

# LEARNING FROM MAAS4EU

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# 1. Objectives of the project

The emerging trend of the integration of on-demand transportation modes in conjunction with public transport led to a new concept called Mobility-as-a-Service (MaaS). In the MaaS scheme routing, booking, payment and ticketing is integrated in a one-stop-shop application, offering public and private mobility services. MaaS4EU project received funding under the Horizon 2020 programme in order to deliver an end-to-end approach for Mobility-as-a-Service tools, business models, enabling framework and evidence for European seamless mobility.

The main goal of MaaS4EU is to provide quantifiable evidence, frameworks and tools, to remove the barriers and enable a cooperative and interconnected EU single transport market for the MaaS concept, by addressing challenges at 4 levels: business, end-users, technology and policy. This will be achieved by defining sustainable business models that support the cooperation across transport stakeholders, understanding user needs and choices, implementing the required technological infrastructure and identifying the enabling policy and regulatory frameworks.

Three pilots were designed in MaaS4EU for testing different MaaS schemes. Table 1 is describing the different solutions.

1. Table MaaS4EU pilot locations

Location	Operator	Business channels	End users
<b>Budapest</b>	independent company is the operator	business to customers (B2C)	locals, tourists
<b>Manchester</b>	public transport authority is the operator	business to business, business to customers (B2B, B2C)	locals, tourists
<b>Luxembourg</b>	mobility service provider is the operator	business to business, business to customers (B2B, B2C)	locals

The original objectives of the project were reached at different levels in the different pilot locations. RegiaMobil partner BME was mainly involved in the Budapest pilot case, so the further descriptions are applied only to the Budapest pilot location. In Budapest (after a change in partners) Toll Service took the MaaS operator role. This company’s core business is road fare collection, and not providing mobility services. For the Budapest pilot, end-users were addressed of distinct groups: locals and tourist. MaaS4EU aimed to offer six modes of transport: public transport (BKK Centre for Budapest Transport), bike-sharing services (MOL-Bubi), car-sharing services (GreenGo) and taxi services (City Taxi) in Budapest; intercity public transport services in Hungary (MÁV Hungarian Railways) and intercity an cross-border ride-sharing services (Motar). At the beginning of the project, Budapest was not considered as a mature market for MaaS. However, during the project it turned out, that market maturity not in strong connection with the success of a pilot as only Budapest could keep all the proposed partners till the pilot. Due to the COVID-19 pandemic, the project was extended with another 5 months, so that the pilots can be finished. It means that this document has some mid-term results, since the last testing period not yet started.



## 2. Pilot/project preparations

### 2.1. Stakeholder involvement

Three rounds of stakeholder involvement were carried out during the planning process: expert workshop, focus group meetings and stakeholder interviews.

First, an expert workshop was organized amongst local professionals with various background (academic, urban planning, service providers, authorities, policy makers, energy sector, associations, etc.) and members of the consortium. The experts could express their opinion, how they see the MaaS value proposition and potential business models. Group discussion and plenaries took turns to discuss MaaS scheme, technical, regulatory, business and end-user status and requirements in the pilot location. A business canvas was created with the specialities of the potential MaaS market in Budapest. During the workshop, participants could fill a comprehensive expert survey about business models. Finally, the MaaS operator of Budapest pilot and possible mobility service providers could establish their common work in a peer-to-peer conversation. By this, MaaS4EU project partners could collect knowledge on the pilot site.

The second part of the stakeholder involvement process was a three round focus group meeting, where potential users were interviewed. Students and young adults were in the first group, adults were in the second and elderly people in the third. The participants could watch two videos about the MaaS scheme and MaaS solutions to have a first impressions. The softly led conversations were about generally the MaaS scheme, how the application should look like, and their level of interest as a paying customer. Naturally the younger generations expressed their interest in a future MaaS application, elders were also motivated even if the use of such an application is certainly challenging for them. Since no participants had ever tested MaaS in real life, further discussions were about parts of the service, such as ideal route planner, dynamic passenger information system or electronic ticketing.

