GECKO

GOVERNANCE FOR NEW MOBILITY SOLUTIONS

Review of business models for new mobility services

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LIST OF ACRONYMS

CAV – Connected, automated vehicles

CCAM –Connected, Cooperative and Automated Mobility

D – Deliverable

EU – European Union

EV – Electric Vehicles

GDPR – General Data Protection Privacy

GPS – Global Positioning system

HEV – Hybrid Electric vehicles

IoT – Internet of Things

ITS – Intelligence Transport System

LEZ – Low Emission Zone

MaaS – Mobility as a Service

PHEV – Plug-in hybrid electric vehicle

TFL – Transport for London

TM – Traffic Management

UN – United Nations

WP – Work Package

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. EXECUTIVE SUMMARY

Deliverable 1.2 is one of the key deliverables in work package 1 “Technological, operational, business and social trends and innovations”. Based on findings from deliverable 1.1, this deliverable reviews and analyses business models of disruptively new mobility services and technologies in four innovation categories: 1) connected, cooperative and automated mobility, 2) infrastructure, network and traffic management, 3) MaaS and MaaS platform, and 4) shared on-demand mobility. Each disruptive innovation is critically evaluated by Osterwalder business model canvas and business ecosystem approaches, with different case studies.

The research team conducted desk research and semi-structured interviews with practitioners and public authorities to investigate the value creation (i.e., what value propositions are proposed in order to create value in the market), delivery (i.e., how the value is delivered to the new mobility services or technologies receivers), and capture mechanisms (i.e., how the value is captured by the new mobility services or technologies providers) of these cases. Nine building blocks of business model canvas were first identified, including customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure. The research team then investigated how these building blocks work together to create, deliver, and capture value for disruptive new mobility services and technologies.

The aggregate data analysis shows that each innovation category has its own distinctive value propositions. These value propositions keep evolving because of the uncertainties of frequently changeable market status and regulations. Most of the value of new mobility services or technologies are delivered through online channels; however, offline channels such as conferences and exhibitions are also powerful channels for certain types of disruptive innovation, which implies that demonstration opportunities and support from authorities are important. Different value capture mechanisms are identified by the analyses. These findings, together, provide guidance for authorities to design and implement better and suitable regulatory policies in order to aid the development of the transport industry.

2. INTRODUCTION

2.1. Deliverable Motivation

Disruptive innovation is crucial to the growth of economies.[1] Over the last decade, a variety of disruptive innovations have been developed within the transport sector, such as autonomous vehicles, drones, and ride hailing.[2] These innovations have the power to redefine industries and change users' behaviour in both positive or negative ways, given high uncertainties of disruptive innovations. It is therefore important to understand the new business models of mobility firms that possess these disruptive innovations. A state-of-the-art knowledge would enable the authorities to design an adaptive regulatory and governance framework which foster the development and implementation of disruptively new mobility services and technologies. However, there is a limited understanding of the business models of these disruptive firms and how their business models evolve over time, which restricts the development of appropriate regulatory policies and governance framework.

Against this background, this deliverable reviews and analyses business models of disruptive innovations for passengers and goods transport. The Osterwalder business model canvas approach is adopted to investigate the key elements of these business models and how these elements create, deliver, and capture value of disruptive innovations.[3] The findings provide guidance for authorities to design and implement better and suitable regulatory policies in order to prosper the development of the transport industry.

2.2. Deliverable Scope

Following the innovation categories identified in D 1.1, this deliverable focuses on the business models of 1) connected, cooperative and automated mobility, 2) infrastructure, network and traffic management, 3) MaaS and MaaS platforms, and 4) shared on-demand mobility. Each innovation category has various disruptive innovations. Therefore, different cases are also

[1] Christensen institute (2019), Official Website.

[2] University of Oxford (2018), Disruptive Change in the Transport Sector.

[3] Osterwalder and Pigneur (2010), Business Model Generation: A handbook for visionaries, game changers and challengers.

introduced and discussed in order to capture the whole picture of disruptive changes in the transport sector. Most cases in this deliverable are new start-ups, which partially reflects the nature of disruptive innovations in the transport industry.

Please note, this deliverable has to anonymize some firms' name and describe their business models in a general way as interviewees thought such information is sensitive and they are not willing to reveal it.

The following are some descriptions of four innovation categories. For more details, please refer to GECKO deliverable 1.1:

- **Connected, cooperative and automated mobility**: Most modern vehicles and drones already have connected devices. A connected vehicle is defined as a motor vehicle "that connects to other vehicles and/or devices, networks and services outside the car including the internet, other cars, home, office or infrastructure". In the future, they might directly interact with each other and with the road infrastructure. This interaction is the domain of cooperative mobility, which is enabled by digital connectivity between vehicles and between vehicles and transport infrastructure. An automated vehicle is defined as "a motor vehicle which has technology available to assist the driver so that elements of the driving task can be transferred to a computer system". In contrast, an autonomous vehicle is defined as "a fully automated vehicle equipped with the technologies capable to perform all driving functions without any human intervention". Example of disruptive innovations in this category includes connected and automated vehicles, passenger urban air mobility, and drone last mile delivery.
- **Infrastructure, network and traffic management**: Infrastructure can be defined as innovations in infrastructure management, pricing, taxation and finance, digitalization and integration. Network and traffic management "provides guidance to the European traveller and haulier on the condition of the road network. It detects incidents and emergencies, implements response strategies to ensure safe and efficient use of the road network and optimises the existing infrastructure, including across borders. Incidents can be unforeseeable or planned: accidents, road works, adverse weather conditions, strikes, demonstrations, major public events, holiday traffic peaks or other capacity overload". Example of disruptive innovations in this category includes big data for fleet management and logistics, TM 2.0, and Hyperloop.
- **MaaS and MaaS platforms**: "Mobility-as-a-Service (MaaS) is a user-centric, intelligent mobility management and distribution system, in which an integrator brings together offerings of multiple mobility service providers, and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility". "The MaaS Platform is the IT structure that is used by the MaaS Operator to provide the final service of mobility to the end-users". Example of disruptive innovations in this category includes MaaS and MaaS platforms.

- **Shared on-demand mobility**: Shared mobility and on-demand mobility are two trends emerged as a response to the change in traveller need for cheaper transport (e.g. sharing the cost of travel) and the need for easy access to a transport (service) at a given moment. Shared mobility and on-demand mobility can also reduce congestion and space by private vehicles in cities. Shared mobility can be defined as usage of shared resources, in this case vehicles, which are made available to registered users at various locations in the city. On-demand mobility, on the other hand, is service provided 'on-demand', when requested by the customer, and not based on a fixed schedule. Example of disruptive innovations in this category includes car-pooling, bike sharing, e-scooter sharing/micromobility, ride-hailing and TNC, and on-demand ridesharing.

2.3. Deliverable Structure

This document is comprised of the following chapters:

- Chapter 1 has a succinct executive summary for deliverable 1.2.
- Chapter 2 presents an introduction to discuss the motivation, scope and structure of deliverable 1.2.
- Chapter 3 introduces the definition of disruptive innovation, business model and the business model canvas by ecosystem approach.
- Chapter 4 summarises the research methodology for this deliverable, including desk research for business model canvas and interviews with experts.
- Chapter 5-8 discuss the business models in four innovation categories, including connected, cooperative and automated mobility, infrastructure, network and traffic management, MaaS and MaaS platform, and shared on-demand mobility. Specific cases will also be introduced in these chapters, with implications for authorities and policy makers.
- Chapter 9 summarise key findings of deliverable 1.2. It discusses the similarities and differences of these business models. Suggestions and guidance for policy makers are also provided in the end of this chapter.

3. BUSINESS MODEL CANVAS AND BUSINESS ECOSYSTEM APPROACH

3.1. Definition of Disruptive Innovation

According to the Christensen Institute[4], disruptive innovations have the potential to be an incredibly positive force in the world. If there is no uniformly accepted definition of disruptive innovation, at least some criteria to qualify an innovation as a disruptive one can be identified. It is important to start by presenting what disruptive innovations are not[5]: disruptive innovations are not new technologies that make good products better[6]. The commonly accepted definition of disruptive innovation is the definition from Clayton Christensen[7] according to which disruptive innovation is: "a process by which a product or service initially takes root in simple applications at the bottom of a market, typically by being less expensive and more accessible, and then relentlessly moves upmarket, eventually displacing established competitor." For more discussion on disruptive innovation, please see deliverable 1.1.

3.2. Definition of Business Model

Transport organizations need to develop a sustainable business model in order to survive in todays' competitive environment. "A business model articulates the logic, the data, and other evidence that support a value proposition for the customer, and a viable structure of revenues and costs for the enterprise delivering that value. [...] It's about the benefit the enterprise will deliver to customers, how it will organize to do so, and how it will capture a portion of the value that it delivers" (p.179).[8] With a well-defined business model, organizations are able to specify what customers need and want, what customers want, and how organizations can best meet those needs and get paid for doing so.[9]

[4] Christensen institute (2019), Official Website.
[5] Larson (2016), Disruptive innovation theory: What it is & 4 key concepts.
[6] Christensen institute (2019), Official Website.
[7] Christensen, Raynor, and McDonald (2015), What is disruptive innovation?
[8] Teece (2010), Business models, business strategy and innovation.
[9] Ovans (2015), What Is a Business Model?

3.3. Business Model Canvas by an ecosystem approach

This deliverable selected the business model canvas as the main tool because it is a well-established way to investigate the multitude of business model elements, which offer a comprehensive view of how a firm creates, delivers, and captures value. A business model can also be described through multiple elements that show the logic of how an organization intends to make money, which is known as business model canvas.[10] Business model canvas is a strategic management tool for developing new or verifying existing business models. It can be explained by nine building blocks, including customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure.[11] Table 1 presents the description of the nine building blocks.

