2010)	End-users (commuters, everyday mobility..etc)	Charge for each use of a product or service (metered use, metered subscriptions, pay-as-you-go).	The use of the E-Car sharing service EARL is charged pay-per-use (Use Case #47). It is a combination of price per hour plus billing according to metres driven.

[11] https://www.cerema.fr/system/files/documents/2020/04/cerema_parangonnage_maas_rapport_complet_eng.pdf

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Revenue sharing (Gassman et al, 2014)	Operators/MSP	Revenue sharing refers to practice of sharing revenues with stakeholders, such as complementors or even rivals. Thus, in this business model, advantageous properties are merged to create symbiotic effects in which additional profits are shared with partners participating in the extended value creation. One party is able to obtain a share of revenue from another that benefits from increased value for its customer base.	The use of the E-Car sharing service EARL is charged pay-per-use (Use Case #47). In case a user also is customer of the local public transport provider RVV they receive discounted hourly rates. It is assumed that the EARL provider and RVV share the revenue in some way.
Start up fees		Start up fees means the one time, user-specific startup fee will be charged to traveller to enable unlocking a service (scooter & car sharing, EV charging etc).	To enable the use of the E-Car sharing service EARL a one-time start up fee needs to be paid. Afterwards the pricing model is pay-per-use (Use Case #47) plus an unlock-fee per use.
Subscription (Johnson, 2009)	End-users (commuters, everyday mobility..etc)	Continuously provide customers with products or services and regularly charge upfront fees, typically on a monthly or annual basis. While customers mostly benefit from lower usage costs and general service availability, the company generates a more steady income stream.	• BIXI in Montreal, use an hybrid revenue model with periodic susbscription fees to use the service with restriction in tima and pay-as-you-go for additional minutes. • The Deutschland-Ticket is a monthly subscription based ticket to use all local public transport throughout Germany.

The relevance of each pattern for each of the mobility solution reviewed in this deliverable is synthesised in

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Table 3 below. This will be used in the next section to re-inforce the “revenue model” part of each business model.

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Table 3: Relevance of each selected pattern for the different mobility solutions

Solution / Patterns	Multimodal mobility services						Autonomous mobility		Alternative-fuel vehicles	
	MaaS	Shared mobility / bike	Shared mobility / e-scooter	Shared mobility / car	Multimodal shared mobility	On-demand public transport	Autonomous shuttle	Autonomous delivery	EV charging stations	H2 FCB and HRS
Affiliation (prospect fees)										
Banner advertising										
Efficiency-based										
Fixed flat -rate										
Freemium (free trial)										
Flexible pricing										
Leverage customer data										
Membership										
Pay-per-use										
Revenue sharing										
Start up fees										
Subscription										

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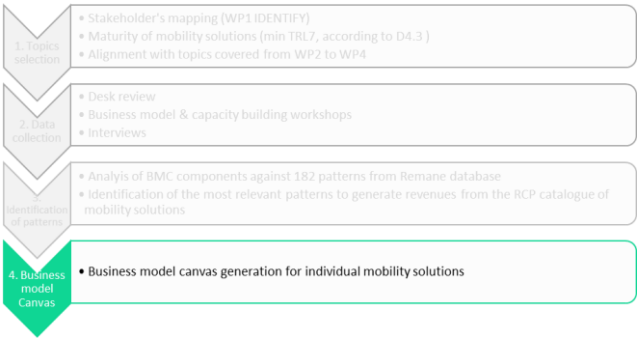
6. Generated business model canvas



Real business models are often a combination of several business model patterns, and those patterns should not be considered in isolation: on the contrary, combining several patterns can provide a more robust business model. Business models also need be tailored to the type of territory and the set of actors.

This section presents the 'generic' business models developed for each of the selected mobility solution. These business models bring together (under the form of an adjusted BMC) all the knowledge and good practices gathered from existing 'real-life' cases. Different options (patterns) for revenue models are also provided in the canvas: when relevant, they can be combined to make the business model more economically viable. In all cases, they should be selected and adjusted depending on the local context and constraints.

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6.1. Multimodal Digital Mobility Services

6.1.1. MOBILITY-AS-A-SERVICE

What is Mobility-as-a-Service (MaaS)?

Mobility as a Service (MaaS) is a concept that aims to provide users with a seamless and integrated approach to transportation. It involves combining different modes of transportation, such as public transit, ride-sharing, bike-sharing, walking, and transport-related services, into a single mobility service that users can access ideally through a single application or account and a single payment channel.

MaaS has the potential to transform the way we think about transportation, shifting the focus from individual car ownership to more sustainable and connected modes of transportation. It offers a convenient and cost-effective alternative to traditional car ownership, making it easier for people to choose sustainable modes of transportation that best suit their needs. As such, MaaS is seen as a key enabler of the shift towards more sustainable and connected cities.

By design, MaaS services generally cover large urban areas where various mobility options are already proposed. However in Finland, several pilot projects are aiming to develop MaaS services in rural areas. Unlike urban MaaS systems, these projects include one or more actions directly related to the mobility offer, ranging from optimising or decompartmentalising existing mobility offers to creating new mobility services, generally in the form of demand-responsive transport or shared taxis.[12]

MaaS value propositions

From the use cases analysis and the literature review, three MaaS value propositions are identified:

1. *seamless and integrated planning, payment, and ticketing system*
2. *enhanced end-to-end customer experience with multi-modal transport choices*
3. *data analysis and data sharing to propose custom-made mobility packages*

A local authority, city or public transport organization initiating a MaaS should define its value proposition depending on its territory and investment capacity. It could for instance choose to first invest in the seamless and integrated planning, payment and ticketing system (value proposition #1) as a minimum viable product, then scale-up its MaaS offer with an enhanced customer experience (value proposition #2) and finally offer custom-made mobility packages (value proposition #3).

[12] MaaS in Europe: Lessons from the Helsinki, Vienna and Hanover Experiments, Dec 2019.

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Lessons learnt and good practices

- ***Revenue model and financing***

When looking at the economic balance of MaaS, user fees and participant fees are not enough to cover costs. It is important to keep in mind that **from a city point of view, the improvement of the mobility services itself and the shift towards more sustainable mobility and reduced car use are key benefits of MaaS**. Capturing the value corresponding to cost of congestion, air pollution, parking costs, quality of life etc could balance the economic investment into a MaaS solution. To capture this value, the Interreg PriMaaS project has developed a multidimensional Indicator of MaaS systems Performance that could be worth the try. It is also advised to follow a training programme on this matter and/or to outsource such assessment.

From the information collected during the business model workshops or interviews of use case providers, investments in **MaaS solution still need public funding (40 to 100%)** either through federal/national funding programs focusing on cooperative projects or on sustainable mobility shift, or through EU funding program such as the Interregional Innovation Investment (I3), the European Structural and Investment Funds (ESIF), Interreg, Connecting Europe Facility, Urban Innovation Action, etc.

The remaining part (up to 60%) is usually covered by "private" investment from the partners (i.e. from the MSP to the municipalities, tourism association etc.).

To save costs, from the experience of RCP stakeholders, the following points should be considered:

- Use standard solution and compare system providers
- Exploit synergies / share costs through innovation partnerships with other regions/ neighbouring communities with the same providers.
- In continuation with the previous idea, design a multi-tenancy[13] platform in order to connect this platform with other platforms. It is a way to share costs, do clients sharing, shift synergies when creating new features or adding new mobility service providers inside the platform.

- ***Key partnerships & customer relationships***

By definition, MaaS is built on cooperation with a large set of actors. It is a fact that no single actor in the MaaS ecosystem will be able to perform all tasks alone, strengthening the concept of collaboration to an important necessity. To proactively manage the ecosystem, it is important to understand the goals and motivations of each stakeholder. **Common win-win goals** should then be defined, based on a shared understanding of customer needs, policy goals, as well as associated MaaS solution requirements.

> ***⇨ Authorities – often supported by PTOs or other public actors – will need to evolve from being regulators ("framing") to being partnership managers ("enabling"), which in some cases will require a major shift in role, capabilities, and culture.***

From this large cooperation, new incentives schemes could be defined for both citizens and corporate. Indeed, although incentives schemes are well known to support the acquisition of clean transport solutions at individual level (such as electric vehicles, bicycles, etc.), incentives for the use of shared resources are still missing or poorly replicated. To ensure a fair treatment of environmentally friendly mobility services regarding financial

[13] Multitenancy is a reference to the mode of operation of software where multiple independent instances of one or multiple applications operate in a shared environment. The instances (tenants) are logically isolated, but physically integrated.

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incentives, it is crucial to reassess the existing incentive schemes. This re-evaluation would allow for the utilization of an optimized mix of mobility options, including shared fleets and various mobility services, particularly in multimodal urban areas.

> ***⇨ To incentivise MaaS adoption, different strategies have been identified such as gamification and nudging, promotional information and offers, discounts, loyalty programs and trial offers.***

MaaS business model

The following business model canvas results from the analysis of the literature review and RCP Use cases (especially from the Seamless multimodal mobility REGIOMOVE (GE), DOMINOS MaaS (AT), SOFTLY MOBILE TOURISM MOBILITY (AT) use cases) and consolidates the inputs from the business model and capacity building workshops. It also integrates the revenue model options derived from the business model patterns.

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<table>
<tr>
<th>Key actors, offerings and co-creation</th>
<th>Key activities</th>
<th>Value Proposition (for Customers)</th>
<th>Actor Relationships</th>
<th>Network Beneficiaries</th>
</tr>
<tr>
<td>- Public authorities and regulator (incl. City /metropolitan/ regional authority)
- PTAs/ urban planners/ engineers
- MaaS providers (aggregator and platform operator)
- ICT companies providing enabling services: data manager, cloud companies, payment platform, ICT developers
- Mobility Service Providers : Taxis, Bus, Train, Shared/Micro-mobility providers, e-car charging companies, gas/oil companies, parking managers
- Legal departments to draw up contracts between different mobility providers
- Local companies to extend the offering
- Non-profit companies & Local communities to understand the needs of people and cities
- Investors to scale-up the solution
- Users (see network beneficiaries)</td>
<td>- Development and provision of the service (itineraries, around me, booking & ticketing, payment)
- After-sales & complaints
- Marketing, customer acquisition & loyalty, usage development, customer feedback
- Contracts with new partners, new routes and API integrations
- Relationship management with TOAs and MSPs, data processing and exchange, optimisation
- Organisation of Mobility Hubs

Key resources & infrastructure
- Human Resources and time to plan/design, develop and deploy the solution (Product owners, UX/ UI, Developers, Quality assurance, analysts, support)
- Access to data & data sharing (IN & OUT)
- Sales & business department (customers, contractual & partnerships relation
- Control of technological assets and adaptation to territories
- Intellectual properties and sovereignty (map representations, mono & multimodal calculators, multimodal GPS,</td>
<td>Save time and budget on door-to-door:

- Optimise your budget (tickets, packages, mobility passes, coupons and incentives)
- Make comparisons and choices easier,
- Customise your mobility according to your criteria, understand the impact of your mobility
- Adapt to disruptions before or during the journey, alerting
- Simplify intermodality (one stop shop), make journeys more fluid (from information to guidance through to payment)
- Discover new itineraries to use your car less or do without a 2nd car
- Adapt to the increasing restrictions on access by car to the city centre
- Improve mobility routines, CO2/ Pollution/ Congestion reductions (from the whole ecosystem perspective)</td>
<td>Customer relationship:
Automated services from App/website, Assistance, CRM (onboarding, nudging, etc)
Offering tailored to customer needs & partners,
Actor relationship:
Contracting, partnerships, Data sharing, pricing, win-win goals, common ticketing systems
Authorities supported by PTOs, to become a partnership manager
Deployment Channels
- App store/ web app/ website
- Referencing & app store rating
- Social media, promotion by partners/multipliers (e.g. housing companies, universities, tourism)
- Advertising, press, local events
- Sales force (B2B)
- NGOs/Ambassadors</td>
<td>Geographical segmentation:
- Hyper-urban with access to a rich travel offer
- Suburbs/residential neighbourhoods close to a public transport network
- Suburbs further away from the public transport network

Professional segmentation
- Employees commuting to work
- Schoolchildren / Students
- Public entities
- Teleworkers (Resident or long-distance)
- Binding professional activities : tradesmen, delivery drivers, health professions, shift work, etc.

