Position Paper

# MaaS driving sustainability





The position paper realised in collaboration with







## **Executive summary**



### Mobility as a Service (MaaS)

integrates various forms of transport and transport-related services into a single, comprehensive, and on-demand mobility service. MaaS offers end-users the added value of accessing mobility through a single application and a single payment channel instead of multiple ticketing and payment operations. Data from the latest Household Budget Survey (HBS) shows that in 2020, in 23 EU countries, the average household consumption dedicated to transport is 10,8%. Therefore, transportation is a major expense for EU families, mostly devoted to private mobility. This represents an unsustainable cost in the long run, especially when citizens have been forced to own more than one car and additionally pay for shared mobility trips.

Currently, most transport systems rely heavily on private car usage. Furthermore, most  $CO_2$  emissions in road transport come from private cars, which are often used by a single passenger and are typically much older than alternative shared modes of transport, such as vehicle rental and carsharing. Where users currently have a choice between a private car or public transport, the latter is often perceived as more uncomfortable, confusing and timeconsuming. MaaS helps overcome the user challenges of multimodality and ticketing by offering integrated tickets and helps overcome unfamiliarity by providing end-to-end journey planning through one, easy to use platform. MaaS thus has the potential to enable a viable and desirable alternative to private, and often polluting, car travel in the short term and offer multi modal alternatives that are more sustainable. The purpose of the paper is to present the benefits of MaaS in several aspects. Mobility is an area which has a strong impact on everyday life, and which has important repercussions both in terms of city congestion and air pollution.

However, citizens will need to be encouraged and assisted in this transition and phase of digital transformation. Therefore, this paper sheds light on the various benefits of a Mobility as a Service solution and what needs to be done to make it a viable alternative to the private car.

A MaaS solution could be a strong ally in the near future, but it will only be possible if public governance and MaaS stakeholders find a common path in favour of citizens who are called upon to change their habits.

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Reducing private car usage is imperative to improving the sustainability of passenger transport. To enable this, alternative transport options must be available and accessible to the public. Starting with a foundation of excellent public transport, active travel infrastructure and other servicebased transport options, such as car rental and sharing. MaaS thus has the potential to enable a viable and desirable alternative to private, and often polluting car travel in the short term and offer multimodal alternatives that are more sustainable. In particular shared vehicles are typically newer, more heavily utilised and omit less emissions than the private car fleet.

This paper aims to explores how MaaS can change user behaviour and mindset, contributing to meeting sustainability goals while reducing congestion in cities. Thanks to MaaS, citizens could change their mindset by re-thinking mobility – and their routes - that will have a strong impact on their daily travel approach and enable them to think about mobility from a multimodal and shared mobility perspective.







Currently, most transport systems rely heavily on private car usage. It can even be an underlying assumption that people have access to private vehicles when planning housing developments, shopping centres and workplaces.

This assumption leads to a greater dependence on private car ownership to facilitate daily journeys and means that public investment models are set up to favour car infrastructure; in fact, investing in car-centric infrastructure reduces the available budget for public transport and makes car usage comparably more attractive to the user. Hence, it is very important that people have visibility and options to use vehicles differently by sharing them through vehicle rental and car share. Data from the latest Household Budget Survey (HBS)<sup>1</sup> show that in 2020, in 23 EU countries, the average household consumption dedicated to transport is 10,8%, the third biggest item.

This follows the long-term pattern of households spending around 10% of their budget for transport, but a deeper analysis indicates differences between countries. Expenditure on housing, water, electricity, gas and other fuels represented the highest share of household budgets in the vast majority of EU countries, ranging from 8.4% in Malta to 49.2% in Hungary. The second most important item was expenditure on food and non-alcoholic beverages for most Member States. In Denmark, Germany, Luxembourg, Austria and Slovenia, the second position was for transport. *(figure 1).* 

<sup>1</sup> Eurostat, Housing, food & transport, March 2023

Structure of consumption expenditure by COICOP, EU, 2020 (Share of consumption)



- Furnishings, Household Equipment and Routine Household Maintenance (4.9%)
- Clothing and Footwear (4.0%)
- Communications(3.1%)
- Education(0.9%)

Figure 1: Eurostat Household Budget Survey



Therefore, transportation is a major expense for EU families. This represents an unsustainable cost in the long run, especially when citizens have been forced to own more than one car and additionally pay for shared mobility trips e.g. when they cannot access the city centre by private car. As it is becoming increasingly expensive to own and operate private cars, some of this is due to environmental policies that are being introduced.