A final stakeholder involvement focused on the business opportunities and regulatory requirements of the MaaS scheme. MaaS scheme has some obstacles, and regulation is definitely one of them and it affects the market players how they imagine their possible role (e.g. if there will be any public MaaS operator, or any kind of monopoly). This data collection was based on deep interviews with the public transport authority (BKK Centre for Budapest Transport), the ministry responsible for public transport (Ministry of Innovation and Technology), mobility service providers (MÁV Hungarian Railways, Motar ride-sharing, MOL Limo car-sharing, GreenGo car-sharing) and state-owned mobility data integrator (KTI Institute for Transport Sciences). Hungarian regulators are aware of the required legislative tasks, but currently it is not considered as a top priority. Hungarian market players expressed ambivalent approaches, on the one hand, they see the potential in the MaaS scheme, on the other hand, also foresee many threats.

One additional stakeholder involvement was created in an informal way. An open discussion forum in Facebook was provided to the pilot testers, in order to have a fast and flexible question and answer platform during testing. This platform was also applicable for open feedbacks and it turned out to be a good solution. The pilot testers will also have the opportunity to express their experience in an exit survey.

### 2.2. Methods and technologies

#### 2.2.1. Overview of the preparations

Since MaaS scheme is a very new form of mobility, Budapest pilot had to elaborate the pilot in three fields (legal, technical and business) from scratch. Although the final outcome was an application, the development process was done by use cases, which basically means that for every mobility and payment service provider, there was a separate development process.

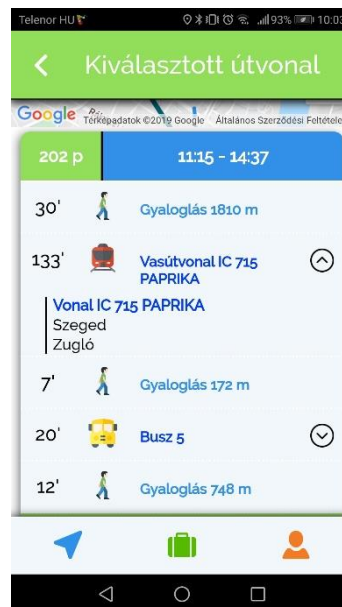
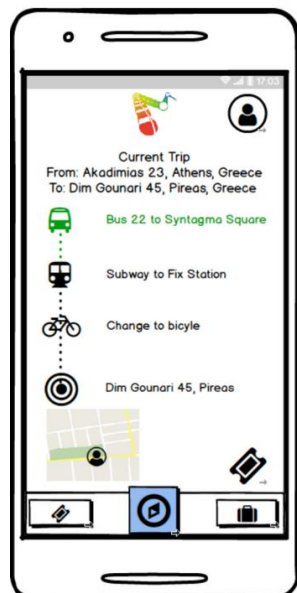


The pilot preparations for Budapest consisted of the following process:

1. Initial use case development: Defining high level use cases by mapping mobility service provider (MSP) opportunities, demands and requirements. Project level decisions were done on what is acceptable as a proof of concept (such as limiting the products for subscriptions).
2. Draft technical use cases: An ideal design before coding was created for every use case for every MSP represented by flow charts. It contained a process description with four actors: MaaS4EU application, MaaS operator, MSP and user processes.
3. Final technical use cases: Iteration between the MaaS4EU technical team and Budapest pilot MSPs were made to complete the final technical use cases before implementation with iterative discussions between mainly IT representatives of the partners.
4. Draft business use cases: Different package elements were designed for each MSP (e.g. bonus minutes for GreenGo).
5. Draft graphical user interface: Implementation of the first version of MaaS4EU application

The application has an enter survey for research purposes, and a mobility questionnaire which than suggests mobility packages. The main functionalities are journey planner, booking (when specific modes are selected in routing) and ticketing (this is also available through journey planner). In settings, user can modify mobility preferences.

6. Draft legal documents: Initial version of General Terms and Conditions and agreements between MSPs and MaaS Operator were drafted. Key concepts and general structure for legal documents were defined.
7. Final graphical user interface was created.



1. Figure Graphical user interface - from wireframe to actual screenshot

8. Final business use cases: Potential packages were created by the project partners; final packages were sorted out and priced by TOLL Service and BME.



9. Final legal documents: All legal documents shall provide a comprehensive business and legal framework for contracted services and products. Accordingly, legal documents were created after the technical and business development.