Segmentation by "restricted route”
- People with reduced mobility, the elderly, young children ...

Occasional:
- Tourists & visitors</td>
</tr>
</table>

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Who owns the solution? Local authority investing in the MaaS deployment owns the app & the competition agreement right but the source code usually stays in the MaaS provider.	platforms, sourcing and integration of open source and private data, etc.) - ICT infrastructure - Mobility Equipment & infrastructure (e.g. Mobility hub)			

Budget Costs	Revenue Streams
Investments: Platform development & media, Mark creation ⇨ 2 to 3 years to develop a MVP, from 500k€ up to 2 million € **Operation & Maintenance:** Depreciation of investments, Marketing & advertising, Service provision (MSP, PSP, PTO, Platform costs), After sales and guarantees, platform maintenance, media, security & privacy, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, etc.) ⇨ O&M costs depend on the size of the network and the outsourcing of the operation (100 to 300k€ per year) **Scale-up:** app update, additional features, communication and marketing, increased number of bikes, bus trips& mobility hubs, extension of the geographical coverage, replication and in other regions & interoperability	**Affiliation**: Commission on sales of mobility services (pay-as-you-go, mobility passes) & Commission on transactional services related to mobility **Pay-per-use & Fixed flat-rate:** Revenues from user-pay options Resale of technology (API, white-label app) **Banner advertising:** Advertising revenues from specific private companies (e.g. hotel in the area) **Leverage customer data:** Company revenues (management costs per employee) Public subsidies based on KPIs
Environmental Impacts: costs and benefits	**Social Impact: Values and Costs**
- Shift towards more sustainable mobility / reduced car use - CO2/ Pollution/ Congestion reductions - Parking costs reductions - Increased quality of life	- Improvement of the mobility services itself - Jump-start / job creation - Facilitate discovering the best the city has to offer (culture, activities, shopping….)

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6.1.2. SHARED (ON-DEMAND) MOBILITY

What is shared mobility?

Shared mobility can be defined as the shared use of mobility resources such as bike, e-scooter, car or even carpooling, which are made available to users at various locations in a city. It thus provides short-term and on-demand access to vehicles without the burdens of their ownership (Machado et al., 2018). While some shared mobility services such as car rental, taxi and public transport are embedded in the mobility network for some time, the digitalization of the urban mobility sector have enabled innovative offerings and business models to emerge (e.g. Bike and e-scooter sharing, car-sharing, on-demand services ride, courier network services, alternative transit services).

6.1.2.1. Bike sharing

Bike sharing value proposition

Bike-sharing programs are classified into four operating modes (van Waes et al, 2018) that can be considered as four different value propositions :

1. *two-way station-based (also called round-trip): users pick up and return shared bikes to a designated docking station*
2. *one-way station-based: one way trip & return to any docking stations*
3. *peer-to-peer bike-sharing: bike sharing between private owners for recreational purpose*
4. *free-floating: a network of bicycles within a specified area where bikes can be park anywhere*

As the peer-to-peer bike sharing model focusing on recreational users, and being operated by private actors, it is not considered in this report.

Lessons learnt and good practices

- ***Revenue model and financing***

- Bike-sharing needs to be regulated to prevent problems like oversupply, hazardous parking, and vandalism. While **local governments** take this role, they regularly launch their service or seek partnerships and **offer tenders with private bikesharing operators**. Bike-sharing operators, in some cases, receive financial support from governmental bodies to run their systems and provide societal benefits. In exchange, local governments can gain valuable mobility insights through their partnerships with these operators.
    a. For publicly funded systems, capital and operating costs are a function of the system size and the revenues to the city depends on usage levels.
    b. For privately funded bikeshare systems, capital costs to the city are nominal. However, in-kind costs - which could include staff time to oversee the permit application review process, remove or re-park bikes, etc.— are likely. Some of these costs can be offset if the city decides to charge fees to private bikeshare operator such as annual permit fee, permit review fee, administrative fee, performance bond, etc.
- According to RCP stakeholders, bike-sharing systems are not economical and **they should come to a point where they are either self-sufficient or where cost should be shared** with all actors including the travellers. An example could be the deployment of cooperative companies investing in bike development and the related logistic as a tool to improve the society and based on social economy. For

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that the establishment of a trusty ecosystem partners is needed and allow to provide service management in micro hubs. An example of such cooperative company is La Cicleria [14] in Zaragaoza which intends to develop Green Hub together with Grupo Laveloz and CoopCycle.

- When **non-profit organisations operate bike-sharing services, they are often backed by a combination of government funding and grants**. An example of such non-profit organizations is Santander Cycles in London[15].

- ***Key partnerships & customer relationships***

- In **rural** areas there is still a bridge between housing and mobility plan: business cases should be better studied to define the optimal size of operation, and collaboration with housing companies should be reinforced at planning stage
- **Private owners and municipalities can come in conflict** when it comes to building a new bicycle lanes and docking stations in front of their house or when it comes to expropriation. A regulatory framework is needed to avoid this type of conflicts and continue to raise awareness.
- Clean-up actions or … should be developed **to remove old, broken and abandoned bicycles** in order **to reduce the risk of theft and vandalism** that can act as a barrier for citizen/private owners acceptance.
- **Bicycle and safety rules** should be reviewed and mobility plan should adapted accordingly as currently the same signs apply for the cars and bicycles while they should be different for safety improvement. These revised rules should be designed to avoid or to reduce conflict between car users and bike users in bicycle/shared streets.
- Finally, when it comes to e-bike sharing, energy infrastructure providers must be involved at the planning stage to define the right spots to install docking stations.

Bike sharing business model

The following business model canvas results from the analysis of the literature review (e.g. BIXI in Montreal, Canada) and consolidates the inputs from the business model and capacity building workshops (e.g. Yapidrom, Example of Kolumbus service in the City of Stavanger, Norway). It also integrates the revenue model options derived from the business model patterns.

[14] https://lacicleria.com/

[15] Santander Cycles. (2021). Santander cycles - transport for london. https://tfl.gov.uk/modes/cycling/santander-cycles

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<table>
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<th>Key actors, offerings and co-creation</th>
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<th>Value Proposition</th>
<th>Actor Relationships</th>
<th>Network Beneficiaries</th>
</tr>
<tr>
<td>- Local Government (a minima for the regulation of the service and the provision of the infrastructure/station placement)
- Public Transport Agencies
- Bike sharing operator
- Bike provider/manufacturer
- IT provider
- Bikerepair shop or social workplaces to maintain the fleet
- Non-profit organization for operating the one way station based service in some cities
- Local businesses
- Travelers
- Housing association and promoters for a better planning and integration of stations/ parking points
- Financial institutions to handle transactions
- Users (see network beneficiaries)

Who owns the solution ? This depends on the value proposition :
- Round trip : public transport agencies and local governments
- One-way station based : PTAs or Bikesharing providers</td>
<td>- Development and provision of the service (bicycle distribution & redistribution, location, tracking, booking & payment)
- Maintenance of the IT system
- Data analysis: identification of the intensity of the demand at specific locations
- Bike maintenance: outsourced to local social workplaces, bikerepair shop or human-crew at the stations
- After-sales & complaints
- Marketing, customer acquisition & loyalty, usage development, customer feedback
- Relationship management with TOAs, data processing and exchange, optimization

Key resources & infrastructure
- Human Resources and time to plan/design, develop and deploy the solution (Service owners, UX/ UI, IT Developers, QA, analysts, support)
- Data analysts (geo-data)
- Data sharing (OUT)
- Sales & business department (customers, contractual & partnerships relation)
- Control of technological assets and adaptation to territories (bicycle lanes and stations)
- ICT infrastructure: website & mobile app, terminal/payment system</td>
<td>For all value propositions:
- Improve mobility routines (increased use of public transit and alternative modes)
- Active and healthy mobility
- CO2/ Pollution/ Congestion/Noise/ Parking space reductions
- Discover new itineraries to use your car less or do without a 2nd Car
- Adapt to the increasing restrictions on access by car to the city centre
- Lower transportation costs
- Flexibility / Free mobility (no schedules)
Round trip (users pick up and return shared bikes to a designated docking station):
- Last-mile solution for commuters in addition to the public transport infrastructure (complimentary service) rather than the provider's core business.
One-way station based (one way trip & return to any docking stations)
- Urban mobility between designated locations
Free-floating (a network of bicycles within a specified area where bike can be park anywhere)
- Save time on the “last-mile” between a public transport stations and end destinations
- Free urban mobility</td>
<td>Customer relationship:
Automated services from App/website, Assistance, CRM (onboarding, nudging, etc)
Offering tailored to customer needs & partners
Actor relationship:
Contracting, partnerships, Data sharing

Deployment Channels
- App store/ web app/ website
- Referencing & app store rating
- Physical bikes present in the city
- Social media, promotion by partners/multipliers (e.g. housing companies, universities, tourism, large companies managing commuters)
- Advertising, press, local events
- Sales force (B2B)
- NGOs/Ambassadors</td>
<td>Geographical segmentation:
- City centre
- Suburbs/residential neighborhoods close to a public transport network
- Suburbs further away from the public transport network

Professional segmentation
- Employees commuting to work
- Schoolchildren / Students

Occasional:
- Tourists & visitors</td>
</tr>
</table>

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or advertising companies deploying bike-sharing services in exchange for advertising space in the city - Free-floating : Bikesharing providers, considered as the investor in this case No matter the value proposition and the owner, all the actors participating to the provision of such services have operational costs to cover (bikerepair shop, IT provider, Bikesharing operator, local governments)	- Bike/e-Bike, GPS tracker, Stations (also called port or terminal) - Call center staff (assistance) - Intellectual properties rights, data privacy and sovereignty (map representations, GPS, etc)	- Adapt to public transport disruptions before or during the journey		

Budget Costs	Revenue Streams
Investments: Platform development & media, Mark creation, Bike Fleet, Depot, charging system for e-bike **Operation & Maintenance:** Depreciation of investments, Marketing & advertising, Service provision (MSP, PSP, App), After sales and guarantees, Bike O&M, App maintenance, media, security & privacy, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, etc.) ⇨ O&M costs depend on the size of the network and the fleet and the outsourcing of the operation **Scale-up:** app update, additional features, communication and marketing, increased number of bikes, extension of the geographical coverage, replication	- Rental fees: **pay-as-you-go, start up fee** to start a trip and for a maximum duration, additional fee for extra minutes of use, periodic **subscription** fees (or an hybrid system pay-as-you-go / periodic subscription fees) - **Exploitation of user data** - **Advertising** revenues from specific private companies in the area - IT: Operating fee for developing and maintaining the app - For privately funded bikesharing system: Permit & administrative fees

Environmental Impacts: costs and benefits	Social Impact: Values and Costs
- Shift towards more sustainable mobility / reduced car use - CO2/ Pollution/ Congestion reductions - Parking costs reductions - Increased quality of life	- Improvement of the mobility services itself: uptake rate, trips by type of user, farebox recovery to evaluate the system's financial health. - Jump-start / job creation - Facilitate discovering the best the city has to offer (culture, activities, shopping....) - Healthy lifestyles - Cost: non inclusive mobility

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6.1.2.2. E-scooter sharing

E-scooter sharing value proposition

For E-scooter sharing systems (scooters and mopeds), a free-floating value proposition is usually applied, where the service is offer through a digital platform/application.