Table 1: Nine Building Blocks of Business Model Canvas

Building Blocks	Definitions
1) Customer segments	This building block defines the different groups of people or organizations an enterprise aims to reach and serve.
2) Value propositions	This building block describes the bundle of products and services that create value for a specific Customer Segment.
3) Channels	This building block describes how a company communicates with and reaches its customer segments to deliver a value proposition.
4) Customer relationships	This building block describes the types of relationships a company establishes with specific customer segments.
5) Revenue streams	This building block represents the cash a company generates from each customer segment (costs must be subtracted from revenues to create earnings).
6) Key resources	This building block describes the most important assets required to make a business model work.
7) Key activities	This building block describes the most important things a company must do to make its business model work.

[10] Osterwalder and Pigneur (2010), Business Model Generation: A handbook for visionaries, game changers and challengers.

[11] Hossain (2014) Business Development Model of Canvas: The 9 Building Block Approach

8) Key partnerships	This building block describes the network of suppliers and partners that make the business model work.
9) Cost structure	This building block describes all costs incurred to operate a business model.

4. METHODOLOGY

There are three phases of data collection and analysis in this deliverable. First, secondary data related to cases of D1.2 were collected from company websites, industry reports, newspapers, industry magazines, and other sources. In this phase, a drafted business model canvas is proposed in order to understand how the business model works in different innovation categories (i.e., connected, cooperative and automated mobility, infrastructure, network and traffic management, MaaS and MaaS platform, and shared on-demand mobility).

Second, in-depth interviews with key informants of each case were conducted to validate the proposed business model canvas and investigate the main drivers/barriers of business model innovation. In the phase 2, an interview guide is developed by two researchers. This interview guide includes semi-structured questions that stimulates discussions between the interviewer and interviewee. Before the interview starts, the interviewer describes the interview objective and introduces the deliverable context to interviewees. During the interviews, different types of questions are asked, such as 'grand tour' questions, verification questions, and other questions. Then the researchers investigate each key element of business model canvas to see how a firm's business model works. One of the limitations in these interviews is that most firms in our cases are new start-ups. The business model analysis is limited because some companies are planning to commercialize their products/services/solutions in the future instead of now.

In phase 3, the interviewer updated the business model canvas based on the findings of the interviews. An aggregate analysis of these interviews was conducted to find the key elements of business model in transport sector and the similarities and differences of business models across four innovation categories. To perform this analysis, the researchers first identified keywords in the nine building blocks of business model canvas and then labelled the value creation, value delivery, and value capture mechanisms for them. Based on this aggregate analysis, the deliverable found how a disruptive innovation creates, delivers, and captures value. Implications for authorities are also proposed in the concluding section. In the following chapters, different business models in each innovation category will be discussed.

5. CONNECTED, COOPERATIVE AND AUTOMATED MOBILITY

Connected, cooperative, and automated mobility is critical to the development of innovation in the transport industry. Example of disruptive innovations in this category includes connected and automated vehicles, passenger urban air mobility, and drone last mile delivery. In the chapter 5, we will discuss and analyse three different business models in Connected, cooperative, and automated mobility. Specifically, the business model canvases of Arrival, Griff, and Drone Delivery Company A are presented, followed by a brief discussion on how their business model works.

5.1. Case Study 1 Arrival

[Case background]

Arrival is a technology company creating iconic commercial electric vehicles at the same cost as petrol and diesel equivalents to make electric vehicles mainstream. Arrival has taken a ground-up approach to make vehicles in a new way - light, modular and efficient, saving 50% cost of ownership with a range of up to 300 miles. Using design thinking, Arrival is reimagining the engineering and manufacturing of vehicles to confront legacy industry challenges that to date have prevented the mainstream adoption of EV technology.[12]

[Business model explained]

Arrival develops and manufactures a number of different electrical and semi-autonomous vehicles. These vehicles have an advantage over ICE vehicles in that they are cleaner and quieter. Furthermore, Arrival's vehicles include a variety of electronic features. These features allow Arrival to offer exclusive services that make these vehicles more efficient in the market. Finally, Arrival aims to make these vehicles cost competitive with traditional ICE vehicles. It currently focuses on package delivery services. Then main clients are large delivery companies, such as UPS and Royal Mail.

[12] Arrival (2019), Official Website

The technological advancements in these vehicles make it possible for clients to increase their efficiency significantly. As the interviewee notes that 'Arrival has developed close relationships with all fleet operators currently operating their vehicles. This allows them to constantly optimize their vehicles according to the needs of their customers.' Arrival stays in contact with their customers through personal contacts and regular meetings. Currently, all products that will be sold by Arrival are in a prototype stage.

To operate their business model, Arrival needs to maintain a number of key resources, including 1) physical resources: the factory where the vehicles are manufactured and the workshop where the vehicles are designed, 2) human resources: the engineers and the technicians for the hardware of the vehicle and software developers for the core software, 3) financial resources: as Arrival is currently not selling their products they need to have access to sufficient funding to finance the development of their products. Key activities that these resources perform are the development of all the essential driving systems on the vehicles, the development of the autonomous driving technology and other software features of the vehicle, and finally the manufacturing of the vehicles.

The cost structure that follows from this business model is mainly related to the research and development costs of the vehicles and all the associated technologies, the costs of the components and materials of the van, the production costs and the salaries of the workforce. In the future, Arrival also expect to have marketing and sales cost. Figure 1 summarizes the business model canvas of Arrival.

[Other factors influencing business model]

It is interesting to mention that legislation has a large influence on the business model of Arrival. Firstly, currently legislation does not allow for autonomous driving to happen without a driver in the car. This legislation affects the direction of the development of Arrival's product because it needs more consideration on human-technology interactions. Secondly, the general push back on ICE vehicles can make Arrival's vehicles even more cost competitive due to a decrease in the tax burden on these kind of vehicles.

[Implications for decision-makers from authorities / public transport]

Although there is an increasing trend in developing electronic and autonomous vehicles, the above case shows that the legislation will significantly influence the R&D direction for new start-ups in the area of autonomous vehicles. It is therefore important for policy makers to design a regulatory framework that can guide these firms to develop something fitted with a government's long-term planning.

Moreover, this case also identified the difficulties of such new start-ups. To survive in the competitive market where ICE vehicles dominate, they need to provide their clients with free products and services before the formal commercialization. In this situation, some companies might fail to succeed because of the financing issues. The transport authorities are encouraged to develop training programs/incentives that can educate the delivery companies or other relevant companies the benefits of using environmental friendly electronic vehicles. In this way, there will become active customers who will seek new mobility solutions by themselves.

<table>
<tr>
<td rowspan="2">Key Partners
Suppliers of components & raw materials
Customers on trial projects (UPS, RM)
Investors</td>
<td>Key Activities
Development driving systems
Development autonomous-driving systems
Development of software
Manufacturing the vans
Big data collection and analysis</td>
<td rowspan="2">Value Proposition
Environmentally friendly (i.e., clean and quiet) vehicles
Autonomous driving characteristics
Cost compatible with ICE vehicles
Increasing amount of electronic services and innovative solutions in the mobility sector</td>
<td>Customer Relationships
Close R&D with client
Personalized seller-buyer relationship in the future</td>
<td rowspan="2">Customer Segments
Package delivery services (e.g. UPS, RM)
Public transport operators</td>
</tr>
<tr>
<td>Key Resources
Physical resources: manufacturing site, R&D workshop
Human resources: engineers, technicians, software developers
Financial resources</td>
<td>Channels
B2B sales channels with sale representatives
Website channel
Personal communication</td>
</tr>
<tr>
<td colspan="3">Cost Structure
Components/materials cost
R&D costs
Production cost
Employee salaries</td>
<td colspan="2">Revenue Streams
Selling of products and solutions in the future
Public funding</td>
</tr>
</table>

Figure 1: The Business Model Canvas for Arrival

5.2. Case Study 2 Griff Aviation

[Case background]

Griff aviation was founded few years ago.[13] The aim of its business is to develop drones, which are capable of lifting heavy weight objects and carrying them over relatively short distances (5-8km). Its business model is based on two points of sales. They sell a set of standardized drones on their website, and they R&D more complex and customized drones for large customers with specific requirements for their drones.

[Business model explained]

Griff's drones bring value to their customers in three ways: 1) the drones can be used to transport heavy objects over a short distance, 2) using their drones to transport heavy objects is substantially more cost effective then using helicopters, which are traditionally used for these kinds of tasks, 3) producing drones that are specifically designed for customer needs, giving them the abilities to perform niche tasks.

Currently, the main customer segment of Griff is energy infrastructure construction. Their drones are also used for construction and wind-farm maintenance. Griff finds that customers often approach the company through their website after they have heard about the company from a media source or via word-of-mouth. With clients who buy a standard drone from Griff, the relationship is defined by a buyer-seller transaction. For the drones that are customized, Griff has an intensive interaction with the customers throughout the design period of the drone to ensure that both parties are satisfied with the drone once it is ready to operate. The revenue stream for Griff is defined by the selling of the drones.

To ensure the operation of the business model, Griff needs a number of key resources. These resources are 1) physical resources, including the drone factory and the workshop where the drones are designed, 2) human resources which include all the people involved in the design and manufacturing of the drones, people who are specialized in the legal aspects of selling drones, and the sale team itself, and 3) financial resources, as it is very costly to develop new drones, Griff needs enough financial capability to finance new developments and improvements. These resources together perform the key activities for the business, which includes the designing of new and customized drones, the manufacturing of drones, and the communication with customers who have specific requirement for their drones.

The main costs that stem out of this business model are Aviation approvals by the CAA (Civil Aviation Authorities) and EASA (European Aviation Safety Agency), the costs of designing the

[13] Griff Aviation (2019), Official Website

drone, the cost of customize the "perfect" set-up of components in line with regulations, the costs of manufacturing the drones and the salaries paid to the workforce. Figure 2 summarizes the key elements of business model canvas of Griff.

