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Author(s) and contributing partner(s) - if any

Name	Organisation	Contribution
Various authors	All pilot cities	Final draft of pilot's reporting input
Jet Berndsen	City of Amsterdam	Consolidation of all pilot's reporting
Jet Berndsen	City of Amsterdam	First draft ready
Various authors	All pilot cities	Last review of consolidated report

Contents

1. Executive Summary

In seven European cities with different urban characteristics and demographics, a comparison is made between smart mobility hubs. The cities involved in this project are Amsterdam, Eindhoven, Helmond, Lisbon, Sant Cugat de Vallès, Setúbal and Warsaw. At the end of the project, these cities had 8 SmartHubs operationalized. The aim of the SmartHubs project is to test and validate economically viable mobility hub concepts that foster the modal shift to sustainable transportation and more efficient use of urban space. The two pilot years resulted in many learnings and various outcomes. For example, the relevant insights that can be obtained by setting up a co-creation process while designing the SmartHub, or that also weather conditions will affect the use of different modes, the importance to keep an eye on which trips are substituted in order to stay focussed on the goals of that SmartHub, the importance of knowing how to handle wrongly parked vehicles at the hub, the fact that one size hub does not fit all, the importance of taking gender into account (the SmartHubs attracted more male than female users), the importance of proper signage and information. Some SmartHubs outperformed expectations and will be further developed into SmartHubs networks, other SmartHubs simple did not reach the desired demand and/or did not attract the right target group.

2. Amsterdam

2.1. Pilot plan

2021

The city of Amsterdam is already working on several small neighbourhood SmartHubs so-called 'BuurtHubs' as part of the eHUBS Interreg project. Based on their location, in the Amsterdam case on privately owned premises, the city wishes to build on those SmartHubs and enlarge them to attract more users. The city wishes to roll out the concept on a bigger scale and on a different level, integrating them into their MaaS ambitions and creating a wide network of SmartHubs. Amsterdam is also involved in one of the biggest expansions in years, adding +75.000 homes. These new urban areas are predominantly car-free and will require a different approach to (shared) mobility and accessibility and involving new questions about procurement and governance. Amsterdam pilot plan involves the opening of 2 SmartHubs in the city. The goal of the two SmartHubs is to research if it was possible to create viable SmartHubs on private areas.

Figure 1: Left: SmartHub Fashion Hotel. Right: SmartHub Student Hotel

2022

In the second year of the project the Amsterdam pilots will test and validate smart value propositions. To reduce the number of privately owned cars parked on public space and the amount of car movements throughout the city we will create a competitive and comprehensive offer for this target group. The proposition was developed by joined forces of Hely, new partner of the SmartHubs project: Parkbee and the City of Amsterdam.

The proposition was as followed: A 3-month testing period in which selected residents would receive €50-shared mobility credit from Hely Student Hotel SmartHub. At the same time, Parkbee would provide free

parking space further away from the hub, in the South-East of Amsterdam. Finally, the City of Amsterdam would provide financial compensation for the unused parking permit. The target group for this proposition were residents who owned a car and lived near the SmartHub of the Student Hotel. At the start and the end of the pilot applicants would be interviewed by a researcher to provide their experience form participation in the pilot. To recruit subjects for this, experiment a communication campaign was developed. This campaign linked to a registration website on the website of city of Amsterdam.

2.2. Reflection

2021

The goal of the pilots was to research if it was possible to create viable SmartHubs on private areas. Two SmartHubs were created, one in parking lot of Amsterdam Student Hotel and one in parking garage of Amsterdam Fashion Hotel, a mixed-use building: part hotel, part residential housing. The SmartHubs at the Student Hotel and Fashion Hotel City opened in July 2021. Hely is the operator of these SmartHubs. Hely operates 12 SmartHubs in Amsterdam (2021) and plans to open 8 more in 2022.