Lessons learnt and good practices

- ***Revenue model and financing***

To finance an e-scooter sharing system, investors who are willing to accept the financial risk for the potential return on investment are crucial. Some e-scooter companies, successfully developed their activity thanks to a crowdfunding campaign (e.g. Emmy, Blinkee, etc). It opens the opportunity to people with lower levels of capital to invest their money consciously into early-stage companies that can positively impact the environment. Investors receive special benefits, usually proportionate to the amount of money they provided. For e-scooter companies, this allows to invest in their growth, upgrade their service (app & scooter) and replicate their solutions in other cities and countries.

Local city funding, regional and EU funds are also important levers.

- ***Key partnerships & customer relationships***

A regulatory framework at the EU level and translated at the MS level is needed for e-scooter sharing to regulate the market and the uses. Indeed, in some cities or countries there is different regulation, and in many cities, they are only licensing big scooter companies, hindering the chance of new companies to start their business. This has a major impact on e-Scooter-sharing business model as it determines if a company is allowed to operate in a city or not. While the e-scooter industry has been receiving a lot of funding from investors, this allowed already settled Scooter-sharing Company to expand quickly and operate in a large number of cities

e-Scooter sharing business model

The following business model canvas results from the analysis of the literature review and RCP use cases (ZISTEM project, DUCKT micromobility) and consolidates the inputs from the business model and capacity building workshops. It also integrates the revenue model options derived from the business model patterns.

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<th>Key actors, offerings and co-creation</th>
<th>Key activities</th>
<th>Value Proposition</th>
<th>Actor Relationships</th>
<th>Network Beneficiaries</th>
</tr>
<tr>
<td>- Local Government (for the regulation of the service)
- Public Transport Agencies
- E-scooter sharing operator for picking-up, maintaining and charging e-scooters
- E-scooter provider/manufacturer
- IT provider
- Local businesses
- Travelers
- Insurance
- Investors
- Financial institutions to handle transactions
- Users (see network beneficiaries)

Who owns the solution ? E-scooter sharing providers, considered as the investor.</td>
<td>- Development and provision of the service (e-scooter distribution & redistribution, location, tracking, booking & payment)
- Maintenance of the IT system
- Data analysis: identification of the intensity of the demand at specific locations
- E-scooter maintenance and charging
- After-sales, complaints & parking management
- Marketing, customer acquisition & loyalty, usage development, customer feedback
- Relationship management with TOAs, data processing and exchange, optimization

Key resources & infrastructure
- Human Resources and time to plan/design, develop and deploy the solution (Product owners, UX/ UI, Developers, QA, analysts, support)
- Data analysts (geo-data)
- Data sharing (OUT)
- Sales & business department (customers, contractual & partnerships relation)
- ICT infrastructure: website & mobile app
- Depot for maintenance & charging
- E-scooter & GPS tracker</td>
<td>For all value propositions:
- Improve mobility routines (increased use of public transit and alternative modes)
- Active mobility
- CO2/ Pollution/ Congestion/Noise/ reductions
- Parking space reductions and hence increasing free space in cities
- Discover new itineraries to use your car less or do without a 2nd Car
- Adapt to the increasing restrictions on access by car to the city centre
- Lower transportation costs
- Save time on the “last-mile” between a public transport stations and end destinations
- Free urban mobility
- Adapt to public transport disruptions before or during the journey</td>
<td>Customer relationship:
Automated services from App/website, Assistance, CRM (onboarding, nudging, etc)
Personal assistance
Actor relationship:
Contracting, partnerships, Data sharing

Deployment Channels
- App store/ web app/ website
- Referencing & app store rating
- Physical scooter present in the city
- Social media, promotion by partners/multipliers (e.g. housing companies, universities, tourism, large companies managing commuters)
- Advertising, press, local events
- Sales force (B2B)</td>
<td>Geographical segmentation:
- City centre
- Suburbs/residential neighborhoods close to a public transport network
- Suburbs further away from the public transport network

Professional segmentation
- Employees commuting to work
- Schoolchildren / Students

Occasional:
- Tourists & visitors</td>
</tr>
</table>

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	- Intellectual properties rights, data privacy and sovereignty (map representations, GPS, etc)			

Budget Costs	Revenue Streams
Investments: Platform development & media, Mark creation, e-Scooter Fleet, charging system and depot rent **Operation & Maintenance:** Depreciation of investments, Marketing & advertising, Service provision (MSP, PSP, App), After sales and guarantees, e-Scooter O&M, App maintenance, media, security & privacy, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, etc.) ⇨ O&M costs depend on the size of the network and the fleet and the outsourcing of the operation **Scale-up:** app update, increased number of e-scooter, extension of the geographical coverage, replication in other cities and regions	- Rental fees: **Start up fee** per trip/to unlock a ride, **pay-per-use**: ride costs per minutes, **fixed flate rate** for unlimited trip per month - **Dynamic pricing**: rental prices of mopeds in areas with low demand are lower than prices in areas with high demand - **Exploitation of user data** - **Advertising** revenues from specific private companies in the area - Public subsidies based on KPIs - Crowdfunding
Environmental Impacts: costs and benefits	**Social Impact: Values and Costs**
- Shift towards more sustainable mobility / reduced car use - CO2/ Pollution/ Congestion reductions - Parking costs reductions - Increased quality of life	- Improvement of the mobility services itself: uptake rate - Jump-start / job creation - Facilitate discovering the best the city has to offer (culture, activities, shopping….) - Cost: non inclusive mobility

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6.1.2.3. Car-sharing

Car sharing value proposition

Like in bike-sharing, various operating modes are identified:

- *the station based sharing model where the cars fleet is stationed are one or more stations. Here a centralized or decentralized systems can be distinguished:*
    - *In a centralised system, the operation are managed from one or a few large centralised stations*
    - *In a decentralised system, the operation are managed at distance and operator rely on information technology to manage their fleet*
- *The free-floating model, allowing traveller to pick up and drop the car at any location within the service area.*
- *The peer-to-peer car sharing model where operators provide a platform where private car owners and users can be matched. This model won't be detailed in this report as it is implemented, operated and owned by private companies.*

Lessons learnt and good practices

- ***Revenue model and financing***

In Regensburg, the implementation of EARL (100% electric car sharing system) was iterative. The project first start with one car in 2016. The fleet was then expanded to five cars in 2018 and to twenty cars in 2021 with several types of vehicles. In 2018, a cooperation has been set-up with the KERL car-sharing system for the rural district of Regensburg to reinforce the service.

To incentivise the use of the car sharing system and therefore increase the number of customers and revenues, Regensburg offers the following incentives:

- *A discount on the unit price (i.e. tariff per hour and/or km) for all annual subscribers of the public bus operator (RVV), customer of the regional green electricity, or the regional telecommunication company.*
- *The registration fee is offered to the customer of the regional green electricity provider, supplying the e-car charging stations of the city and the region*

- ***Key partnerships & customer relationships***

Local governments play a crucial role in providing locally suitable and economically viable carshare parking (Dowling & Kent, 2015). This involves designating specific parking spaces, which is particularly important for decentralized station-based systems and free-floating car-sharing companies operating in areas with limited parking availability. The provision of adequate parking serves as an incentive for individuals to engage in car-sharing and supports local governments in achieving their sustainable mobility objectives.

Car sharing business model

The following canvas applied for both conventional and electric car fleets. It results from the analysis of the literature review and RCP use cases (e.g. EARL car sharing system in Regensburg) and consolidates the inputs from the business model and capacity building workshops. It also integrates the revenue model options derived from the business model patterns.

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Key actors, offerings and co-creation	Key activities	Value Proposition	Actor Relationships	Network Beneficiaries
- Local Government (a minima for the regulation of the service and the provision of the infrastructure/station placement) - Public Transport Agencies - Car sharing operator to maintain the system and the fleet - Car provider/manufacturer - IT provider - Bikerepair shop or social workplaces to maintain the fleet - Non-profit organization for operating the one way station based service in some cities - Local businesses - Travelers - Housing association and promoters for a better planning and integration of stations/ parking points - Financial institutions to handle transactions - Insurance company to cover risk - Users (see network beneficiaries) **Who owns the solution?** This depends on the value proposition :	- Development and provision of the service (bicycle distribution & redistribution, location, tracking, booking & payment) - Maintenance of the IT system - Data analysis: identification of the intensity of the demand at specific locations - Car maintenance - After-sales & complaints - Marketing, customer acquisition & loyalty, usage development, customer feedback - Relationship management with TOAs, data processing and exchange, optimization **Key resources & infrastructure** - Human Resources and time to plan/design, develop and deploy the solution (Product owners, UX/ UI, Developers, QA, analysts, support) - Data analysts (geo-data) - Data sharing (OUT) - Sales & business department (customers, contractual & partnerships relation) - Control of technological assets and adaptation to territories (charging stations, parking spots) - ICT infrastructure: website & mobile app, terminal/payment system	**For all value propositions:** - Improve mobility routines (increased use of public transit and alternative modes) - CO2/ Pollution/ Congestion/Noise (for eVs) / Parking space reductions - Do without a 2nd Car **Station based (return to any docking stations)** - Urban mobility between designated locations **Free-floating (a network of cars within a specified area where car can be park anywhere)** - Save time on the "last-mile" between a public transport stations and end destinations - Free urban mobility - Adapt to public transport disruptions before or during the journey	**Customer relationship:** Automated services from App/website, Assistance, CRM (onboarding, nudging, etc.) Offering tailored to customer needs & partners **Actor relationship:** Contracting, partnerships, Data sharing **Deployment Channels** - App store/ web app/ website - Referencing & app store rating - Physical cars present in the city - Social media, promotion by partners/multipliers (e.g. housing companies, universities, tourism, large companies managing commuters) - Advertising, press, local events - Sales force (B2B) - NGOs/Ambassadors	**Geographical segmentation:** - City centre - Suburbs/residential neighborhoods close to a public transport network - Suburbs further away from the public transport network **Professional segmentation** - Employees commuting to work - Schoolchildren / Students **Occasional:** - Tourists & visitors