[Other factors influencing business model]

A major factor that plays a role in Griff's business model is regulation. At the moment governments have regulated the drone industry to a minimum extent. This means that there is no or very little safety regulation when it comes to manufacturing and flying drones. Griff has responded to this by designing their drones in such a way that aviation authorities would approve them if there were stricter regulations.

[Implications for decision-makers from authorities / public transport]

Griff has responded to regulation by designing their drones in a way that aviation authorities would approve them. Griff's dedication to ensure they would comply with aviation standards strongly influences the design of their products and the type of clients that they choose. This implies that a well-established regulations or at least an adaptive but concrete governance framework is necessary for such companies.

In order to develop disruptive innovations, these drone companies often need to identify emerging customer needs and wants, design an innovative porotype, and optimize the manufacturing process. However, without clear regulations, it will be difficult for drone companies to develop a long-term blueprint for next 20-30 years. This long-term blueprint often determines the success of these firms in the future. Therefore, the policy makers need to develop an adaptive regulation framework and provide a transparent guidance for these start-ups. By doing so, mobility companies will be more confident to pursue disruptive innovations, which can prosper the development of modern transportation.

<table>
<tr>
<td rowspan="2">Key Partners
• Co-contractors
• Aviation authority
• Investors (e.g. Research Council of Norway
• Branding manager</td>
<td>Key Activities
• Designing drones
• Manufacturing drones
• Communication with customers
• Big data collection and analysis
• Customizing components to meet aviation standards</td>
<td rowspan="2">Value Proposition
• Heavy weight lifting & air transportation over short distances
• More economical then helicopters
• Drones tailored to specific customer needs</td>
<td>Customer Relationships
• Close R&D with client
• Seller-buyer relationship</td>
<td rowspan="2">Customer Segments
• Energy infrastructure companies
• Construction companies
• Wind-farms companies
• Filming companies</td>
</tr>
<tr>
<td>Key Resources
• Physical resources: factory and R&D workshop
• Human resources: engineers, software engineers, aviation specialists, legal specialists, sales team
• Financial resources</td>
<td>Channels
• Website
• UAV conventions air-shows
• Word-of-mouth</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• R&D costs
• Production cost
• Employee salaries</td>
<td colspan="2">Revenue Streams
• Selling of products and solutions</td>
</tr>
</table>

Figure 2: The Business Model Canvas for Griff Aviation

5.3. Case Study 3 Drone Delivery Company A

This case study has been anonymized. Since the drone delivery is such an innovative service, this company has been reticent to share their business model and strategies. For this reason, the description of the following case study derives from the analysis of the information made available by a drone delivery company (hereinafter referred to as "Drone Delivery Company A").

[Case background]

Drone Delivery Company A is a publicly traded company which expects to commence its drone logistic services by offering a depot to depot service, initially working exclusively in rural areas. Once this service model is fully tested and proven, the service will also be extended to more urbanized areas and will be integrated with direct consumer delivery services (depot to consumer).

[Business model explained]

Drone Delivery Company A provide retailers, service organizations and government agencies in just in time delivery service. Currently the value proposition is to reduce the operating costs of its customers for the delivery of goods in remote areas. The use of drones makes it possible to transport food, retail goods, first aid and emergency road side assistance more quickly and economically where infrastructure is scarce.

Revenue streams are federal funding from remote communities but subscription fees, from utilizing the company's services that pay integration and setup fees (it' s required to contract to a minimum monthly service rate). Additional charges are charged once the minimum delivery count is exceeded.

The drones obviously constitute the main resource of the company. It must be specified that Drone Delivery Company A is not a hardware company and therefore purchases or leases hardware components, various subsystems and systems, and raw materials from a limited group of suppliers.

The highly seasoned technology professionals are engaged in research and development activities mainly focused on the design, development and implementation of its proprietary logistics software platform and on the development of a logistics platform drone. Furthermore, the company's platform is intended to be used as Software as a Service ("SaaS") for government and corporate organizations.

Another important activity is the continuous seeking of partnerships with industry leading retailers, service organizations and government agencies because they try to develop an integrated solutions for their future customers. At the moment the main partners, in addition to investors and suppliers, are universities, academics and third party software development firms with which Drone Delivery Company A collaborates in its research and development activities. Figure 3 presents the key elements of business model canvas of Drone Delivery Company A.

[Other factors influencing business model]

There are also a number of factors that are important for the business model but are not reflected in the canvas. The Company has obtained Special Flight Operations Certificate ("SFOC") which authorizes it to operate in all national provinces and territories. Furthermore, the company is investigating the possibility of offering its services also in the USA and Europe.

[Implications for decision-makers from authorities / public transport]

Uncertainties and concerns about drones (noise pollution, security and privacy issues) have fostered a rather cautious approach by the authorities. In general, to date, most national civil aviation authorities in the world, at the request of operators, are more likely to release single interventions for testing or service in less densely urban areas; recently the Civil Aviation Safety Authority of the Australian Government approved Wing Aviation Pty Ltd, which authorized Wing to perform tests even in populated areas. Europe instead is preparing the creation of a law to regulate commercial airspace corridors of drones called U-Space to allow a wide deployment of drone delivery services.

<table>
<tr>
<td rowspan="2">Key Partners
Investors
Universities, academics and organizations
third party software development firms
hardware suppliers</td>
<td>Key Activities
R&D
Design, development and implementation of its proprietary logistics software platform
Seeking partnerships with industry leading retailers, service organizations and government agencies</td>
<td rowspan="2">Value Proposition
Faster and cheaper, just in time delivery services from depot to depot (to date, exclusively in remote areas with poor infrastructure networks) and from depot to consumer (in more densely urbanized areas)</td>
<td>Customer Relationships
N.A.</td>
<td rowspan="2">Customer Segments
Retailers
Service organizations
Government agencies</td>
</tr>
<tr>
<td>Key Resources
Drones
Knowledge resources: highly seasoned technology professionals</td>
<td>Channels
Website channel</td>
</tr>
<tr>
<td colspan="3">Cost Structure
Drone procurement
Operating costs
R&D costs</td>
<td colspan="2">Revenue Streams
Federal funding from remote communities
Subscription fees from customers</td>
</tr>
</table>

Figure 3: The Business Model Canvas for Drone Delivery Company A

5.4. Conclusion

This chapter discusses the business models of Arrival, Griff, and Drone Delivery Company A. The analyses show that the main value propositions of connected, cooperative, and automated mobility is to 1) provide a more environmentally friendly, economical, and efficient vehicles and drones, 2) develop the most advanced technologies or services to satisfy emerging and unaddressed customer needs (e.g., long-distance healthcare) integrate various functions (e.g., technical functions and entertainment functions) in order to offer an integrated solution for future competitive markets. Their customers can either be B2B or B2C customers. Although the B2B customers are their main focus now, B2C customers might also be highly profitable in the future.

For connected, cooperative, and automated mobility, they usually deliver their value proposition by website, conferences, and international exhibitions. Developing close buyer-seller relationships is also key for them to keep their customers and improve their products and services. The revenue stream depends on different business models. However, all of these companies are trying to sell integrated solutions for their clients. This means that revenue from services outside the products will become more and more important in the future transport industry. In these cases, most of them focus on R&D activities now because they are very young start-ups. Nevertheless, the marketing activities will gradually become a critical activity as other competitors are emerged in the markets. These firms also need to form some strong partnerships with governments, and others from different industries in order to secure their competitive advantages. Based on the interviews, a close partnership with clients is a key for them to keep developing new solutions that will address future needs.

In addition to business model canvas, the interviews also point out that legislation is an important factor that determine their product and service features, which in turn, partially determine the direction of business model innovation. To develop a long-term innovation blueprint for the next 20-30 years, new mobility companies need to follow an adaptive regulation framework or regulation guidance from policy makers. The interviewees also concluded that the collection, analysis, and transformation of big data is critical to all the elements of their business models.

6. INFRASTRUCTURE, NETWORK AND TRAFFIC MANAGEMENT

European cities are currently facing congestion issues because of massive concentrations of people in urban areas and the preferences for private vehicles. Traffic management has thus a great impact on health, economy and more generally on quality of life because it is a effective way to solve congestion problem.

Traffic management plans are currently established with information provided by traditional sensing and surveillance technologies located on the road, without considering information coming from the drivers themselves through the connected vehicles or the apps they use (Waze, Google Maps, etc.). The advent of these Internet of Things allows advanced monitoring technologies, and information improvement regarding traffic conditions. Cooperation between all the stakeholders could thus improve road traffic management, leading to decreased congestion and improvements in air quality. This will lead to innovative business models, arising from these new cooperation models that are currently being built through initiatives such as TM2.0's[14], an innovative platform setup in order to provide new solutions on traffic solutions.

In addition, disruptive mobility solutions that require new infrastructure are currently being developed, such as ultrafast trains or urban air transport[15]. These low polluting mobility solutions can revolutionize our transportation system. For example, the ultrafast trains, with a velocity up to 700 km/h, could replace planes for medium-range distance. We can also imagine that this will revolutionize commuting in a way that people can live much further from their office, thus limiting the concentration of population and related congestion issues that cities and suburban areas are currently facing.

Policy makers are addressing congestion issues through different ways: the improvement of traffic management with real-time data, the incentivization of alternative and sustainable mobility solutions through the use of disruptive transport (see case study 1) or car's charging (see case study 2).

[14] See Deliverable D1.1 « Review of new technologies and services"

[15] Supraways (2019), Official Website.

6.1. Case Study 1 Space train

[Case background]

Space Train, created at the end of 2016, is one of the subsidiaries of Jacques Vaucanson company which focus on developing complex systems requiring robotics skills (mechanics, electronics, signal treatment, automation, computer science, artificial intelligence).