## 2.2.2. Use cases

### 2.2.2.1. Public transport

BKK is the transport authority for Budapest. During the use case development, tested and trusted solutions for e-ticketing were not yet available in Budapest. Consequently, this use case was developed using paper-based tickets. Several options were discussed to solve the issue of payment for public transport through the app. However, none of them could provide an easy-to-use solution. Ultimately, it was decided that users should buy their public transport tickets from vending machines. Routing with public transport in Budapest can be accessed via API, moreover, there is an API providing information on ticket vending machines. This solution is suitable for testers who already have monthly, quarterly or yearly passes for public transport, which we expect to be a typical scenario. During the development of this use case, an initial idea of storing pass information was rejected as it brings little value to the user, but more tasks and it did not fit in the overall flow of using the app.

In Hungary, various types of social discounts are available. For the MaaS4EU demonstration, three main target groups for discounts will be included: students, pensioners and those with free-of-charge access to public transport. BKK public transport use case in the MaaS4EU Budapest demonstration offers a routing option only. Booking is not applicable, ticketing and payment are carried out outside the app, as users are guided to the nearest vending machine.

#### 2.2.2.2. Bike sharing (MOL Bubi)

MOL Bubi is a station-based bike sharing system in Budapest, operated by BKK (along with T-Systems). MOL Bubi has now 156 dock stations and 2071 bikes. Concerning the regular terms of usage, temporary users can access the service by tickets (24-hour, 72-hour or 7-day tickets) entailing the commitment of deposit payment. Permanent users must sign the contract personally, and they get access to the service by quarterly, annual or semi-annual passes without the obligation to pay a deposit. In the regular case, users have a direct contact with the operator, and responsibilities and liabilities are generated between the operator and the user. MOL Bubi bikes can be picked up with proximity cards, through an application with QR code, or with a telephone number and PIN code. The first 30 minutes are covered by the tickets or passes, over-usage is charged on the user.

For the MaaS4EU use case, two main tasks had to be solved:

- handling legal issues through a MaaS operator

For the demonstration, Toll Service as the MaaS operator took over all the responsibilities of the user towards BKK, the operator of MOL Bubi. It means that in the agreement between BKK and Toll Service, BKK is considered as the provider of the service, while Toll Service is considered as the user. Concerning the legal relationship between Toll Service and the user, however, Toll Service is transferring all user responsibility to the user. However, Toll Service will not request a deposit for their service, since based on the experience in operating MOL Bubi, abuses of bikes and the service did not occur on a regular basis, and a deposit would hold back testers from taking part in the MaaS4EU demonstration.

- providing access to the bikes for users

Having considered various alternatives, telephone numbers and PINs were selected as the means of providing access to the service. Other alternatives carried several disadvantages: the proximity card is not in line with



the MaaS concept and using QR codes would require external IT development. At the same time, phone numbers and PINs are easy to handle and give seamless access to the bikes. In order not to interfere with other credentials, dummy phone numbers were used.

MOL Bubi use case in MaaS4EU Budapest demonstration provides routing, booking, ticketing and payment also. The main concept is described below.

1. MSP MOL Bubi creates a table of dummy phone numbers and PINs for Toll Service in predefined contingents according to the contract.
2. Toll Service has access to the MaaS4EU dashboard and will upload the table of data, which then can be assigned to users.
3. Routing with MOL Bubi is linked to MOL Bubi stations.
4. When a user purchases a package containing MOL Bubi access, the MaaS4EU application displays the dummy number and PIN to the user, thus the user gets access to the service.
5. Whenever a MaaS4EU user exceeds the 30-minute limit with their ride, the MSP issues an invoice to the MaaS operator. The MaaS operator is entitled to charge the cost on the user.

#### 2.2.2.3. Car-sharing (GreenGo)

GreenGo is the first car-sharing operator in Budapest to offer solely electric vehicles in its fleet. GreenGo operates with two types of business models, a post-paid one with no monthly fee, and another one with a fix monthly fee and lower rental tariffs. Also, bonus minutes are available, which users can use either for driving or for parking. Entering into a cooperation with GreenGo was essential in the Budapest pilot for two main reasons. Firstly, the Budapest pilot and GreenGo have overlapping primary target groups, secondly, GreenGo is a private company from the market, therefore - unlike in the case of taxis - its service prices are not determined by the law, so we had the opportunity to negotiate with them about potential discounts. A complete integration of GreenGo into the MaaS4EU platform was not a feasible option, since opening and closing the cars is a security issue, and validating driving licences and ID cards is an activity that requires authorization. For routing, the locations of available cars and the service area are provided. Also, a new API was developed to check GreenGo account existence and to transfer bonus minutes purchased in the MaaS4EU package.