It is important that governments provide mitigation and incentivisation to people to transition away from their old high polluting cars. These credits could be provided on a MaaS platform in the future<sup>2</sup>.

As the *figure 1* explains, transportation consumption comes before recreationculture, hotel and communication expenses. MaaS could help families to reduce the large expenditure in favour of customized mobility packages.

Prof. Glenn Lyons<sup>3</sup> has developed a model showing the vicious cycle of planning for the car-centric mobility system shown in *figure 2*. Put simply, planning our transport system for cars, encourages more car usage which leads to requirements to build more infrastructure for more cars.

The majority of the private car fleet is made up of internal combustion engines, fuelled by petrol or diesel, which have the highest carbon dioxide emissions per kilometre travelled compared to other common local transport modes as seen in *Figure 3*.

#### Transport system - physical (motorised) mobility



Figure 2: Vicious cycle of the car-centric transport system

<sup>&</sup>lt;sup>2</sup> Coventry City Council - Mobility credits

<sup>&</sup>lt;sup>3</sup> Prof. Glenn Lyons, Triple Access Planning, Systems thinking – a causal loop diagram depicting variables and dynamics in the transport system





#### Carbon footprint of travel, 2021

Figure 3: Carbon footprint UK 2021, 5T elaboration<sup>4</sup>

As shown in *Figure 3*, most CO<sub>2</sub> emissions come from private vehicles, which are often used by a single passenger. In contrast, a shared or rental car produces less CO<sub>2</sub> for two main reasons (1) shared and rental fleets are newer and thus less polluting than the average vehicle fleet and (2) the average occupancy rate for a passenger car used in urban trips is generally between 1.20 and 1.90 persons (e.g. 2,2 in France, 2,5 in UK)<sup>5</sup>. Also, during the pandemic we have seen how active mobility (walking and cycling) is the most used mode and the one with the smallest impact in terms of carbon footprint. The approach A-S-I (Avoid, Shift, Improve) is one of the major approaches to the decarbonization with the final objective to create more liveable cities.

To achieve a long-term climate-neutral 2050 strategy, as called by the EU, we need to break the vicious cycle by incentivizing electric and shared mobility.

MaaS will be the starting point to get users to change how they travel. A customized mobility offer will enable users to give up their own cars and move around the city with the same comfort and convenience. It is also going to be very important to ensure that the mobility ecosystem is diverse and broad to meet the varying demands of MaaS users; it needs to be attractive as a consumer proposition.

<sup>&</sup>lt;sup>4</sup> Source: Greenhouse gas reporting: conversion factors 2021 - GOV.UK <sup>5</sup> Elaboration started from Greenhouse gas reporting, cit.;



To break up the current car-centric transport system referenced in *Figure 1* requires an increase in demand for alternative modes and a normalisation of having a non-private car option for daily journeys. The promise of Mobility as a Service is that it can deliver the flexibility and affordability needed to be a real alternative to car ownership, and hence begin to shift people to more sustainable modes. *Figure 4* introduces the virtuous cycle of using MaaS to reduce a city's reliance on private cars. 'Alternative modes' refers to any MaaS mode offering as opposed to a private car journey such as public transport, active travel, car sharing and car rental or ride hailing.



Virtous cycle for MaaS

Figure 4: Virtuous cycle for MaaS leading to reduced carbon emissions



#### The key assumptions driving this model include:

- People will use the transport mode that they perceive to be most personally advantageous for each journey. Factors considered include cost, comfort, convenience, reliability and reduced travel time
- People are most interested in how transport policies impact modes which they use
- Politicians prioritise policy and investment decisions for modes which are popular with voters
- MaaS requires a foundation of excellent component services
- People need to trust there will always be an alternative option available and affordable for them to give up a car completely
- People without cars are less likely to use cars
- Having fewer cars in the transport system, and using them less will lead to a reduction in CO<sub>2</sub>, which is also dependent on user adoption of shared travel options

#### Focus: a MaaS solution

Mobility as a Service (MaaS) integrates various forms of transport and transport-related services into a single, comprehensive, and on-demand mobility service. MaaS offers end-users the added value of accessing mobility through a single application and a single payment channel instead of multiple ticketing and payment operations. To meet a customer's request, a MaaS operator hosts a diverse menu of transport options, including public transport, active modes such as walking and cycling, ride-, car-, and bike-sharing, taxi, and car rental or lease. MaaS aims to be the best value proposition for users, societies, and the environment<sup>6</sup>.

