C-MOBILE

Accelerating C-ITS Mobility Innovation and deployment in Europe

D2.5 Initial Business Models

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Legal disclaimer

Contributors

The table below presents the list of stakeholders for each pilot site that have participated in the business model workshops, and afterwards in reviewing the resulting models. They have contributed significantly to the results presented in this document. We would like to thank all stakeholders for their valuable input and contributions.

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Table of Contents

Figures

Tables

Abbreviations

Abbreviation	Definition
3G	3rd generation of mobile telecommunications technology
C-ITS	Cooperative Intelligent Transport Systems
BASE/X	Business Agility through Cross-organisational Business Engineering
SDBM/R	Service-Dominant Business Model Radar
GLOSA	Green Light Optimal Speed Advisory
RSU	Road-Side Unit
OBU	On-Board Unit
VRU	Vulnerable Road User; e.g. pedestrians, cyclists …
HGV	Heavy Goods Vehicle; e.g. trucks, lorries …

Executive Summary

In the past years, there has been tremendous progress in the field of intelligent transport systems; several successful cooperative mobility initiatives have proven potential benefits of cooperative systems in increasing both energy efficiency and safety for specific transport modes. However, the large variety of cooperative applications have been designed for different goals, stakeholders or specific settings / environments and have been developed on a silo-based approach and deployed independently from each other, serving however, at higher level, similar goals and functionalities for the end-user. Scalability, IT-security, decentralization and operator openness are some of the most important properties that a technical and commercial successful solution must provide.

C-MobILE aims to stimulate / push existing and new pilot sites towards large-scale, real-life C-ITS deployments interoperable across Europe. Well-defined operational procedures will lead to decentralized and dynamic coupling of systems, services and stakeholders across national and organizational borders in an open, but secure C-ITS ecosystem, based on different access technologies, the usage of which is transparent for service providers and seamless and continuous for the end-users across different transport modes, environments and countries.

Although C-ITS services and its implementation are of prime interest within this project, successful marketization and adoption of these services significantly depend on the business models which encapsulate these services. Implementing C-ITS services without a clear goal or without being directed towards stakeholders who will actually benefit from these services is likely to lead to a failure. Specifically, it is important that the business models surrounding these C-ITS services are viable and sustainable. Inviable business models force users or stakeholders to incur unacceptable losses, whereas unsustainable business models will not survive the long-term horizon for which the services are able to generate value. This also hinders large-scale deployment of these services. Therefore, exploring the design of business models surrounding the use of C-ITS services is of high importance. The design of a business model should make clear what value will be offered through the mobility solutions that employ C-ITS services, which stakeholders will be involved, what responsibilities each stakeholder has in implementing these mobility solutions. Moreover, it should become apparent how costs and benefits are distributed after the implementation. In turn, business model blueprints may serve as a plan for implementing C-ITS services and as an incentive for stakeholders to participate in scenarios using these services.

Past European projects within the C-ITS mobility domain, such as Compass4D [1], or ongoing projects, such as NEWBITS [2], have acknowledged the need for exploring business opportunities and deriving business models to support the deployment of these services. In Compass4D, business models for deploying C-ITS services have been designed with the Business Model Canvas. As a result, the designed business models adopt a more organisation-centric view, reasoning from the perspective of the municipality for a pilot site. However, C-ITS services are not deployed in isolation by a single organisation, but are the product of collaborations between multiple stakeholders within the business model, including authorities, municipalities, infrastructure providers, service providers and users. Therefore, there is a need for exploring business models for C-ITS services from a networked business perspective, examining the role of involved stakeholders within such a business collaboration. The NEWBITS project does aim to consider business models from a networked business perspective, however is still in its early stages (in which no business model deliverables are yet present).

In this project, we take an explicit networked perspective for creating solution-oriented mobility services to users. We organized workshops at each C-MobILE local site, and with the participation of several stakeholders at each site, we collaboratively designed business model blueprints for mobility solutions that use C-ITS services. This document presents the *initial* business model blueprints, which elaborate how value is created for all stakeholders through applications of C-ITS services and describes the role of the stakeholders involved. These blueprints aim to provide guidance for the implementation of C-ITS services, emphasizing the importance of creating viable and sustainable business networks. Each business model blueprint has emerged from discussions and interactive stakeholder workshops at the relevant C-MobILE local sites. A business model blueprint covers one or more C-ITS services, depending on the specific needs and goals of the involved stakeholders. As such, the full the set of business model blueprints covers almost all identified C-ITS services within the C-MobILE project and can serve as guidance on how these services can successfully be put in practice from a business perspective. In addition to others, this document will also serve as a basis for the deliverable D4.5, which will present the final business models that will be derived from the actual implementation of these solutions and the deployment of the C-ITS services.

1. Introduction

1.1. C-MobILE at a glance

The C-MobILE (Accelerating C-ITS Mobility Innovation and depLoyment in Europe) vision is a fully safe & efficient road transport without casualties and serious injuries on European roads, in particular in complex urban areas and for Vulnerable Road Users. We envision a congestion-free, sustainable and economically viable mobility, minimizing the environmental impact of road transport. C-MobILE will set the basis for large scale deployment in Europe, elevating research pilot sites to deployment locations of sustainable services that are supported by local authorities, using a common approach that ensures interoperability and seamless availability of services towards acceptable end user cost and positive business case for parties in the supply chain.

1.2. Objective

The objective of this document is to communicate the results of task T2.4 and as such to present a set of business model blueprints designed in collaboration with all C-MObILE local sites and parties, which will guide the implementation of C-ITS services for large-scale and sustainable business. In designing business model blueprints, we used the service-dominant business model-radar (SDBM/R) for designing business model blueprints that put emphasis on creating value for all involved stakeholders (including the customer), and as such serve as an incentive for all stakeholders to participate. Moreover, each business model blueprint has emerged from stakeholder workshops at pilot sites within the C-MobILE project. As such, they are catered to the specific needs and context of the respective local site. However, the blueprints are designed in such a way that they can be applied across other local sites of C-MobILE, as well as other cities outside the C-MobILE context.

1.3. Intended audience

This document is intended for all stakeholders / parties which will participate or may be willing to participate in the presented business model blueprints. As each business model blueprint has emerged from a stakeholder workshop at a specific pilot site, relevant stakeholders for these specific pilot sites can use these respective business model blueprints as a basis for implementing C-ITS services in a viable and sustainable manner. However, all stakeholders may draw from business model blueprints from different cities in order to foster creativity and explore different business opportunities through implementing different C-ITS services.

1.4. Approach

Currently, many developments are taking place in the field of mobility, transportation, and traffic management. Many of these initiatives, however, have a hard time finding their way to practical, large-scale exploitation. One of the reasons behind this is the limited view on business models and market considerations. Many of these developments have a technology-push character, where things are developed inside-out, with a focus on the concepts and technology in the mobility transportation from the very start, and with limited attention for actual business deployment at the end. This situation is made worse by the fact that complex mobility scenarios involve a multitude of stakeholders, each of which has its own business interests.

Several initiatives in the C-ITS domain (e.g., Compass4D [1], NEWBITS [2]) emphasize the need for exploring the opportunities to derive business models to support large-scale deployment and long-term sustainable operation of C-ITS services. However, business models designed in such initiatives typically address an organisation-centric view, reasoning from the perspective of a single party in a pilot site (e.g., municipality). However, C-ITS services are not deployed in isolation by a single organisation, but are the product of collaborations between multiple stakeholders within the business model, including authorities, municipalities, infrastructure providers, service providers and users. Therefore, there is a need for exploring business models for C-ITS services from a networked business perspective, examining the role of involved stakeholders within such a business collaboration. Networked, service-dominant business models can address this need.

Recent projects on the design of agile, service-dominant business models in multi-stakeholder contexts in the mobility landscape have shown that the application of such a business design approach offers a constructive, collaborative way to develop blueprints for the definition of cases of concrete added value of mobility technologies and new forms of business collaboration to realize these cases of added value [3]–[6]. A service-dominant business model identifies the added value of the service to the customer or user, functions and capabilities required by each party (organizations, institutions, companies, customers, etc.) participating in the model, as well as the expected costs and benefits. The business models (BMs) for a service (or a coherent collection of services) provide a solid basis for the requirements for the solutions and cost & benefit analysis for such solutions.

Adopting a service-dominant perspective, we initiated the tasks for designing blueprint business models for the C-ITS services and service bundles in collaboration with the stakeholders in the C-MobILE local sites. The approach followed for Business Model Design is based on the BASE/X (Business Agility through Service

Engineering in a Cross-Organizational Setting) framework [3] that has been successfully used in business engineering in several domains - particularly in mobility and traffic management [5]–[7]. The conceptual tool used as a guiding reference for business model design is the SDBM/R, which is an integral component of the BASE/X framework [8]. The SDBM/R tool accommodates a typical networked perspective for designing business models, facilitating all stakeholders to be considered and incorporated concurrently for implementing C-ITS services. Moreover, the SDBM/R explicitly focuses on the value that is created by the C-ITS service (*value-in-use*), and how this value can be appropriated to the customer, as well as other stakeholders involved. As such, the SDBM/R is able to incorporate the specific characteristics of these C-ITS business models, which typically involve multiple concurrent actors for deploying C-ITS services, for which it is difficult to appropriate how value is created and distributed within this collaboration (as well as for the customer). Moreover, it contrasts business model design methods as the Business Model Canvas [9] used in previous initiatives or projects, which are more organization-centric and less value-oriented. For these methods, it may become difficult to represent how value is created, appropriated and distributed amongst all stakeholders involved in these C-ITS business models.

We organized workshops in all eight C-MobILE local sites (between June and September 2017) to help engage relevant stakeholders (partners, associate partners, and other third-party stakeholders in the region) in collaboratively designing business model blueprints for sustainable deployment and operation of C-ITS services. A list of the specific workshops, as well as the dates these have been conducted can be found in Table 1. Up front, local site leaders were asked to consider the mobility challenges faced in their region, and elicit the potential use of C-ITS services to address these challenges that were deemed most important in their local context. Consequently, site leaders were asked to invite a selected group of stakeholders, which were required for implementation of the C-ITS services, potential (end-) users of the services, or interested in joining or contributing to these business collaborations.

Each workshop consisted of two phases. The first phase involved a tutorial on the concept of service-dominant business, the BASE/X framework, and on the use of SDBM/R. The second phase comprised the core of the interactive design of a particular business model using the SDBM/R under the guidance of the business model design team of the project. Following a practical approach, large posters and 'post-its' were used to represent the SDBM/R blueprints and its specific elements. The blueprinting involved the analysis of the stakeholders (including the customer, the focal organization that orchestrates the service, and other required parties), their exact added value (in qualitative terms), and the cost/benefit structure in a business network of these parties. Emphasis was put on the value created by the mobility solution, and how each stakeholder may contribute and benefit from this business collaboration. Each workshop was concluded with one or two draft business model blueprints. Each blueprint draft was completed and sent to relevant stakeholders participated in the workshops for review. The blueprint business models were consequently finalized based on the feedback received and further discussions with the stakeholders in local sites.

The blueprint models are designed in such a way that they can act as templates for concrete models in existing local sites, or in settings beyond the C-MobILE project scope. A business model blueprint that involve a particular set of C-ITS services shows the stakeholders that are involved in offering that solution including their contributions and the main cost and benefit involved in the deployment of the solution. It acts as a guideline in understanding and presenting the operative and economic aspect of the solution. The blueprints can be concretized in local sites and by relevant parties, facilitating an open collaboration of stakeholders in an operational way.

Table 1: List of business model workshops

Business model workshops	Date
North-Brabant / Helmond, Automotive Campus	27-06-2017
Thessaloniki, CERTH offices	10-07-2017
Copenhagen, City Hall	21-08-2017
Bordeaux, CEREMA offices	28-08-2017
Barcelona, RACC offices	18-09-2017
Vigo, City Hall	19-09-2017
Bilbao, City Hall	20-09-2017
Newcastle, City Hall	22-09-2017

1.5. Document structure

The remainder of the document is structured as follows. Section 2 discusses the business model design methodology, which elaborates on the BASE/X framework for service-dominant business engineering, and the Service-Dominant Business Model Radar tool (SDBM/R) used for designing service-dominant business models. Section 3 presents the business model blueprints that emerged from the stakeholder workshops. Each business model design is discussed in detail with potential variants. Section 4 concludes with an overview of the C-ITS services that have been covered by the set of business models, and follow-up tasks on the business model design.

1.6. Use disclaimer

The BASE/X framework and Service-Dominant Business Model Radar (SDBM/R) are research products which have been developed in and as such belong to the Eindhoven University of Technology. The research performed by TU/e is intended for general use. However, no part of these products can be used in any form without explicitly acknowledging the following sources: [8] [3].

2. Business model design methodology

2.1. Service-dominant business logic

Current business practices within the transport and mobility domain are characterised by a shift from a goods-dominant towards a service-dominant perspective. Customers recognize that value is not in *owning* a product, which requires asset management and maintenance, but rather in *using* a product or service (without requiring to physically own it). Given this implication, business practices within the transport and mobility domain transition from offering or delivering stand-alone products towards providing complete service solutions to customers. For example, instead of offering or leasing cars to customers, *BMW* increasingly engages (in collaboration with *SIXT*) in car sharing programs, facilitating customers to travel from A to B without having to own, manage or maintain the car. The service-dominant perspective therefore emphasizes creating *value-in-use* for customers. Although services may consist of, or require the deployment of stand-alone products (e.g. manufacturing cars), these products are not the focal point of interest and become part of the delivery channel of offering services.

The shift towards a service-dominant business has strong implications for business practices. Firstly, customers expect coherent service solutions rather than stand-alone products or components. Offering these service solutions thus becomes highly complex and require the integration of capabilities which typically not all reside within the boundaries of the focal organisation. In order to reduce this complexity, organisations within this domain are required to establish and coordinate business networks in order to be able to offer these complex service solutions. As such, business collaborations are expected to emerge between transport or logistic organisations, municipalities, (road) authorities, IT or equipment providers, but will also include the user or consumer as a key stakeholder for establishing suitable service solutions. Moreover, driven and reinforced by rapid technological change and digitization, requirements to these service solutions may change rapidly over time. As such, in order to maintain a strong position in the market, organisations are required to create business agility in order to cope with dynamically changing customer demands.

Reducing service complexity and creating and increasing business agility requires a tight integration between the *what* and *how* of business practices: what strategy and business models does the organisation follow and participate in and how will these will these plans be executed and supported through IT. Organisations are required to redesign business practices in order to accommodate a service-dominant perspective. This is not a trivial task and should be supported through an approach which takes the premises of service-dominant business at its core to adequately redesign business practices. The BASE/X framework is such an approach.

2.2. BASE/X Framework

BASE/X is a business engineering framework catered to a service-dominant perspective, and covers the definition and design of the entire business spectrum, including key constructs as business strategy, business models, service compositions and business services. The framework is conceptualized in such a way that all constructs are tightly aligned and build upon each other. The framework takes two premises at its core in order to cope with service complexity and the need for business agility.

- Firstly, the framework takes an explicit focus on providing business services, creating *value-in-use* for the customer. Business services can differ per organisation and can be integrated in order to create service solutions which adhere to the preferences of the customer. Note that the customer is also an essential stakeholder within this collaboration.
- In order to create service solutions, business networks between organisations / parties are to be generated and orchestrated. Given the dynamicity and volatility of customer and market demands, these networks should moreover be dynamic and should as such facilitate the fast integration, recombination or exclusion of stakeholders in business networks.

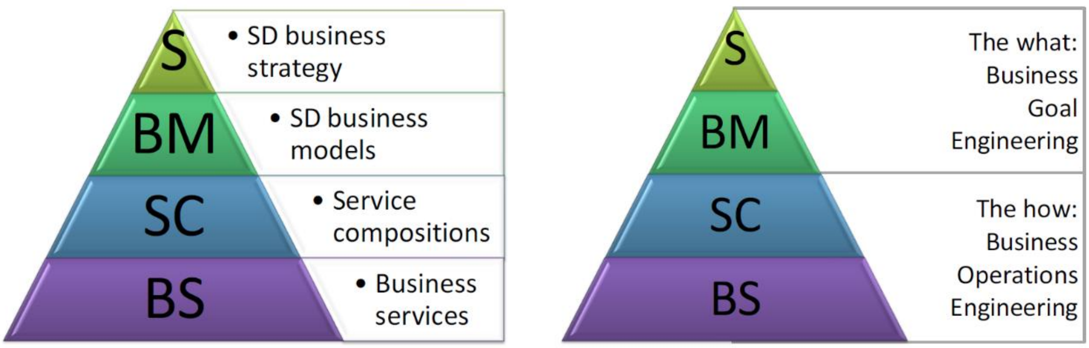


Figure 1: BASE/X business design pyramid

The BASE/X framework consists of four layers to design service-dominant business (Figure 1). The top layer concerns the business strategy of an organisation, which describes its identity and the (long-term) goals the organisation desires to achieve. The business strategy is relatively stable in nature and evolves over time. Consequently, the abstract strategy is (partially) translated into concrete service-dominant business models (the second layer). Each business model presents the collaboration between organisations, parties and the customer, the service solution in terms of market offerings created through this collaboration and the value-in-use it produces. Given the volatility of market demands, business models are required to change quickly over time and as such are agile in nature. Both the business strategy as the business model layer describe the 'what' of business, describing which strategic direction and goals an organisation pursues and how the organisation plans to achieve these goals.