GreenGo use case in MaaS4EU Budapest demonstration provides routing, booking to some extent, ticketing (storing the available balance of bonus minutes) and payment. The main concept is described below.

1. During registration, users who intend to buy packages with GreenGo service shall make sure to register for GreenGo services. Purchasing a MaaS4EU package with GreenGo service is available only if the user has a valid GreenGo account. The existence of a valid GreenGo ID and driving license is verified through a separate API.
2. If the verification is successful, bonus minutes are transferred to the GreenGo system. When bonus minutes are used, the current balance is migrated to the MaaS4EU system.
3. Routing with GreenGo considers the availability of cars. When GreenGo is selected for a trip, the user can book a specific car. When it is time to opening the car, MaaS4EU redirects the user to the GreenGo app.

#### 2.2.2.4. Taxi (City Taxi)

The taxi market in Budapest involves two types of actors: taxi service organizer/management companies and self-employed taxi drivers, which is more typical. Consequently, this use case involves four partners: the taxi driver, the taxi organizer, the MaaS operator and the user. For the taxi use case, City Taxi was selected to become a project partner, since they have an all-inclusive online taxi-ordering application in





operation. In Hungary taxi service tariffs are determined by law, which carries two relevant outcomes to our use case:

- the official tool for calculating taxi tariffs is the taximeter, which is an offline stand-alone tool in taxis, thus it cannot be integrated into our application;
- there is no competition in the market regarding the price of the service, therefore no negotiations can be conducted.

It shall also be noted that taxi is a typical post-paid service, since the final price is based on the elapsed kilometres and minutes (added to a base price). It means that the MaaS4EU packages cannot contain top ups in any other currency than Hungarian forint, and it cannot exactly be pre-determined how many minutes/kilometres the particular amount would cover. Since the MaaS4EU consortium decided not to use post-paid use cases (mainly based on the technologic concerns related to payment services), this taxi use case works with a taxi balance. The taxi use case in MaaS4EU Budapest demonstration provides routing, booking and payment. Ticketing is not applicable here. The main concept is described below.

1. If the purchased MaaS4EU package contains taxi services, users must enter their phone number in order to avoid misunderstandings.
2. If the purchased MaaS4EU package contains taxi services, Toll Service has access to the service sales platform of City Taxi and can send out coupons to users.
3. The MaaS4EU application communicates directly with the ordering system of City Taxi and can book a taxi.
4. After a taxi ride is completed, users can pay with MaaS4EU coupons, cash and/or card. Users enter the amount used for the taxi ride, so the MaaS4EU application can store the available balance.
5. Clearing between the taxi driver and City Taxi will be based on the coupons.

#### 2.2.2.5. Rail services (Hungarian Railways)

MÁV, Hungarian Railways operates train services in most regions of Hungary, including the functional urban area of Budapest. MÁV has already developed its e-ticketing system, which is QR code based. Although, initially the company expressed its interest to provide their API for the MaaS4EU project, at the end they decided not to join the project. We assume their decision was based on two factors: they have different business interest and their financial framework was not sufficient to cover the IT development required for our project. Currently no other company but MÁV can sell their e-tickets. BKK passes cover MÁV services inside the municipality area of Budapest, therefore routing with MÁV trains is applicable in the case of intercity routes only. Train services use case in MaaS4EU Budapest demonstration provides routing. Ticketing, booking and payment can be accessed with redirection to the MÁV application.

#### 2.2.2.6. Ride-sharing (Motar)

The Hungarian legislation does not consider ride-sharing as a service with a service fee, but a mutual agreement on a common ride with fuel costs split amongst travellers. It means, that for this use case neither payment nor ticketing was an issue. Also, since ride-sharing is a very flexible mode of transport, and booking is an iterative process, typically based on phone calls or instant messaging between driver and passengers. As a result, only routing was developed in this use case.





## 2.3. Risks and obstacles

The following risks and obstacles were identified and surpassed during MaaS4EU project.