A successful MaaS service also brings new business models and ways to organise and operate the various transport options, with advantages for transport operators including access to improved user and demand information and new opportunities to serve an unmet need. MaaS aims to provide an alternative to using the private car that may be as convenient, more sustainable and to help to reduce congestion and constraints in transport capacity at an affordable and competitive price.

A Mobility as a Service offer needs an efficient ecosystem to work and bring benefits to the users. Various ecosystem models were identified in literature including Commercial integrator, Open back-end platform, Transport as integrator, Decentralised ledger technology for MaaS. Several studies were done and an Open backend platform seems to be a better ecosystem for achieving MaaS benefits especially when deployed by public authorities. In this model, the system is based on rules defined by the public administration, which arises as a public infrastructure on which market players can build a MaaS solution. Among the advantages of this model are that the public coordinator guarantees certainty and neutrality; competition between MaaS operators is at the customer service level; requires that all publicly procured or owned operators share the APIs of mobility; innovative and impartial service offered to the costumers; the local mobility operators are

<sup>6</sup> What is MaaS?



less afraid of being integrated. Weaknesses are that an open platform needs to be financed with public resources; the biggest operators could decide not to join the public administration ecosystem preferring other market strategies, maybe competitors.

An open ecosystem with fair competition supports both innovation and the systematic reform of the mobility sector. Open systems offer multiple benefits as they encourage a more balanced market development and provide more choices for users. Open data policies accompanied by appropriate platform regulation that ensures market access, fair competition, and more choices for the consumer are the building blocks of the open systems that generate social, economic, and environmental benefits<sup>7</sup>.

# How MaaS will lead to increased usage of alternative modes

MaaS acts as the enabler which sets the chain of positive outcomes in motion by breaking down barriers between users and mobility service operators. Where users currently have a choice between a private car or public transport, the latter is often perceived as more uncomfortable, confusing and time-consuming; at the same time, where the shared mobility services offer is high, the mobility demand shifts or could shift to that. The unfamiliarity of using a non-car mode may also add to the reluctance to try an alternative even if journey time will be faster or cost will be lower overall. MaaS helps overcome the user challenges of multimodality and ticketing by offering integrated tickets and helps to overcome unfamiliarity by providing end-to-end journey planning through one, easy to use platform. Cost calculators can also help to show the real cost of individual car usage including potential parking and road charging, challenging false perceptions that the private car is the cheaper option. Total car costs include a lot more than a loan

payment. When taking into account loan interest, depreciation, fuel, insurance, maintenance and fees, the cost of owning a car makes a big leap. Europeans pay on average € 27.500,00 for a new car<sup>8</sup>. To be added to this, a new car will lose at least 20% of its value as soon as you drive it off the dealership lot, and it continues to lose roughly 10-15% of value every year thereafter. On the other hand, buying an older car gives more room for negotiation and it is less likely to experience the pains of depreciation, but there are other factors to consider as e.g. maintenance and insurance costs are higher as well as pollution. Buying a new car, probably it will not have to cover any repair costs for the first few years while for an older car the average maintenance costs hover around € 1.000,00 in addition to the replacement of tires every six years. Last, with the fuel cost increase, the overall costs of owning and driving a car have gone up again: the average monthly fuel cost in Europe is € 100 for petrol and € 70 for diesel. So overall, the average cost of owning a car in Europe is € 616 per month <sup>9</sup>.