The bottom layer describes the fundamental business services of an organisation, and as such describe the service capabilities that an organisation in essence can deliver. The set of business services should be created in such a way that these adequately represent the strategy the organisation desires to pursue. They represent the essential building blocks of the organisation. As such, these services should also be relatively stable over time. The third layer describes the service compositions, and details how the fundamental business services of an organisation, but also the business services of other stakeholders within the business network, should be composed in order to realise the planned service-dominant business models. Given the interrelated nature between business models and service compositions, service compositions are also agile in nature and evolve rapidly over time. The business services and service compositions represent the 'how' of business, describing how the strategic plans of the top layers will be realised.

As we focus on generating service-dominant business models for providing C-ITS solutions within this project, we take an explicit focus on the business model layer.

2.3. Service-dominant Business Model Radar (SDBM/R)

The business model in essence describes the logic of how value is created for the customer, the costs and benefits that emerge from the business model as well as how the outcomes of the model relates to the strategic decision making of the organisations involved [10]–[12]. Several tools have been proposed for guiding the design of business models. A prominent example is the Business Model Canvas (BMC) [9]. However, these approaches usually do not adopt a service-dominant perspective and do not accommodate a networked view of business models, in which value is created through a collaboration of multiple organisations. Therefore, for designing service-dominant business models, BASE/X is accommodated by a business model design tool proposed in [8], [13] which takes service-dominant logic as the basis called the Service-dominant Business Model Radar (SDBM/R) (Figure 2).

Figure 2: Template of SDBM/R

At the heart of the radar is the co-created value-in-use, which describes the value of the proposed service solution for (and with) the customer. The central co-created value-in-use is encapsulated by three outer rings, for which each ring is divided into slices based on the number of stakeholders involved (and as such created a networked view). As such, each 'pie slice' represents the organisation-specific contributions needed or obtained to create the central value-in-use. The actor value proposition ring describes the value contribution that each stakeholder offers in order to create the central value-in-use. This value proposition may be directly related to or part of the central value-in-use (core partner) or may enhance the value proposition of other stakeholders (enriching partner). The actor coproduction activity ring describes the activity an organisation conducts or performs in order to offer their respective value proposition. Lastly, the actor costs and benefits ring describes the specific costs and benefits which each stakeholder accrues or generates when participating in the business model. These costs and benefits can be *financial*, but also *non-financial* (for instance social or environmental benefits) in nature.

3. Design of Business Model Blueprints

In the following subsections, we will present the business model blueprints that were developed in collaboration with relevant stakeholders at the C-MobILE local sites.

In presenting each blueprint, first, we briefly introduce the C-ITS service(s) involved in the mobility solution targeted by the business model. Next, we describe the business model scenario including the SDBM/R that reflects the blueprint design. Finally, we focus our attention on the actors involved in the model and their cost/benefit structure. For some blueprints, we also present potential variants that can be implemented as alternatives.

Table 2: List of C-MobiLE business model blueprints for C-ITS Services

ID	Business Model Blueprints	Section
BM1	Comfortable Commuting by Bike through Traffic Light Prioritisation for VRUs	Section 3.1
BM2	Optimized Driving Experience through Green Light Optimal Speed Advisory	Section 3.2
BM3	Hassle-free Concert Experience through Mode and Trip Time Advice	Section 3.3
BM4	Reliable Arrival Times through Mode and Trip time Advice	Section 3.4
BM5	Green and Comfortable Commuting through Urban Parking Availability	Section 3.5
BM6	Safe Travelling Experience by Warning System for VRUs	Section 3.6
BM7	Safe Driving Experience with Warnings Bundle	Section 3.7
BM8	Efficient and Effective Public Services via Green Priority	Section 3.8
BM9	Fast and Safe Travel of Emergency Vehicle via Green Priority and Emergency Vehicle Warning	Section 3.9
BM10	Efficient Freight Delivery in an Urban Area with Parking Availability	Section 3.10
BM11	Reliable and Efficient Transportation via Traffic Information Provisioning (Bundled)	Section 3.11

3.1. Comfortable Commuting by Bike through Traffic Light Prioritisation for VRUs

3.1.1. Introduction to applied C-ITS service

"Traffic light prioritisation for designated VRUs" or "Cooperative traffic light for VRUs" aims to increase the safety and comfort of pedestrians or cyclists in traffic through warranting priority or additional crossing time (i.e., extending the green light phase or lessening the red phase). As such, a more regular flow or speed can be maintained whilst cycling, improving the comfort of the user. The service can be catered to the needs or characteristics of the user or can be altered for special conditions (such as the weather). More details about the service and related use-cases are available in the deliverable D2.2 [14]

3.1.2. Business model scenario

In this business model, an *employer* (an organization or a business or industrial zone) aims to endorse or stimulate cycling as the mode of commuting for its *employees*. This is with the aim to reduce traffic in the vicinity of the business premises, and to reduce the need for parking spaces for cars on location. To foster this, a *service provider* offers priority crossing for cyclists via a smartphone application, which can be activated through software codes. These software codes are bought by the *employer*, which distributes these codes to its *employees* that commute or will commute by bike. The service can be adapted or customized to fit the needs of the user or the environment (i.e., can only be activated during rush hours).

In order to operate the service, floating data is collected concerning the location and travel direction of the user through the smartphone application. The application will run in the background; as such, no interference of the cyclist is needed. Moreover, traffic lights are equipped with C-ITS applications, allowing the application to interact with these systems. Once the cyclist (carrying an active smartphone application) approaches the traffic light, two scenarios can occur. In case of a red light, increased priority is given to the VRU by activating the green light quickly and allowing the cyclist to continue with reduced waiting time. In case of a green light, the duration is extended to support the flow.

The blueprint business model, which emerged in the pilot site workshop in North Brabant, is given in Figure 3.

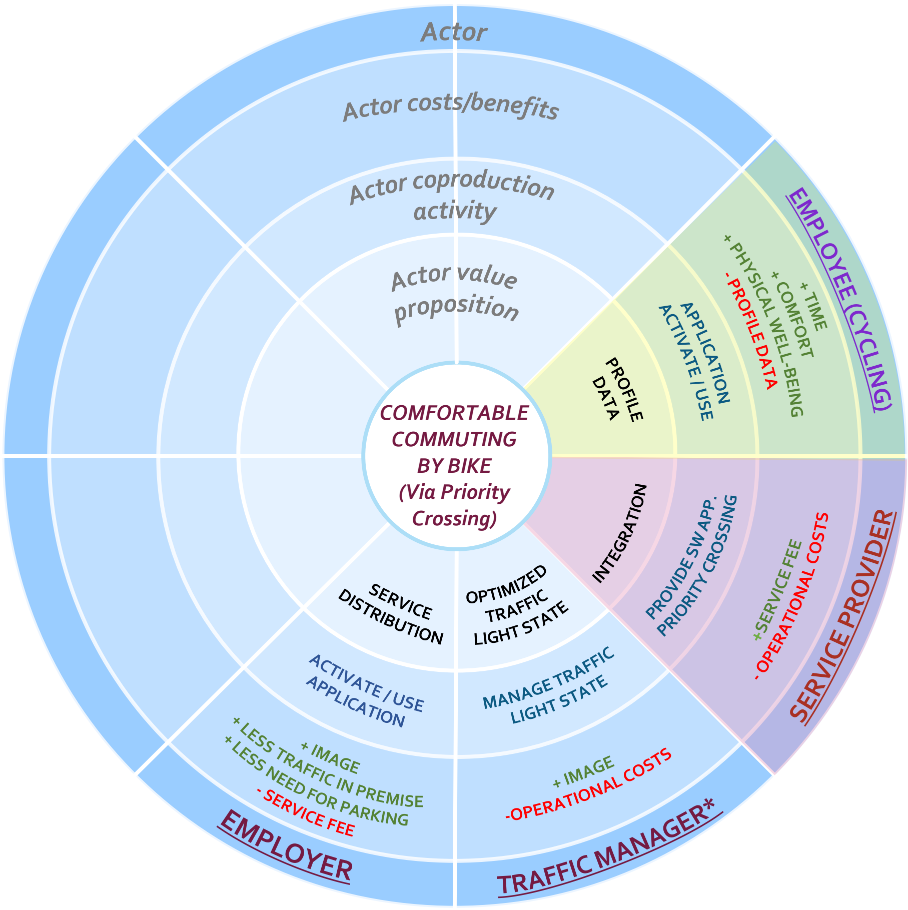


Figure 3: Business model radar for comfortable commuting by bike

3.1.3. Value in use

The co-created value in use is the comfortable commuting by bike to employees who commute or will commute by cycling. The comfort implies that the cyclist can maintain a regular speed or flow whilst cycling and is either interrupted less frequently at intersections or can more quickly continue his or her journey after a stop.

3.1.4. Actors in business model

3.1.4.1. Employee (customer)

The employee (cyclist) uses the code to activate the application, which runs in the background and interacts with traffic lights (and associated systems at intersections). The application tracks the location and direction of the employee and integrates this data with traffic light state information in order to provide traffic light prioritisation to cyclists. This service can be customized or adapted based on the user's characteristics or profile (i.e., handicapped or elderly user). Therefore, the value proposition of the employee is to provide (profile) data, which is generated through the coproduction activity of activating and using the software application. The employee benefits from shorter travelling and increased comfort, as stops at traffic lights are decreased or even avoided. Moreover, employees may also benefit from increased physical well-being as a more stable and regular flow and speed can be maintained whereas stress can be largely avoided whilst cycling. As a cost, the employee has to provide profile and/or location data, particularly if the service should be customized to the user's needs.

3.1.4.2. Service provider (orchestrator)

The service provider provides traffic light prioritisation to its users. The service depends on integrating floating cyclist data with traffic light state data in order to provide priority to approaching cyclists at a specific traffic light. This data is consequently forwarded to the traffic manager. Therefore, the value proposition of the service provider is to *integrate* both sources of data in order to provide the service to the employee. As coproduction activity, the service provider provides the software application to operate the service and integrate both streams of data. The service provider benefits from *service fees* paid to activate and using the service, whereas *operational costs* are incurred to manage and maintain the software application and service.

3.1.4.3. Traffic manager (core partner)

The traffic manager* (or in case integrated, *the municipality*) is responsible managing the traffic lights and providing optimized traffic light states for cyclists using the service application. Based on the integrated data received from the service provider, the traffic manager warrants either priority to additional crossing time at traffic lights (i.e. either faster time to green or extended green). Therefore, the value proposition of the traffic manager is to offer *optimized traffic light states*, which is offered through the coproduction activity of *managing traffic light states*. The traffic manager benefits from a more *eco-friendly* or *green image*, as the business model stimulates commuting by bicycle instead of car. Moreover, as priority is given to cyclists, a *less stressful and safer experience to cyclists* can be offered, whereas accidents can be avoided. In turn, this should further benefit the traffic *image*.

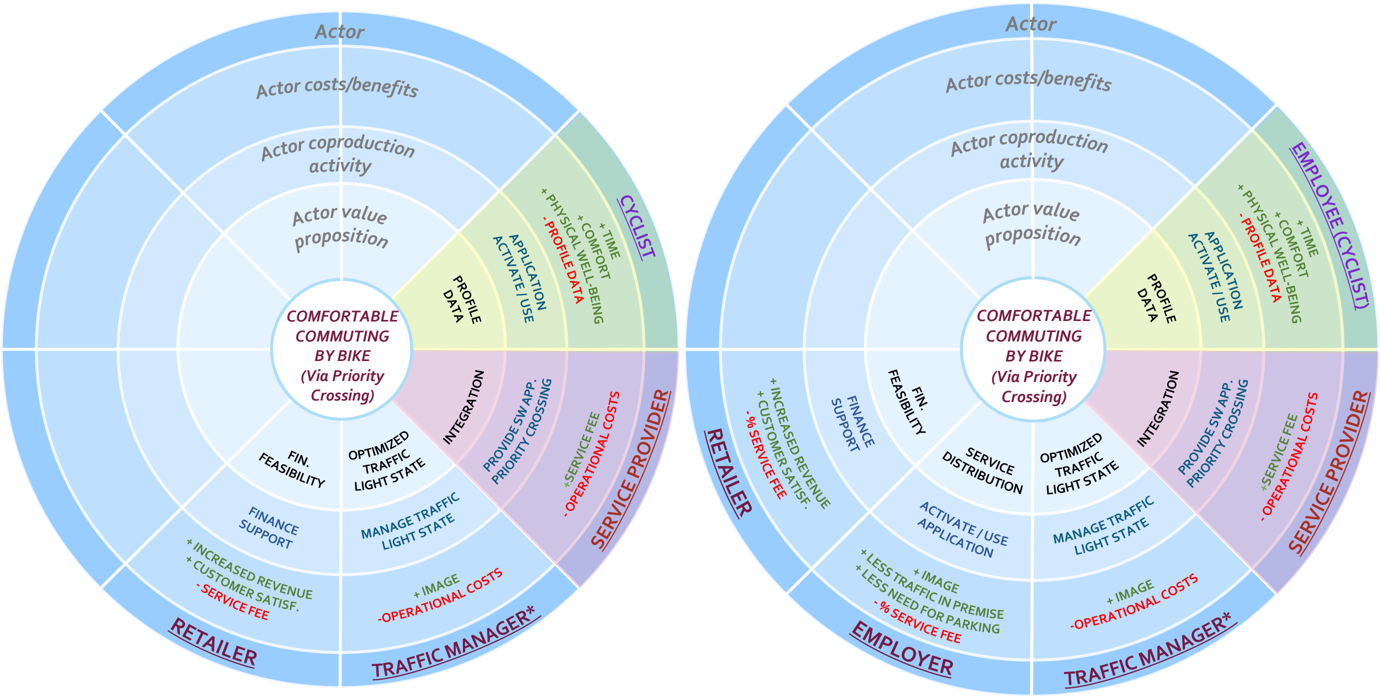
3.1.4.4. Employer (core partner)

The employer wishes to stimulate its employees to commute by bike. The role of the employer is to distribute the service through buying and offering the codes to its employees. Therefore, the value proposition of the employer is *the distribution of the service*. The employer does so through the coproduction activity of *promoting the use of the application*, which incorporates financing the codes, distributing the codes of employees who commute or will commute by bike and further promoting the service. The employer will benefit from *less traffic in less premises of the business area,* as use of the car is avoided. Moreover, this will also result in *a decreased need for parking spaces on-site*. As a cost, the employer will pay a service fee per employee to the service provider.

3.1.5. Business model variants

3.1.5.1. Retailers

The business model can potentially be further financed through including retailers, or retailers can even account for all service fees, allowing the service to be offered to a wider public. The service generates profile and regular routing information of the cyclists which can be used to provide customized promotions for the commuters. Retailers might be interested in advertising products or services through the application if the data profile shows that cyclists take a route on which the retailer is located or in the vicinity. As such, revenues can be increased for retailers, which can partially accommodate for the service fees to stimulate the adoption of the service (which can then be offered freely through the service provider). Examples of these



business model scenarios are given in Figure 4.

Figure 4: Business model radars for financing comfortable commuting by bike

3.1.5.2. Traffic light prioritization for pedestrians

The ‘traffic light for VRUs’ service can be used also for promoting safety for elderly and/or handicapped pedestrians in urban areas. For instance, the municipalities can use the service to provide more comfortable and safer walking experience for its elderly and handicapped citizens. The service can be used to extend the green-light duration in crossings through the use of the software application. Following a similar scenario in the business model depicted in Figure 3, the employer can be replaced by municipalities, insurance companies, or non-profit organizations aiming at improving the quality of life for elderly and handicapped (a blueprint of this business model can be seen in Figure 5).