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- station based : private companies, cooperatives and governments/PTAs - Free-floating : private companies	- car/eVs & GPS tracker - Intellectual properties rights, data privacy and sovereignty (map representations, GPS, etc)			

Budget Costs	Revenue Streams
Investments: Platform development & media, Mark creation, Car Fleet, Charging stations/parking **Operation & Maintenance:** Depreciation of investments, Marketing & advertising, Service provision (MSP, PSP, App), After sales and guarantees, refueling or recharging costs, car maintenance, App maintenance, insurance, media, security & privacy, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, etc.) ⇨ O&M costs depend on the size of the network and the fleet and the outsourcing of the operation **Scale-up:** app update, additional features, communication and marketing, increased number of cars, extension of the geographical coverage, replication	- Rental fees: **membership** fees (registration) and/or **pay-per-use**: rental fees from travellers by duration only or a combination of distance and duration, **subscription**. - **Exploitation of user data** - **Advertising** revenues from specific private companies in the area - Public subsidies based on KPIs - IT: Operating fee for developing and maintaining the app

Environmental Impacts: costs and benefits	Social Impact: Values and Costs
- Shift towards more sustainable mobility / reduced car use - CO2/ Pollution/ Congestion/noise reductions - Parking costs reductions - Improved quality of life	- Improvement of the mobility services itself, quality of life and territory attractiveness - Jump-start / job creation - Facilitate discovering the best the city has to offer (culture, activities, shopping….)

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6.1.3. MULTIMODAL SHARED MOBILITY

What is multimodal shared mobility?

Multimodal shared mobility provides a solution to the problem of dispersed transport supply and demand, by offering users additional transport options to public transport or the private car, and by bringing all services together on a single platform/application for itineraries, booking, ticketing and payment. The multimodal shared mobility usually supports first/last mile travel, denoting the capability and increasing the effect of Mobility as a Service (MaaS), and stimulates additional non-private car travel demand to reduce congestion and related effects on air quality, CO2 emissions, quality of life.

Multimodal shared mobility value proposition

Multimodal shared mobility business models are currently focusing on linking shared mobility services at major public transport nodes.

Lessons learnt and good practices

- Multimodal shared mobility requires improved parking infrastructure at accessible locations and at public transport nodes but also a better management of parking points between private and shared uses, and at crowded locations.
- In a multimodal offering, big-data should consider information from future scenario assumption and not only historical data to be more valuable for future planning and estimate future transport service reliability. Government policy should facilitates the application of big data to transport but also provides powerful market intervention.
- Cybersecurity measures must go beyond protection of customer information describing travelers' locations , i.e. reduce service disruptions caused by attacks.

Multimodal shared mobility business model canvas

From the portfolio of RECIPROCITY solutions, micro-mobility (e-scooter and e-bike) and e-car-sharing services are part of a Multimodal shared mobility offering and are further described in the BMC below. The use cases analysed are the ZISteM project in Regensburg (GE), Regiomove seamless multimodal mobility (GE) and the DUCKT/ACTON smart infrastructures, born in Istanbul (TK).

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<table>
<tr>
<th>Key actors, offerings and co-creation</th>
<th>Key activities</th>
<th>Value Proposition (for Customers)</th>
<th>Actor Relationships</th>
<th>Network Beneficiaries</th>
</tr>
<tr>
<td>- Public authorities and regulator (incl. City /metropolitan/ regional authority)
- Local transportation manager/ urban planners/ engineers
- MaaS providers (aggregator and platform operator)
- IT companies providing enabling services : data manager, cloud companies, payment platform, IT developers
- Mobility Service Providers : Shared/Micro-mobility providers, charging stations, operators, parking managers
- Legal departments: draw up contracts between different mobility providers
- Local companies to extend the offering
- Non-profit companies & Local communities to understand the needs of people and cities
- Investors to scale-up the solution
- Users (see network beneficiaries)</td>
<td>- Development and provision of the service (itineraries, around me, booking & ticketing, payment, organisation of mobility hubs)
- After-sales & complaints
- Marketing, customer acquisition & loyalty, usage development, customer feedback
- Contracts with new partners, new routes and API integrations
- Relationship management with AOMs and MSPs, data processing and exchange, optimisation
- Organisation of Mobility Hubs: redistribution and maintenance of the fleet, location of stations-based model, charging while stationary, safe parking

Key resources & infrastructure
- Human Resources and time to plan/design, develop and deploy the solution (Product owners, UX/ UI, Developers, QA, analysts, support)
- Access to data & data sharing (IN & OUT)
- Sales & business department (customers, contractual & partnerships relation
- Control of technological assets and adaptation to territories (bicycle lanes, station and parking points)
- Intellectual properties and sovereignty (map representations, mono & multimodal calculators, multimodal GPS,</td>
<td>- Save time on door-to-door
- Connect better first/last mile transport by using shared mobility services
- Optimise your budget (tickets, packages, mobility passes, coupons and incentives)
- Make comparisons and choices easier
- Customise your mobility according to your criteria, understand the impact of your mobility
- Adapt to disruptions before or during the journey, alerting
- Simplify intermodality (one stop shop), make journeys more fluid (from information to guidance through to payment)
- Discover new itineraries to use your car less use or do without a 2nd Car
- Adapt to the increasing restrictions on access by car to the city centre
- Improve mobility routines and lifestyles
- CO2/ Pollution/ Congestion reductions</td>
<td>Customer relationship:
Automated services from App/website, Assistance, CRM (onboarding, nudging, etc)
Offering tailored to customer needs & partners,
Actor relationship:
Contracting, partnerships, Data sharing, pricing, win-win goals, common ticketing systems
Authorities supported by PTOs, to become a partnership manager

Deployment Channels
- App store/ web app/ website
- Referencing & app store rating
- Social media, promotion by partners/multipliers (e.g. housing companies, universities, tourism)
- Advertising, press, local events
- Sales force (B2B)
- NGOs/Ambassadors</td>
<td>Geographical segmentation:
- Hyper-urban with access to a rich travel offer
- Suburbs/residential neighborhoods close to a public transport network
- Suburbs further away from the public transport network

Professional segmentation
- Employees commuting to work
- Schoolchildren / Students
- Public entities
- Teleworkers (Resident or long-distance)
- Binding professional activities : tradesmen, delivery drivers, health professions, shift work, etc.

Segmentation by “restricted route”
- People with reduced mobility, the elderly, young children …

Occasional:
- Tourists & visitors</td>
</tr>
</table>

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	platforms, sourcing and integration of open source and private data, etc.) - ICT infrastructure - Mobility Equipment & infrastructure (e.g. Mobility hub) - Evs Fleets (e-bike, E-car, E-scooter)			

Budget Costs	Revenue Streams
Investments: Platform development & media, Mark creation, Fleet **Operation & Maintenance:** Depreciation of investments, Marketing & advertising, Service provision (MSP, PSP, PTO, Platform costs), After sales and guarantees, platform maintenance, fleet & charging stations maintenance, media, security & privacy, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, etc.) **Scale-up:** app update, additional features, communication and marketing, increased number of bikes/scooters/cars, mobility hubs, extension of the geographical coverage, replication in other regions & interoperability	**Hybrid model: pay-per-use/ fixed-flat rate/subscription:** Rental fees & user-pay options **Leverage customer data:** Exploitation of data **Affiliation:** Commission on sales of mobility services (pay-as-you-go, mobility passes) & Commission on transactional services related to mobility **Banner advertising:** Advertising revenues from specific private companies (e.g. hotel in the area) Public subsidies based on KPIs Resale of technology (API, white-label app)

Environmental Impacts: costs and benefits	Social Impact: Values and Costs
- Shift towards more sustainable mobility / reduced car use - CO2/ Pollution/ Congestion/Noise reductions - Parking costs reductions - Improved quality of life	- Improvement of the mobility services itself, quality of life and territory attractiveness - Jump-start / job creation - Facilitate discovering the best the city has to offer (culture, activities, shopping….)

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6.1.4. ON-DEMAND PUBLIC TRANSPORT

What is on-demand public transport?

On-demand mobility solutions refer to transportation services that are available to users on and as-needed basis, rather than following fixed schedules or routes. These solutions are often facilitated by technology platforms, such as mobile apps or web portals that allow users to book and pay for transportation services in real-time.

Examples of on-demand mobility solutions are micro-mobility and car sharing systems (described in the previous sub-chapter), which allow users to rent a bike, e-scooter or car on a minute/hourly or daily basis. Other on-demand mobility solutions include on-demand public busses and shuttles (also named "Demand-Responsive Transport", "Transportation on Demand" or "On-Demand Ridesharing") to complement the existing transport network in areas where conventional mobility is diffuse: low or irregular passenger flows, sparsely populated areas, off-peak periods…etc. On-demand ridesharing **enable to enrich the service portfolio of public transport,** hence in one-hand, helping to attract new user groups and, on the other hand, **to save costs of fixed routes where the balance between the offer and the demand is usually not met**.

On-demand public transport value propositions

On-demand public transport can be set-up in two ways:

- *With defined route and stops: to move from one stop to another on a defined line, the bus/shuttle doesn't leave until a passenger has made a reservation on the route.*
- *By zone: the bus/shuttle is rerouted online to dynamically accommodate the users's requests within a given area. Depending on their point of departure, the passengers can start their journey from one or more bus stops. The bus service operates upon request.*

On-demand public transport is a technology-driven shared transport service operated by a company with professional drivers (or autonomous system) with flexible schedule, and/or flexible stops and/or flexible routing. Complementary to, and integrated with, regular public transportation networks (through a common pricing system and/or operational schedules) they provide flexibility and freedom in daily mobility.

Lessons learnt and good practices

- ***Revenue model and financing***

100% of public funding, mostly from Regional Authorities and contribution from the concerned municipalities.

- ***Key partnerships & customer relationships***

Key choices to make when considering deploying an on-demand solution include:

- Route — flexible (demand-driven) or fixed / semi-fixed
- Schedule / timing / hours of coverage
- Fleet — vehicle type, size of fleet, fuel type
- Relationship to existing fixed-route public transport network — supplementary / or substitute

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- Payment — linked to transit smart card or stand-alone
- Fares — equivalent to transit fares or premium priced
- Technology / digital platform — platform providers; integration with existing public transport app
- Service area — urban core, urban fringe (first mile / last mile) or regional
- Branding — identifying platform provider or other local or service feature

⇨ For these reasons, it is crucial to understand the local needs, to set-up agreements with the concerned municipalities and to integrate the service with the broader public transport network. Additionally, by effectively incorporating on-demand ridesharing/public transport aggregation into comprehensive mobility platforms like Mobility-as-a-Service (MaaS), we can lay the foundation for more environmentally friendly urban transportation systems.