The technology that is being developed in Space Train relies on the experiment "Aerotrain" that was carried out in the 1970's with the technology invented by Jean Bertin. It is a currently at a TRL up to 3 (experimental proofs), this objective is to perform a prototype demonstration (TRL 6) in 2019 before deploying the fully qualified technology in 2024 (TRL 9).

[Business model explained]

Space Train is positioning itself as a transport manufacturer and supplier, selling the disruptive Space Train to railway operators (B2B).

In order to get revenues before the deployment of this technology in 2025, a second revenue stream has been setup: innovative technologies that are integrated in the Space train (autonomous air bearing technologies, smart energy management, etc.) will be sold from 2021 to automotive and aerospace industrial sectors. Figure 4 summarizes the business model canvas of Space Train.

[Other factors influencing business model]

There are also several factors that are important for the business model but are not reflected in the canvas:

- **Financing:**

First, it is interesting to mention that government incentives and regulations can play a significant role in how the business model is developed. The deployment of these ultrafast autonomous trains requires investment that couldn't be provided if this technology is not included in the future transport roadmap drawn by states or supranational bodies. It is important to point out that traction systems [16] and automated train operation technologies [17] developed in order to

[16] Shift2Rail (2019), Innovation Programme 1

[17] Shift2Rail (2019), Innovation Programme 2

implement high-speed trains is part of the targeted achievements highlighted in the European Shift2Rail program.

In addition, private investors have also their requirements regarding the technology. A compromise must be made between public and private expectations.

- **Policy and social acceptancy:**

The infrastructure is a key point regarding the deployment of the Space Train. As the ultrafast shuttle is very disruptive, a policy framework has been setup, requiring work in partnership with construction industries (infrastructure experts) to be compliant with policies.

In addition, social acceptancy could be crucial regarding infrastructure and technological choices. As an example, cityscape and architectural heritage could be factors that could influence aerial train or track on ground.

[Implications for decision-makers from authorities / public transport]

Decision-makers from authorities/public transport should define an urban plan that integrates the Space Train in the city, with an infrastructure compliant with standards that have to be defined at a national or international level, in collaboration with all stakeholders.

<table>
<tr>
<td rowspan="2">Key Partners
• Investors
• Private sector (Dassault Systemes, Air Liquide, Ingérop, Axane, Paolini, MathWorks, Langlois, Progiss 3DVF.FR, ANSYS
• Private investors
• Collectivities: Région Centre-Val de Loire, Loire & Orléans Eco
• Universities: Université d'Orléans, Polytech Orléans, Université de Technologie Belfort-Montbéliard, Université Evry Val-d'Essonne, Université Paris-Saclay
• Clusters: UITP, Mov'eo, World Alliance
• Railways operators
• Infrastructure stakeholders</td>
<td>Key Activities
• Production of Ultrafast autonomous shuttle
• Development and marketing of technological components</td>
<td rowspan="2">Value Proposition
• No tube is required, lowering significantly infrastructure and maintenance costs compared to Hyperloop for instance.
• 0 GHG emission (electric propulsion with hydrogen)
• Speed higher than current high-speed trains for lower maintenance costs.</td>
<td>Customer Relationships
• Buyer-seller relationships
• Maintenance services</td>
<td rowspan="2">Customer Segments
• Rail operators
• Automotive and aerospace industries for technological building blocks
• Interurban</td>
</tr>
<tr>
<td>Key Resources
• Infrastructure resources: first tests launched on "Aérotrain" infrastructure that will be modernized for that purpose.
• Human resources: 20 collaborations in France and worldwide, 15 R&D engineers, 3 PhDs
• Financial resources from private sector (bank loans, fundraising campaigns, etc.), public subventions
• Technological resources: test benches in laboratories, components that are developed and tested</td>
<td>Channels
• Online Channels</td>
</tr>
</table>

Cost Structure • Infrastructure development/maintenance cost • Employee salaries • Marketing and advertising fees • Land purchase	*Revenue Streams* • Selling products and services to rail operators • Selling technological components to automotive and aerospace industries

Figure 4: The Business Model Canvas for Space Train

6.2. Case Study 2 Municipality of Milan

[Case background]

A more traditional Traffic Management approach is the one adopted by the Municipality of Milan: the adoption of a congestion charge. More specifically, since 2008 the Milan area subject to the congestion charge has been widened, up to become one of the widest European ones. The impact of this strategy has been notable in a city characterized by high rates of car ownership, and more importantly by a strong usage of private vehicles for daily trips.

Technically, the area subject to congestion charge works through a monitoring network that - among other things - serves as a real time traffic monitoring. Moreover, as a part of a short trial, the monitoring network has also served to control the levels of air pollution.

[Business model explained]

The congestion charge zone has been divided into two concentric areas, the smaller Area C and the wider Area B.

Area C was introduced in its first configuration in 2008 (it was called *Ecopass*). It covers all the central area of the city. The underlying monitoring network consists of 43 gates to control the vehicles accessing to the city centre.

Area C is mainly intended to reduce traffic congestion, but it also serves to the aim to reduce vehicles pollution. In this vein, electric vehicles and some hybrid vehicles have free access. To access to the Area C is necessary a ticket. The latter could be bought through online and offline channels. The online channels are the Area C official website, and the Telepass profile. The latter channel is part of a broader collaboration between the Municipality of Milan and Telepass, which facilitates also the purchase of parking tickets in the city. As for the offline channels, the Municipality relies on the same channels used for selling metro tickets: tobacco stores and metro desks. To ease and incentivize the access, drivers can buy tickets also once they've accessed in the area.

The more recently introduced Area B covers almost the whole territory of the city of Milan, and serves mainly to the aim of reducing pollution, by banish the access to the most polluting vehicles. To access to the Area B is necessary to be registered *via* the official website. Electric, LPG, methane, biofuel and hybrid vehicles are exempted.

Some exemptions apply for both the area. More specifically, it is possible to register a vehicle on a website in order to get limited access for limited purposes such as: service vehicle for gas, water, electricity, waste; vehicles of companies that have their operational headquarter in Milan; mail delivery; transport of valuables and suppliers. If a vehicle does not have the required parameters, it can circulate in the Area for a limited amount of days.

[Other factors influencing business model]

Data are collected by the municipality of Milan in order to provide statistics for the city and to ensure functioning and penalties.

There is no national and regional legislation and all the regulatory frameworks are in the hand of the Municipality. All the revenues are reinvested to develop sustainable and "soft" mobility in the city or to develop new form of shared mobility such us the s.c. BikeMi, a station-based bike sharing service that covers all the city.

[Implications for decision-makers from authorities / public transport]

The Municipality of Milan is competent for the congestion charge zone. Which implies that decisions are based on different public instances, namely traffic management, public incomes and pollution control.

Public incomes from tickets selling and fines amounted to thousands of millions in 2015[18], and they increase year by year. Still, the debate on the reinvestment of these resources is not unambiguous and gives life to the public debate.

Pollution control is gaining centrality among the drivers of congestion charging zone policies. In this regard the Municipality has launched a plan (which is up to 2025) consisting in reducing year by year the access for some categories of vehicle to one or both the area.

[18] https://milano.corriere.it/notizie/cronaca/15_settembre_24/area-c-256-milioni-3-anni-multe-ticket-cittadini-spennati-533c8b0e-62b5-11e5-95fc-7c4133631b69.shtml

<table>
<tr>
<td rowspan="2">Key Partners
Private transport companies
Public policy makers
Transport service providers
Maps Providers
Payments Providers
Camera Access control</td>
<td>Key Activities
Access regulation on the city centre and monitoring</td>
<td rowspan="2">Value Proposition
Traffic jam reduction
Public incomes
CO2 reduction
Reducing old vehicles circulation
Exceptions for some categories of vehicles (e.g. disabled vehicles)</td>
<td>Customer Relationships
Automated services and self-services.</td>
<td rowspan="2">Customer Segments
Milan residents and non-residents</td>
</tr>
<tr>
<td>Key Resources
Physical resources: Software enabling platform (ticketing services, real-time travel times).
Human resources: website and App designers and developers (IT), marketing and sales team (Marketing and Sales), and CRM team (Customer Relationship)
Two access rings (Area A and Area B)</td>
<td>Channels
Online channel (App, institutional website, Telepass)
Offline channels (such as tobacco shops, metro desks)</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Network implementing
Software development/maintenance cost
Marketing and advertising fees</td>
<td colspan="3">Revenue Streams
Pay-as-you- access payments</td>
</tr>
</table>

Figure 5: The Business Model Canvas for Municipality of Milan

6.3. Conclusion

The case studies that were performed highlighted two ways of improving traffic management and fostering sustainable mobility solutions: the use of disruptive transport and the taxation of private car owners.

- Case study 1: Space Train

Regarding disruptive transport, ultrafast trains are a disruptive transport mode that could completely change commuting and incentivize the use of sustainable mobility solutions for medium-range travel distances (travel between two border countries for example). Hyperloop and Space Train are currently developing solutions. This last company was selected regarding the case study. Space Train presents competitive advantages allowing for the deployment of the technology in 2024: former experience with the "Aérotrain", innovative technological components developed by the R&D which has strong expertise, the use of air bearing technology that lowers significantly the maintenance costs. The sale of these innovative components, such as smart energy management, will provide first revenue streams, but will also enhance the development of other sustainable mobility solutions (e.g. hydrogen propulsion for cars).

The interview that was carried out also highlighted the high investment requirement regarding the deployment of this kind of technology, due to high R&D and infrastructure costs. In addition, policy and social acceptancy are key parameters to consider.

- Case study 2: Municipality of Milan

The Municipality of Milan, second city in Italy, is currently facing strong congestion issues, ranked as the third city in Europe regarding GHG emissions[19]. Local policy makers implemented the first congestion charging scheme for polluting vehicles to solve this major problem, Area C, with a constant environmental condition monitoring. This regulatory measure has a significant impact, with a traffic reduction average reduced by 30%[20], and CO2 emission rate decreased by 22%.