Also it is important to note is that the prices given refer to a period the war in Ukraine: since then the petrol price increased significantly, as did maintenance and other ancillary services. In addition, it is necessary to consider that most EU citizens drive cars on average 12 years old. Countries as Greece and Estonia have the oldest car fleets, with vehicles almost 17 years old; on the contrary, the newest passenger cars can be found in Luxemburg around 7,6 years old<sup>10</sup>. This means more polluting vehicles on the road and more costs for the owners because older cars need more maintenance than newer ones.

By increasing accessibility to public transport and all forms of shared mobility, you can entice a greater proportion of the population to not use private cars for at least some journeys, especially those journeys where they give a user advantage of cost or journey time. For example, doing longer journeys between cities by train which have a direct route could be more desirable to the user

<sup>&</sup>lt;sup>7</sup> MaaS Alliance, MaaS Market Playbook, 2020

<sup>&</sup>lt;sup>8</sup> Germany €32.000, France €26.000, Spain €25.000, Italy €22.500, S. Brenters, Revealed: the true cost of driving, LeasePlan Consultancy Services, Medium, May 2018

<sup>&</sup>lt;sup>9</sup> S. Brenters, Revealed: the true cost of driving, cit.;

<sup>&</sup>lt;sup>10</sup> Acea driving mobility for Europe, Average age of the EU motor vehicle fleet, by vehicle type, May 2023



than driving. In the meantime, these services must be presented to the users as trusted, affordable and cost competitive as well as comfortable. All these actions require a strong leadership from public transport services provider in order to change the user's journey perspective. Those who already use public transport, may begin to use it for more journeys too as they become more aware of the opportunities for multi-modal travel or are incentivised through gamification. By growing usage from new and existing users you can increase the ridership of shared modes of transport. This has immediate benefits of improving the economics of public transport through increased revenue, modal shift away from private car journeys and the potential to reduce carbon dioxide and NOx emissions per kilometre travelled.

#### Increased use of alternative modes will lead to increased public interest in alternative modes

Transport is integral to people's everyday lives, from work requirements and social activities to essential shopping and caring responsibilities, people must get from A to B. Everyone then, has a personal interest in policies which optimise their personal journeys.

The challenge is that many private car users have very infrequent, if no interaction with non-car modes. On the opposite, people who use carsharing often travel in a multimodal way. Public interest in transport policies is dominated by more on-street parking, cheaper permits and better road surfacing. Car centric policies are more likely to win a vote over cheaper buses or new shared bike schemes. It is precisely policies that are the first point of citizen-sustainability rapprochement: only through effective messages coming from all sides, policies first and foremost, will citizens be able to visualize the change needed, bringing benefits not only to the environment but also to their own spending.

By increasing the proportion of people who interact with shared transport, active travel and other non-private car modes, the more people will be personally affected by any policy or infrastructure changes. Even when for an individual, alternative mode usage is still small compared with private car travel, some interaction with other modes will improve awareness. This will result in increased public interest in non-private car modes. When a broader range of demographics use the shared transport network and are interested in it, the more people will feel like beneficiaries of public and shared transport investment, hence this will lead to prioritisation of shared transport policy and investment over traditional car-centric investments and will lead to improvement of public/shared transport services and other non-private car modes in the MaaS system.

In recent years, thanks to policies restricting private car use, many citizens have had to reorganize their commutes in favour of shared modes of transportation. Making mobility alternatives attractive will help the transition, and MaaS will be seen as a tool that improves user mobility. The relative offering between private cars and alternatives needs to be rebalanced. Improving the foundational services of MaaS is only possible with public authority intervention through policy changes and investment in infrastructure.

There is only so much road space and capacity available, so by promoting the use of public and shared mobility, the relative offering of the MaaS solution can be improved. For example, bus lanes can help to improve journey times and journey time reliability of bus trips and cycle lanes improve the safety and desirability of active travel.

Even so, the comfort and ease of private car usage which can offer a truly door-to-door service for a full spectrum of trip types at an affordable price, is extremely hard to compete with. This is where the 'stick' element is required to reduce the car owner's flexibility, personal control or choice. Measures such as congestion zone charging, limited parking availability and low traffic neighbourhoods help to lower the attractiveness of car usage for some trips. Therefore, prioritising some stick measures will address the balance between car-centric policy and alternative modes in a complementary way. If we want to untether society from its reliance on automobiles, we cannot avoid the difficult work



of building places that don't need them. It means investing in LEZ or LTZ areas, rethinking shared areas in a community with all needed services nearby, investing in transit and bike lanes to let people have real choices about how they travel.