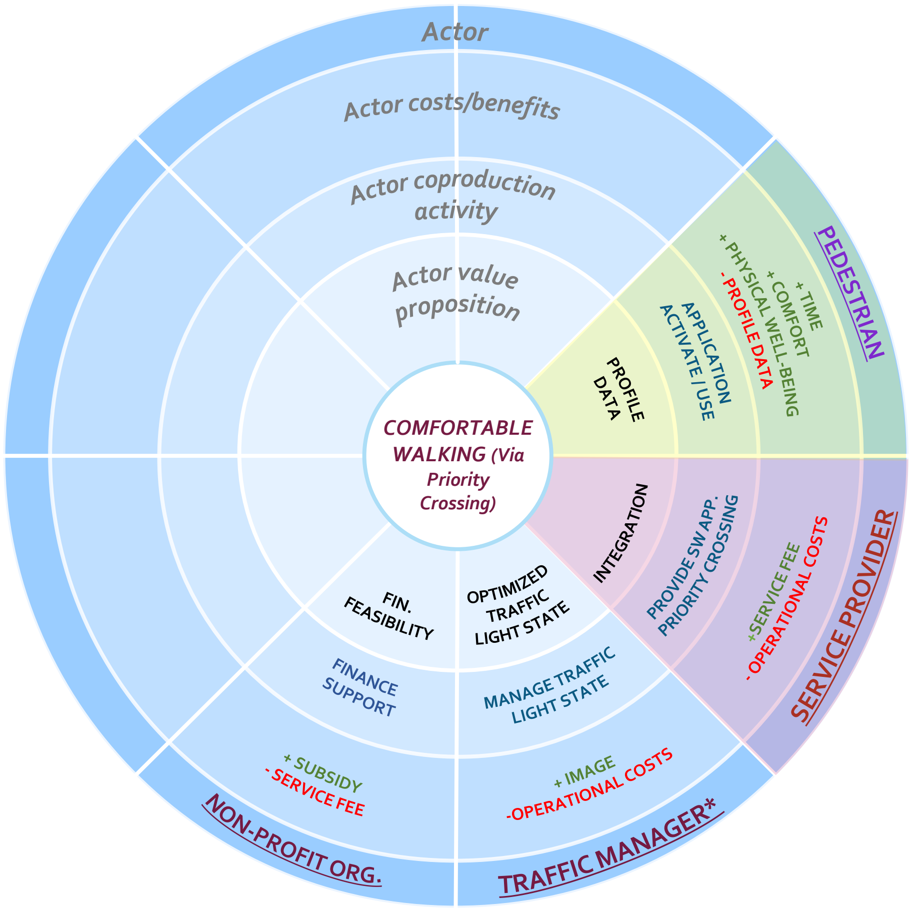


Figure 5: Business model radar for comfortable walking

3.2. Optimized driving experience through Green Light Optimal Speed Advisory (GLOSA)

3.2.1. Introduction to applied C-ITS service

“Green light optimal speed advisory” (GLOSA) or “dynamic eco-driving” provides drivers an optimal speed advice when they approach to a signalized intersection. This advice may involve maintaining actual speed, slowing down, or adapting to a specific speed, allowing the user to reach a green light and minimize fuel consumption and emissions. If a green traffic light cannot be reached in time, GLOSA may also provide information on time-to-green when the vehicle has stopped. Application of GLOSA takes advantage of real-time traffic sensing and infrastructure information to communicate to users an optimal speed advice. The service enables the user to experience more eco-friendly and comfortable driving, as a more regular speed can be maintained, whereas unnecessary braking or stopping can be diminished or avoided which in turn should benefit the environment. More details about the service and related use-cases are available in the deliverable D2.2 [14]

3.2.2. Business model scenario

In this business model, *car drivers* can use and benefit from the GLOSA service offered by the *service provider* to create a more eco-friendly and comfortable driving experience. This is with the aim to reduce pollution and improve the flow of traffic, as *car drivers* are informed of traffic behaviour and can use this information to improve decision making with regards to their speed. In order to effectively benefit from this application, the service is offered on a free basis to car drivers to increase its adoption. As more *car drivers* adopt the service, increased effects on traffic flow and reduction of pollution can be experienced. *Car drivers* will be able to use a software application (either an on-board unit or smartphone application) which tracks the speed and location of the user, and integrates this data with real-time traffic data. Accordingly, when a *car driver* approaches to a traffic light, the application calculates an optimal speed advice for the driver, taking into account the current speed and location of the driver as well as the state of the upcoming traffic light. If the traffic light is green and can be reached in time, the application advises the car driver to adopt a certain driving speed in order to facilitate this. If a green traffic light cannot be reached in time, or in case the traffic light is red, the application provides information on time-to-green, allowing the user to decide on the appropriate driving speed accordingly. As such, the driver can maintain a more regular driving speed as stops and/or braking at traffic lights can be decreased or even avoided.

The blueprint business model, which emerged in the pilot site workshop in Thessaloniki, is given in Figure 6.

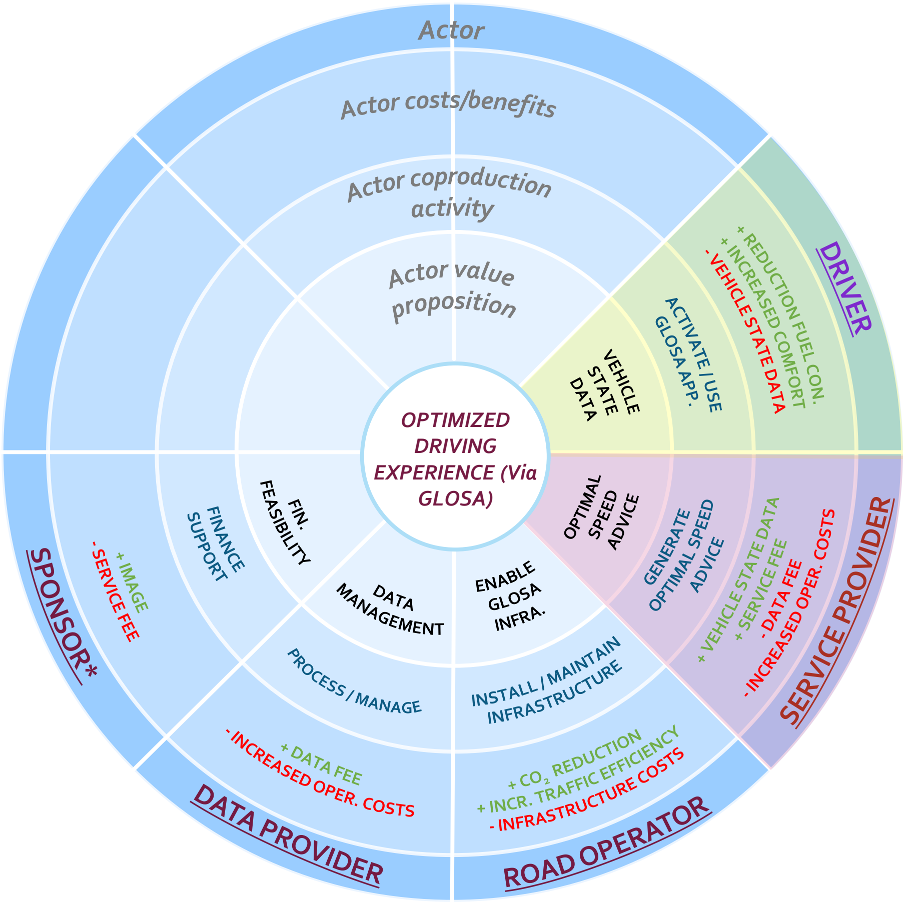


Figure 6: Business model radar for optimized driving experience with GLOSA

3.2.3. Value in use

The co-created value in use is the optimized driving experience to car drivers. Optimized implies that the car driver can maintain a more regular speed whereas unnecessary braking or stopping can be diminished or avoided which in turn should benefit the environment. In turn, this should allow the user to drive more comfortably and eco-friendlier.

3.2.4. Actors in business model

3.2.4.1. Car driver (customer)

The car driver uses the software application (either an on-board unit or smartphone application) to receive optimized speed advice. The application tracks the speed, location and direction of the user and can interact with upcoming traffic lights to collect state information. Accordingly, when a user approaches a specific traffic light, the user is either advised to maintain the current speed or accelerate in order to reach the next traffic light on time, or advised to slow down in order for the traffic light to turn green again, in case the current state is red. In order for the service to be effective, vehicle state data with regards to the car driver's location, speed and direction is required. Therefore, the value proposition of the car driver is to *provide vehicle state data*, which is generated through the co-production activity of *activating and using the GLOSA software application*. In turn, the car driver benefits from a *reduction of fuel consumption*, as unnecessary braking and acceleration is reduced. Moreover, as a more regular speed can be maintained, the car driver should experience *increased comfort* while driving. As a cost, the car driver has to provide *vehicle state data*, which may influence the privacy of the car driver.

3.2.4.2. Service provider (orchestrator)

The service provider is responsible for generating an optimal speed advice for car drivers, based on integrated traffic and user data (received from the data provider). The service provider moreover should ensure that the software application is maintained, in order to warrant that an optimal speed advice can continuously be offered to users. Therefore, the value proposition of the service provider is the *optimal speed* *advice*, which is conducted through the co-production activity of *generating this advice*. The service provider will benefit from a *service fee* for offering the service, whereas the provider will also become owner of the *vehicle state data* (which may be sold on or used in different business models). The service provider will incur costs for receiving the (useable) *user data*, whereas *operational costs* will be incurred for managing the service.

3.2.4.3. Road operator (core partner)

In order for the application to be able to interact with nearby or oncoming traffic lights, the traffic lights should be connected to or equipped with roadside units which can communicate with the service application. In turn, the application can collect data with regards to traffic light state information and calculate an optimal speed advice accordingly. Therefore, the value proposition offered by the road operator is the *enabling of the GLOSA infrastructure*. This is achieved through the co-production activity of *installing and maintaining the GLOSA infrastructure*. Enabling the service allows car drivers to maintain a more regular speed and drive more eco-friendly. In turn, this should benefit the road operator through a *reduction in CO_2-emissions* and an *improved traffic flow and efficiency*. The road operator will however incur costs for installing and maintaining the necessary GLOSA infrastructure.

3.2.4.4. Data provider (core partner)

The data provider is responsible for collecting and transforming the raw data collected by the software application into usable data elements, which consequently is transferred to the service provider. Therefore, the value proposition of the data provider is *data management*, which is offered through the co-production activity of processing and managing the raw data. The data provider receives *a fee* for transforming the data, whereas *operational costs* are incurring for doing so.

3.2.4.5. Sponsor (core partner)

In order for the service to be effective, use of the service should be stimulated through a sponsor. The city or municipality can participate as actor in the business model as sponsoring or financing partner. In this scenario, the municipality is responsible of financing the increased operational costs of the business model, allowing the service provider to offer the service to the car driver for free. Therefore, the value proposition of the city or municipality is the *promotion and distribution of the service*. This is conducted through the co-production activity of *financing and promoting* the service. In turn, the city will benefit from an *improved image*, as effort is put in creating a more efficient and eco-friendly traffic scenario within the city. As costs, the city will accommodate for the service fees to stimulate the adoption of the service (and thus its effectiveness).

3.2.5. Business model variants

3.2.5.1. Private companies as sponsors

The business model can potentially also be financed through including private companies rather than municipalities as sponsor for providing the service. As the business model stimulates eco-friendly behaviour, sponsors can benefit from increased image and corporate social responsibility (e.g. contributing to decreasing CO_2 emissions). As example, oil or gas companies may be included to improve their corporate social image. Similarly, as a more regular flow of traffic can be maintained, whereas users are informed of time-to-green for upcoming traffic lights, users may be less inclined to take risks and reach a green light in time. In turn, accidents may be avoided. A decrease in accidents can be an incentive for insurance companies to participate as a sponsor, as (part of) the costs for offering the service can be compensated through a decrease in insurance pay outs.

3.2.5.2. Fleet owners as customer

The service solution can also be catered to fleet owners (replacing car drivers) which represent all taxi, public or private transportation drivers. As such, the value in use will change to *optimized transport (via GLOSA)* .The fleet owners can finance the service directly, and will distribute the service over its drivers. Consequently, the fleet owners will benefit from reduced fuel consumptions over their entire fleet which may offset the costs of buying and distributing the service. An example of this business model is presented in Figure 7.

3.2.5.3. Bundling to stimulate adoption of car driver

Adoption of the service may also be stimulated through bundling the service which extends the value offered to the car driver. The bundle may involve - apart from GLOSA, services on navigation and hazardous location notifications. In this case, the need for the sponsoring partner can be reduced and the driver can be asked for fee to accommodate for the operational costs of other parties.

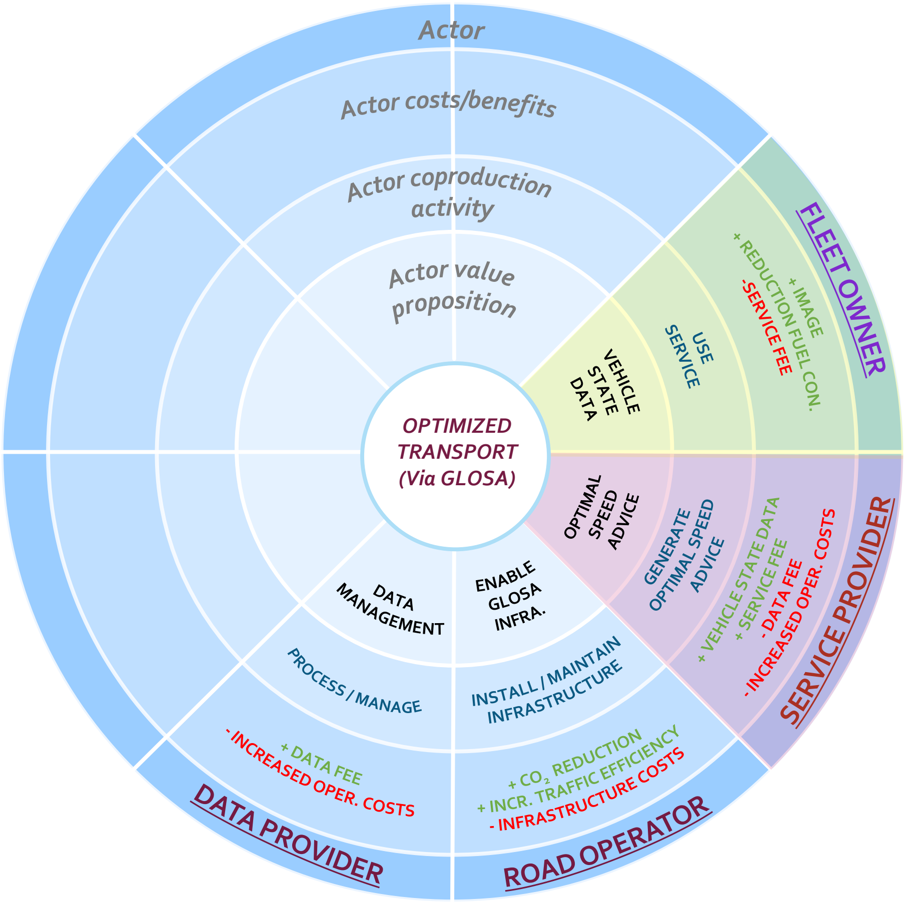


Figure 7: Business model radar - fleet owners as customer

3.3. Hassle-free Concert Experience through Mode and Trip Time Advice

3.3.1. Introduction to the applied C-ITS service

Mode & trip time advice (e.g. by incentives) aims to provide a traveller with an itinerary for a multimodal passenger transport journey, taking into account real-time and/ or static multimodal journey information. Based on user data with regards to the user's current location and desired destination, and taking into account traffic data with regards to density, congestion and flow, the service can provide an optimized multi-modal advice on how to venture efficiently through a specific area. The service enables the user to enjoy a more comfortable and efficient travel experience, as traffic stress can be largely avoided whereas (waiting) time in traffic can be decreased. More details about the service and related use-cases are available in the deliverable D2.2. [14]

3.3.2. Business model scenario

In this business model, *event visitors* are stimulated to take public transport to visit a large event instead of travelling by car based on the density and flow of traffic near the event location. In order to do so, the *service provider* assesses the current traffic conditions at large events. Based on these conditions, the *service provider* may offer to *event visitors* free (or with increasing discounts based on traffic data) public transport tickets in order to stimulate *event visitors* to use a different mode of transport and reduce traffic at the event location. This will be accommodated by a travel advice with regards to connections between modes of transport, trip duration and expected departure and arrival times. As such, the *event visitor* will benefit from reduced travelling expenses and increased travelling comfort, as the *event visitor* does not have to endure traffic congestion at the event location, whereas *event visitors* can benefit from increased freedom from not having to manage the car.

The blueprint business model, which emerged in the pilot site workshop in Copenhagen, is given in Figure 8.

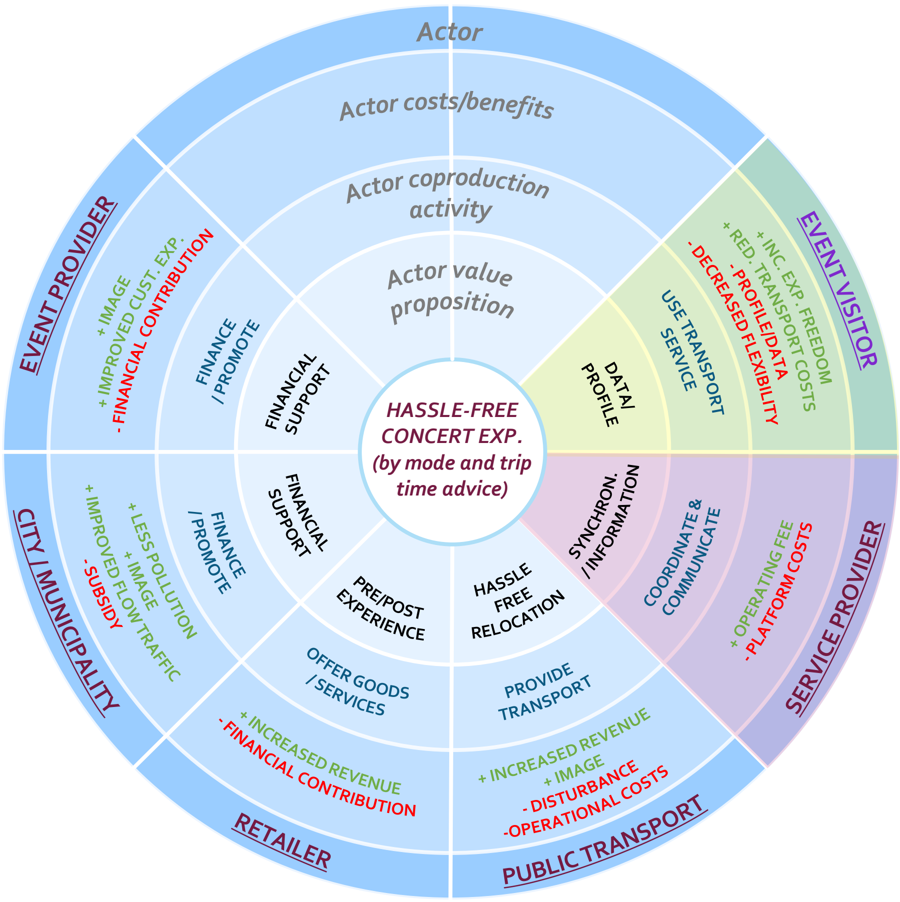


Figure 8: Business model radar for hassle-free concert experience

3.3.3. Value in use

The co-created value in use is a *hassle-free concert experience (through mode and trip time advice)* for event visitors. Hassle-free implies that by taking public transport instead to an event location instead of travelling by car, the event visitor will benefit from not having to worry about waiting in traffic, dealing with congestion or parking the car at the location, whereas the visitor can experience more freedom at the event location.