- The MaaS Operator (Maas Global) of the proposal phase withdrew from the project, therefore the current operator entered with a delay. This was due to different business interests.
- Due to the fact that this pilot is an R+D project, and there has not been any similar projects conducted in Hungary before, the leaders of the MSPs got highly involved in the negotiating and contracting process since they had no precedent to apply. Consequently, the process was a lot more time-consuming than we had expected. The large number of associated partners (not funded and legally not bonded partners) is a huge risk.
- There are some grey areas related to the legal liabilities of a MaaS operator in Hungary, so the MaaS operator needed to analyse and import the key provisions and conditions of each MSP as well as the effective Hungarian regulations, when drafting the general terms and conditions designated for the Budapest pilot.
- MaaS scheme operates with at least two mobility service providers. Legal documents are consequences of the developed technical and business solutions, so the agreement between the MaaS operator and the service provider can only be realized at the final stage of the development. Parallel development of more use cases brings the risk that if any partner steps back, it affects the whole concept.
- In case of the Budapest pilot, those use cases were highly risky, where payment was integrated. Even if it was a pilot project and also the communication highlighted this fact, whenever there is a money transaction, the testers become customers. Pilot status is giving flexibility in terms of technical and economic aspects (e.g. manual handling MOL Bubi PINs is only acceptable since it's a pilot). However, for legal development, this flexibility is not given. Every legal document must be the same as it was a commercial service.
- Another obstacle comes as the result of the “pilot effect”. It means, that partners, who are not funded in the project and are not legally bonded, have a lower level of engagement. They are less motivated to modify their business processes for the success of the project.
- However, one of the main obstacles was to comply with the GDPR requirements. With MaaS concept several sensitive data is generated, such as location of the users. Additionally, in this pilot project the consortium could not fit to the GDPR compliance, since this is not a legal entity, and taking legal responsibility over data handling must be connected to a legal entity. Moreover, users (testers) are only in a legal contract with the MaaS operator, but the IT system was not developed and operated by the actual MaaS operator. Several agreements were done in order to fulfil this requirement.

## 3. Pilot/project implementation

### 3.1. Developed technical use cases

The following technical development was done in the Budapest pilot. With every technical use case development, the objective was to reach full integration in the MaaS4EU application: routing, booking, ticketing and payment. For some reasons, these objectives were not reached in all cases. The final level of integration is represented in Table 2, showing what final solution was implemented by subsector. N/A stands for not applicable, in some cases for obvious reasons (e.g. booking for urban public transport is not really an option).



## 2. Table Level of integration by MPSs

Subsector	MSP	Routing	Booking	Ticketing	Payment
Urban public transport	BKK	Through Maa4EU app	N/A	routing with vending machine	at vending machine
Bike-sharing	BKK (MOL-Bubi)	Through Maa4EU app	Through Maa4EU app	N/A	Through MaaS4EU app
Car-sharing	Through MaaS4EU app	Through MaaS4EU app	MaaS4EU app redirects to GreenGo app	Through MaaS4EU app	Through MaaS4EU app
Taxi	CityTaxi	Through MaaS4EU app	Through MaaS4EU app	N/A	partially through MaaS4EU app
National / international public transport	Hungarian Railways (MÁV)	Through MaaS4EU app	Through MÁV app	Through MÁV app	Through MÁV app
Ride-sharing	Motar	Through MaaS4EU app	MaaS4EU app redirects to Motar app	N/A	N/A

Although the original goal was the full integration of one MSP per transport mode, the final level of integration is still very good. Only bike-sharing was fully integrated into MaaS4EU without any loss of main features. The following points describes the incompleteness of the integration for other subsectors.

- For urban public transport, digital ticketing is being parallelly developed by BKK, but in order to avoid risks of not having a final electronic system, implementation of this solution in the MaaS4EU app was not realized. In order to tackle this issue, an extra option was added to the route planner, so that the app could navigate users to the closest ticket vending machine in case of not yet having a pass for public transport.
- As for Hungarian Railways, although the maturity of e-ticketing is good, as of now it is a closed system without reselling opportunity. Unfortunately, there was low business interest and missing effort allocation to develop interfaces.
- Concerning car-sharing, booking was a security issue, since these actions are closely related to opening the cars. To avoid these security risks, redirection to GreenGo application was developed.
- Ride-sharing in Hungary is not a service by law, therefore it cannot be resold. The price of the ridesharing is considered as a split of fuel costs between travellers.
- In case of taxi services, a parallel payment system was developed, since taxi drivers are legally individual partners of the taxi operator, and accounting between these two parties required a different platform. This parallel payment is only a consequence of time constraints of IT development; a final solution could not be developed under the pilot term.