In fact, the start of the virtuous cycle leads to the displacement of private car journeys with MaaS alternatives. Once a MaaS solution is more mature. we hope to achieve the goal of reduced car ownership. For some users, as the MaaS offering improves, the proportion of journeys made by non-private car modes will increase until a point where car ownership is no longer economically advantageous. This could manifest as households going from multiple vehicles to just one, followed by an increase in no car households and enabling young people to never take up driving to begin with. A recent analysis indicates that young people are not interested in owning car or driving at all, instead they prefer flexibility, time efficiency and lower prices. In the USA, around 25% of 16 years old Americans had a driving licence in 2020 in comparison to 40% in 1997 which shows a significant decrease<sup>11</sup>. In Europe, 61,7% of under

30 years old would give up car ownership if efficient public transport was available<sup>12</sup>.

Policy needs to step into this potential void and support new generations in preferring shared modes of transportation.

As MaaS is only as good as its foundational services, improving public transport, active travel and other service offerings is vital to improving the MaaS solution. To make significant improvements in sustainability, MaaS needs to get to a point where many people who can afford to own and operate a car, still choose not to due to a desirable alternative.

For users to relinquish car ownership altogether, they will need to trust that MaaS will always provide them with a transport option which is competitive with a private car. This includes all the edge cases and may well be heavily reliant on ride-railing and car rental services for off-peak or emergency journeys where cars provide the most convenient modal choice on demand. Not all services need to be better than a car, but the combined MaaS system needs to be at the forefront.

<sup>&</sup>lt;sup>11</sup> D. Zipper, Gen Z's Turn Against Driving Is a Mirage, Bloomberg, 2023

<sup>&</sup>lt;sup>12</sup> E. Costa, J. Ceccon, Young people increasingly uninterested in car ownership, data from survey of Center for Automotive e Mobility Innovation (CAMI) at Ca' Foscari's Department of Management







People who don't own a car will look for the most appropriate mode for each trip. To enable citizens to choose the mode of transportation that best meets their changing needs, we must first consider that this choice is influenced by various variables such as the purpose of travel and the stage of change they are currently in (*Figure 5*). This is an important point to aid in understanding the required timeframes in meeting transport and environmental goals. If what we offer is to be more attractive than owning an old high polluting car that is not used efficiently, then it is essential that citizens are presented with a broad variety of options that include active, public and shared mobility.

Cycling to leisure places



Figure 5: Stages of change of Surrey residents about their willingness to cycle<sup>13</sup>

<sup>13</sup> Gatersleben, B., Reeby, C., Thomopoulos, N., Geusen, J., Collinson, E., Nelson, E., Hyde, C., Essex, R. (2021) Active Travel in Surrey, Surrey Living Lab Project Report, Surrey



Coronavirus has drastically changed people's travel behaviour. Many people are working from home and only commuting to the city for leisure reasons. *Figure 6* shows how individual travel has changed over the years depending on the mode of transportation<sup>14</sup>.



#### Individual travel behaviour change

Figure 6: City of Antwerp, Survey Modal Split residents

*Figure 7* from Uber shows that urban households without a car are much more likely to use public transit or active travel for trips than those who own one. There is a still a reliance on personal vehicles (likely people riding with friends or family, around

20%) and on rideshare or taxis to sufficiently cover all their mobility needs, but a MaaS system can accommodate this by including car-sharing and ride hailing schemes in their offering.



#### Person-tips by mode in urban households

Distrubution of person-trips in four mode categories, for urban households with and without cars.

Figure 7: Uber's graph for urban transport comparing households with cars to those without<sup>15</sup>

Households with cars Households without cars

<sup>&</sup>lt;sup>14</sup> City of Antwerp, Survey Modal Split residents, Effect - Maglr EN

<sup>&</sup>lt;sup>15</sup> Three Early Takeaways from the 2017 National Household Travel Survey



Additionally, MaaS can increase the use of carsharing and ride-hailing services by addressing user concerns about fellow passengers. This has been found<sup>16</sup> to be a major barrier in several countries, particularly regarding passengers of different gender within the Automated Vehicles context as shown in *Figure 8.* It is important to address these concerns for the full environmental benefits of car-sharing and ride hailing MaaS services to be realised.