The Student Hotel SmartHub is located on a parking lot next to a hotel. The hotel is aimed at students who stay for periods up to 6 months in Amsterdam. The SmartHub is easily accessible from the surrounding streets but not directly visible. The distance to the subway station is within 100 meters walking distance. The SmartHub started operation with city bikes, comfort bikes and e-bikes. In 2022, a cargo bike would be added. The SmartHub is aimed at residents from the Student hotel and neighborhood of the SmartHub. Secondary group of users are visitors to the area. This could be tourist of people arriving through the subway.

The SmartHub at Fashion Hotel is different from other SmartHub: it is located inside a building. The SmartHub is not directly visible but easily accessible from the surrounding streets. The SmartHub started operation with city bikes, comfort bikes and e-bikes. In the future there will be an expansion with cargo bikes. The SmartHub is aimed at visitors (both leisure and business) coming into the city by car; business guests in the local business area; city residents who use the SmartHub to get out of the city and residents from the neighborhood of the SmartHub.

Some delays and complications occurred during the pilot. The SmartHubs were opened later than planned (March), due to a later start of the project and due to longer-than-expected contract negotiations. After opening a communication campaign by Hely, Parkbee and the city of Amsterdam was run to help boost the usage of shared mobility. Another complication occurred due to the decrease in travel movements, due to COVID 19 restrictions. This resulted also in severe lock-down measures during the second half of 2021. Although difficult to measure, this undoubtably had an impact on the usage of the SmartHubs.

2022

The social media campaign went great. The website had 500 views and we received 25 applications.

Selection of the participants had proven to be more difficult. Not all participants met all the requirements. Reactions both from within the neighborhood as well as further outside the neighborhood came in. From these registrations there was a selection to reach 5 participants. The selection was based on distance to the SmartHub and a check if participants understood the rules of participation (parking your car further away, using mainly shared mobility). This was not understood by all participants and proved to be a bottleneck for some. Personal circumstances, such as for example uncertainty over a job switch made participation too difficult.

The next step for running the experiment was to sign up the participants at Hely and Parkbee and grant the participants certain discounts. At this point we ran in to difficulties. We were unable to register the participants for the services of Hely and Parkbee. The participants did not answer our call to action to sign-up, they were unreachable for calls or emails. Despite their original enthusiasm during the screening phone call, they did not follow up and go through with further steps needed to run the experiment. The city of Amsterdam reached out to applicants to ask for their considerations of not participating but was also unable to get in touch with them.

City of Amsterdam, Hely and Parkbee were disappointed that we were unable to run the research as proposed but this did result in relevant insights and lessons learned as an alternative result (please see chapter 2.5).

As for our testing the goal if it was possible to create viable SmartHubs on private areas: It is very difficult to increase user group of a SmartHubs on private lands to the public domain (not community based). At the Fashion Hotel hub, the indoor hub, it even proved too difficult, and decision was made to cease operation of the SmartHub in summer of 2022. Although way-finding improvements were made, it proved to be too difficult to reach the right target group. For a SmartHub inside a building there needs to be a highly tailored approach to make it viable.

2.3. User data

2021

The number of trips and users at the two SmartHubs did not reach the expected level for the first year. In 2021 the total number of rentals of the Fashion Hotel SmartHub was: 80 rentals by car and 15 rentals by ebike. For the Student Hotel SmartHub this was: 103 car rentals and 61 ebike rentals. The number of trips was growing until October, but then fell back. Assumably, the most probable cause were the tightening Covid–restrictions. This has probably led to less usage of the SmartHub due to lower amount of travel of residents and of visitors to Amsterdam. This has had an important impact in the number of users and growth of the SmartHubs.

Up until now there is limited data about the origin of the users, so it is difficult to state conclusions. Currently, the users are mainly students/residents of the hotels, or near the hotels. Specificized information

is missing about the number of people who use the SmartHub as a transfer location from car to shared mobility.