3.3.4. Actors in the business model

3.3.4.1. Event visitor (customer)

The event visitor can create an account on the platform of the service provider in order to access its services, which includes advice on itinerary for travelling to the event location, and may include discounts for public transport tickets (or even for free) depending on the current traffic conditions at the event location. The advice can be customized based on the preferences of the user as well as the specific offerings. The value proposition of the event visitor therefore is *profile data*, which can be used to customize the service offerings, but can also be used for financing the service. Profile data is generated through the co-production activity of *using the (transport) service,* as in order to access the service visitors have to create an account and indicate their preferences. As taking the car is avoided, the event visitor will benefit from *increased freedom* (or *decreased hassle of managing the car*, e.g. the event visitor can enjoy a drink*)*. Moreover, since tickets will be offered at reduced rates, the event visitor will benefit from *less transport costs*. As a cost, the event visitor should present profile data, which may influence his or her privacy. Furthermore, as the event visitor is bound to public transport arrival and departure times, the event visitor has *less travel flexibility*.

3.3.4.2. Service provider (orchestrator)

The service provider is responsible for offering the platform which event visitors can use to receive information with regards to the optimal mode of transport to take as well as how to arrive at the event location, but also to buy and acquire tickets through. Moreover, acquiring the transport tickets (at reduced prices) as well as travel and arrival times should be synchronized with the public transport operator. Therefore, the value proposition of the service provider is to provide *information and synchronisation*. This is conducted through the co-production activity of coordinating and communicating relevant information through the platform to stakeholders. The service provider will incur *platform costs* for offering the service, for which a fee will be obtained as compensation.

3.3.4.3. Public transport operator (core partner)

The public transport operator is responsible for transporting the event visitors to the event location. The value proposition of the public transport operator therefore is *hassle free relocation*, emphasizing that the event visitor will obtain a comfortable and efficient travelling experience (in contrast to travelling by car). This will be conducted through the co-production activity of providing public transport. As taking public transport is stimulated, the public transport operator will benefit from *increased revenues* and *increased customers*, which in turn may benefit the *image* of taking public transport as a suitable travelling alternative. The public transport operator will however incur increased operational costs, whereas more disturbance (e.g. late arrivals, crowdedness) may be generated in public transport due to transporting more customers than usual.

3.3.4.4. Retailer (core partner)

Through offering reduced rates for early public transport tickets, event visitors may be stimulated to arrive early at the event location. Profile data of event visitors can be used by retailers to customize their offerings to become more appealing. Therefore, the value proposition of retailers is to take care of the pre and post experience of event visitors. The pre and post experience will be created through offering customized goods and services based on the profile data of visitors. Retailers will benefit from increased (attention of) customers, whom moreover can spend more as public transport tickets are offered at reduced rates. Part of these increased revenues can be invested in ensuring that the business model is financially feasible (e.g. covering for discounts on public transport tickets).

3.3.4.5. City / Municipality (enriching partner)

The city / municipality can be included as an enriching partner to further finance the service solution. As the municipality will benefit from *decreased pollution*, an *improved flow of traffic* and as such an *increased image*, the municipality may be willing to *subsidize* offering the service solution. As such, the value proposition of the municipality is to offer *financial support*, which is conducted through the co-production activity of *financing and promoting* the service.

3.3.4.6. Event provider (enriching partner)

The event provider is responsible for hosting the event, to which the service solution is catered. As the service solution may enhance the full customer experience for the event, the event provider may be stimulated to further support offering the service (through incurring costs of providing a *financial contribution* towards offering the service). As a result, the event provider will benefit from *increased image*, as event visitors will enjoy a hassle free experience, as well as *increased customer expectations* (as event visitors will go home more satisfied). This may further stimulate customers to buy tickets for future events. As a sponsoring party, the value proposition of the event provider is the *event experience*, which is offered through the co-production activity of *hosting the event*.

3.4. Reliable Arrival Times through Mode and Trip Time Advice

3.4.1. Introduction to the applied C-ITS service

Mode & trip time advice (e.g. by incentives) aims to provide a traveller with an itinerary for a multimodal passenger transport journey, taking into account real-time and/ or static multimodal journey information. Based on user data with regards to the user's current location and desired destination, and taking into account traffic data with regards to density, congestion and flow, the service can provide an optimized multi-modal advice on how to venture efficiently through a specific area. The service enables the user to enjoy a more comfortable and efficient travel experience, as traffic stress can be largely avoided whereas (waiting) time in traffic can be decreased. More details about the service and related use-cases are available in the deliverable D2.2 [14]

3.4.2. Business model scenario

In this business model, *truck companies* (fleet owners representing truck drivers) are offered more reliable arrival times at retailers based on trip time advice and floating traffic data. In order to so, *truck companies* (specifically *truck drivers*) present (real-time data) with regards to location, route and delivery destination. The *service provider* integrates this data with floating traffic data concerning the density and flow of traffic within the city. As such, an optimized routing advice accommodated by estimated trip times can be presented to the truck driver. This allows the truck driver to avoid traffic congestion, whereas more reliable estimates are obtained with regards to delivery arrival times. Reliability can be even further improved through incorporating delivery data of retailers, for which the expected arrival times of truck drivers can potentially be synchronized with delivery due dates of retailers. As the service solution offers more reliability to truck drivers, the truck drivers should benefit from less driver stress, which in turn should benefit their driving style (less accidents or driver incidents). This will improve the image of the *truck company*.

The blueprint business model, which emerged in the pilot site workshop in Copenhagen, is given in Figure 9.

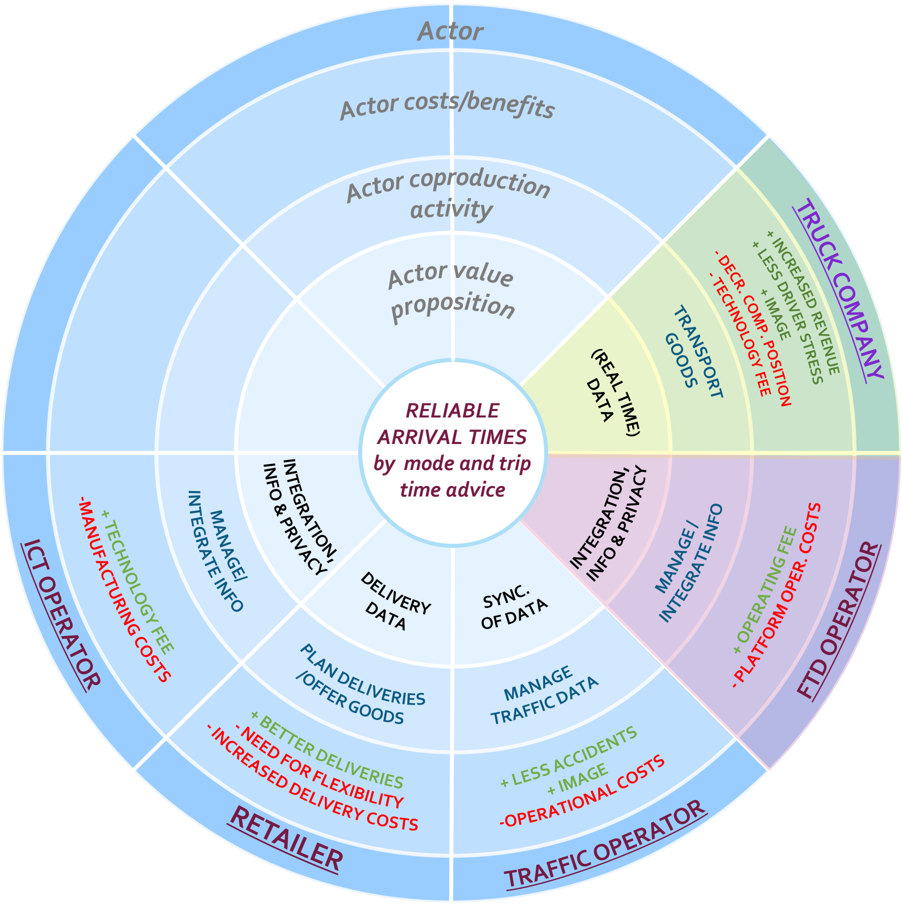


Figure 9: Business model radar for reliable arrival times

C-MOBILE

3.4.3. Value in use

The co-created value in use is reliable arrival times (through mode and trip time advice and floating car data) for truck companies. If arrival times are more reliable, truck drivers should experience less stress, which in turn should benefit the image of truck companies.

3.4.4. Actors in the business model

3.4.4.1. Truck companies (customer)

The truck companies co-create the value in use through providing (real-time) data with regards to the location, route and destination of its truck drivers. This data will consequently be used by the service provider to generate an optimized advice to truck drivers to improve their delivery time reliability. The value proposition of truck companies therefore is the *(real-time data)*, which is generated through the co-production activity of transporting goods and services to retailers. As benefits, *truck drivers will experience less stress while driving* (as more certainty is created with regards to delivery reliability), whereas truck companies will benefit from *increased revenues* (as deliveries are more on-time) and *improved image* (which can be related to *increased reliability*, but also to *a decrease in road accidents*, as stress is avoided). As costs, the truck companies will have to pay a *fee for using the service*, whereas presenting (real-time) data may *impact their competitive position* (due to competitors using this data to improve their own logistic processes).

3.4.4.2. Service provider (orchestrator)

The service provider is responsible for offering an optimized trip advice to truck drivers, based on (real-time) truck data and floating traffic data. The service provider therefore has to take care of integrating both streams of data, generating trip advice to truck drivers, but also ensure that data is treated carefully (with regards to security). The value proposition of the service provider thus is to provide *integration, information and privacy*. This is offered through the co-production activity of managing and integrating the streams of data. The service provider receives *an operating fee* for providing the service, whereas *platform operating costs* are incurred to operate the service.

3.4.4.3. Traffic operator (core partner)

The traffic operator takes care of generating and synchronizing traffic data, which should be integrated with real-time truck data to provide optimized trip advice. Therefore, the value proposition of the traffic operator is the *generation and synchronization of traffic data*, which is conducted through the co-production activity of managing the traffic data. As truck drivers will experience less stress while driving, *road accidents (involving truck drivers) can be decreased*, which can be considered as a benefit for the traffic operator. Moreover, as trucks are rerouted to avoid being stuck in traffic, congestion can be reduced, which should benefit the *image of traffic in the city*. The traffic operator incurs *operational costs* however for generating and synchronizing traffic data.

3.4.4.4. Retailer (enriching partner)

The retailer can further contribute to providing reliable arrival times by presenting delivery data with regards to planned due dates and delivery locations. This data can be used to further optimize the trip route and time advice for truck drivers to increase reliability. Moreover, advice can be presented on more flexible delivery due dates to further ensure reliability if necessary. Therefore, the value proposition of retailers is *delivery data*, which is generated through the co-production activity of planning deliveries and offering goods. The retailer will benefit from the service solution as deliveries are increasingly more likely to be on-time (*improving the quality of deliveries*). This can be further stimulated through more flexible delivery times, which would require the retailer *to increase flexibility* as a cost. Moreover, as reliability is improved, *the deliveries* may become *more expensive*.

3.4.4.5. ICT operator (core partner)

The ICT operator is responsible for installing and operating the necessary ITS infrastructure to generate traffic data (this may also be integrated under the traffic operator). As such, the value proposition of the ICT operator is to enable data collection, which is conducted through the co-production activity of managing and installing the ITS infrastructure. The ICT operator will benefit from a *technology fee* for operating the infrastructure, which should compensate the *manufacturing costs* that are incurred for doing so.

3.4.5. Business model variants

3.4.5.1. Municipality as sponsor

The current business model scenario would provide optimized route and trip advice to avoid trucks becoming stuck in traffic, but also as a consequence to avoid trucks creating traffic congestion. Decreasing congestion can moreover lead to decreased pollution from traffic and road accidents which may occur. These derived benefits are valuable for the municipality, which contribute to improving the image of the city. The benefits of the service solution however depend on the adoption of truck companies (and therefore truck drivers), as a larger adoption base can increase the added effects of the benefits. The municipality therefore may be inclined to financially support the service solution through covering for the service costs. The service thus can be offered 'for free' to truck drivers which should stimulate its adoption. The costs of financially supporting the business model are then offset by the decrease in pollution and traffic congestion, whereas the overall image of the city can be improved. Figure 10 presents an example of this business model.

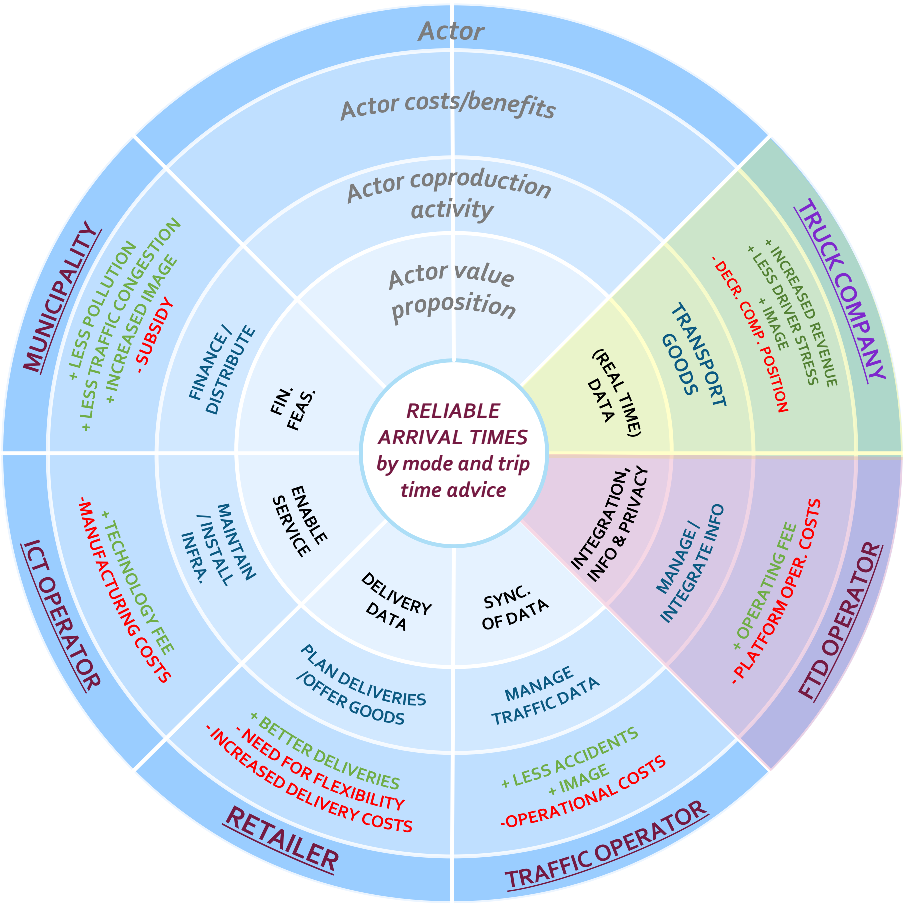


Figure 10: Business model radar for reliable arrival times – municipality as a sponsor

3.4.5.2. Integrating actors into different roles

The current business model treats the ICT operator as an explicit role, responsible for managing the ITS infrastructure necessary to operate the service. However, depending on the implementation of the service, this role may also be incorporated in other roles, as currently, the value proposition of the ICT operator is only to enable the service.

Similarly, it can be expected that the service operator chosen for the business model may also include the functionalities and value proposition that the traffic operator currently possesses, for instance when the service is offered by the traffic operator already (considering that the service builds on floating traffic data) or by (a branch) within the municipality. For Copenhagen, the current business model structure was deemed most suitable, however it may be expected that if the current structure is applied in different pilot sites, some actors may be integrated or omitted from the model. In such cases, one could even expect the roles of the ICT operator, traffic operator, municipality and FTD operator to converge (simplifying the model strongly).