## 3.2. MaaS4EU mobility packages in Budapest

The pilot was divided into three waves. In Wave 1 only a user survey and a travel diary were carried out. In Wave 2 and 3 a functional application was provided to testers with slightly different content.

In Wave 2 two types of packages were realized: designated for tourists and for citizens. For citizens there were one-, three- and seven-day and monthly packages for different prices for adults, pensioners, and students. For tourist, there were one-, three- and seven-day packages at one price. As an example, Table 3 shows the monthly packages (indicating what kind of mobility services are part of the subscription).

### 3. Table Example of packages: monthly citizen packages

Name of package	Public Transport	Taxi	Car-sharing	Bike sharing
Basic	Monthly pass			
Sharing Start	Monthly pass		1 hour	Monthly pass
Sharing Max	Monthly pass		3 hours	Monthly pass
Combo Start	Monthly pass	3 000 HUF		Monthly pass
Combo Plus	Monthly pass	6 000 HUF		Monthly pass
Combo Max	Monthly pass	9 000 HUF		Monthly pass
Full Start	Monthly pass	3 000 HUF	1 hour	Monthly pass
Full Plus	Monthly pass	6 000 HUF	1 hour	Monthly pass
Full XL	Monthly pass	3 000 HUF	3 hours	Monthly pass
Full Max	Monthly pass	6 000 HUF	3 hours	Monthly pass

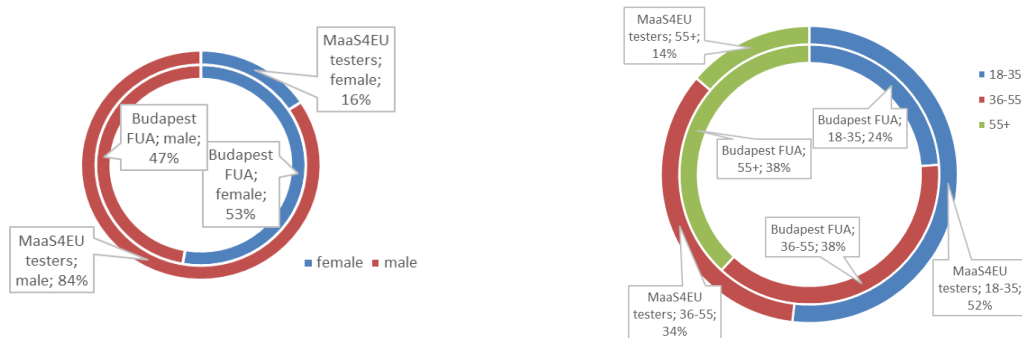
The names of packages were defined to express the content, and to have an easy-to-learn phrase. The second column shows public transport pass validity. The third column shows the amount of money to be spent on taxi rides. The fourth column is the number of hours to be spent on driving with car-sharing. The fifth is bike-sharing access, which means an unlimited number of maximum 30 minute-trips for a month. For example, in the Combo Max package, there is a monthly pass for public transport, 9 000 HUF amount of money for taxi rides and a monthly pass for bike-sharing. During the preparation of Wave 3, new prices will be introduced, since the pandemic changed a lot in the MSPs offerings.

## 3.3. Marketing strategies

A Budapest pilot Facebook page has been created, where the promotional materials and information leaflets were published. In addition, the MaaS operator created an official press release, which appeared on a large number of printed and online newspapers. For Wave 2 and the Wave 3 (which most probably starts after this document is delivered), incentives were planned to encourage users for testing. During Wave 2, these incentives could not be introduced due to the Covid-19 pandemic.

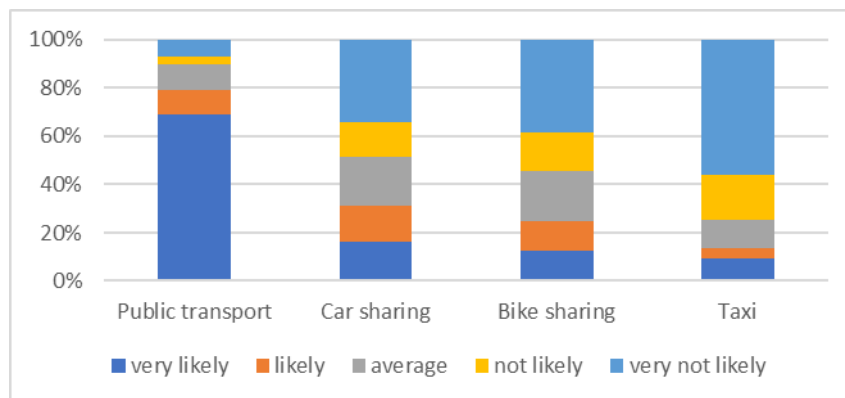
## 4. Results

Live demonstration in Budapest started early in February and ended in May. The number of users at this point was 998, which effectively describes the typical early adopters of MaaS services. The collected data are compared to statistical data of the Budapest Functional Urban Area (FUA) in Figure 1.