2022

The SmartHub at The Fashion Hotel was closed due to the fact that there wasn't enough demand. In 2022 the total number of rentals of the Fashion Hotel SmartHub was: 107 rentals by car, 11 rentals by ebike and 2 rentals for the eCargobike. For the Student Hotel SmartHub this was: 292 car rentals, 150 ebike rentals and 18 for the eCargobike. The revenue barely covered 40% of the costs. Also, there are not enough unique customers who are using the SmartHub. We have invested quite a lot of time and marketing costs to inform the surrounding neighborhoods which didn't led to more users. Hely terminates any location that don't cover over 100% of the operational costs after 1 year.

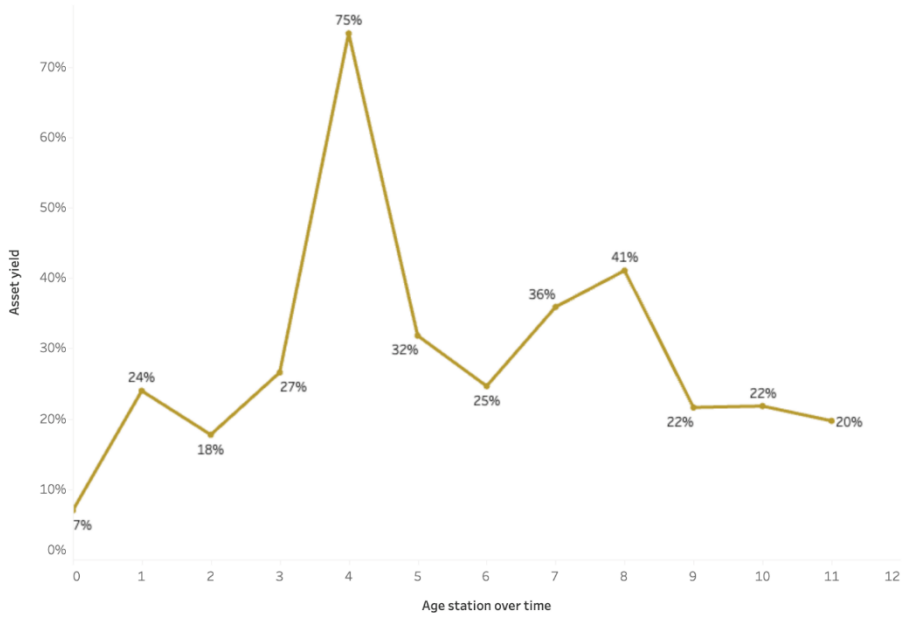


Figure 2: Asset yield

Based on the current performance of the The Student Hotel, we will close this location end of year. Without additional funding, there isn't enough demand to continue operation of the SmartHub after 1 year.