On-demand public transport business model canvas

The provided business model canvas primarily concentrates on models involving professional drivers providing rides, such as the On-demand Public Transport in Pilsen use case. The next chapter will address the specific “autonomous shuttle” model.

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<th>Value Proposition (for Customers)</th>
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<th>Network Beneficiaries</th>
</tr>
<tr>
<td>- Public authorities and regulator
- Municipalities from suburb / rural areas
- Public Transport Agency/ urban planners/ engineers
- On-demand transport operators
- Bus/Shuttle Providers & operators
- IT providers: Booking & payment platform, communication of road user information, connectivity and traffic management
- MaaS providers (aggregator and platform operator)
- Non-profit organisation & Local communities to understand the needs of commuters/end-users
- Investors to scale-up the solution
- Users (see network beneficiaries)</td>
<td>- Development and provision of the service (order collection, dynamic itineraries, connectivity & traffic management, schedule, incident management, fleet optimisation, booking & payment, integration with the local PTO/mobility hubs, communication services)
- After-sales & complaints
- Marketing, customer acquisition & loyalty, usage development, customer feedback
- Contracts with new partners, new routes and API integrations
- Relationship management with TOAs and MSPs, data processing and exchange, optimisation
- Organisation of Mobility Hubs & user acceptance

Key resources & infrastructure
- Human Resources and time to plan/design, develop and deploy the solution (Product owners, UX/ UI, Developers, QA, analysts, support)
- Bus/Shuttles Fleets, GPS tracker, Depot, Stops
- ICT infrastructure / platforms, integrated or not with the public transport/ MaaS app</td>
<td>- Connect better first/last mile transport in underserved communities
- Optimise your budget (tickets, packages, mobility passes, coupons and incentives)
- Optimise routes in real-time, optimise pick-up points/stop
- Securing pedestrians, children, people with restricted mobility
- Simplify intermodality (one stop shop), make journeys more fluid (from information to guidance through to payment), provide seamless interchanges and supplement school bus services
- Improve mobility routines & reduce unnecessary travel
- CO2/ Pollution/ Congestion/Parking space reductions</td>
<td>Customer relationship:
Automated services from App/website, Call center, Assistance, CRM (onboarding, nudging, etc)
Offering tailored to customer needs & partners,
Actor relationship:
Supplementing existing public transport, contracting, partnerships/agreement with municipalities in rural areas, Data sharing, pricing, win-win goals, common ticketing systems
Authorities supported by PTOs, to become a partnership manager

Deployment Channels
- App store/ web app/ website
- Referencing & app store rating
- Social media, promotion by partners/multipliers (e.g. housing companies, universities, tourism)
- Advertising, press, local events
- Sales force (B2B)
- NGOs/Ambassadors</td>
<td>Geographical segmentation:
- Urban core
- Suburbs/residential neighborhoods close to a public transport network
- Suburbs further away from the public transport network
- Rural areas, technology park, campus

Population segmentation
- Schoolchildren / Students
- Elderly, less mobile and impaired citizens
- No age restrictions

Occasional:
- Tourists & visitors</td>
</tr>
</table>

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	- Control of technological assets and adaptation to territories (stops, defines route, areas) - Intellectual properties and sovereignty (map representations, mono & multimodal calculators, multimodal GPS, etc) - Sales & business department (customers, contractual & partnerships relation			

Budget Costs	Revenue Streams
Investments: Platform development & media, Mark creation, Fleet and parking spot (depot). ⇨ To reduce the cost, a pilot phase with an information telephone line and a web form could be proposed to collect the orders **Operation & Maintenance:** Depreciation of investments, Marketing & advertising, Service provision (MSP, PSP, PTO, Platform costs), After sales and guarantees, platform maintenance, fleet & charging stations maintenance, media, security & privacy, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, etc.) **Scale-up:** app/platform update, relocation of services or service expansions, communication and marketing, replication and in other regions & interoperability,	- **Pay-per-use or fixed-flat rate:** Billing via the tariff system of the local PTO or via the app - **Affiliation**: Additional new service: Reservation of parking spaces at the stops and within the district - **Efficiency-based:** Reduced compensation payments for saved vehicle kilometres resulting from unfulfilled and not profitable fixed timetable public transport - Distribution of costs and refinancing through technology providers
Environmental Impacts: costs and benefits	**Social Impact: Values and Costs**
- Shift towards more sustainable mobility / reduced car use - CO2/ Pollution/ Congestion reductions - Parking costs reductions - Increased quality of life	- Improvement of the mobility services itself: better connectivity and inclusivity - Reduce total cost to deliver public transport (increase cost recoveries) - Additional income for low-income residents (by offering a cheap solution, compared to private car ownership and by reducing the government subsidies) - Jump-start / job creation

RECIPROCITY

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6.2. Connected, cooperative and autonomous mobility

What is Connected, Cooperative and Autonomous Mobility (CCAM)?

Autonomous vehicles, also known as self-driving cars, are vehicles that use a combination of sensors, cameras, and advanced algorithms to navigate without human input. These vehicles have the potential to revolutionise the way we travel, as they have the potential to improve road safety, reduce traffic congestion, and increase access to transportation for people who are unable to drive themselves.

The sensors detect and interpret information about the surrounding environment, including other vehicles, pedestrians, and road conditions, and use this information to make decisions about how to navigate. Advanced algorithms then use this information to control the vehicle's steering, acceleration, and braking. This connection between vehicles and between vehicles and transport infrastructure is part of connected, cooperative and autonomous mobility.

6.2.1. AUTONOMOUS SHUTTLE FOR PASSENGERS

Autonomous shuttle for passengers value proposition.

Three different value propositions are identified for automated shuttles for passengers[16]:

- *Point-to-point shuttles: Automated urban shuttles travelling between fixed stations, complementing existing urban transport.*
- *On-demand urban shuttle service:*
    - *Anywhere-to-anywhere shuttles: Automated urban shuttles travelling between not fixed locations*
    - *Last mile automated shuttles: Automated urban shuttles providing convenient first/last mile solutions, complementing public transport.*

Lessons learnt and good practices

- ***Revenue model and financing***

- The initial investment to buy shuttles and to define the types of service and routes is usually supported by public funding from the national authority or research projects. For the operation, it seems that no funding apply when R&I projects are completed.
- Infrastructure adaptation measures are still complex: consider the obstacles and first develop autonomous shuttle in closed area (without other road users)
- Set up a maintenance contract with the manufacturer and IT provider instead of an entire service contract and buy spare parts in-house when possible

[16] Levitate H2020 project, D5.5 Guidelines and recommendations for future policy of cooperative and automated urban transport

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- ***Key partnerships***

- Do not over rush: Shuttle run better after some testing and training to fine-tune the operation/connectivity of the system with the manufacturer.
- Once in operation, there is still an extreme dependence on the manufacturer that could be a burden

Autonomous shuttle for passengers business model canvas

The following business model canvas results from the analysis of the literature review and RCP Use cases (in particular the EMILIA Autonomous People Mover-Shuttle in Regensburg, with a maturity evaluated at TRL 7), and consolidates the inputs from the business model and capacity building workshops. It also integrates the revenue model options derived from the business model patterns.

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</tr>
<tr>
<td>- Public authorities and regulator
- Municipalities from suburb / rural areas
- Public Transport Agency/ urban planners/ engineers
- On-demand transport operators (could include escort on board who can intervene if necessary)
- Autonomous Shuttle Providers
- IT providers: Booking & payment platform, communication/sensing of road user information, connectivity and traffic management
- MaaS providers (aggregator and platform operator)
- Non-profit organisation & Local communities to understand the needs of commuters/end-users
- Investors to scale-up the solution
- Insurance providers: to reduce the exposure to risk for the MSPs and the travellers
- Users (see network beneficiaries)</td>
<td>- Development and provision of the service (order collection, dynamic itineraries, connectivity & traffic management, schedule, incident management, fleet optimisation, booking & payment, integration with the local PTO/mobility hubs, communication services)
- After-sales & complaints
- Marketing, customer acquisition & loyalty, usage development, customer feedback
- Contracts with new partners, new routes and API integrations
- Relationship management with TOAs and MSPs, data processing and exchange, optimisation
- Organisation of Mobility Hubs & user acceptance

Key resources & infrastructure
- Human Resources and time to plan/design, develop and deploy the solution (Product owners, UX/ UI, Developers, QA, analysts, support)
- Bus/Shuttles Fleets, GPS tracker and sensors, Depot & charging stations, Stops
- ICT infrastructure / platforms, integrated or not with the public transport/ MaaS app
- Driver/Operator license</td>
<td>- Connect better first/last mile transport
- Optimise your budget (tickets, packages, mobility passes, coupons and incentives)
- Optimise routes in real-time, optimise pick-up points/stop
- Road safety and securing pedestrians, children, people with restricted mobility
- Simplify intermodality (one stop shop), make journeys more fluid (from information to guidance through to payment), provide seamless interchanges
- Improve mobility routines & reduce unnecessary travel
- CO2/ Pollution/ Congestion/ Parking space reductions</td>
<td>Customer relationship:
Automated services from App/website, Call center, Assistance, CRM (onboarding, nudging, etc.)
Offering tailored to customer needs & partners,
Actor relationship:
Supplementing existing public transport, contracting, partnerships/agreement with municipalities in rural areas, Data sharing, pricing, win-win goals, common ticketing systems
Authorities supported by PTOs, to become a partnership manager

Deployment Channels
- App store/ web app/ website
- Referencing & app store rating
- Social media, promotion by partners/multipliers (e.g. housing companies, universities, tourism)
- Advertising, press, local events
- Sales force (B2B)
- NGOs/Ambassadors</td>
<td>Geographical segmentation:
- Urban core
- Suburbs/residential neighborhoods close to a public transport network
- Suburbs further away from the public transport network
- Rural areas, technology park, campus

Population segmentation
- Schoolchildren / Students
- Elderly, less mobile and impaired citizens
- No age restrictions

Occasional:
- Tourists & visitors</td>
</tr>
</table>

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	- Control of technological assets and adaptation to territories (stops, defines route, areas) - Intellectual properties and sovereignty (map representations, mono & multimodal calculators, multimodal GPS, etc) - Sales & business department (customers, contractual & partnerships relation			

Budget Costs	Revenue Streams
Investments: Platform development & media, Fleet with sensors, charging infrastructure, training of operators, parking spot (depot). ⇨ Consider obstacles in the existing network. The most accessible sites are private ones or enclosed area (without other road users). ⇨ 600k€ for two shuttles **Operation & Maintenance:** Depreciation of investments, Marketing & advertising, Service provision (MSP/Manufacturer, PSP, PTO, Platform costs), After sales and guarantees, platform maintenance, fleet -depot- charging stations O&M, media, security & privacy, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, etc.) ⇨4k€ per month per vehicle ⇨ Set up a maintenance contract instead of an entire service contract and buy spare parts in-house **Scale-up:** app/platform update, relocation of services or service expansions, communication and marketing, replication and in other regions & interoperability,	- **Pay-per-use or fixed-flat rate:** Billing via the tariff system of the local PTO or via the app - **Affiliation**: Additional new service: Reservation of parking spaces at the stops and within the district - **Efficiency-based:** Reduced compensation payments for saved vehicle kilometres resulting from unfulfilled and not profitable fixed timetable public transport - Distribution of costs and refinancing through technology providers
Environmental Impacts: costs and benefits	**Social Impact: Values and Costs**
- Shift towards more sustainable mobility / reduced car use - CO2/ Pollution/ Congestion reductions - Parking costs reductions - Increased quality of life	- Improvement of the mobility services itself: better connectivity and inclusivity - Reduce total cost to deliver public transport (increase cost recoveries) - Additional income for low-income residents (by offering a cheap solution, compared to private car ownership and by reducing the government subsidies) - Jump-start / job creation

RECIPROCITY

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6.2.2. AUTONOMOUS DELIVERY/ URBAN LOGISTIC

What is autonomous delivery?