### 2. Figure Gender and age comparison between MaaS4EU testers and Budapest FUA demographics

Amongst early adopters, males are represented almost two times more than in the Budapest FUA demographics. Same applies for the age group 18-35. Compared to the age group 36-55, the representation in the test pool is almost equal to the demographics (Budapest FUA 38% - MaaS4EU testers 34%). These outcomes of the pilot can be used efficiently for marketing commercial services. Users were also asked about their willingness to use different modes of transport. This is represented in Figure 2.



### 3. Figure Willingness to use different modes of mobility amongst MaaS4EU testers

The MaaS concept assumes more than one mode of transport on a regular basis. The more modes a user uses, the larger the benefit of the MaaS application provides them. Testers of the MaaS4EU application are likely to use two modes of mobility (mainly public transport and/or a shared service) but using three or more modes is not typical. However, causation can be reverse, when using the MaaS application. As it becomes easier to use several modes of transport, it may lead to a change in travel behavior of users and finally people may tend to use more modes of transportation.

Wave 2 was disturbed by Covid-19 pandemic; thus, consequences can be formulated with caution. A strategic decision was made during the mobility package generation: no unimodal packages will be offered, except the PT package. Since the MaaS scheme is about offering competitors (or at least co-competitors) in one-platform, the packages were created using this formula. Only public transport was offered unimodal. As a consequence of the missing ticketing integration of PT, we could provide “free packages” for those, who have a PT pass already, so testers can try the route planner without stronger commitment. As a result, very low number of paid packages were sold. This was caused either the low willingness-to-pay, or the distrust of an unfamiliar innovation or both.



## 5. Lessons learned

In the beginning of the MaaS4EU project, for Budapest Pilot partners Mobility-as-a-Service was a vision with many uncertainties. Choosing a cyclical methodology for developing a live demonstration, from a vision it turned out to be a good idea.

However, it can be stated that the maturity of information and communication technology (ICT) does not determine the easiness of the use case development. Although taxi services are considered as mature ICT systems, its use case development was far more complex, because of the separate systems the taxi operator had (traffic control system, sales system and mobile application). Same applies for the railway use case, which had a promising starting point with its e-ticketing system but was not realized finally.

Related to business and legal use case development, the role of legislation turned out to be more important, than estimated earlier. Both taxi services and public transport operates with predefined prices, causing too many restrictions when creating the packages. Moreover, monthly packages were created for the majority of citizens (adults, students, pensioners), but several other social policy discounts could not be implemented, which cannot be the case in a commercial solution.

The MaaS concept looked promising for those MSPs, who participated in the final product. During the discussions and agreements, the pilot status provided some flexibility for the cooperation with MSPs. This flexibility was derived from the short-term live demonstration and the relatively low predicted number of testers. Most likely this cannot be the case for a long-term commercial service.

Vast majority of the user feedback was about the reliability of the route planner. While offering packages was an unknown scheme for testers, route planners are well-known, and used daily. As a lesson learned, a proper route planner is a key to have a successful MaaS initiative based on user feedback.

Coping with large number of associated partners is challenging. To lower the risks and avoid dead-end roads, early written engagement between the MaaS operator and the MSPs should be efficient. This agreement could contain required efforts, timing of the project, communication channels, main responsibilities etc. It seems to be also efficient to contact every relevant department of an MSP (executive level, IT, sales, PR).

In case of MaaS4EU, a good graphical user interface is a key to success. At first sight the MaaS scheme is complex and hard to understand for the general user. However, if the steps in the application are self-evident, users will not get lost and could easily discover and understand the MaaS scheme without additional explanation.

The Covid-19 pandemic changed the travel behaviour very quickly, since authorities banned or at least not suggested the use of the public transport. A good MaaS service could have been a suitable tool to support this fast transition with providing complementary services in a one-stop-shop solution, however the maturity of the pilot did not enable to use this opportunity.