**Figure 8:** Willingness to share, or not, an AV in the different countries, according to the number of co-passengers and their gender<sup>17</sup>

<sup>16</sup> Polydoropoulou, A., Tsouros, I., Thomopoulos, N., Pronello, C., Elvarsson, A., Sigbórsson, H., Dadashzadeh, N., Stojmenova, K., Sodnik, J., Neophytou, S., Esztergár-Kiss, D., Hamadneh, J., Parkhurst, G., Etzioni, S., Shiftan, Y., di Ciommo, F. (2022) Who is willing to share their AV? Insights about gender differences among seven countries, Sustainability, 13, 4669 <sup>17</sup> European Green Deal: Commission proposes rules for cleaner air and water, October 2022



To achieve a long-term climate-neutral 2050 strategy, as called for by the EU, a fundamental step is to take off endotherm vehicular traffic from our roads as well as investing in cleaner vehicles and supporting business models that promote the use of clean and shared vehicles, 15 minutes cities approach, pedestrian areas, shared mobility. When citizens are given valid instruments to choose a better solution than the private car, this will bring a lot of benefits to the community. MaaS can represent a valid solution, leading citizens to feel comfortable using different modes of transport depending on their needs. E.g. a bike for short journeys when it's sunny, an e-scooter when there

are no shower facilities, a train for long distance trip, a bus to commute to the grocery store when for example carrying a stroller or a rental car for trips to more remote areas

For car owners, the car becomes the default mode for almost all trip types leading to system-wide issues of congestion, poor air quality and global warming from the release of more carbon emissions than reasonably required to fulfill those trips. Therefore, they can

begin to optimise their journeys through the MaaS platform, increasing multimodality and reducing the environmental impacts of their journeys.

Air pollution alone means nearly 300,000 Europeans die prematurely each year: new rules from European Commission aim to reduce this number as well reducing pressure on ecosystems and biodiversity caused by poor air quality. The proposals leave it to national and local authorities to determine the specific measures they would take to meet the standards. At the same time, existing and new EU policies for environment, energy, transport, agriculture, R&I and other fields will make a significant contribution (*figure 9*)<sup>18</sup>. The annual limit value for the main pollutant - fine particulate matter ( $PM_{2.5}$ ) - is proposed to be cut by more than half.

PM<sup>2.5</sup> levels in 2020





Figure 9: European Green Deal: proposes rules for cleaner air and water

<sup>&</sup>lt;sup>18</sup> European Green Deal: Commission proposes rules for cleaner air and water, October 2022



Road transport constitutes the highest proportion of overall transport emissions — in 2020 it was responsible for 77% of all EU transport GHGs<sup>19</sup>. A strong answer from mobility sector is required. The MaaS ecosystem can propose itself as a model that would contribute to the transition and reaching the required EU goals.

Since MaaS provides access to a diverse range of modes of differing environmental credentials, a system thinking approach must be applied to ensure the most sustainable outcomes are achieved. If each mode is thought of in a silo, it can be challenging for sustainability arguments, since introducing a new service such as e-scooters has the potential to shift users up or down the sustainability travel hierarchy.

If e-scooters shift users from their cars, this has great environmental benefits, but if they shift users from walking, then they could appear to be reducing sustainability. MaaS must be thought of as a system of systems, which together enables an alternative to car ownership.

Where shared mobility services provide greater accessibility to transport hubs and reduce journey time, they can be a key part of a system which convinces people to give up a car. Nowadays, users desire multimodal journey planning, called also "trip-chaining travel"; this approach can be facilitated via MaaS platform by visualising transport networks appropriately to ensure their sustainability.

To calculate environmental impact, you can combine all journeys taken by a user in a year, and the use of a MaaS system will reduce the carbon emissions per kilometre travelled greatly compared to using a car for every trip. In addition, the embedded emissions of passenger vehicles are rising due to increased battery electric vehicle sales and increased functionality and size. Reduction in car ownership reduces the number of cars in the private passenger fleet which will reduce the embedded emissions from the vehicles themselves, that is the emissions associated with raw material extraction and manufacture.