Besides the impact on traffic management, the revenue generated by this taxation measure was used to provide investment for sustainable mobility solutions (see reference in footnote 8):

[19] News Editor (2015), Area C in Milan: from pollution charge to congestion charge (Italy)

[20] https://use.metropolis.org/case-studies/sharing-mobility-strategy-in-milan

- New Park and Ride (Metro Line 3): € 3.8M
- Improvement of bike sharing system (2nd phase up to 200 stations at the end of 2012): € 3M
- Public transport (fleet renewal and increased frequency): € 10M.

7. MAAS AND MAAS PLATFORMS

MaaS and MaaS platforms have brought significant influence to the transport industry. “Maas is a user-centric, intelligent mobility management and distribution system, in which an integrator brings together offerings of multiple mobility service providers, and provides end-users access to them through a digital interface, allowing them to seamlessly plan and pay for mobility.”[21] “The MaaS Platform is the IT structure that is used by the MaaS Operator to provide the final service of mobility to the end-users”.

These two disruptive innovations not only develop their own business models but also drive the changes of business models for other firms. In this chapter, we will discuss three MaaS cases (i.e., MaaS Company A, Transdev, and Urbi). For each case, the case background, business model canvas, and other relevant factors are discussed.

7.1. Case Study 1 MaaS Company A

This case study has been anonymized. Since MaaS is such an innovative service, this company has been reticent to share their business model and strategies. For this reason, the description of the following case study derives from the analysis of the information made available by a MaaS company (hereinafter referred to as "MaaS Company A").

[Case background]

The App operates in different cities around Europe where they provide mobility services to urban travellers. Their long-term goal is to become a complete replacement for car ownership.

[Business model explained]

This company focuses on young urban couples and single people households; however, their product is used over all age segments. They have also started to form partnerships with corporate clients who offer MaaS services to their customers and employees. MaaS Company A intends to provide value to customers by providing them with a personalized subscription model for

[21] MaaSLab (2018), The MaaS Dictionary.

mobility. It integrates different transport service offerings into one App, with multiple functions of planning, payment, and ticketing. Its App enables customers to see live travel times, pay different forms of transport and get from their location to destination via different transport methods more efficiently. There are currently several channels to allow MaaS Company A gets in contact with its clients. However, the app-based channel is the main way for them to deliver their value to customers. MaaS Company A develops relationships with customers by providing automated and self-services, with personal assistance in some special situations.

There are three different revenue streams for MaaS Company A: 1) subscription (i.e., where customers pay a fixed amount of fees per month for limited travel) and unlimited' subscription (where customers pay a fixed amount of fees for unlimited travel), 2) pay-as-you-go (where customers pay for individual trips separately), and 3) fee for additional services customers may pay, like an upgrade to a nicer rental car.

To ensure their daily operation, MaaS Company A needs to manage their key resources and activities. Key resources include a well-designed app that is user-friendly and a platform that can connect all the information available with customers and allow them to purchase tickets. It also has strong human resources, with product design and pricing specialists, partnership management, IT, marketing and sales team. For daily activities, there are five main activities that are needed to keep the business running: 1) ensuring maximum number of transport provider is connected to the platform is essential to ensure good mobility service, 2) relationship management with all partners MaaS Company A has, 3) maintain the platform to ensure services are provided in an efficient way, 4) collect and analyse data, 5) make sure all services provided by the company are up-to-date.

The payment to transport providers is a one of MaaS Company A's main costs. Another main cost is their marketing and PR expenditure. Other major costs related to their business model are the software maintenance and updating costs and the salaries paid out to their workers.

[Other factors influencing business model]

It is interesting to mention that the company has attracted a lot of investment from incumbent firms in the transport sector. This has allowed firms to expand, starting their business in new cities. However, it could bring potentially negative influences on the current partnerships with transport providers because they include some of their competitors as investors.

[Implications for decision-makers from authorities / public transport]

Government incentives and regulations can play a significant role on how a business model is developed. For example, one transit agency first refused users to use their monthly passes. These forced MaaS Company A's customers to purchase a new ticket every time. The local government then made it obligatory for transit agency to open their monthly passes to third parties, which could severely influence the revenue structure and cost structure of MaaS Company A. There is no explicit mentioning of this in the current literature but it is easy to imagine how certain subsidies or tax incentives can strongly affect the business model. For instance, if the government start taxing more on private vehicles, more people may choose to use mobility-as-a-service app instead of owning their own vehicle.

In order to help MaaS companies develop a sustainable business model, the policy makers need to design a more concrete regulation, incentive, and governance framework. As the above case shows, the disruptive MaaS innovations often encounter a variety of uncertainties in the commercialization stage. A well-established framework from authorities can support them promote MaaS products to different cities in a more efficient and effective way.

<table>
<tr>
<td rowspan="2">Key Partners
• Investors
• Public policy makers
• Transport service providers
• Specialised technology providers (GPS, payment, analytics, and specialised API)
• Insurance firms
• Third party platform providers</td>
<td>Key Activities
• Ensuring maximum number of transport providers included in platform
• Relationship management with other key partners
• Maintenance platform including ticketing services and real time travel data
• Big data collection and analysis from transport providers and other service providers
• Solitary innovation of all services</td>
<td rowspan="2">Value Proposition
• A personal mobility subscription provider (car replacement)
• Seamless and integrated planning, payment, and ticketing interface (e.g., price competitiveness, cost reduction, convenience with less time)
• Enhanced end-to-end customer experience with multi-modal transport choices</td>
<td>Customer Relationships
• Automated services and self-services, with personal assistance in specific situations.</td>
<td rowspan="2">Customer Segments
• Young urban couples
• Single people households
• All age segments
• Employees of corporate clients</td>
</tr>
<tr>
<td>Key Resources
• Physical resources: Software enabling platform (ticketing services, real-time travel times).
• Human resources: Product design and pricing specialist, partnership management, IT personnel, marketing team, and CRM team
• Financial resources
• Information Resources</td>
<td>Channels
• App-based channel
• Website channel
• Third party platforms (utility, energy banks, etc.)</td>
</tr>
<tr>
<td colspan="2">Cost Structure
• Payment to transport providers
• Software development/maintenance cost
• Employee salaries & PR costs
• Marketing and advertising fees</td>
<td colspan="3">Revenue Streams
• Subscription fee (with basic and premium options) from customers
• Pay-as-you-go.
• Fee for additional services (premium services)</td>
</tr>
</table>

Figure 6: The Business Model Canvas for MaaS Company A

7.2. Case Study 2 Transdev

[Case background]

Transdev is a worldwide company, operating 17 modes of transport and the first European operator of zero emission mobility solutions. Relying on their expertise regarding sustainable mobility solutions deployment, and the good knowledge regarding public service and their experience regarding relationships with local policy makers, Saint Etienne Metropole chose Transdev to be one the first cities to develop MaaS in France. A first version was setup in 2016, including real-time and multi/intermodal information (road traffic, bike-sharing, trains and planes), parking, booking and transport payment (public transport, bike-sharing). The payment of transport was performed through ebeacons, parking via QRcodes. In 2019, a new MaaS application will be deployed, including new mobility services (carsharing, carpooling, taxis), predictive information, ticket selling for all modes and new payment solution.

[Other factors influencing business model]

Regarding the business models, customers receive a bill at the end of the months for the payment of all transport modes they used. The price is fixed for each transport mode, there is not yet a "mobility package" regarding pricing. The funds are thus redistributed to service providers with charged fees.

Three levels of services could be sold:

- **Global offer**: Transdev develops MaaS technological for cities, but also ensures MaaS operation and other services operated by the ***MaaS operation service department*** (customer support, data analysis to propose custom-made offers);
- **MaaS operation**: cities (medium-sized to metropoles, large transport network) could launch tenders for MaaS operation. Transdev can answer this call and provide both technology solution and MaaS operation.
- MaaS solution provider: Transdev can provide a MaaS technical solution to smaller cities. MaaS operation will be performed by public transport.

Big cities to regions	Medium-sized cities, metropoles with large transport network	Smaller cities, small or medium-sized transport network
MaaS operation complementary services (customer support, data	MaaS operation and technology supply	MaaS technology supply

analysis to propose custom-made offers)		

[Data • policies • incentives • financing • taxation structure]

It is important to point out key parameters that have not been highlighted by the business model canvas:

- **Data exchanged:**

Data sharing is carefully considered regarding MaaS to keep users' privacy and safety. All Transdev development are compliant with GDPR rules. In addition to that, cities and local policy makers (main customers) own data, which make them available to Transdev after anonymization process. This allows Transdev to analyse data in order to improve transport organization and mobility service offer.

- **Policy:**

Policy could be an enabler regarding MaaS deployment, as many initiatives are being setup in order to change mobility paradigm (Low Emission Zone, dedicated path for carsharing users…)

[Implications for decision-makers from authorities / public transport]

Decision-makers and public transport have to set-up a regulatory framework for the cooperation between public and private parties in order to have guidelines to build win-win partnerships, thus guaranteeing policy objectives while preserving interests of private sector.