Autonomous deliveries in urban areas or automated urban logistics refer to the process of delivering goods and services in urban areas using autonomous or automated systems. It involves the use of various technologies, such as road-based autonomous vehicles (e.g. car, vans and trucks), robots (semi-autonomous or follower), drones, artificial intelligence, and advanced sensors, to transport parcel without the need for human intervention.

As autonomous deliveries can be performed in several ways, **the following section focus on road-based autonomous shuttles for goods.**

Autonomous shuttles for goods value proposition

Autonomous shuttle for goods delivery provide a service for urban logistic using light transport vehicles such as passenger vehicles. Its model relies on an optimised load and vehicle usage and a potential to operate 24/7 without the limitations of driver shift hours or breaks. Autonomous shuttle can adapt to various delivery scenarios and customer requirements such as navigating into narrow urban streets or accessing restricted areas. This operating mode translates into an increased productivity and improved delivery reliability. Autonomous vehicle being in majority electric, this solution could contribute to reduce carbon emissions from urban logistics.

Lessons learnt and good practices

- ***Revenue model and financing***

According to Williamsson (2022)[17], door-to-door deliveries of intermittent and low-volume batches to and from the depot or between local receivers are attractive and feasible service segments while the realisation of a more valuable high-volume door-to-door service would require considerable investments at both the depot and the delivery point. This is particularly true for the light commercial autonomous vehicles such as the vans/shuttles where material handing operations play an important role.

Indeed, fitting a large number of parcels into a limited space while considering the delivery sequence requires significant expertise and time in material handling. Additionally, automating these material handling processes at the last-mile deconsolidation and transshipment points is challenging due to their large scale. As a result, the cost advantages of using smaller road-based vehicles for urban delivery are offset by the additional expenses associated with facility and handling. One effective approach to reduce the negative impact of material handling is to adopt standardized loading units and pre-sort parcels. By employing standardized loading units, it becomes possible to sort parcels at an aggregation level lower than usual, such as within a delivery van or a roll container. This method proves beneficial in mitigating the drawbacks of material handling and streamlining the overall delivery process. [18]

[17] Jon Williamsson, Business model design for campus-based autonomous deliveries – A Swedish case study, Research in Transportation Business & Management, 2022, https://doi.org/10.1016/j.rtbm.2021.100758

[18] ULaaDS project, D3.1 Benchmarking business/operating models & best practices

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- ***Key partnerships***

In the Guide to Zero Emissions Urban Logistics, published in December 2021 by POLIS & ETIP ALICE, the need for a close and seamless collaboration between cities and urban freights and logistic companies is discussed. Cities should define Sustainable Urban Logistics Plans (SULP) and emissions reduction targets, together with a short-medium term implementation by the cites. To make sure that freight is not forgotten in overall transport planning, SULP should be developed as part of the Sustainable Urban Mobility Plans (SUMP).

Autonomous shuttle for goods business model canvas

The following business model canvas results from the analysis of the literature review and consolidates the inputs from RCP Mobility Missions and Assemblies. It also integrates the revenue model options derived from the business model patterns.

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<table>
<tr>
<th>Key actors, offerings and co-creation</th>
<th>Key activities</th>
<th>Value Proposition</th>
<th>Actor Relationships</th>
<th>Network Beneficiaries</th>
</tr>
<tr>
<td>- Vehicle manufacturers and technology providers
- Maintenance and servicing providers
- IT providers: communication/sensing of road user information, connectivity and traffic management, order collection and planification
- Retailers, e-commerce platforms, or local businesses for collaboration
- Regulatory authorities and local governments for compliance and permits
- Cities
- Public Transport Agency/ urban planners/ engineers
- Investors to scale-up the solution
- Insurance providers
- Users (see network beneficiaries)</td>
<td>- Developing and maintaining autonomous delivery vehicles
- Managing and optimizing logistics and route planning algorithms
- Establishing partnerships/ Contracting with retailers and local businesses
- Ensuring compliance with regulations and safety standards
- Customer support, after-sales & complaints
- Marketing, customer acquisition & loyalty, usage development, customer feedback

Key resources & infrastructure
- Human Resources and time to plan/design, develop and deploy the SULP
- Skilled engineers and technicians for vehicle maintenance and software development.
- Depot & charging stations
- IT infrastructure for data processing and analysis
- Control of technological assets and adaptation to territories (stops, defines route, areas)</td>
<td>- Fast and efficient delivery service
- Enhanced convenience for customer
- Reliable and secure delivery through automated systems.
- Potential for customized or specialized delivery services.
- Improve urban delivery practices & reduce unnecessary mile
- CO2/ Pollution/ Congestion/ Parking space reductions</td>
<td>Customer relationship:
- Seamless and user-friendly online ordering platforms or applications
- Efficient customer support channels for inquiries, issues, and feedback
- Personalisation and customisation options for specific customer requirements
- Building trust through reliable and timely deliveries
Actor relationship:
Integration of urban logistic into mobility plans, contracting, partnerships/agreement with municipalities
Deployment Channels
- App store/ web app/ website
- Referencing & app store rating
- Social media
- Advertising, press, local events
- Sales force (B2B)
- Partnership with e-commerce platform or local businesses for integration
- Delivery autonomous shuttlte itself</td>
<td>- E-commerce customers who require quick and convenient delivery.
- Local businesses seeking cost-effective and reliable delivery options.
- Businesses or organizations in need of specialized delivery services (e.g., medical supplies, food, etc.).
- Urban dwellers looking for sustainable and efficient delivery solutions.</td>
</tr>
</table>

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	- Logistics and operations management software - Autonomous vehicles equipped with navigation and sensing technologies - Sales & business department (customers, contractual & partnerships relation)			

Budget Costs	Revenue Streams
Investments: fleet acquisition, charging stations, depot, containerisation of the fleet **Operation & Maintenance:** Depreciation of investments, Marketing & advertising, Service provision (Manufacturer, Platform costs), After sales and guarantees, platform maintenance, fleet -depot- charging stations O&M, media, security & privacy, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, etc.) **Scale-up:** relocation of services or service expansions, communication and marketing, replication and in other regions & interoperability	- **Affiliation** in case of various local businesses clustered to one new delivery offer - **Pay-per-use:** Delivery fees charged to customers based on distance, package size, or other variables - **Subscription:** for frequent customers - **Revenue sharing**: Partnership agreement with retailers or businesses for revenue sharing
Environmental Impacts: costs and benefits	**Social Impact: Values and Costs**
- Shift towards more sustainable urban logistics - CO2/ Pollution/ Congestion/noise reductions	- Improvement of the urban delivery itself: better accuracy, reliability and connectivity to local businesses - Jump-start / job creation

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6.3. Electric and H2 vehicles

The EU Directive 2014/94/EU "establishes a common framework of measures for the deployment of alternative fuels infrastructure in the European Union. […] The Directive sets out minimum requirements for the building-up of alternative fuels infrastructure, including recharging points for electric vehicles, and refuelling points for natural gas (LNG, and CNG), and hydrogen, to be implemented by Member States' national policy frameworks.[…]"

From the city perspective and to reply to the needs of RCP stakeholders, this chapter focuses on the installation of EV charging stations and on Hydrogen-Electric mobility as a future of urban and peri-urban transportation.

6.3.1. EV CHARGING STATIONS

What is the public EV charging demand?

In a city context, a large number of electric vehicles can be found however, there are lower numbers of single-family homes. This translates in an increased need for public charging, especially in dense cities, with high amounts of on-street and commercial garage parking.

In this respect, the following EV owners' needs should be satisfied:

- *Easy access, easy payment and attractive offers*
- *Simple search and booking*
- *Availability at high-demand locations*
- *Charging speed in accordance with average stay at destination*

EV charging stations value proposition

Installing public EV charging stations can be done in two ways:

- *On-demand charging points programs: enable the deployment of public EV charging points in areas where inhabitants without access to private parking are over-represented and where their sufficient use is guaranteed (e.g. Oslo, Amsterdam and Rotterdam)*
- *One-time charging stations: allow an EV user to restore, in a short period of time, a sufficient level of charge to complete a journey. Usually these stations are installed in places where potential users park for at least 30 minutes and never for more than two hours, such as commercial and cultural venues. It can also fit the needs of taxis and chauffeur-driven vehicles.*

Lessons learnt and good practices

Cities and municipalities who are thinking about deploying public ev charging infrastructure can find some guidelines here: Top 6 factors to consider when deploying Public EV charging.

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- ***Revenue model and financing***

To reply to EV owners needs, i.e. offering charging at low costs, it is important to keep EV charging infrastructure costs as low as possible. With a growing market, competition and a wide range of services and prices, it is today quite difficult to compare costs across solution providers. However, there are some cost drivers to consider:

- **Save costs by using a smart EV charging** that spans EV charging and energy management system to reduce operational costs and optimise energy utilisation.

- **Save on grid hosting capacity** by avoiding grid upgrade thanks to an effective upstream collaboration with DSO and utilities and by using a EV charging management platform with dynamic load management and energy management features, balancing demand throughout the day to ensure continuous charging capabilities without having to supplement electrical infrastructure.

- **Save on software integration** costs by deploying a platform that is hardware agnostic and based on open standard communication protocols that support most charger models, for a cost optimal and future-proof approach. Having the flexibility and achieving interoperability will ensure you cost saving opportunities, with the most cost-effective hardware and network services combination. Some providers EV charging hosts to purchase proprietary management software through expensive contract. You can avoid this by purchasing an open hardware agnostic EV charging management platform separately from the hardware.

- **Save costs by properly defining the location and type of chargers** you will implement to have an adequate coverage of recharging points and with a charging speed in accordance with average stay of EV users.

Various funding programmes are still available at national levels to incentivise the cities in installing EV charging stations. For instance in Austria, a subsidy of up to €30,000 for the purchase and installation of DC charging stations designed to accommodate heavy goods vehicles is available. In France, the government finance up to 40% of the purchase and installation costs (capped at €2,160) of charging stations for public entities. In Poland, a grant of up to 25 percent of eligible costs for the construction of a charging station with a power of at least 22 kW is available.