3.5. Green and Comfortable Commuting by Urban Parking Availability

3.5.1. Introduction to the applied C-ITS service

Urban parking availability provides parking availability information to its users to make informed decisions about available parking places. The service aims to reduce congestion, time loss, pollution and stress caused by cruising for parking. Based on user data and parking availability data in the vicinity of the user (which can be collected through roadside units (RSUs) and / or on-board applications), the service offers an optimal advice to the user (through *in-vehicle signage*) with regards to the nearest available parking space, in order to minimize the search for a suitable parking location. The value of the service can be further enhanced through accompanying *urban parking availability* by *mode and trip time advice* to facilitate travelling from the parking location to the desired destination. This way parking outside of congested areas or high traffic city sections can be made more comfortable. Below, we discuss the application of this service bundle on a blueprint business model. More details about the services and related use-cases are available in the deliverable D2.2 [14]

3.5.2. Business model scenario

In this business model, the municipality (as representative of car drivers in the city) is offered green and comfortable commuting in the city through offering a service bundle including urban parking availability, mode and trip time advice and in-vehicle signage. A *service provider* offers a software application (either as a smartphone application or as on-board unit) to *commuters by car* which is financed by the municipality. The application allows car commuters to use the service bundle, which collects data on the location and desired destination of the user. This data is integrated with data on parking availability in the vicinity of the user. Consequently, advice and guidance is presented to the user on where to find the nearest suitable parking space, accompanied by mode and trip time advice to reach the desired destination from this parking space (if necessary). Preferably, parking spaces are selected outside of the city centre to avoid congestion in the inner city. To stimulate this behaviour of the user, public transport tickets are offered through the application for reduced tariffs or even for free, depending on the current traffic situation and behaviour in the city. As such, commuters by car are stimulated to avoid driving or cruising around the inner city to find a parking space, which should reduce pollution and driving stress. As such, a more green and comfortable commuting experience is created for car commuters.

The blueprint business model, which emerged in the pilot site workshop in Bordeaux, is given in Figure 11.

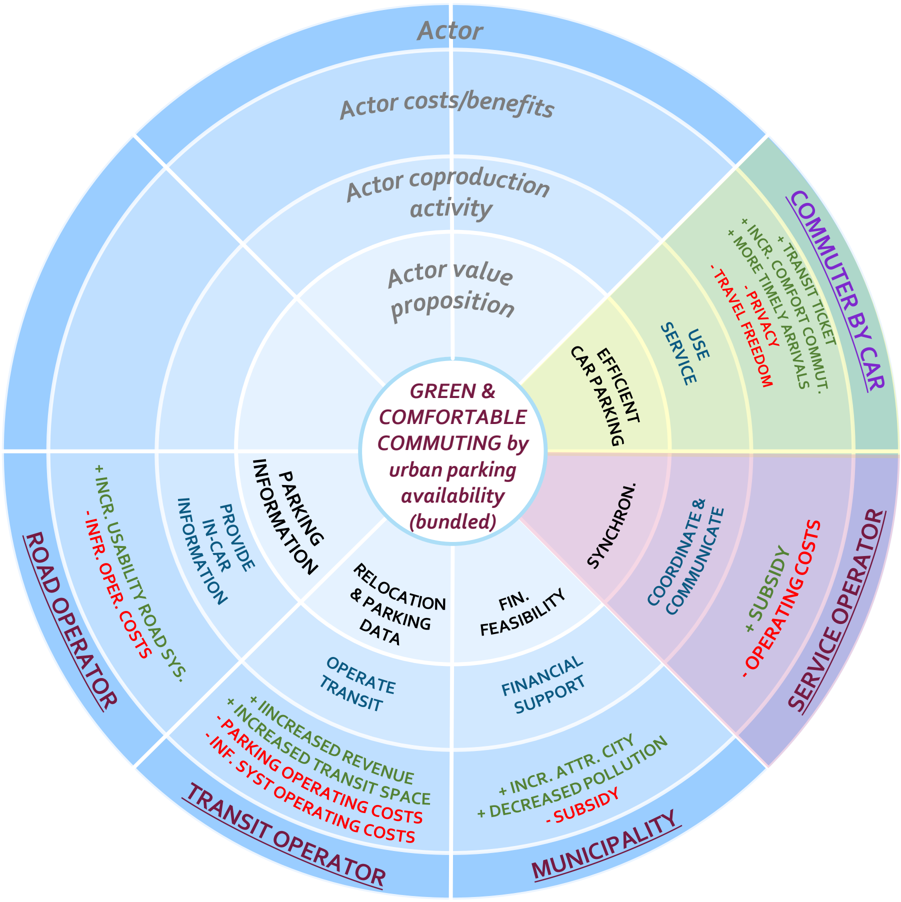


Figure 11: Business model radar for green and comfortable commuting

3.5.3. Value in use

The co-created value in use is green and comfortable commuting in the city (through a service bundle of urban parking availability, mode and trip time advice and in-vehicle signage). As unnecessary cruising for parking is avoided, a more eco-friendly commuting experience can be created. Moreover, through optimized mode and trip time advice, users can reach their desired destination without the hassle of stress when driving and searching for a suitable parking space.

3.5.4. Actors in business model

3.5.4.1. Commuter by car (customer)

The commuter by car can use the service through in-vehicle signage to receive advice and guidance on parking space availability. The feasibility of the value in use offered through the business model depends on the adoption of the service and the behaviour of the car commuter whilst using the service. Therefore, the value proposition of the car commuter is the *effective use of the service*, or *efficient parking of car*. If commuters by car are not stimulated to park outside of the inner city, the value in use decreases. This value proposition is offered through using the service (effectively). The car commuter will benefit from reduced tariffs or even free transit tickets through using the service. Moreover, as optimized and adequate advice is given on where to park and how to reach the desired location, an *increased comfortable commuting* experience should be obtained. In order to use the service, the users has to present location and destination data, which may *impact the privacy* of the user. Moreover, the user is bounded to public transport arrival and departure times, which may *impact his or her travel freedom*.

3.5.4.2. Service operator (orchestrator)

The service operator is responsible for generating parking advice and guidance, as well as providing mode and trip time advice on how to reach the desired location of the user from the parking space. Therefore, the service operator has to take care of integrating and synchronizing these streams of data in order to provide the service. Therefore the value proposition of the service provider is the *synchronization of data*. This is conducted through the co-production activity of coordinating the different streams of data and communicating with related business model stakeholders. As the model is subsidized through the municipality, the service operator benefits from *subsidies* for providing the service, whereas *operating costs* are incurred to do so.

3.5.4.3. Municipality (core partner)

The municipality will benefit from the service solution offered in the business model through *decreasing pollution* as traffic congestion is decreased and car drivers do not unnecessarily cruise around the city to find a suitable parking space. Moreover, the municipality will benefit from an *increased attractiveness of the city* (or *increased image)*. However, these benefits depend on the adoption of the service amongst commuters by car. Therefore, in order to stimulate this adoption, the municipality can finance the service, allowing the service to be offered for free to car drivers. Therefore, the value proposition of the municipality is to offer *financial feasibility* of the service, which is conducted through subsidizing the service. Logically, the municipality will pay *subsidies* as costs for supporting the business model.

3.5.4.4. Transit operator (core partner)

The transit operator (or public transport operator) takes care of transporting car commuters from their parking space to their desired destination. Moreover, as the transit operator can monitor and assess the parking space availability at metro, bus or train stops, parking information can be offered as well to benefit the service solution. As such, the value proposition of the transit operator is the *relocation of commuters and to provide parking availability data*. This is conducted through the coproduction activity of operating the transit. As car commuters are stimulated to take public transport to reach their desired location in the city, the transit operator will benefit from increased revenues, as more customers are attracted. Costs for offering tickets at reduced rates (as part of the service solution) are covered through the municipality. However, the transit operator does incur costs for monitoring parking availability (*parking operating costs)* as well as for maintaining the necessary *information system*.

3.5.4.5. Road operator (core partner)

The road operator takes care of providing the parking information to the commuter by car, based on traffic data and the location of the user (through in-vehicle signage). Therefore, the value proposition of the road operator is to offer parking advice to the car commuter, which is conducted through the co-production activity of providing in-car information. In order to generate traffic data, the road operator is required to install and maintain the necessary ITS infrastructure, and therefore will incur infrastructure operating costs. However, given that congestion is decreased, the road operator will benefit from a better usable road system (as the flow of traffic is improved).

3.5.5. Business model variants

3.5.5.1. Employers as promotor of service solution

Employers can be included as a sponsor in the business model, either through employers striving for a green and eco-friendly image (as corporate social responsibility), or through catering the service solution to commuters by car of a specific employer. In this scenario, employers cover (part of) the costs of offering transit tickets at reduced rates, and may distribute the service to its own employees. The employer therefore incurs costs of compensating the transit tickets, but in return may benefit from a green image, whereas its personnel can be more on-time as traffic congestion and inefficient cruising for parking is avoided. Moreover, employers can be subsidized for participating in the business model, as part of the costs now do not have to be covered by the municipality (note that part of the subsidies still cover service operating costs).

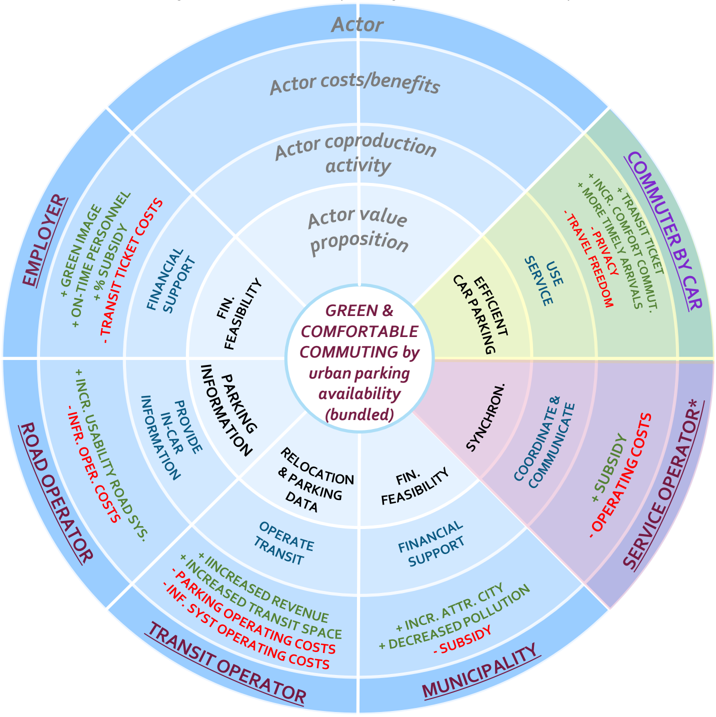


Figure 12 gives an example of this business model scenario.

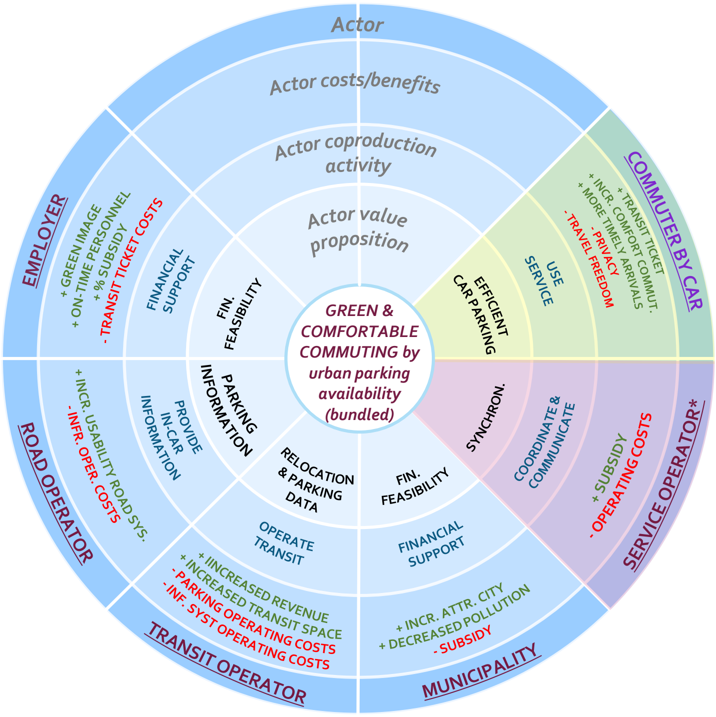


Figure 12: Business model radar for green and comfortable commuting - including employers

3.5.5.2. Parking provider as a core actor

Currently, the business model scenario considers and includes parking space which is available at the various public transit boarding locations (i.e. bus stops, metro or train stations). As such, it is assumed that responsibility over these parking spaces as well as their associated costs and benefits lie with the transit operator. However, parking can also be managed by explicit parking providers, and as such offer a wider variety of parking locations (i.e. off-street parking). In this scenario, the parking provider becomes a core actor within the model, and takes over part of the value proposition of the transit operator (*i.e. parking data and management*). In this scenario, the transit operator is responsible for relocating commuters to their desired location, whereas the parking provider manages the parking infrastructure and generates data on parking space availability. As costs and benefits, the parking provider benefits from *parking revenues*, whereas costs are incurred for *operating and maintaining the parking spaces*.

3.5.5.3. Including a Mobility as a Service (MaaS) provider

As opposed to public transport, *relocation of commuters* from a parking space to travel location can also be covered by a mobility provider (i.e. taxis or private mobility companies). In this scenario, the vehicle on-board unit or software application of the commuter can include the functionality to book or receive a ride at a certain location and time, as well as allowing the commuter to indicate where he would like to go. This will be synchronized to the mobility provider who can accordingly dispatch a suitable ride for the commuter. As opposed to the original business model scenario, it is likely that the costs of these rides are covered in a similar manner as using public transport. The mobility provider will consequently benefit from *revenues* that are accrued from relocating commuters, whereas costs are incurring for *operating the taxis*. The value of this service may even be further enhanced if combined with including a parking provider as a core actor (as parking space are more 'wide-spread' available, see above).

3.6. Safe Travelling Experience by Warning System for VRUs

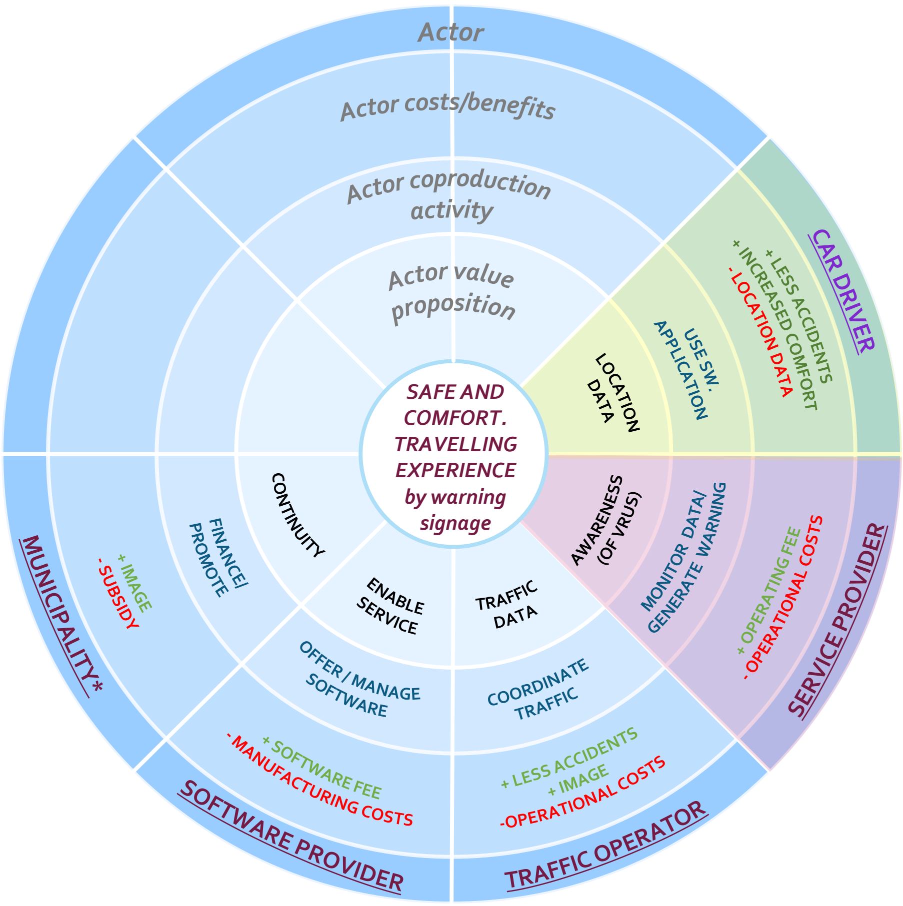
3.6.1. Introduction to the applied C-ITS service

Warning system for VRUs (not limited to crossings) aims to detect risky situations (e.g. road crossing) involving VRUs, allowing the service to warn car drivers or to automatically control the vehicle (e.g. braking) in case the situation requires immediate attention. The service is particularly valuable when the driver is distracted or visibility is poor. In order to operate the service, data is collected on the speed and location of the driver, which is integrated with data on VRUs in the vicinity. This data is collected via C-ITS systems installed next to the road or to traffic lights. Collection of data on VRUs can be operationalised through traffic cameras or movement sensors[1]. If a scenario occurs in which, based on the speed and location of both the driver and VRUs, a collision is expected, the service emits a warning signal (or automatically takes control) to avoid the collision. In turn, this should improve the safety of both the driver and VRU. The service can even be extended to also monitor the behaviour of other traffic users (e.g. car drivers, busses, trains). More details about the services and related use-cases are available in the deliverable D2.2 [14]

3.6.2. Business model scenario

In this business model, the *car driver* is offered a safe travelling experience through warning signage. The service is offered by the *service provider* through either a smartphone application or as an on-board unit. The application tracks the location, direction and speed of the car driver. The application can interact with roadside units (RSUs) which collect data on the behaviour of VRUs in the vicinity of the car driver. The service consequently analyses, based on both streams of data, whether a dangerous scenario may occur (e.g. a potential collision between the car driver and VRUs). If such a scenario is bound to occur, the service signals a warning to facilitate the car driver to react timely and adapt to the environment. As such, the service enhances the awareness of the car driver and improves his or her decision making. In turn, this should lead to a safer (and also comfortable) travel experience, as potential accidents can be avoided.