In terms of air quality, during the project "Mobility Voucher" by the City of Turin and 5T s.r.l.<sup>20</sup> an environment benefits analysis was carried out. Evaluating the 13km travelled in one year by the users who responded to the questionnaire and considering the percentage distribution for their trips by mode of transport, we can say that a MaaS journey – means journeys done through services available in a MaaS app – as multimodal trips produced 31,4 tons of CO<sub>2</sub> in one year.

If we consider the same trips made exclusively by car, during these journeys users produced 62 tons of  $CO_2$  with a petrol car or 59 tons of  $CO_2$  with a diesel car<sup>21</sup>.

Having a mobility system that responds to our travel needs, which can be accessed via a simple and understandable app, as well as being able to benefit from different mobility options by choosing the most suitable route to reach the destination, will encourage citizens not to use their cars and to favour alternative and more sustainable means of transport. Furthermore, adding the possibility of having an "allinclusive" subscription in the future, thanks to which one no longer has to worry about which means of mobility to choose/purchase for one's journey, will bring an additional benefit to the user experience. MaaS will therefore be able to become a valid ally for designing the future of mobility together with users, public administration and the market.

<sup>&</sup>lt;sup>19</sup> EEA, Greenhouse gas emissions from transport in Europe, 2022

<sup>&</sup>lt;sup>20</sup> 5T, Mobility Voucher Project Final Report, March 2023

<sup>&</sup>lt;sup>21</sup> Methology: UK Department for Energy Security and Net Zero and Department for Business, Energy & Industrial Strategy, 2022, "Greenhouse gas reporting: conversion factors 2022, Greenhouse gas reporting: conversion factors 2021 - GOV.UK (www.gov.uk), the value of CO<sub>2</sub> emitted on average by a bus is 101gr\*km\*ps, whereas if one considers a journey by car sharing or taxi the values are 110.6gr\*km\*ps and 66.4gr\*km\*ps 9 respectively







Changing mobility behaviour is a long-term objective and takes several stages. It is sometimes easier to start with the introduction of new mobility services during leisure time when people are not under stress to come on time to work. Additionally, while some consumer groups are keen to explore innovation, for others it might be better to just package new mobility services as part of some activities and events, making the introduction of new innovation as a pragmatic choice which is not over-exposed.

To shift citizens' attention from the private car to alternative modes of transportation, globally the concept of mobility demand incentives has taken hold. Many forms of incentives for users have been introduced in recent years, such as vouchers, discounts, rewards and gamification.

Starting from the latter, gamification is the use of gaming elements within non-gaming contexts to influence real-world behaviour. Gamified programmes take the features of games that keep player's attention, like points, badges, leader boards and challenges, and apply them to real-world situations that otherwise might seem mundane or boring to increase engagement. Gamification can take a number of forms, from the simple introduction of points and rewards for carrying out key sustainable behaviours in the office, to video- and computer-games oriented towards educating people on sustainability (known as serious games).

However, mobility-related gamification initiatives are still few and far between, while incentives in the form of discounts and/or vouchers are gaining momentum. One of the key points of owning a car is its high cost: urging citizens to experiment with different forms of mobility while getting a financial return can be the main starting point for behaviour change. Over the past year, several pilots have been conducted in Europe to experiment with various forms of incentives.

A real-world lab was conducted during November/ December 2022 to test a mobility budget as part of the research project "InnaMoRuhr" in the Ruhr area, Germany. In total, 138 university employees and students received 120  $\in$  per month on a virtual credit card to book any kind of mobility service for work-related and leisure-time activities. In the first month, an average of 77 $\in$  was spent per person and 179 $\in$  in the second month. From a sustainability perspective, the mobility budget had an impact: 57.5% of the students and 69.4% of the employees used their budget to replace at least one trip with a private car by another mobility option, most of the time by public transportation.