- ***Key partnerships & customers relationship***

With suppliers/private operators:

- Ensure a high quality of charging service by **integrating performance requirements into your public tenders and support measures**. Chargers must withstand all kinds of weather and keep on charging safely (weatherproof exterior) to ensure their durability. Another way to look at long-term value in EV charging is to think about longevity, both in the product and the company you buy it from.
- **Encourage interoperability** across competing charging networks through common technical standards and roaming agreements. Select a supplier that gives you the freedom to choose and change of network provider to run your charging stations (Open Charge Point Protocol). This ensures reduced vulnerability to individual system suppliers, reduced development costs and eases connectivity between an electricity supply point and a charger of electric vehicles.
- Encourage the investment of private operators in charging hubs, through **a favourable market framework and by facilitating access to public land** in certain key zones of your territory. Ultimately,

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showcase EV charging as a political priority and attract private investment by stating that EVs transition is at the top of your agenda

In addition, an effort to structure the ecosystem must be maintained and deepened between the market stakeholders and the public authorities, to improve solutions for charging at work or in business parks and offer high-performance additional charging solutions as part of these urban hubs (i.e. charging space reserved for taxis but also spaces managed by shopping centres, transport operators or cultural venues). **For an efficient infrastructure roll-out,** IEA advises in its Policy brief (IEA, 2022) to facilitate communication between stakeholders and **streamline and clarify permitting processes**.

Finally, make sure that users have access to transparent and reliable information about charging stations and pricing.

EV charging stations business model canvas

The following business model canvas results from the analysis of the literature review and RCP Use cases (e.g Issy-les-Moulineaux, Coventry), and consolidates the inputs from the business model and capacity building workshops. It also integrates the revenue model options derived from the business model patterns.

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<table>
<tr>
<th>Key actors, offerings and co-creation</th>
<th>Key activities</th>
<th>Value Proposition</th>
<th>Actor Relationships</th>
<th>Network Beneficiaries</th>
</tr>
<tr>
<td>-Providers and Operators of charging stations
- Local authorities to provide the land & procure the service
- Public Transport Agency/ urban planners/ engineers
- Utilities and energy providers for power supply
- Software providers for charging station management
- Payment service providers for transaction processing
- Shopping centers and cultural venues
- Investors to scale-up the solution
- Insurance providers
- Users (see network beneficiaries)</td>
<td>- Installing, operating, and maintaining public EV charging stations
- Securing partnerships and agreements with property owners or managers
- Collaborating with electric vehicle manufacturers for compatibility and integration
- Establishing relationships with utilities for power supply and grid integration.
- Ensuring compliance with regulations and safety standards
- Developing and implementing charging station management software
- Marketing and promoting the charging infrastructure to EV users

Key resources & infrastructure
- Human Resources and time to plan/design, develop and deploy
- Skilled engineers and technicians for station installation and maintenance
- Charging stations
- IT infrastructure for charging station management
- Adaptation to areas
- Access to suitable locations for charging station installation</td>
<td>- Convenient and accessible charging infrastructure for EV owners
- Improved urban mobility
- CO2/ Pollution/ Congestion/ Parking space reductions</td>
<td>Customer relationship:
- User-friendly mobile applications or web platforms for charging station location, reservation, and payment
- Efficient customer support channels for inquiries, issues, and feedback
- Regular communication and updates on charging station availability and status
- Building trust through reliable and efficient charging services
Actor relationship:
- Collaboration with property owners or managers to enhance customer experience, relationship management
- Potential for partnerships with electric vehicle manufacturers.

Deployment Channels
- App store/ web app/ website
- Referencing & app store rating
- Social media, Advertising, press, local events
- Property owners, Cultural sites, Shopping centres
- Partnership with e-commerce platform or local businesses for integration
- Charging stations in city</td>
<td>- Electric vehicle owners and users
- Property owners or managers interested in offering charging points
- Businesses or organisations looking to promote sustainability initiatives</td>
</tr>
</table>

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	- Regulatory knowledge and compliance expertise - Sales & business department (customers, contractual & partnerships relation)			

Budget Costs	Revenue Streams
Investments: charging stations, groundworks, communication infrastructure, installation **Operation & Maintenance:** Depreciation of investments, Marketing & advertising, Service provision (Manufacturer, PSP), Electricity, After sales and guarantees, charging stations O&M, security & privacy, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, marketing etc.) **Scale-up:** service expansions, communication and marketing, replication and in other regions & interoperability	- **Start up fee** - **Pay-per-use:** pay per kWh, minutes or both - **Fixed-flat rate** - **Subscription:** for frequent customers - **Revenue sharing**: Partnership agreement with retailers or businesses for revenue sharing
Environmental Impacts: costs and benefits	**Social Impact: Values and Costs**
- Shift towards more sustainable urban mobility - CO2/ Pollution/ Congestion/Noise reductions - Improved air quality	- Improvement of the urban mobility, quality of life and territory attractiveness

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6.3.2. HYDROGEN FUEL CELL BUS AND REFUELLING STATIONS

What is a (Green) Hydrogen Fuel Cell Bus?

Hydrogen buses (or Fuel Cell Buses, FCB) are recognised as one of very few routes to the full decarbonisation of public transport in cities.

A fuel cell bus is an electric bus that includes both a hydrogen fuel cell and batteries/capacitors. In such hybrid architecture, the fuel cell provides all of the energy for the vehicle operation, whilst the batteries/capacitors are able to provide peak power to the motors to meet rapid acceleration and gradients. All the energy required for the bus to operate is provided by hydrogen stored on board. As hydrogen offers higher energy density compared to electrical storage systems, this enables a longer range of operation compared to systems where the batteries are used as stores of energy.

Hydrogen fuel cell bus offer some interesting advantages such as a refuelling of the bus in 7 minutes and no additional city infrastructure work or permits other than a centralized hydrogen refuelling station (HRS) at the bus depot.

Whilst most of the hydrogen is produced in a conventional way, which released a large amount of CO2, the majority of HFS deployed today are based on green hydrogen (i.e. from low and zero carbon sources). Furthermore, regions across Europe are trying to position themselves to become leading players of a future green hydrogen economy, making the implementation of FCB lines in cities more and more interesting.

What is Hydrogen Refueling?

The Fuel Cell Electric Buses knowledge base developed by the JIVE project summarised the basic component of hydrogen refuelling concepts as follows:

- *Hydrogen production and supply:*
  - *Hydrogen can be generated on-site by electrolysis of water or by small scale reformation of natural gas*
  - *Hydrogen can be produced centrally and delivered to the site in liquefied for, as gaseous hydrogen, by tube trailer or via a pipeline, produced via reforming of Natural Gas, supplied as by-product from industrial processes*
- *Hydrogen storage: delivered as a liquid or as a compressed gas*
- *Hydrogen Refueller: Cascade storage fill system or Booster compressor fill system*

(Green) Hydrogen fuel cell bus and refuelling station value proposition:

The fuel cell electric bus is an all-electric zero emission solution that offers an operation close to that of a diesel bus and provide a clean solution to replace diesel bus in long-driving range areas such as in rural areas or in areas where electrification is not a viable option. However, the availability of hydrogen refuelling stations is still poor. In this business model we propose to consider a case where a fleet of (green) hydrogen FCB is acquired and a refuelling station at bus depot is built.

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Lessons learnt and good practices

- ***Revenue model and financing***

The following financing options have to be explored when sourcing finance:

- *European programs: The Clean Hydrogen Partnership, Innovation fund, Interregional Innovation Investments (I3), Just Transition Fund, Public Procurement of Innovative Solutions, European Regional Development Fund, INTERREG programmes*
- *Private: cascade funding for providers, green energy funding organisations such as Hy24 Clean Hydrogen Investment Platform, the 5t Hydrogen Financing the Foundation of Hydrogen Economy*

- ***Key partnerships***

Hydrogen mobility needs support mechanisms to overcome the barriers related to the risks and higher costs of the technology, until it become economically viable, before having the economy of scale effect. Regulatory bodies should ensure that a common & single protocol to install and operate a HRS is deployed (to avoid what happened in EVs with various types of charger). To ensure that support mechanisms arise, politics buy-in is needed. To get politics on board, it is important to show them that the citizen see the need, that the region will profit from this, that it fits both EU 2030 targets and the local strategic objectives etc.

FCB & HRS business model canvas

The following business model canvas results from the analysis of the literature review and consolidates the inputs from the business model and capacity building workshops. It also integrates the revenue model options derived from the business model patterns.

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Key actors, offerings and co-creation	Key activities	Value Proposition	Actor Relationships	Network Beneficiaries
- National Government (regulation & funding) - Regional authority & PTA - Public Transport Operator (independent or local authority) - Green H2 provider - City - Infrastructure provider (city, region) - Fleet providers and owners (FCB here but it could be cargo bike, buses, taxis…) - Private company to operate the HRS - Energy provider & grid operator - Safety services - Non-profit companies & Local communities to understand the needs/concerns of the neighbouring habitants/businesses - Research center/academics Who owns the solution?	- Developing and operating hydrogen generation and refuelling stations. - Acquiring and maintaining hydrogen fuel cell vehicles. - Establishing partnerships with public transportation agencies or operators. - Collaborating with vehicle manufacturers for fleet deployment. - Ensuring compliance with safety and environmental regulations - Conducting research and development to improve hydrogen technologies - Marketing and promoting the benefits of hydrogen-powered public transport	- Environmentally friendly public transportation solution for rural areas - Improve mobility routines, CO2/ Pollution/ Congestion reductions (from the whole ecosystem perspective) - Potential for future hydrogen fuel cell adoption in other sectors	Customer relationship: - Building trust and relationships with PTA or PTO - Educating and informing customers about the benefits of hydrogen-powered public transport - Addressing concerns or inquiries related to hydrogen safety and refuelling. Actor relationship: Collaborative partnerships for long-term contracts and service agreements, Data sharing, pricing, win-win goals, Authorities supported by PTOs to become a partnership manager, Political buy in, Collaboration with providers of alternative technologies and Continuous communication and support for efficient operations and maintenance, Raise awareness & elucide risks and benefits for the politics and the citizens, Early meetings with all stakeholders to define win-win spots Deployment Channels	Geographical segmentation: - Suburbs further away from the public transport network Professional segmentation - Commuters and general public using public transport Segmentation by "restricted route" - People with reduced mobility, the elderly, young children … Occasional: - Tourists & visitors

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<table>
<tr>
<td></td>
<td>
Key resources & infrastructure
- Human Resources and time to plan/design, develop and deploy the solution (control of technological assets and adaptation to territories)
- Business department (contractual & partnerships relation)
- Communication department (raise awareness)
- Emergency/Security department
- Data / Forecast of energy resources
- Public funding
- Land to install a H2 facility
- Power & H2 (HRS)
- FCB
- Vehicles (PT or private ones)
- Security protection equipment
- Funding and investment for infrastructure development.
</td>
<td></td>
<td>
- Social media, Advertising, press, local events
- Sales force (B2B)
- NGOs/Ambassadors
- Bidding processes or tenders for public transportation contracts
- Collaboration with vehicle manufacturers for fleet deployment
</td>
<td></td>
</tr>
<tr>
<td colspan="3">Budget Costs</td>
<td colspan="2">Revenue Streams</td>
</tr>
<tr>
<td colspan="3">
Investments: H2 station & fleet acquisition
Operation & Maintenance: Depreciation of investments, Marketing & advertising, Service provision (PTO, H2 generation), After sales and guarantees, HRS and FCB O&M, Security, Human Resources & contractors, Transversal costs (legal, insurance, HR, finance, offices, etc.), R&I
Scale-up: increased fleet, extension of the geographical coverage, replication in other regions
</td>
<td colspan="2">
- For the FCB: Pay-per-use: Revenues from user-pay options & Subscription
- For the HRS: Refuelling fees (pay-per-use) or subscription models for hydrogen usage
- Government grants, subsidies, or incentives for adopting hydrogen technology and based on KPIs
</td>
</tr>
<tr>
<td colspan="3">Environmental Impacts: costs and benefits</td>
<td colspan="2">Social Impact: Values and Costs</td>
</tr>
<tr>
<td colspan="3">
- Shift towards more sustainable/integrated mobility
- CO2/ Pollution reductions
- Decongestion of fuel stations (?)
- Increased quality of life
</td>
<td colspan="2">
- Improvement of the mobility services itself / fleet modernisation
- Convergence of technology for multiple purpose activity (beyond transport)
- Jump-start / job creation
- Recognition of early adopters/innovative city, prestige and political buy-in, economic attractivity
</td>
</tr>
</table>

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7. Conclusion

The main goal of D3.3 was to build comprehensive business models to accelerate the replication of clean and innovative mobility solutions from the portfolio of RECIPROCITY solutions. Ten business models are proposed and supported by lessons learnt and good practices from the RCP ecosystem, collected during Mobility Assemblies and Missions or through an analysis of the literature available.