<table>
<tr>
<td rowspan="2">Key Partners
• Public policy makers
• Transport manufacturers
• Transport service provider: STAS (Transdev branch), Citiz (carpooling), Mov'ici (carsharing), Karhoo and local taxis, Vélivert and Smoove (bikesharing)
• Specialized technology providers (GPS, payment, analytics, and specialised API)</td>
<td>Key Activities
• Operator and integrator of mobility services: bus, cars, tramways, metros, trains, ferry, taxis (85% public transport)[22]
• Sustainable mobility solution provider: "green vehicles" for transport (alternative fuels, electric mobility), development of services such us on-demand and carpooling transport (smartphone apps, autonomous shuttles)
• Pioneer regarding multi-modal mobility and MaaS, developing smartphone solutions: route calculating and real-time information (Moovizy in Saint-Etienne, Triplin in Toronto), "M ticketing & SMS ticket services" (public transport purchase)</td>
<td rowspan="2">Value Proposition
• Seamless and integrated planning, payment, and ticketing interface
• Enhanced end-to-end customer experience with multi-modal transport choices: data analysis to propose custom-made mobility packages</td>
<td>Customer Relationships
• Automated services and self-services, with personal assistance in specific situations thanks to data analysis and predictive data processing.</td>
<td rowspan="2">Customer Segments
B2G:
• Cities
B2C:
• Urban young commuters
• Students
⇨ Diary travels, local MaaS deployment</td>
</tr>
<tr>
<td>Key Resources
• Physical resources: Software enabling platform (ticketing services, real-time travel times) for smartphone applications, transportation technologies.</td>
<td>Channels
• App-based channel</td>
</tr>
</table>

[22] Propos recueillis par Virginie de Kerautem (2018), Transdev est-il un acteur public ou privé ?

	Technologies are developed in Citiway Transdev branch. • Human resources: strong expertise with 82 000 employees worldwide over 20 countries. • MaaS operation service: this new department will be setup in order to provide operation services as well as a call centre to guarantee customer support			
Cost Structure • Software development • Transport service providers payments • Employee salaries • Marketing and advertising fees • 20-25 M€ investment per year for innovation • Investments on other MaaS initiatives		*Revenue Streams* • Contracts with public authorities • Fees charged regarding the distribution of funds to mobility service providers.		

Figure 7: The Business Model Canvas for Transdev

7.3. Case Study 3 Urbi

[Case background]

Urbi has been founded by the app developer, Emiliano Saurinin, in 2014. The birth of Urbi has been possible thanks to the funding activity of the tourist platform Lastminute.com. At the core of Urbi lies a MaaS platform, aggregating different third parties sharing mobility services. During the years, Urbi has expanded up to reach 15 major European cities, with 200,000 downloads in total. In 2017 the tolls company Telepass has become the main shareholder (70% of share) of the company.

[Business model explained]

Urbi, is an aggregator of shared mobility services active in a city, simplifying their use. In addition, Urbi gives the end user the opportunity to plan their travel, in real-time. By accessing the application, the user can geolocate in real time on a map all the shared media available.

Furthermore, by selecting the desired destination, Urbi shows all the possible alternative routes, with indications on costs and times, taking into consideration the traffic on the selected route. It delivers an overview of all the shared resources available in the city, detecting those available and nearest to the user, and calculating the best route.

Recently, the offer was implemented by adding indications on taxis and Uber. Moreover, the aim for the near future is to integrate public transport.

As for payment, Urbi relies on a pay-as-you-go model. In addition, Urbi offers the opportunity to buy different package/voucher combining some of the mobility services available on the platform.

Urbi is not part of transitions between mobility service suppliers and users. This as a result of the bargaining power of the partners, which are difficult to be convinced by Urbi difficulty to be incorporated into the aggregator. Currently, Urbi includes 46 services and is available in 23 cities between Italy, Spain, Germany, the Netherlands and Austria.

[Other factors influencing business model]

Data collection is at the core of Urbi functioning. Data are collected in order to provide the users suitable solutions for their travel. As aforementioned, due to its strong shareholder, the company financing relies on debt capital instead of risk capital.

[Implications for decision-makers from authorities / public transport]

The implications for decision-makers and public transports are those related to the development of MaaS platforms. More specifically, public transport companies could decide to enjoy a MaaS platform such as Urbi, but to do so, access to the ticketing system should be grant to the aggregating platform. Public authorities and decision makers should establish a set of rules dealing with some sensitive issues, such as data treatment as platforms as Urbi can collect a huge amount of users' data).

<table>
<tr>
<td rowspan="2">Key Partners
• Transport service providers
• Payments Providers
• Cloud Providers</td>
<td>Key Activities
• Third parties' mobility services aggregator</td>
<td rowspan="2">Value Proposition
• Traffic jam reduction
• CO2 reduction
• Unique platform for different mobility services (car sharing, scooter sharing, bike sharing)</td>
<td>Customer Relationships
• Automated services and self-services.
• Personal assistance through Contact Service in specific situations</td>
<td rowspan="2">Customer Segments
• Commuters resident and non-residents in the major European cities
• Smart and no-car owner workers/students resident in the major city centres
• Companies</td>
</tr>
<tr>
<td>Key Resources
• Physical resources: Software enabling platform.
• Human resources: website and App designers and developers (IT), marketing and sales team (Marketing and Sales), and CRM team (Customer Relationship)</td>
<td>Channels
• App-based channel
• Website channel</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• Network implementing
• Software development/maintenance cost
• Marketing and advertising fees</td>
<td colspan="2">Revenue Streams
• Revenues from commission on third parties services</td>
</tr>
</table>

Figure 8: The Business Model Canvas for Urbi

7.4. Conclusion

In this chapter, the business models of MaaS Company A, Transdev, and Urbi are presented and discussed in terms of customer segments, value propositions, channels, customer relationships, revenue streams, key activities, key resources, key partnerships, and cost structure. Based on the interviews, the results show that the value propositions of MaaS and MaaS platforms are 1) seamless and integrated planning, payment, and ticketing interface, 2) enhanced end-to-end customer experience with multi-modal transport choices, and 3) data analysis to propose custom-made mobility packages. Their customer segments can be generally divided into B2G and B2C, though the interviews also point out that B2B market is highly potential when the MaaS ecosystem become more complete.

An app-based channel is the main way MaaS providers deliver their services to customers. The revenue stream of MaaS and MaaS platforms comes mainly from the contract with B2G customers (i.e., public authorities), subscription fees with frequent users, pay-as-you-go with other users. The interviewees also suggest advertising will also become an important source of revenue when the user base is well build.

IT and marketing resources are key in their business models. Although these firms are focusing on R&D activities, the constant improvement of data acquisition and analysis in order to optimize the real-time decision of customers is critical to maintain their competitive advantages and compete with future competitors. In addition, forming strong partnerships with key stakeholders is a key to maintain the operation of their daily businesses.

In the end of interviews, most of interviewees suggest that the role of government and upcoming legislation rules might positively or negatively influence their direction of business model innovation. These will also change the rule of industry, which may attract more potential entrants in this new markets. To compete in the future, MaaS firms need to have a team with strong legislation sensing capabilities and developing innovative offerings that address future customer needs and fit new legislation.

To help MaaS companies develop a sustainable business model, the policy makers need to design a more concrete regulations and governance framework. As these cases show, the disruptive MaaS innovations often encounter a variety of uncertainties in the development and commercialization stage. A well-established framework from authorities can support them to overcome these uncertainties and promote MaaS products to different cities in a more efficient and effective way.

8. SHARED ON-DEMAND MOBILITY

In this chapter the business models of three cases of shared-on demand mobility are analysed: Taxistop for carpooling, Scooter-sharing Company A for scooter sharing and Helbiz for car sharing. Shared mobility can be defined as usage of shared resources, in this case vehicles, which are made available to registered users at various locations in the city. On-demand mobility, on the other hand, is service provided 'on-demand', when requested by the customer, and not based on a fixed schedule. As with other innovation categories, business models are represented according to the business model canvas. Subsequently a brief description of the operation and relations between the sections of the Canvas model is given. Finally, additional information is included that is not included in the canvas template.

8.1. Case Study 1 Taxistop

[Case background]

Taxistop is a non-profit organization which provides sharing mobility services such as carsharing and carpooling. For the carpooling service their app Carpool.be helps its users find a carpool partner for regular or single rides.

[Business model explained]

Taxistop provides carpooling services for individual travellers and companies, but with the increasing competition (big platforms such as Uber, BlaBlaCar) in recent years they are focusing more on commuters and B2B models especially in the Belgian market.

Compared to its competitors, the value proposition of Taxistop is that they offer personal contact with expertise and dedication, working together with their partners to create customized services and being also available by telephone (which create more trust in customers). In the future the focus will probably be directed to interconnected mobility, leveraging on past research projects (e.g. SocialCar) and MaaS schemes for multimodal travels.

In the past, revenue streams came mainly from the government (subsidies in general), while now it is much more from businesses. In fact, the government cannot intervene in the market, so it was risky to rely only in one customer.

Key resources for Taxistop are the IT platform, marketing and mobility experts. Innovation is also very important to them, to the point that they have recently created a new role whose main responsibility is innovation. Other resources come from Google for geodata and maps, from Oracle for databases and some licenses but there are no direct relationships with suppliers.

Given that carpooling is a difficult market, among other activities that Taxistop is carrying out in the field of carpooling there are also activities aimed at finding new strategies, such as: the promotion of carpool software for individual travellers in cooperation with the government, the collaboration of young student population to try to innovate their business model, try to offer carpool journeys linked to others tools, even investigating in how they can be valuable to MaaS operator.

Taxistop's main partnerships are mainly with companies but also with regional governments and public transport operators. In particular, regional governments such as Wallonia, Brussels and Flanders sometimes finance their innovations.

[Other factors influencing business model]

There also a number of factors that are important for the business model but are not reflected in the Canvas, for example regarding how the business model has evolved over time according to internal and external factors.

The difficulties that Taxistop had to face and that led to the change of their business model over time are mainly linked to the fact of being a non-governmental organization (although over the years this type of organization has increasingly acquired a modus operandi similar to that of companies) and, sometimes, the lack of the resources needed to implement the large number of ideas and initiatives. This has made it difficult to compete with international platforms like Blablacar or Uber, that have more financial capacity. Furthermore, from a technological point of view, Taxistop cannot compete with larger companies with some 30-40 developers.