The blueprint business model, which emerged in the pilot site workshop in Copenhagen, is given in Figure 13.



[1] 'Warning system for VRUs' considers the (passive) detection of VRUs with regards to their behaviour (i.e. through traffic cameras or movement sensors in cars), see deliverable D2.2 [14]. Although data could actively be collected through smartphone applications, this is currently not considered (hence the VRU is not included as an actor in the model). This scenario however is included as a variant.

Figure 13: Business model radar for safe travelling experience

3.6.3. Value in use

The co-created value in use is a safe and comfortable travelling experience for car drivers (through warning signage). As warning signage facilitates car drivers to timely react to dangerous scenarios, and as such increases the awareness of the driver, accidents with VRUs can be avoided. In turn, this should create a more safe and comfortable travel experience for car drivers.

3.6.4. Actors in the business model

3.6.4.1. Car driver (customer)

The car driver is warned by the service (through in-vehicle signage) if a dangerous scenario (e.g. collision with VRUs or other traffic users) is bound to occur. In order to assess whether a dangerous scenario may occur, the service tracks the speed, location and direction of the car driver. Therefore, the value proposition of the car driver is to present *location* or *user data*. This data is generated through the coproduction activity of using the software application. As the car driver is signalled if a collision is bound to occur, *the number of accidents* can be *decreased* (or even avoided). The car driver benefits moreover from *increased comfort*, as driving becomes less stressful (especially in high-traffic environments). However, in order for the service to be effective, the car driver has to present *location data*, which may influence the privacy of the user.

3.6.4.2. Service provider (orchestrator)

The service provider is responsible for operating the service, specifically generating the warning signals if dangerous scenarios are bound to occur. As a result, the car driver can benefit from increased awareness and improve his or her decision making. Therefore, the value proposition of the service provider is to create *awareness (of VRUs)*. This is generated through the coproduction activity of monitoring the user and traffic data and consequently generating the warning. For providing the service, the service provider receives an *operating fee (or service fee)*, whereas *operational costs* are incurred to maintain / operate the service.

3.6.4.3. Traffic operator (core partner)

The traffic operator (or in case integrated, the city / municipality) is responsible for generating and distributing traffic data, specifically with regards to the behaviour of VRUs in the vicinity of the car driver. This data consequently is integrated by the service provider to provide warning signage when needed. As such, the value proposition of the traffic operator is the *traffic data*, which is generated through coordinating or monitoring the behaviour of VRUs. This may also be extended to other traffic users to further enhance the service. The traffic operator benefits from *less accidents* as awareness of the driver is increased, which in turn will also lead to an *improved image of traffic* within the city or municipality. For generating the required traffic data, *operational costs* are incurred.

3.6.4.4. Software provider (core partner)

The software provider has to take care of providing and maintaining the platform on which the service will operate. As such, the value proposition of the software provider is *enabling the service*, which is conducted through the coproduction activity of providing and managing the software. The software provider receives a *fee* from the service provider to provide and maintain the software, whereas *manufacturing costs* are incurred in order to maintain and update the software.

3.6.4.5. Municipality (core partner)

In order to stimulate the adoption of the service, the service can be offered for free to car drivers. To compensate for the costs incurred of offering the service, the municipality can act as a sponsoring party. The municipality as such *subsidizes* the service to increase adoption amongst car drivers. As the amount of potential accidents is reduced, the municipality benefits from an *improved image of the city* (which may validate financing the service solution).

3.6.5. Business model variants

3.6.5.1. Insurance companies as sponsor of service

The business model can also be financed through including insurance companies, which can distribute and promote the service over car drivers in their insurance package. As the amount of accidents is decreased (or even completely diminished), insurance companies less frequently are required to pay out to compensate for incurred damages. Therefore, stimulating safe (and comfortable) driving in turn will benefit the insurance companies through less pay outs required. Moreover, this may also lead to an improved corporate image (as the insurance company actively invests in social responsibility). Part of these retained profits consequently can be invested in ensuring that the service remains financially feasible in order to maintain these benefits. As such, no participation or subsidization of the municipality is required. An example of this business model is presented in Figure 14.

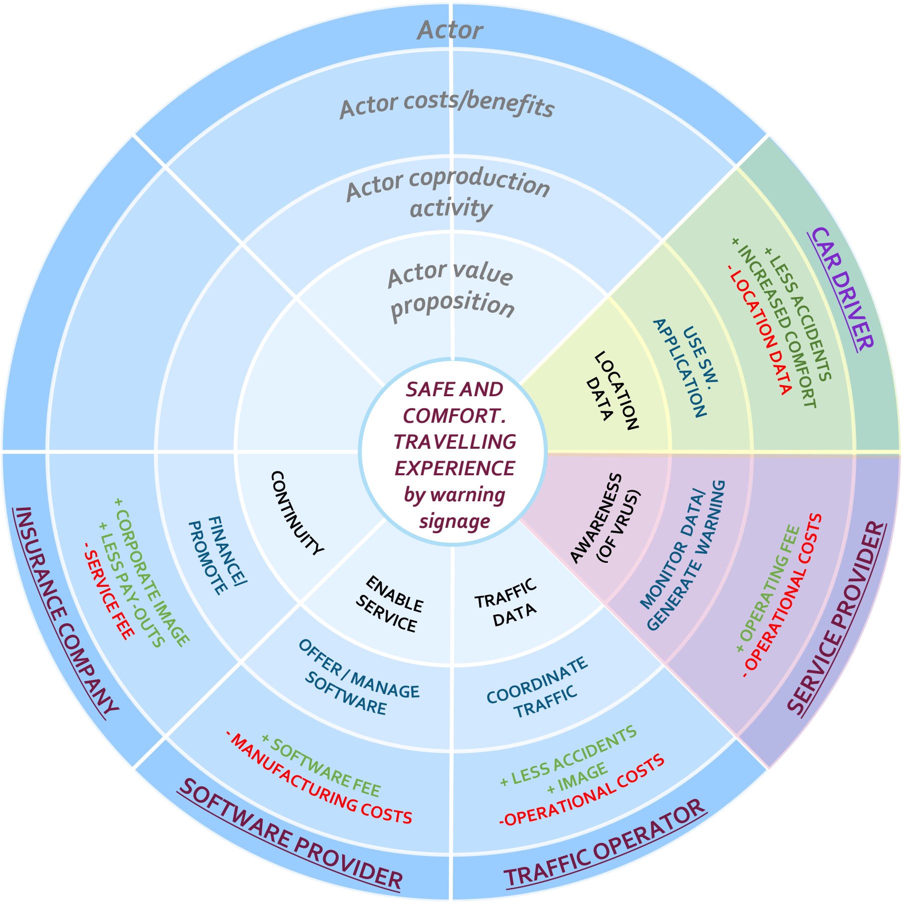


Figure 14: Business model radar for safe and comfortable travelling - including insurance companies

3.6.5.2. Integrating business model stakeholders

The current business model treats the software provider as an explicit role, responsible for managing the C-ITS infrastructure necessary to operate the service. However, depending on the implementation of the service, this role may also be incorporated in other roles, as currently, the value proposition of the software provider is only to enable the service. Similarly, the traffic operator can be integrated under the responsibility of the municipality. In this case, the municipality is responsible for generating the traffic data (as value proposition) and incurs costs for subsidizing the service (to be offered for free to car drivers).

3.6.5.3. Active participation of VRUs

The central value-in-use can be further improved if VRUs actively contribute data with regards to their behavior and location. In this variant, VRUs may be able to download a smartphone application which monitors and generates data with regards to their behavior. This data consequently is forwarded to the service provider and integrated with the data generated by the traffic systems. As such, the quality of the data to be used can be improved, resulting in more optimized decision making with regards to the C-ITS service. In this scenario, the value proposition of the VRU is the *behavior and locational data*, which is actively collected through *using the smartphone application*. The VRU will benefit from *increased safety* as accidents are decreased. As a cost, the VRU has to give up some *privacy* with regards to presenting his or her locational data.

3.7. Safe Driving Experience with Warnings Bundle

3.7.1. Introduction to the applied C-ITS service

The in-vehicle warning services[2], such as warning system for VRUs, motorcycle approaching indication, and road works warning, aim to alert the driver through an in-vehicle warning signage in the case of a potential adverse incident to enhance drivers' (and other road network users') safety. The bundle is particularly valuable when the driver is distracted, visibility is poor, or traffic density is high. In order to operate the service, data is collected on the speed and location of the driver through sources such as road-side units, vehicles, and VRUs (including powered two-wheeler riders). In case a potential incident is detected, the service emits a warning signal to the driver to avoid the incident (e.g., collision). In turn, this should improve the safety of both the driver and other traffic users (e.g., pedestrians, powered two-wheeler riders, and other VRUs). More details about the services, related use-cases and bundles are available in the deliverable D2.2 [14]

3.7.2. Business model scenario

In this business model, the *service provider* collects data from road-side units, vehicle drivers, and the other traffic users (VRUs, powered two-wheeler riders, etc.) and uses it to offer *vehicle driver* a safe travelling experience through warning signage. The application tracks the location, direction and speed of the vehicle driver. The application can interact with roadside units (RSUs) which collect data on the behaviour of VRUs in the vicinity of the vehicle driver. The service consequently analyses, based on both streams of data, whether a dangerous scenario may occur (e.g. a potential collision between the vehicle driver and other traffic users). If such a scenario is bound to occur, the service alerts the driver through an in-vehicle warning signage in the case of a potential incident with other traffic users. As such, the service enhances the awareness of the vehicle driver and improves his or her decision making. In turn, this should lead to a safer travel experience, as potential accidents can be avoided.

The blueprint business model, which emerged in the pilot site workshop in Barcelona, is given in **Error! eference source not found.**.

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[2] In-vehicle warning services that are bundled under the theme of "Safe Driving" include the following:

Road works warning

Road hazard warning

Emergency vehicle warning

Signal violation warning

Warning system for pedestrian

Emergency brake light

Slow or stationary vehicle warning

Motorcycle approaching Indication

Blind-spot detection/warning

Please refer to deliverable D2.2 [14] for more information.

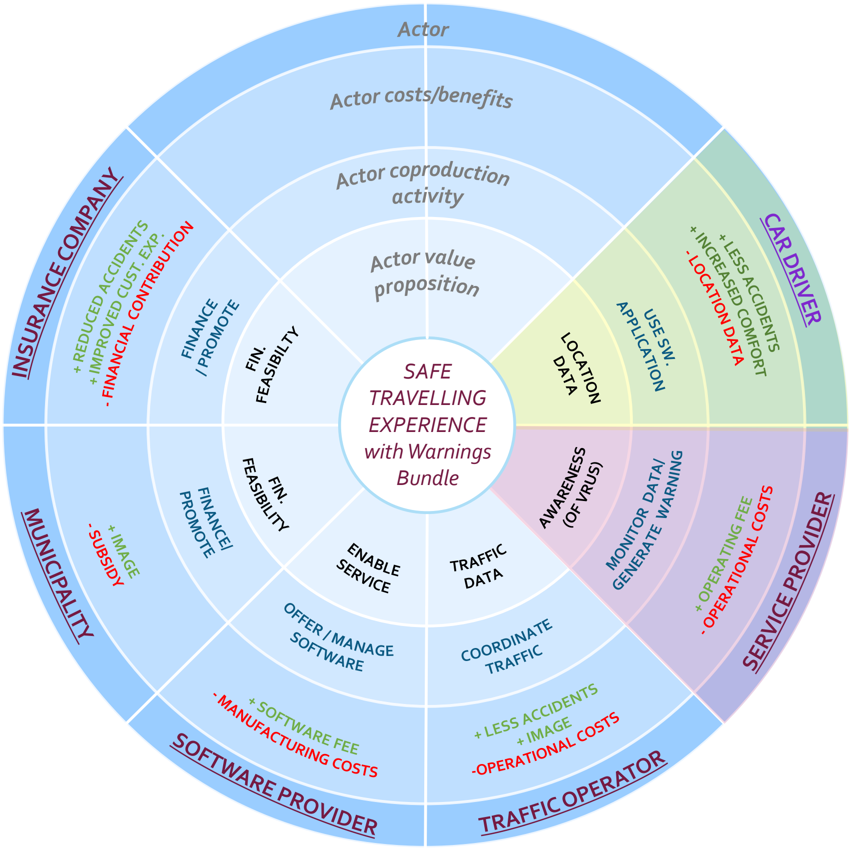

Figure 15: Business model radar for safe travelling experience with warnings

3.7.3. Value in use

The co-created value in use is a safe and comfortable travelling experience for vehicle drivers (through in-vehicle warning signage). As warning signage facilitates vehicle drivers to timely react to dangerous scenarios, and as such increases the awareness of the driver, accidents with other traffic users can be avoided. In turn, this should create a more safe and comfortable travel experience for vehicle drivers.

3.7.4. Actors in business model

3.7.4.1. Vehicle driver (customer)

The vehicle driver is warned by the service bundle (through in-vehicle warning signage) if a dangerous scenario (e.g. collision with VRUs or other traffic users) is bound to occur. In order to assess whether a dangerous scenario may occur, the service bundle tracks the speed, location and direction of the vehicle driver. Therefore, the value proposition of the vehicle driver is to present *location* or *user data*. This data is generated through the coproduction activity of using the software application. As the vehicle driver is signalled if a collision is bound to occur, *the number of accidents* can be *decreased* (or even avoided). The vehicle driver benefits moreover from *increased comfort*, as driving becomes less stressful (especially in high-traffic environments). However, in order for the service to be effective, the vehicle driver has to present *location data*, which may influence the privacy of the user.

3.7.4.2. Service provider (orchestrator)

The service provider is responsible for operating the service, specifically generating the warning signals if dangerous scenarios are bound to occur. As a result, the vehicle driver can benefit from increased awareness and improve his or her decision making. Therefore, the value proposition of the service provider is to create *awareness (of other traffic users)*. This is generated through the coproduction activity of monitoring the user and traffic data and consequently generating the warning. For providing the service, the service provider receives an *operating fee (or service fee)*, whereas *operational costs* are incurred to maintain / operate the service.

3.7.4.3. Traffic operator (core partner)

The traffic operator (or in case integrated, the city / municipality) is responsible for generating and distributing traffic data, specifically with regards to the behaviour of VRUs in the vicinity of the vehicle driver. This data consequently is integrated by the service provider to provide warning signage when needed. As such, the value proposition of the traffic operator is the *traffic data*, which is generated through *coordinating or monitoring the behaviour of VRUs*. This may also be extended to other traffic users to further enhance the service. The traffic operator benefits from *less accidents* as awareness of the driver is increased, which in turn will also lead to an *improved image of traffic* within the city or municipality. For generating the required traffic data, *operational costs* are incurred.

3.7.4.4. Software provider (core partner)

The software provider has to take care of providing and maintaining the platform on which the service will operate. As such, the value proposition of the software provider is *enabling the service*, which is conducted through the coproduction activity of *providing and managing the softwar*e. The software provider receives *a fee* from the service provider to provide and maintain the software, whereas *manufacturing costs* are incurred in order to maintain and update the software.

3.7.4.5. Municipality (core partner)

In order to stimulate the adoption of the service, the service can be offered for free to vehicle drivers. To compensate for the costs incurred of offering the service, the municipality can act as a sponsoring party. The municipality as such *subsidizes* the service to increase adoption amongst vehicle drivers. As the amount of potential accidents is reduced, the municipality benefits from *an improved image* of the city (which may validate financing the service solution).

3.7.5. Business model variants

3.7.5.1. Insurance companies (sponsor of service)

Financing for the business model is also supported through insurance companies, which will distribute and promote the service over vehicle drivers in their insurance package. As the amount of accidents is decreased (or even completely diminished), insurance companies less frequently are required to pay out to compensate for incurred damages. Therefore, stimulating safe (and comfortable) driving in turn will benefit the insurance companies through less pay outs required. Moreover, this may also lead to an improved corporate image (as the insurance company actively invests in social responsibility). Part of these retained profits consequently can be invested in ensuring that the service remains financially feasible in order to maintain these benefits. As such, no participation or subsidization of the municipality can be optional.

3.7.5.2. Integrating business model stakeholders

The current business model treats the software provider as an explicit role, responsible for managing the ITS infrastructure necessary to operate the service. However, depending on the implementation of the service, this role may also be incorporated in other roles, as currently, the value proposition of the software provider is only to enable the service. Similarly, the traffic operator can be integrated under the responsibility of the municipality. In this case, the municipality is responsible for generating the traffic data (as value proposition) and incurs costs for subsidizing the service (to be offered for free to vehicle drivers).