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

- *Most business models are built while being integrated into the current transport network, meaning being supported by sustainable urban mobility plans.*
- *Understanding costs and revenues and their perception within the ecosystem is critical to develop sustainable business model. As every city and municipality has another context, it was not possible to provide clearer figures for investment or operation in the context of this work. In a MaaS ecosystem, the diversity of stakeholders implies to understand the different costs structures that varies as a result to different capital structures, as well as fixed and variable costs, to then formulate common win-win goals.*
- *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.*

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8. References

ACEA. (2022). European EV Charging Infrastructure Master Plan.

Bandeira et al., (2021) PriMaaS Interreg project, Multidimensional Indicator of MaaS systems Performance.

Blank, S. (2013), Why the Lean Start-Up Changes Everything, Harvard Business Review, 91(5), 63-72.

CEREMA. (Dec 2019). MaaS in Europe: Lessons from the Helsinki, Vienna and Hanover Experiments.

Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure

Gassmann, O., Frankenberger, K., & Csik, M. (2014). The business model navigator: 55 models that will revolutionise your business (1st ed.).

JCDeaux. (2021). Supplyingself-servicebikes. Retrieved 29-04-2021, from https://www.jcdecaux.com/partners/supplying-self-service-bikes

Jon Williamsson. (2022). Business model design for campus-based autonomous deliveries – A Swedish case study, Research in Transportation Business & Management, https://doi.org/10.1016/j.rtbm.2021.100758

Meng, Li, Somenahalli, Sekhar, Berry, Stephen. (2020). Policy implementation of multi-modal (shared) mobility: review of a supply-demand value proposition canvas.Transport Reviews. 10.1080/01441647.2020.1758237

Remane, G, Hanelt, A, Tesch, J, Kolbe, L, M. (2017). The business model pattern database — a tool for systematic business model innovation. International Journal of Innovation Management 2017 21:01. https://doi.org/10.1142/S1363919617500049

Spieth, P, D Schneckenberg and JE Ricart (2014). Business model innovation–state of the art and future challenges for the field. R&D Management, 44(3), 237–247.

EMOBICITY. (2021). Report on EV charging pricing, regulatory framework and DSO role in the e-mobility development.

ETIP ALICE & POLIS. (2021). Guide to Zero Emissions Urban Logistics. https://www.etp-logistics.eu/wp-content/uploads/2021/12/POLIS_ALICE_Guide-Zero-Emission-Urban-Logistics_Dec2021-low.pdf

European Alternative Fuels Observatory, A. F. (2021). Pricing of Electric Vehicle recharging in Europe. European Alternative Fuels Observatory.

Giourka et al. (2019). The Smart City Business Model Canvas-A Smart City Business Modeling Framework and Practical Tool. Energies. 10.3390/en12244798

Goldenbeld, C., Gebhard, S., Schermers, G, Nabavi Niaki, M., Gordijn, J, A Osterwalder and Y Pigneur (2005). Comparing two business model ontologies for designing e-business models and value constellations. In Proceedings of the 18th Bled eConference, Bled, Slovenia, Paper 15.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101006576

GSMP. (2021). Policies for a mature, flourishing, equitable EV charging ecosystem.

Hedman, J and T Kalling (2003). The business model concept: Theoretical underpinnings and empirical illustrations. European Journal of Information Systems, 12(1), 49–59.

IEA. (2019). Technology Report. The future of Hydrogen.

IEA. (2022). Policy Brief on Public Charging Infrastructure.

JIVE / JIVE 2 projects. D3.8 Best Practice Report (2022). Clean Hydrogen Partnership Programme.

Johnson, MW (2010). Seizing the White Space: Business Model Innovation for Growth and Renewal. Boston, USA: Harvard Business Press.

Merijn Boer, Oktay Turetken, Onat Adali. (2022). A Review of Business Models for Shared Mobility and Mobility-as-a-Service (MaaS): A Research Report. TU/e. 10.13140/RG.2.2.27170.35524

Mobility as a Service: a practical Guide, Urban Mobility Partnership UK.

Mons, C. (2021). Guidelines and recommendations for future policy of automated urban transport, Deliverable D5.5. H2020 project LEVITATE.

Osterwalder, A and Y Pigneur (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Hoboken, USA: Wiley.

P. Bujis, P. Ozyavas, L. Axinte, N. Sarrio, I. Magallon. (2020). ULaaDS project, D3.1 Benchmarking business/operating models & best practices.

Ping-Jen Kao, Caroline Busquet, Valerio Lubello, Marisa Meta, Christopher van den Heuvel. (2019). Review of business models for new mobility services. GECKO H2020 project. Deliverable D1.2.

UITP. (2023). Mobility hubs: Steering the shift towards integrated sustainable mobility.

UITP. (2022) Ticketing in Mobility as a Service.

Van Audenhove et al. (2021). How to realise the promise of Mobility-as-a-Service. Arthur D. Little.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101006576

9. Annex 1 The Smart City Business Model Canvas

proposed by Giourka et al, 2019

Smart City - Business Model Canvas

Key Actors	Key Activities	Value Proposition	Actor Relationships	Network Beneficiaries
Who are the smart city network key actors? *(Completed by the solution provider in collaboration with the City)* •*Actor 1 (city)* •*Actor 2 (end-user)* •*Actor 3 (core partner)* •*Actor 4 (supporting partner)* Who are the key suppliers? *(Completed by the smart city solution provider)* •*Supplier 1* •*Supplier 2* •*Supplier 3*	Which key activities are required to realize the value proposition (i.e. build distribution channels, customer relationships, revenue streams, build products/services/platforms, install equipment) *(Completed by each actor involved in realizing the smart city solution)* *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*	What value does each actor delivers? Which of the end users' problems is the smart city project helping to solve? What bundles of products and services does the project offers to each end user? Which end-users needs is the project satisfying? (i.e. performance, customization, price, getting the job done, cost reduction, risk reduction, accessibility, convenience/usability) What are the respective target values/thresholds/KPIs to be reached? *(Completed by each actor involved in the smart city project creating value)* *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*	Which type of relationship does each actor expect within the network? Which ones are established? How are they integrated with the rest of our business model? How costly are they? *(Completed by each actor involved in realizing the smart city solution)* *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*	Which target users is the value created for? How the target users benefit from the value created and what are their needs? What specific values each network beneficiary gets? (i.e. Community, business, research organizations, decision-making bodies/government and non-profit). *(Completed by the smart city solution provider in collaboration with each actor involved in realizing the project)* *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*

Key Actors Offerings (*)	Key Resources and Infrastructure	Data (*)	Deployment Channels
What offerings does each actor deliver? (i.e. technology, development of products/processes/services, R&D, Citizen Engagement) *(Completed by the smart city Key Actors in collaboration with the city)* *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*	What key resources are required to realize the Value Proposition (buildings, vehicles, machines, systems, point-of-sale systems, and distribution, networks) Our deployment channels? Our actor relationships? Revenue streams? *(Completed by the smart city solution provider in collaboration with the city)* *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*	What data will be made available from the services designed? To whom and under what conditions? Availability and types of Open Data (i.e. energy efficiency, climate indicators, traffic etc) *(Completed by the smart city solution provider in collaboration with the city and actors involved)* *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*	Through which channels do our customers want to be reached? How are we reaching them now? How are our channels integrated? Which ones work best? Which ones are most cost efficient? How are they integrating with the customer routines? *(Completed by the smart city solution provider in collaboration with the city and actors involved)* *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*
Key Actors Co-creation Operations (*) Which key operations do the key actors perform? (i.e. sourcing of materials, systems's design, operation and monitor and impact monitoring of the smart city solutions, deliver value, city coverage and links to other stakeholders e.g. innovation hubs) (Completed by the smart city Key Actors in collaboration with the city) *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*			

Budget Cost	Revenue Streams
What are the most important costs inherent for each actor deploying a smart city solution? Which key resources are the most expensive? Which key activities are the most expensive? What cost can be covered by each actor? Is there opportunitiy for blending public funding with private financing? Which costs are covered by each mechanism? (Completed by the smart city solution provider in collaboration with the city) *Actor 1 (city):* *Actor 2 (end-user):* *Actor 3 (core partner):* *Actor 4 (supporting partner):*	For what value are the network beneficiaries really willing to pay? For what do they currently pay? How are they currently paying? How much would they prefer to pay? How much does each revenue stream contributing to overall revenues? Which actors have revenues? What are the non-monetary revenues? *(Completed by the smart city solution provider in collaboration with the city)* *Actor 1 (city)* *Actor 2 (end-user)* *Actor 3 (core partner)* *Actor 4 (supporting partner)*
Environmental Impacts: Costs and Benefits What is the ecological cost of the smart city solution? (i.e. Greenhouse gas emissions, land use, energy and water used) What is the ecological benefit of the smart city solutions? % of reducing energy consumption % reducing the environmental footprint (Completed by the smart city solution provider and the smart city)	**Social Impacts: Values and Costs** What is the negative social value generated by the Smart City Solutions? (i.e. Social exclusion, digital illiteracy, accessibility to advanced services etc.) What is the positive social value generated by the Smart City Solutions? (i.e. Growth, job creation, air quality, less traffic etc.) *(Completed by the smart city solution provider and the smart city)*

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101006576

RECIPROCITY (Replication of innovative concepts for peri-urban, rural or inner-city mobility), coordinated by R-Tech Regensburg (Germany), involves 10 partners including clusters, regional development agencies, innovation accelerators and universities. The project started in February 2021 and will run for 32 months.

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The RECIPROCITY project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101006576