For these reasons Taxistop has decided to focus on more specific services and to limit its offer to the Belgian market, taking advantage of its experience, bond and knowledge of the territory, of the main players, and of the regulatory framework (including tax and insurance systems). At present Taxistop intends to further integrate users' feedback. They already have a rating system with stars and descriptions, but they have also started working with user groups to evaluate in advance any updates on tools or features in their software. In the future, the main intentions are to integrate connectivity into their service offerings.

[Implications for decision-makers from authorities / public transport]

In general, carpooling can be seen as a complementary transport service to public transport, managing to serve, on demand, areas that can be characterized by low demand levels.

In particular, some of Taxistop's main partners are regional governments and public transport operators and in the future the organization would also like to focus on MaaS schemes for multimodal travellers. Therefore, the service offered is harmonized with the local authorities and is a support for public transport. This will be even more true when the services will be brought together under a single MaaS platform.

<table>
<tr>
<td rowspan="2">Key Partners
Mobility companies
Regional governments
Public transport operators</td>
<td>Key Activities
Platform maintenance
Customer experience optimisation</td>
<td rowspan="2">Value Proposition
Facilitating carpooling rides between drivers and passengers;
Supporting companies in deploying carpooling initiatives by means of expertise and personal contact with (in-house consultancy) and dedicated campaigns.</td>
<td>Customer Relationships
Automated services and self-services
Personal contact</td>
<td rowspan="2">Customer Segments
Individual travellers
Organizations in charge to optimize mobility in their area/domain</td>
</tr>
<tr>
<td>Key Resources
IT platform
Marketing team
Mobility experts</td>
<td>Channels
App/website
Direct contacts</td>
</tr>
<tr>
<td colspan="3">Cost Structure
Software development and maintenance costs
Marketing and advertising fees
Employee salaries</td>
<td colspan="2">Revenue Streams
Public funding
Pay-as-you-go</td>
</tr>
</table>

Figure 9: The Business Model Canvas for Taxistop

8.2. Case Study 2 Scooter-sharing Company A

This case study has been anonymized. Since the scooter-sharing is such an innovative service, this company has been reticent to share their business model and strategies. For this reason, the description of the following case study derives from the analysis of the information made available by a scooter-sharing company (hereinafter referred to as "Scooter-sharing Company A").

[Case background]

Scooter-sharing Company A is an e-scooter sharing companies. They provide scooter-sharing schemes in a number of cities around Europe. The purpose of the scooter-sharing scheme is to reduce car use in cities by offering an electric scooter. People can pick up a scooter wherever they are in a city and drive it to any destination within the business area of the city. The system is a free floating system, meaning that the scooters can be parked wherever the user wants and do not have to be put into a certain docking mechanism.

[Business model explained]

Scooter-sharing Company A offers value to their customers by providing a fast, convenient, economical, fun and ecological form of end-to-end urban transport. Customers can pick their scooters up from any place in the city and deposit them at any place in the city. Scooters can conveniently be rented with the app. Their customers are from all different age groups and backgrounds and travel distances over the average walking distance. This form of transportation is particularly well suited for the 'last-mile' between a public transport stations and end destinations. Scooter-sharing Company A operates a website and an app as customer channels, however most of their customer communication goes through their app. Customers can automatically find, book and pay for scooters when on the app, if something goes wrong they have the opportunity to speak to a customer support team.

Scooter-sharing Company A generates revenue with this business model by charging their customers a fixed fee per started scooter trip and an additional fee per minute of use.

Scooter-sharing Company A has to possess a number of resources for its business to run smoothly. These are 1) the scooters themselves, 2) GPS tracker systems and an IOT device to track where the scooters are so they can be picked up and communicate with the scooters, 3) the app to allow customers to use the scooters 4) a warehouse in each city where they store and maintain and repair the scooters 5) human resources in the form of operations and marketing team and

mechanics to maintain the scooters, 6) and finally financial resources are needed to fund the expansion of the company. Scooter-sharing Company A has to perform a number of key activities for the business to operate smoothly. Firstly, they have to maintain all scooters. Secondly, they have to maintain the app and ensure optimization of customer experience. Thirdly, good communication with the local authorities is important for them to allow smooth operation of the scooters. For Scooter-sharing Company A's business model to run smoothly they need a number of partners. Firstly, they need a producer of the scooter. Secondly, it is essential that in every city they have a partner that picks-up the scooters and charges them. Thirdly, they need the city authority to allow them to deploy the scooters. Fourthly, it is important that an insurer covers all potential damages induced by the scooter. Finally, they need an investor who provides them with the financial capital.

The costs of running the Scooter-sharing Company A's business model mainly come from the scooter acquisition, maintenance, charging and the daily collection of scooters. Other costs may also be generated by the maintenance of the app and the human resources.

[Other factors influencing business model]

In the scooter sharing industry a number of other factors play a major role in business models of players. First of all, city authority's approach is very varied between different cities. In many cities, they are only licensing a handful of scooter companies to operate in the city. This has a major impact on Scooter-sharing Company A's business model as it determines if they are allowed to operate in a city or not. Secondly, the industry has been receiving a lot of funding from investors. This has allowed Scooter-sharing Company A to expand quickly and operate in a large number of cities.

[Implications for decision-makers from authorities / public transport]

The scooter sharing industry has evolved rapidly. Our findings show that the market is still expanding and more and more players introduce different services to different customer segments. To respond this trend, local authorities need to provide clear guidance and regulations, especially for disruptive innovation like free floating scooter sharing. The transparent guidance would help mobility companies to develop sustainable business models and commercialize the services quickly.

<table>
<tr>
<td rowspan="2">Key Partners
Scooter producer
Operator for picking-up and charging scooters
City authorities
Insurance (AXA)
Investors</td>
<td>Key Activities
Scooter maintenance
Maintenance app
Communication with authorities
Customer experience optimization</td>
<td rowspan="2">Value Proposition
Enhanced end-to-end short distance travel experience using a shared electrical scooter
More economical than owning a scooter</td>
<td>Customer Relationships
Automated services and self-services, with personal assistance in specific situations.</td>
<td rowspan="2">Customer Segments
Urban commuters
Users of public transports travelling their ‘last-mile’</td>
</tr>
<tr>
<td>Key Resources
Electrical scooters
GPS tracker system
App
Human resources: sales and marketing team, mechanics
Depot for maintenance
Financial resources</td>
<td>Channels
App based channel
Website based channel
Physical scooter presents in cities</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Acquisition of scooters
Maintenance of scooters
Collection of scooters
Charging scooters
Maintenance of the app</td>
<td colspan="3">Revenue Streams
Fixed fee per scooter trip
Additional fee for every minute using scooter</td>
</tr>
</table>

Figure 10: The Business Model Canvas for Scooter-sharing Company A

8.3. Case Study 3 Helbiz

[Case background]

Helbiz company, was founded by Salvatore Palella in 2015. At the time of its foundation, Helbiz was conceived as a carsharing platform which should have exploited both the blockchain and ethereum smart contracts technologies.

By evolving, Helbiz has become a micromobility provider. Besides offering a scooter-sharing service with HelbizGo, the company offers also a peer-to-peer car-sharing service (Helbizcar), and autonomous drone taxi service (Helbizair). The focus in on HlbizGo.

[Business model explained]

HelbizGo is a dockless intra urban transportation solution, allowing commuters, via an app, to rent and to leave electric scooters curb side once they have arrived at their destination.

The services refer to the characteristic scooter-sharing customer segments: users from the main cities, those not owning a car and environmentally friendly youngsters, using the specific app.

Besides the typical value proposition of scooter sharing services (as easy parking, and not expensive transportation costs), Helbiz adopts the charging sharing formula: in the United States commuters are paid when recharging the scooters.

As for the payment methods, Helbiz relies on a pay-as-you-go model.

[Other factors influencing business model]

Helbiz platform for fleet management includes artificial intelligence and environmental mapping system.

This technology optimizes operations and guarantees profitability. The information on the travel made, drivers, vehicles and personnel employed which are collected anonymously by the platform and treated through advanced analysis. These data are thus used to correctly implement, monitor and reposition the fleet so as to satisfy demand in different areas and maximize the number of trips.

As for the founding, Helbiz has a double quotation in the Stock market (Aim e Nasdaq).

[Implications for decision-makers from authorities / public transport]

Where city air traffic management is still far from being a relevant problem for public authorities, free-floating scooters is. In this vein, recently some major cities municipalities (among the others Milan, Rome, Paris) have regulated both the scooter driver's conduit and the parking.

<table>
<tr>
<td rowspan="2">Key Partners
• Investors
• Public policy makers (electric scooter regulations)
• Scooter manufacturers
• Specialised technology providers (GPS, payment, analytics, and specialised API)
• Cloud service providers
• Payment service providers</td>
<td>Key Activities
• Free-floating mobility service providing (scooters)
• Peer-to-peer carsharing providing
• Autonomous air taxi mobility services providing</td>
<td rowspan="2">Value Proposition
• Vehicle availability
• Easy parking (free-floating float)
• Charging sharing formula</td>
<td>Customer Relationships
• Automated services and self-services, with personal assistance in specific situations.</td>
<td rowspan="2">Customer Segments
• Young commuters (students and youngsters)
• Smart commuters, either car and non-car owners (environmentally-friendly lifestyle)</td>
</tr>
<tr>
<td>Key Resources
• Physical resources: Software enabling platform (managing float, real-time environment mapping).
• Human resources: website and App designers and developers (IT), marketing and sales team (Marketing and Sales), and CRM team (Customer Relationship)
• Information Resources (data gathered and collected via app)</td>
<td>Channels
• App-based channel
• Website channel</td>
</tr>
<tr>
<td colspan="3">Cost Structure
• Float purchasing and maintenance costs
• Software development and maintenance costs
• Employee salaries
• Marketing and advertising fees
• Payments for charging e-scooters</td>
<td colspan="2">Revenue Streams
• Revenues from service fees (pay-as-you-go)</td>
</tr>
</table>

Figure 11: The Business Model Canvas for Helbiz

8.4. Conclusion

In this chapter the business models of three cases of Shared on Demand Mobility were illustrated: Taxistop for carpooling, Scooter-sharing Company A for Scooter Sharing and Helbiz for Car Sharing.