3.8. Efficient and Effective Public Services via Green Priority

3.8.1. Introduction to the applied C-ITS service

"Green Priority" aims to change the traffic signal status in the path of an emergency or high priority vehicle (e.g., public transportation vehicles), halting conflicting traffic and allowing the vehicle right-of-way, to help reduce response times and enhance traffic safety. The service can be implemented as follows. The green priority request including the identification information of the high priority vehicle can be published via on-board software applications in the vehicle. Consequently, traffic light controllers can pick up this information and determine in what way they can and will respond the request. The same information may also be picked up by road side units (RSUs) and cooperatively communicated to other traffic light controllers on the route of the vehicle or directly to the traffic manager. Different levels of priority can be applied, e.g. extension or termination of current phase to switch to the required phase. The appropriate level of the green priority can depend on vehicle characteristics, such as type (e.g. HGV or emergency vehicle) or status (e.g., public transport vehicle on-time or behind schedule). Below, we discuss the application of this service on blueprint business models. More details about the services and related use-cases are available in the deliverable D2.2 [14]

3.8.2. Business model scenario

The business model aims to offer green priority to public transport to make it more desirable by increasing the timeliness of the public transport services. In the business model, the traffic manager offers increased priority for the public transport vehicles operated by the public transport operator. By making use of this increased priority, especially for the behind-the-schedule vehicles, public transport operator provides increased punctuality for its public transportation services. To compensate the increased operating costs, the public transport operator benefits from fuel savings and lessened driver stress in return. The technology infrastructure required for the service is installed and maintained by the technical service provider. In return for the operational costs related to its co-production activities, the technical service provider benefits from the subsidy support provided by the city municipality. Similarly, the traffic manager will benefit from a potential market advantage and better market position in return for the operational costs resulting from the prioritization of the traffic lights.

The blueprint business model, which emerged in the pilot site workshop in Vigo, is given in Figure 16.

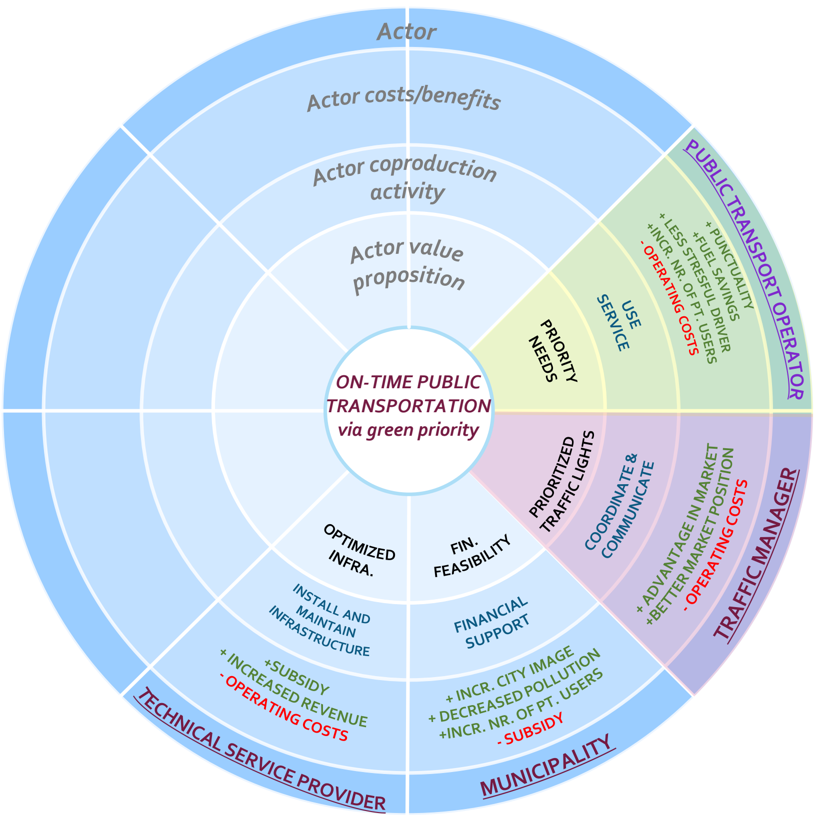

Figure 16: Business model radar for safe travelling experience with warnings

3.8.3. Value in use

The co-created value in use is green priority for public transport to make it more desirable by increasing the timeliness of the public transport services. By making use of this increased priority, especially for the behind-the-schedule vehicles, public transport operators provide increased punctuality for their public transportation services. As a result, the cities will benefit from increased use of public transportation, decreased pollution, and an improved image as the punctuality of the public transportation increased.

3.8.4. Actors in business model

3.8.4.1. Public transport operator (customer)

The public transport operator receives increased priority for its vehicles and by making use of this increased priority, especially for the behind-the-schedule vehicles, provides increased punctuality for its public transportation services. As the punctuality increases, the number of citizens choosing public transport as the main mode of transportation will increase. This in turn will lead to an increase in the *operating costs* but to compensate that, the public transport operator benefits from *fuel savings* and *lessened driver stress* in return.

3.8.4.2. Traffic manager (orchestrator)

In order to provide green priority, the green priority request including the identification information of the public transport vehicle can be published via on-board software applications in the vehicle. Consequently, traffic light controllers can pick up this information and determine in what way they can and will respond the request. The value proposition for traffic manager is c*oordination and communication* of these data streams and *prioritization of the traffic lights* downstream of the public transport vehicles based on them. The traffic manager benefits *from a potential market advantage* and *better market position*. For the prioritization of the traffic lights, *operational costs* are incurred.

3.8.4.3. Municipality (core partner)

To compensate for the costs incurred of offering the service, the municipality can act as a sponsoring party. The municipality as such *subsidizes* the service to promote the service for the citizens. As a result, the city municipality (City of Vigo in this case) benefits from *increased use of public transport*, *decreased pollution and traffic*, and an *improved image of the city* as the punctuality of the public transportation increased, which may validate offering *financial support* (in terms of subsidies) to participate in the business model.

3.8.4.4. Technical service provider (core partner)

For the collection of traffic data coming from C-ITS applications installed in public transport vehicles, traffic lights and road side units, a technology infrastructure needs to be set and maintained. The value proposition offered by the technical service provider is *installation and maintenance* of the technical infrastructure. With the data streams provided by this infrastructure, the traffic manager can provide green priority. In return for the *operational costs* related to its co-production activities, the technical service provider benefits from the *subsidy support* provided by the city municipality. Furthermore, the technical service provider benefits from *an increase in revenue* caused by mainstream deployment of their products.

3.9. Fast and Safe Travel of Emergency Vehicles via Green Priority and Emergency Vehicle Warning

3.9.1. Introduction to the applied C-ITS service

This business model incorporates the "Green Priority" service described above in Section 3.8.1. In this context, the service is incorporated for emergency vehicles combined with "Emergency Vehicle Warning".

3.9.2. Business model scenario

Green priority service can be combined with emergency vehicle warning to reduce the response times of the emergency vehicles, such as ambulances, fire trucks, and police cars. The combination of the two services can be implemented as follows. The green priority request including the identification information of the emergency vehicle can be published via on-board C-ITS applications in the vehicle. Consequently, traffic light controllers can pick up this information and determine in what way they can and will respond the request. The same information can also be picked up by road side units (RSUs) and/or other vehicles and cooperatively communicated to the traffic on the route of the emergency vehicle. This combination not only allows emergency vehicles to travel faster and safer but also allows other vehicles to react faster and in a safe manner.

In the business model, the traffic manager offers increased priority for the emergency vehicles operated by the emergency vehicle operator. By making use of this increased priority, emergency vehicle operator provides quicker response times for the cases of emergency. To compensate the increased operating costs, the emergency vehicle operator benefits from lessened driver stress in return. The technology infrastructure required for the services is installed and maintained by the technical service provider. In return for the operational costs related to its co-production activities, the technical service provider benefits from the subsidy support provided by the city municipality. Similarly, the traffic manager will benefit from potential market advantage and better market position in return for the operational costs resulting from the prioritization of the traffic lights. Furthermore, the city municipality (City of Vigo) benefits from increased citizen safety, decreased number of accidents resulting during the response period of the emergency cases, and an improved image of the city as the safety of the citizens is increased, which may validate offering financial support (in terms of subsidies) to participate in the business model.

The blueprint business model, which emerged in the pilot site workshop in Vigo, is given in Figure 17.

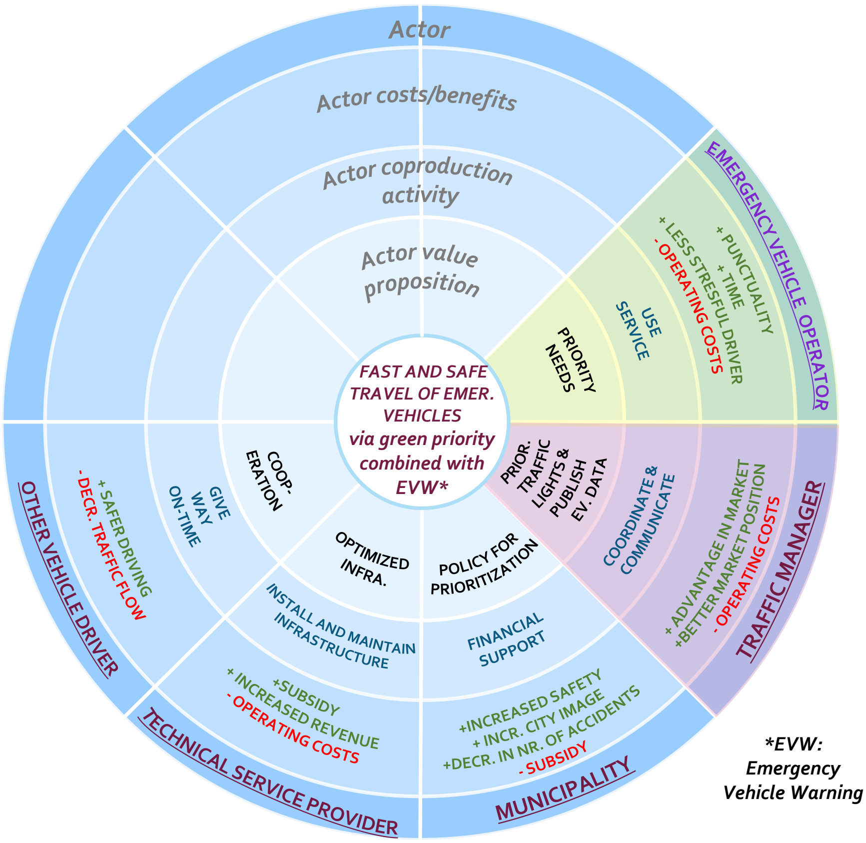

Figure 17: Business model radar for fast and safe travel of emergency vehicles via green priority combined with emergency vehicle warning

3.9.3. Value in use

The co-created value in use is green priority for public transport to make it more desirable by increasing the timeliness of the public transport services. By making use of this increased priority, especially for the behind-the-schedule vehicles, public transport operators provide increased punctuality for their public transportation services. As a result, the cities will benefit from increased use of public transportation, decreased pollution, and an improved image due to increased punctuality of the public transportation.

3.9.4. Actors in business model

3.9.4.1. Emergency vehicle operator (customer)

The Emergency vehicle operator receives increased priority for its vehicles and by making use of this increased priority, quicker response times for the cases of emergency. The emergency vehicle warning accompanying the emergency vehicles downstream their route, guide other vehicle drivers and further increase the response times. As the response times reduce, the overall safety of the citizens of the city increase with the operating efficiency of the emergency vehicle operator. Reasonably, *operational costs* are incurred however for the compensation, the emergency vehicle operator benefits from *lessened driver stress* in return.

3.9.4.2. Traffic manager (orchestrator)

In order to provide green priority and emergency vehicle warning, the green priority request including the identification information of the emergency vehicle can be published via on-board C-ITS applications in the vehicle. Consequently, traffic light controllers can pick up this information and determine in what way they can and will respond the request. The same information can also be picked up by road side units (RSUs) and/or other vehicles and cooperatively communicated to the traffic on the route of the emergency vehicle. The value proposition for traffic manager is *coordination and communication* of these data streams and *prioritization of the traffic lights* downstream of the emergency vehicles based on them. The traffic manager benefits from *a potential market advantage* and *better market position*. For the prioritization of the traffic lights, *operational costs* are incurred.

3.9.4.3. Municipality (core partner)

To compensate for the costs incurred in offering the service, the municipality can act as a sponsoring party. The municipality as such *subsidizes* the service to facilitate its deployment. As a result, the city municipality (City of Vigo in this case) benefits from *increased citizen safety*, *decreased number of accidents* resulting during the response period of the emergency cases, and an *improved image of the city* as the safety of the citizens is increased, which may validate offering *financial support* (in terms of subsidies) to participate in the business model.

3.9.4.4. Technical service provider (core partner)

For the collection of traffic data coming from C-ITS Applications installed in emergency vehicles, traffic lights and road side units, a technology infrastructure needs to be set and maintained. The value proposition offered by the technical service provider is *installation and maintenance* of the technical infrastructure. With the data streams provided by this infrastructure, the traffic manager can provide green priority and disseminate emergency vehicle warning. In return for the *operational costs* related to its co-production activities, the technical service provider benefits from the *subsidy support* provided by the city municipality. Furthermore, the technical service provider benefits from *an increase in revenue* caused by mainstream deployment of their products.

3.9.4.5. Other vehicle drivers (enriching partner)

The value propositions offered by the other traffic users is *cooperation* in the cases of emergency. This basically involves giving-way in a timely manner after receiving the emergency vehicle warning. Therefore, part of their value proposition is also *their absence*; as such, traffic congestion on the downstream of the emergency vehicle is reduced. The other vehicle drivers benefit from *a safer driving experience* as hazardous scenarios are avoided. However, they can suffer from *a decrease in the traffic flow* caused by giving way to the emergency vehicles.

3.10. Efficient Freight Delivery in an Urban Area with Parking Availability

3.10.1. Introduction to the applied C-ITS service

This business model incorporates the "Urban Parking Availability" service described above in Section 3.5.1.

3.10.2. Business model scenario

Freight transport is essential in urban areas for replenishing stocks of various merchandise in shops and markets, and delivering parcels and other supplies to offices in centre locations. However, despite the critical need, the freight delivery in urban areas has a number of adverse effects, such as increased traffic congestion and disruption, and increased air and noise pollution. These effects are amplified in city centres where providing sufficient loading and unloading spots are problematic, yet not managed effectively.

This business model targets at the issues regarding traffic disruption due to urban freight transportation. It does so by bringing structure into the management of parking process and capacity during urban freight delivery through the use of parking availability service.

The business model is enabled by an application where *Parking Operator* offers time and availability information about parking spots that are allocated for freight delivery, and *Truck Drivers* of logistics companies (or of specific associations) indicate their urban delivery information (required time and duration) through reservation. Such parking management schemes is necessary to bring a structure into the related process. However, these schemes are effective only when all relevant stakeholders collaborate closely and the system is operated and monitored effectively. The key stakeholders include the *City Municipality* (that owns the parking spaces and is required to regulate this process for traffic efficiency and security), *Retailers/Shops* (that require delivery of goods for their operation), and *Logistics Companies* (or Truck Associations) that offer the delivery service. The City Municipality provides the parking space that are appropriate for freight delivery free to relevant parties, and pays the Parking Provider for operating the service. In return, it benefits from the optimized use of parking space, and -more importantly from better traffic management leading to less traffic disruptions around these spots. The Parking Provider organizes the time availability of these parking spots, and operates the reservation system, and in turn benefits from the service fee it receives from the City Municipality. Although the Truck Drivers can be less flexible in the time-window for their delivery, they will spend less time (and fuel) for looking for appropriate parking spots and will benefit from securing a parking spot that can be more appropriate for loading/unloading. Trucks that stay longer than heir reserved time-slot can be subject to increased parking rates or fines. As a remark, specific parking slots that are used for loading/unloading can be equipped with sensors that read licence plates to confirm the presence of the vehicles.

The blueprint business model, which emerged in the pilot site workshop in Bilbao is given in **Error! Reference ource not found.**.

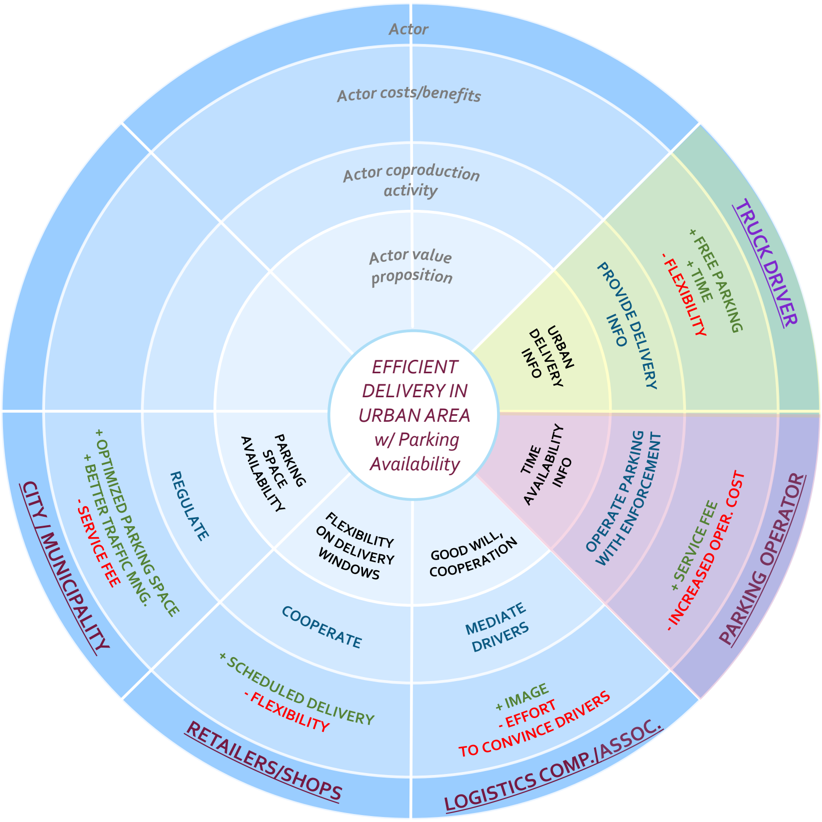

Figure 18: business model radar for efficient freight delivery in an urban area with parking availability

3.10.3. Value in use

The co-created value in use is the efficient freight delivery in the urban areas with the aim to decrease related traffic disruptions and incidents. Truck drivers are expected to reserve parking slots that are offered free to them, which is an indirect benefit also for the retailers/shops and logistics companies (or truck associations) due to decreased operational costs.