During the BIPforMaaS project<sup>22</sup>, carried out in the Piedmont Region, Italy, 250 volunteer users

<sup>&</sup>lt;sup>22</sup> BIPforMaaS project



were given the opportunity to use a MaaS app for 5 months. In return, they received a cashback of up to 15€/month. The incentive proposal was very successful, in fact users continued to use the leftover credit event after the pilot ended. Outside Europe, the Beijing case needs a mention. The objective of Beijing's MaaS scheme is to integrate mobility services across all modes, including aviation and private vehicles. The aim is to provide citizens with comprehensive and convenient "door-to-door" intelligent mobility services throughout the entire journey, encompassing "pre-trip smart decision-making, in-trip guidance, post-trip green incentives, and intercity travel planning services". Beijing MaaS scheme covers the entire area of Beijing – with 6.57 million of motor vehicle fleets including 389,000 electric vehicles – and a strong emphasis on promoting green transport is running. Also the policy is involved: the "14th Five-Year Plan for Transport Development and Construction in Beijing " was released in 2022 with the aim to promote the smart parking services, encourage green and lowcarbon transport, increase the share of green travel, and improve the MaaS platform with integration with more green transport services. In 2023, Beijing MaaS platform has serviced over 30 million users, providing green transport services (e.g., bus, metro, shared bike) to an average of 4.5 million trips daily. In terms of incentive, since September 2020, Beijing has introduced the "MaaS Travel, Green Life" Carbon-Inclusive Campaign, which is built on the MaaS platform to nudge users for green travel. MaaS users who participated in the Campaign will automatically get the carbon reduction credits from their green travel behaviour (e.g., shared bike, bus, metro). Users can then exchange the credits for discounted public transport cards, shopping vouchers, etc. By now, the campaign has attracted over 3.54 million registered users, contributing to a cumulative carbon reduction of nearly 400,000 tonnes<sup>23</sup>.

The vast majority of people use incentives to benefit in some way. However, incentives must encourage positive behaviour. Any rewards need to be both relevant to the individual and also support the overarching objective to reduce carbon emissions. For this reason, the type of incentives matter. The other key word regarding incentives is engagement: community and social recognition are powerful motivators, which can be amplified by offering rewards. However, users must feel that the reward is not just an incentive but a recognition of the effort they have put in<sup>24</sup>.

<sup>23</sup> Beijing's MaaS scheme

<sup>24</sup> Skedgo, "Can MaaS use personalised incentives to help lower carbon emissions?, April 2022







People want to travel in a flexible, comfortable, safe and convenient way and in many cases they believe that the private car is the only option. In order to meet the needs of citizens but at the same time achieve the net zero 2050 targets, the MaaS Alliance strongly believes in the Mobility as a Service paradigm.

This new mobility concept is becoming part of everyday life and experts in the field are working to offer users alternative solutions to the private car. However, this only works if these are the services that the consumer wants. Therefore, a variety of services is essential, and when it comes to cars people need to use them differently, in particular not to use high polluting older private vehicles but shift to public, active and shared travel. Policies are important but so is the commercial viability and consumer demand. Political representatives can approach the topic of MaaS to understand its benefits in terms of both congestion and environmental impact. Building on this, in order for citizens to be enticed to change their habits, central governments will have to provide incentives and support for the new demand for shared mobility coming to cities. In line with the topic of sustainable mobility, MaaS Alliance is a Member of Expert Group on Urban Mobility (EGUM)<sup>25</sup>. The expert group supports the Commission in the implementation of the EU Urban Mobility Framework and promotes a dialogue and the co-creation of actions between cities, regions and stakeholders on urban mobility issues. Among the topics discussed, a lot of attention is given to Sustainable Urban Mobility Planning (SUMP) where new KPIs and sustainable urban mobility indicators will be established in Europe to meet the environmental goals.

<sup>25</sup> New Expert Group on Urban Mobility begins work (europa.eu)

<sup>&</sup>lt;sup>26</sup> Nikitas, A., Thomopoulos, N., Milakis, D. (2021) The environmental and resource dimensions of automated transport: A nexus for enabling vehicle automation to support sustainable urban mobility, Annual Review of Environment and Resources, 46, pp. 167-192



MaaS will represent the first step for a better environment: a combination of different multimodal and sustainable experiences could allow users to change their mindset and bring benefits to all of life's aspects as *Figure 10* shows<sup>26</sup>.



Figure 10: Multimodal transport should include connected, electric and shared transport to achieve wider sustainability goals.

Position paper MaaS driving sustainability

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