The value proposition common to all case studies is to offer a travel experience combining the advantages of the private vehicle (almost immediate availability of the vehicle, end-to-end travel, comfort, privacy) with those of the collective transport (no car ownership, pay-per-use, easiness in parking); this is realised with diverse services, all belonging to the shared mobility universe commuters are the main customer segment served. The reason for this may be attributable to the fact that the systematic trips of commuters make possible to define a more predictable and therefore more easily serviceable demand.

Relations with customers are becoming increasingly automated and take place mainly through app-based channels and websites, even if personal assistance with operators is provided in specific situations and in any case constitutes an additional value proposition. The revenue streams of the cases analysed are mainly from service fees (pay-as-you-go) which seems to be the strategy preferred by the companies.

The possibility of offering on demand services is guaranteed by key resources which are mainly software enabling platforms, powered by geolocation data both of the demand, through access to the GPS position of the user enabled in the smartphone, and of the offer through GPS tracker system and maps. The accuracy of these data, the ever-increasing capacity of smartphones to process them and, in the near future, the spread of 5G will make it possible to provide an increasingly real-time service.

The main partners of the analysed companies are the local authorities and the operators that manage and maintain the fleet for car sharing and scooter sharing, to which the related costs are also associated. Regarding costs, a common item in all the cases analysed are the costs related to the development and maintenance of the applications and of the website that constitute the channels with the users. Finally, from the point of view of funding, the three companies are completely different, with Helbiz listed on the stock market, a Scooter-sharing Company A that receives funding from investors and Taxistop which is a non-profit organization that receives subsidies from the government.

In general, shared on-demand mobility has major problems from both economic and regulatory points of view. In fact, it is known that some mobility services operate at a loss making it sometimes necessary for these companies to receive subsidies to ensure their survival. In particular, car sharing or scooter sharing operators often operate in unprofitable conditions, due to the huge initial costs for the development of the platform, and the purchase of vehicle fleets

and they are partly funded either by public authorities (as part of public-private collective transport policies) or by private companies (promoting broader mobility models based on marketing and customer retention practices).

This situation raises several questions that policy makers have to face regarding the possibility of using public subsidies to achieve critical mass and buy vehicle fleets and what should be the share of private funding for new mobility services[23].

In addition to public subsidies, the share on demand mobility companies can also sell other services to B2B customers based on the big data they collected from consumers. For example, they can transform data into meaningful analyses and sell them to insurance companies. The insurance companies then leverage these analyses to better tailor their service offerings.

These problems, however, have not dampened the growth of the shared on-demand mobility. As analysts, and the service providers themselves, are forecasting an increase in demand in the future, capable of going to amortize the huge initial costs, and of producing not just greater social well-being, but also a gain for the service providers. Indeed, the Millennial generation (aged between 15 to 34) are driving less, living in more urbanized locations, valuing access and convenience over possession. On-demand sharing mobility addresses this convergence by offering this population convenient and affordable access to vehicle anytime[24]. In this sense, accessing and securing market sharing is essential for operators.

On the other hand, decision makers should prepare an appropriate regulatory framework to ensure fair competition, user and data protection and rules for service delivery. In addition, public authorities play a key role in ensuring that shared on-demand mobility services are incorporated into long-term transportation planning that achieve public interest objectives such as reducing the externalities of the transport sector by developing reliable, efficient, competitive, equal and sustainable urban mobility system.

[23] Centre of Regulation in Europe (2019), Shared mobility and MaaS : The regulatory challenges of urban mobility.

[24] Movmi (2019), Shared mobility thoughts.

9. SUMMARY OF BUSINESS MODELS AND IMPLICATIONS FOR AUTHORITIES

This chapter synthesizes the aforementioned business model analyses and provide general implications for public authorities. Three mechanisms of business model are discussed in four innovation categories: value creation mechanism (i.e., what value propositions are proposed in order to create value in the market), value delivery mechanism (i.e., how the value is delivered to the new mobility services or technologies receivers and how the customers can benefit from them), and value capture mechanism (i.e., how the value is captured by the new mobility services or technologies providers). Please see Table 2 for the summary. The implications for authorities are also presented at the end of this chapter.

Table 2: Summary of Value Creation, Delivery, and Capture Mechanisms

	Value Creation	Value Delivery	Value Capture
1) **Connected, Cooperative, and Automated Mobility**	• the offering of more environmentally friendly, economical, and efficient autonomous vehicles and drones • the combination of advanced services and technologies which satisfy the unaddressed needs • the integrated solutions with various technological functions and services	• Online Channel (mainly website) • International conferences and exhibitions	• Selling products or services • Using the way of subscriptions
2) **Infrastructure, Network, and Traffic Management**	• Higher efficiency and speed with lower maintenance cost, and 2) lower emission with new technologies and taxation measure.	• Online Channel • Traditional B2B relationships	• Depends on the nature of services or products in the category of infrastructure, network, and traffic management
3) **MaaS and MaaS Platforms**	• The seamless and integrated planning, payment, and ticketing interface	• Online Channel (mainly App)	• Contract with B2G customers • Monthly Subscription fees

	• The enhanced end-to-end customer experience with multi-modal transport choice • Custom-made mobility package based on sufficient data analysis		• Pay-as-you-go
4) Shared On-Demand Mobility	• Offering a travel experience that combines the advantages of private vehicles (i.e., immediate availability, end-to-end travel, comfort, and privacy) with those of the collective transport (i.e., no car ownership, pay-per-use, and easiness in parking)	• Online Channel (mainly App)	• Monthly Subscription fees • Pay-as-you-go

9.1. Connected, Cooperative, and Automated Mobility

[Value creation mechanism]

The firms within this innovation category generally propose three value propositions to create value for their customers: 1) the offering of more environmentally friendly, economical, and efficient autonomous vehicles and drones, 2) the combination of advanced services and technologies which satisfy the unaddressed needs, and 3) the integrated solutions with various technological functions and services.

[Value delivery mechanism]

Most of the innovations in this category have not been formally commercialized in the market. They are still in the experimentation stage. Therefore, the proposed value of these innovations is delivered mainly through their website. The interviewees also point out that presenting at international conferences and exhibitions is a key channel for them to deliver their value.

[Value capture mechanism]

The current value capture mechanism is quite conventional for these innovations. They capture value mainly through selling products or services or using the way of subscriptions. However,

selling an integrated solution, which combine technological functions to solve customer needs with value added services, is the future direction for connected, cooperative, and automated mobility.

9.2. Infrastructure, Network, and Traffic Management

[Value creation mechanism]

The value propositions for infrastructure, network, and traffic management in the cases generally are: 1) higher efficiency and speed with lower maintenance cost, and 2) lower emission with new technologies and taxation measure.

[Value delivery mechanism]

The value is delivered through online channels. Some transport manufacturers mainly sell their products through traditional B2B relationships.

[Value capture mechanism]

The value is captured via different ways. It depends on the nature of services or products in the category of infrastructure, network, and traffic management

9.3. MaaS and MaaS Platforms

[Value creation mechanism]

The value propositions to create value in MaaS and MaaS platform category are: 1) the seamless and integrated planning, payment, and ticketing interface, 2) enhanced end-to-end customer experience with multi-modal transport choice, and 3) custom-made mobility package based on sufficient data analysis.

[Value delivery mechanism]

App is the main channel for MaaS to deliver their value to customers. The process of value delivery includes complex data collection and analysis to support customers' real-time decision making.

[Value capture mechanism]

MaaS has various value capture mechanisms, including contracts with B2G customers, subscription fees with frequent MaaS users, and pay-as-you-go with other users.

9.4. Shared On-Demand Mobility

[Value creation mechanism]

The value proposition in shared on-demand mobility category is to offer a travel experience that combines the advantages of private vehicles (i.e., immediate availability, end-to-end travel, comfort, and privacy) with those of the collective transport (i.e., no car ownership, pay-per-use, and easiness in parking). The value is created through diverse services.

[Value delivery mechanism]

The value is delivered through app-based channels and websites, with the support of personal assistance in specific situations.

[Value capture mechanism]

Pay-as-you-go is still the main mechanism for shared on-demand firms to capture their value. Some firms have considered to provide monthly subscription services for their members.

9.5. Implications for Authorities and Conclusion

The above findings suggest that support from the government is critical to the business model of these disruptive innovations. In particular, the authorities can develop flexible regulations and policies which foster the development of 'new mobility platforms' for data and resource exchanges. With well-developed platforms, different new mobility service and technology firms are able to acquire the essential resources to develop integrated solutions in the market. Moreover, although these firms generally propose compelling value propositions to the market, our findings suggest that concrete policies or incentives can make customers perceive higher value of adopting new mobility services or technologies. Therefore, it is critical for authorities to consider the 'fit' between the value propositions of these disruptive innovations and new policies or regulative frameworks.

In addition, the findings indicate that the demonstration opportunities and support from authorities are important. In the future, when the authorities design a new initiative, they can include 'multiple and long-term international conferences and exhibitions' for new mobility services and technologies in the plan. Such demonstration opportunities are important mechanisms for new mobility firms to deliver their unique value to various audiences. The

‘cooperation models’ can also be developed by the combination of new mobility platform and international conferences and exhibitions.

Finally, the findings show that the an ‘adaptive and flexible governance framework that breaks the boundary of industries’ is crucial to the business model innovations for new mobility service and technology firms. More and more firms develop an integrated solution instead of a single product or service to their customers. This means that they often combine resources from other industries to address underserved customer needs, such as entertainment, hotel or shopping services.

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