3.10.4. Actors in business model

3.10.4.1. Truck Driver (customer)

The Truck Driver reserves a parking spot for a specific time and duration using the system provided by the Parking Operator. Therefore, the value proposition of the truck driver is to present information with regards to their delivery schedule (to which they have to adhere). This decrease in flexibility and the need for an additional reservation step is compensated through *free and guaranteed parking*. Moreover, this will also save the truck drivers *time* to find a suitable parking location.

3.10.4.2. Parking Operator (orchestrator)

The Parking Operator facilitates the process by a reservation system, which potentially receives data from plate-reading sensors in parking slots. In order for truck drivers to reserve a parking spot, the parking operator offers truck drivers *the time slots for reserving a parking spot (and monitors when trucks should leave*) through the system. *Increased costs* due to the additional operations for running the system are compensated through the *support or service fees* received by the Municipality, who finances the service offering.

3.10.4.3. Municipality (core partner)

The City Municipality typically owns the parking spots and identifies those that are suitable for loading/unloading in urban areas. Therefore, the municipality contributes to the co-created value by *providing data* with regards to which *parking spots are available* (which is forwarded to the parking operator). To compensate for the increased operational costs of the Parking Provider, it provides *financial support*. In return, it benefits from *better traffic management* and potentially *decreased traffic disruptions*.

3.10.4.4. Logistics Companies/ Driver Associations (enriching partner)

Logistics Companies or the Associations (of which the drivers are member) are enriching parties in the business model, which *mediate between drivers and municipality*, endorsing the use of the reservation system, in order to benefit from *free and guaranteed parking*, and eventually *image* within the city. Therefore, their value proposition is to create *cooperation* amongst truck drivers to use the reservation system.

3.10.4.5. Retailers/Shops (enriching partner)

Retailers/Shops are enriching partners which potentially lose their *flexibility in delivery*, but benefit from the *structured process by having scheduled delivery*. By providing *flexible delivery windows*, efficient delivery of freight in urban areas can be further improved, as it will place less pressures on the demand for suitable parking spots.

3.11. Reliable and Efficient Transportation by Traffic Information Provisioning (Bundled)

3.11.1. Introduction to the applied C-ITS service

Traffic information services like *road hazard warning, road works warning* and *traffic jam warning* aim to inform the driver in a timely manner, allowing the driver to be better prepared for upcoming obstacles, to improve his or her decision making while driving and to take action in advance. These services can either be offered through road-side units (RSUs) or combined with the service *in-vehicle signage*. RSUs can collect data on road hazards, road works and traffic jams, as well on real-time the behaviour of traffic users. Consequently, through either *in-vehicle signage* or RSUs, this data can be integrated and communicated to traffic users, allowing them to improve their decision making. The value of these services can moreover be extended through *mode and trip time advice* in case traffic congestion increases or hazardous scenarios may occur, allowing the driver to continue his or her journey. This may include dynamic rerouting or advising to take a different mode of transport instead. As such, a more comfortable and safe driving experience should be obtained. More details about the services and related use-cases are available in the deliverable D2.2 [14]

3.11.2. Business model scenario

In this business model, *bus operators* are offered reliable and efficient transportation through a service bundle of traffic information provisioning services, including road hazards warning, road works warning and traffic jam warning. The service is offered by the *service provider* through either RSUs or through an on-board unit (by *in-vehicle signage*). Traffic data is integrated by the service provider and consequently communicated to the *bus operator* as well as *other traffic users*. *Other traffic users* can use this traffic data to improve their decision making whilst driving. This may include slowing down to adequately cope with hazardous scenarios further up the road or taking a different route instead to avoid a hazardous scenario or traffic congestion. As other traffic users are more informed of upcoming traffic and may potentially change their behaviour, traffic congestion will not increase or even decrease, whereas traffic would become more predictable. As busses are confined to standard routes and are not allowed to deviate from these routes, arrival and trip times for busses would become more predictable and reliable as well, taking into account real-time traffic data. As such, bus operators are able to offer more reliable trip and arrival times to their customers (*commuters by transit*).

To improve the efficiency of transportation for *bus operators*, the *service provider* moreover can collect usage data for busses from *commuters by transit*. This data can be communicated to *bus operators*, showing when peak or high demand periods for busses may occur. Consequently, the *bus operator* can adapt the fleet to match these demand patterns, improving efficiency of the service. *Commuters* which adhere to their proposed travel plans can receive a discount in order to stimulate this behaviour.

The blueprint business model, which emerged in the pilot site workshop in Newcastle, is given in Figure 19.

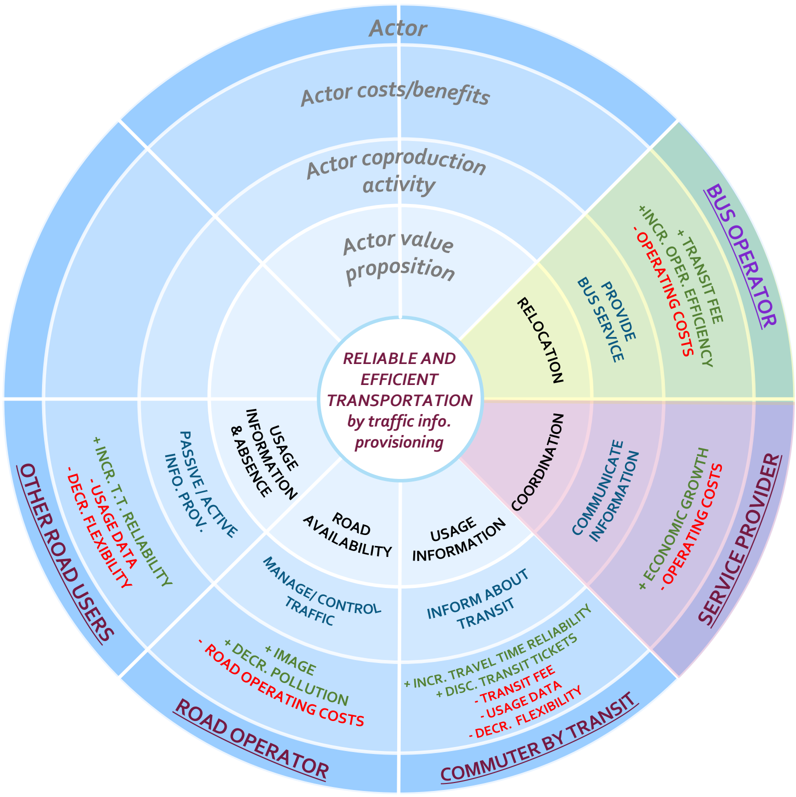

Figure 19: Business model radar for reliable and efficient transportation

3.11.3. Value in use

The co-created value in use is reliable and efficient transportation for bus operators (through traffic information provisioning). By integrating and communicating real-time traffic data, traffic users can make informed decisions whilst driving and can as such be aware of the behaviour of traffic (i.e. congestion, road hazards or road works) and can potentially even be stimulated to stay clear of traffic congestion. As such, the traffic behaviour should become more predictable and reliable, allowing the service provider to offer more reliable and efficient transportation to bus operators. By also collecting data on the usage patterns of commuters, the bus fleet can also be used more efficiently.

3.11.4. Actors in the business model

3.11.4.1. Bus operator (customer)

The bus operator receives both real-time traffic data as well as user data from the service provider in order to create more reliable and efficient transportation. The main role of the bus operator is to provide bus transportation to commuters by transit. Therefore, the value proposition of the bus operator is the *relocation* of commuters. This is conducted through the coproduction activity of providing the bus service. The bus operator receives a transit fee for relocating commuters, which may increase as the bus service becomes more reliable and predictable. Moreover, as usage data is collected, the bus fleet can be operated in such a way that it matches demand patterns. In turn, this should lead to *increased operating efficiency*. In order to operate the bus service, the bus operator logically incurs *operating costs*.

3.11.4.2. Service provider (orchestrator)

The service provider is responsible for serving as an information hub, integrating and communicating real-time traffic data and user data to the respective traffic users. As such, the value proposition of the service provider is the coordination (integration and distribution) of data. This is conducted through the coproduction activity of communicating traffic and usage information to the respective stakeholders, acting as an information centre for traffic users. In the current scenario, the service provider can be considered as a governmental or non-profit organization. The service therefore is offered for free to bus operators, implying that no service fees are accrued by the service provider. However, as traffic behaviour becomes more predictable and controllable, whereas traffic users are timely informed of hazardous scenarios, this will in turn benefit the service provider (and consequently the region) through *economic growth* (including *increased punctuality* of traffic users, *decreased accidents, increased image* and *decreased pollution*). In order to operate the service, *operating costs* are incurred.

3.11.4.3. Commuter by transit (core partner)

In order to provide efficient transportation to bus operators, data is collected from commuters by transit by the service provider, which is consequently communicated to the bus operator. This facilitates the bus operator to analyse when high demand periods for busses will occur, allowing the bus operator to adapt the fleet appropriately. The value proposition of commuters by transit therefore is the *usage information* (describing the itineraries of the commuter). This is generated through the coproduction activity of *informing the service provider about when to take the transit*. As the efficiency of transportation can only be achieved if commuters adhere to their proposed itineraries, the bus operator may provide discounts to transit tickets if commuters indeed do so. As such, commuters will benefit from *discounts to transit tickets*. Moreover, *travel and arrival times* will become *more predictable and reliable*. As costs, commuters have to pay a *fee* for using the transit, whereas *usage data* is required to increase efficiency (which may influence privacy of the user). Moreover, as commuters are required to adhere to proposed itineraries, this may *decrease their travel flexibility*.

3.11.4.4. Road operator (core partner)

The road operator is responsible for ensuring that the roads are available to facilitate both bus operators as well as other traffic users to use the roads. Moreover, the road operator plays a role in ensuring that traffic congestion is managed adequately. Therefore, the value proposition of the road operator is *road availability*. This is conducted through the coproduction activity of *controlling and managing the traffic*. The road operator will benefit from *increased image*, as traffic becomes more stable, predictable and controllable, which should positively influence the appeal of the city. The road operator will moreover benefit from *decreased pollution*, as traffic congestion is stabilized or even decreased. In order to ensure road availability, *road operating costs* are incurred.

3.11.4.5. Other road users (core partner)

Other road users contribute to the collection real-time traffic data, for which their location and direction is monitored through either RSUs or on-board units. Therefore, part of their value proposition is to present data on what roads they are using or will use. However, they are also informed of upcoming traffic scenarios through the service provider. Other road users can use this information to improve their decision making and can stay clear of high traffic areas (or can be stimulated to take a different route instead). Therefore, part of their value proposition is also their absence; as such, traffic congestion is stabilized or even decreased. The value proposition is offered through the coproduction activity of providing and using traffic information. Other road users benefit from increased travel time reliability, as hazardous scenarios or traffic congestion is avoided, allowing the travel time to become more predictable. In case on-board units are used, other road users will present location data, which may influence their privacy. Moreover, taking a different route instead implies that the road user will lose travel flexibility.

3.11.5. Business model variants

3.11.5.1. Social media provider as information platform

The current business model can be extended by including a social media partner (or even multiple channels). The social media partner serves and even extends the current information platform. In this variant, other road users can receive traffic data from social media channels, serving as an alternative to on-board units and providing information quicker than RSUs. The social media provider can potentially receive a fee for doing so, which is compensated by the decreased operating costs (as part of the information platform is now covered by social media) for the service provider. Moreover, given the adoption of the service, the social media provider can moreover potentially benefit from an increased user base, as road users will use the channel to receive real-time traffic data. An example of this model is presented in Figure 20.

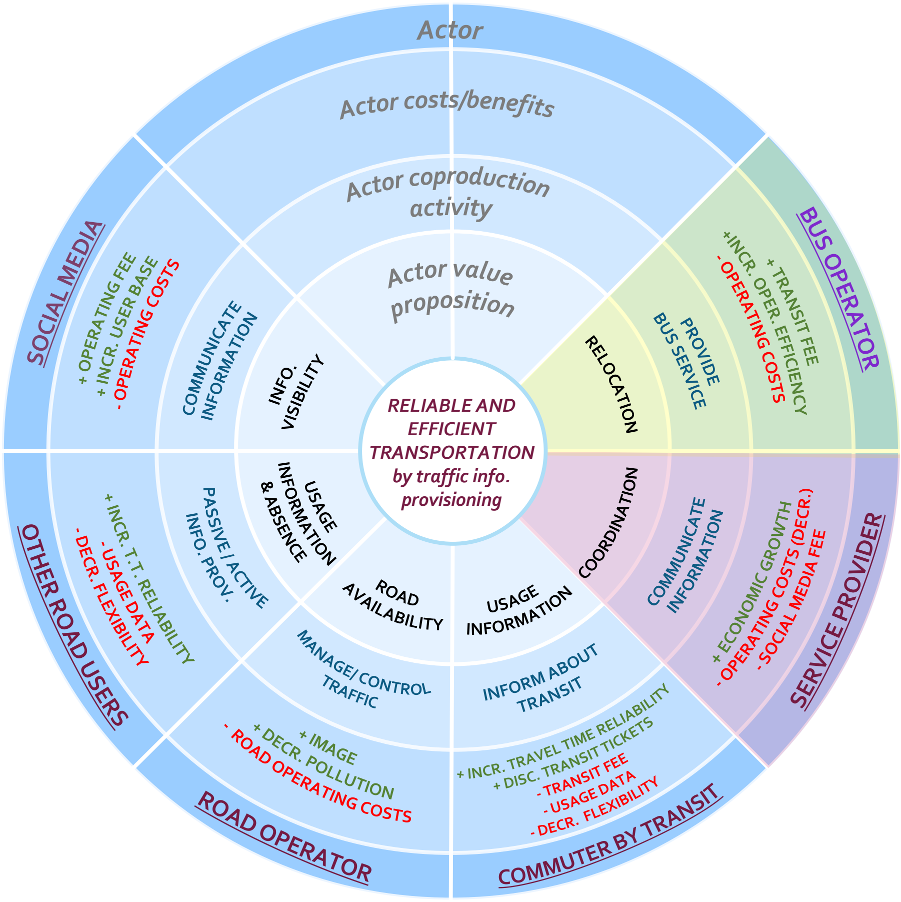

Figure 20: Business model radar for reliable and efficient transportation: Including social media as information platform

4. Conclusions

In this deliverable, we report on the initial business models for the C-ITS services emerged from the stakeholder workshops at the C-MobILE local sites. The business model blueprints are designed collaboratively by various stakeholders in this domain. These workshops ensured that we address the most important mobility challenges faced in 8 C-MobILE local sites, which can be generalized to the challenges faced in many cities across Europe.

The workshops organized in the local sites and the approach used in the design of the business model blueprints were received very well by the participants. We collaboratively identified solutions - which use C-ITS services as core enablers - that address particular mobility challenges of urban areas. In the business model blueprints, we have exploited the majority of the C-ITS services that the C-MobILE project aims to offer in various sites. The blueprints of these solutions will guide and facilitate the development of concrete business models in local sites by relevant parties.

Table 3 shows the coverage of the services by the business models. In our workshops that we conducted in the local sites, we focused on the most urgent mobility challenges of the sites and thus focused on a specific set of services in each site that can be used as a part of the solution. In the local sites that plan to deploy the remaining 4 services, these services were considered to be of less importance when compared with those that are used as a part of the business models. Therefore, for the initial set of business models, the attention was focused on the most important services as deemed by the local sites. The next steps will involve further exploration and viability analysis of the business models and relevant C-ITS services. These steps will be performed mainly within WP4 under Task 4.3 (business and exploitation plans for faster market roll-out; M19 - M42) and are expected to address the remaining four C-ITS services that have not been addressed in the initial business models. The activities will build on the initial business models (i.e., this deliverable) and will involve further elaboration of the value propositions of each party in the network in a particular setting - both public and private with their different views on value of the service, and their required functions/capabilities, as well as the expected costs and benefits. The results will be reported in D4.5- Final Business Models.

Table 3: C-ITS services and their covered by the business models

ID	Service	Addressed?
S01	Rest-Time management	-
S02	Motorway parking availability	-
S03	Urban parking availability	✓
S04	Road works warning	✓
S05	Road hazard warning (incl. jams)	✓
S06	Emergency Vehicle Warning	✓
S07	Signal Violation Warning	✓
S08	Warning system for pedestrian	✓
S09	Green priority	✓
S10	Green Light Optimal Speed Advisory (GLOSA) / Dynamic eco-driving	✓
S11	Cooperative traffic light for pedestrian	✓
S12	Flexible infrastructure (peak-hour lane)	-
S13	In-vehicle signage (e.g.Dyn. speed lim.)	✓
S14	Mode & trip time advice	✓
S15	Probe Vehicle Data	✓
S16	Emergency Brake Light	✓
S17	Cooperative (Adaptive) Cruise Control	-
S18	Slow or Stationary Vehicle Warning	✓
S19	Motorcycle approaching indication (including other VRUs)	✓
S20	Blind spot detection / warning (VRUs)	✓

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