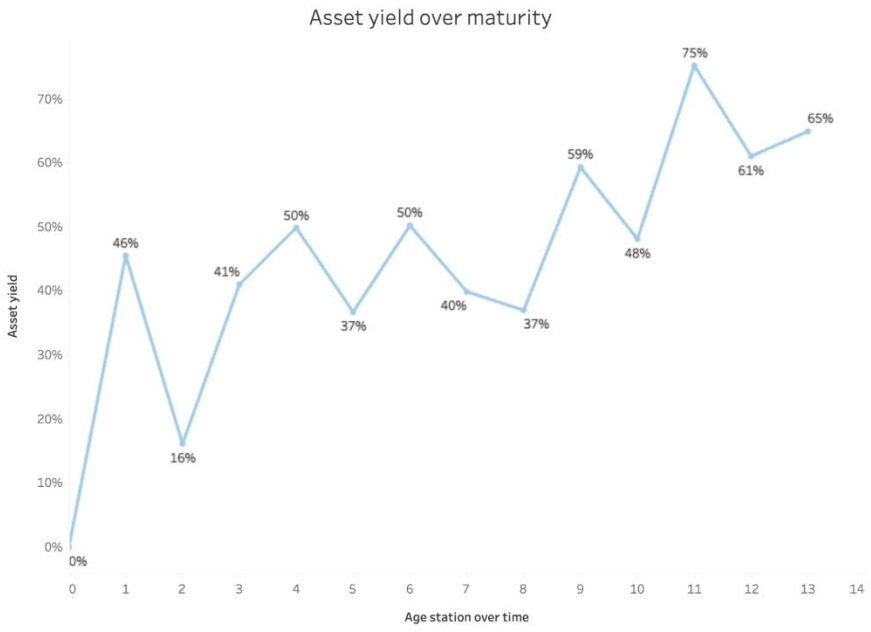


Figure 3: Asset yield over maturity

Results of testing the new business model

- The social marketing campaign reached 12.000 views (Facebook/Instagram)
- 500 people visited the website after seeing the campaign to learn more about the project.
- Registration on the website led to 25 applicants
- From 25 applicants 5 suitable participants were selected.
- Not a successful business model, not the right target group – proposition model

2.4. Additional indicators

2021

The additional indicators proved to be difficult to test. It was difficult to get feedback from the users through questionnaires. Infrequent use of the SmartHub made it nearly impossible or highly time consuming to get in touch with users. Furthermore, the population of The Student Hotel changes every 6-12 months so there was no installed base we could use. We tested the following indicators.

1. User experience public SmartHub in non-public space.

   Besides the difficulty of receiving feedback from the users, the population of The Student Hotel changes every 6-12 months so there was no baseline we could refer to during the course of the first year. We did however, received some feedback though the general feedback loop that Hely

incorporates in their app. The customers who used the SmartHub were very positive. The only negative reviews we have received were related to a dirty car, or referring to a malfunctioning bike. Out of 700 rides, 187 received a 4- or 5-star rating, 28 rides received a 2- or 1-star rating. 435 received no rating which is a usual percentage compared to other SmartHubs.

2. Effective 'catchment area' of indoor vs outdoor SmartHubs – how long are residents willing to travel to access the SmartHub?

   Hely states that users are willing to travel for almost 2 kilometers to the SmartHub. This is a recognizable spread and has to do with the price model of Hely. Hely offers a fixed hourly-tariff with all kilometers included. Other carsharing-companies have a kilometer-tariff. So, for long drives, Hely is a very affordable option for which customers are willing to travel.

3. Distance residential address & knowledge of SmartHub' s existence.

   See map for the home address of users of the SmartHub. This is aggregated data (GDPR proof).

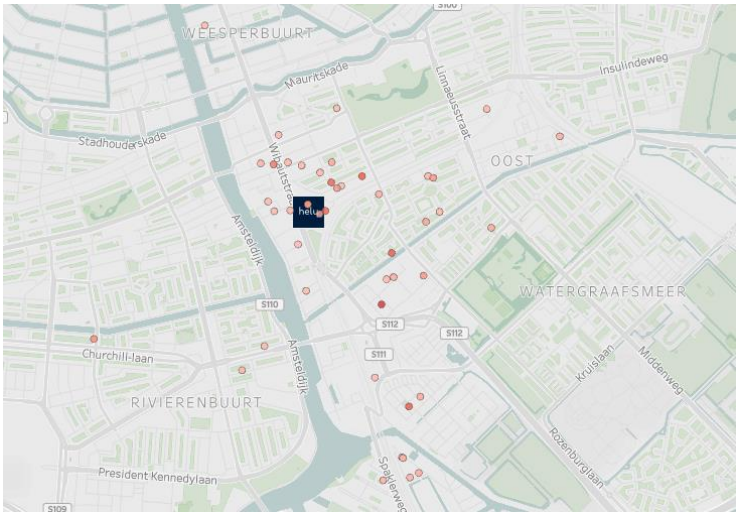


Figure 4: Home address of users of the SmartHub Student Hotel

4. Number of users that parked their car and then moved to Hely mobility solutions.

We don't have any data on how people reached the SmartHub. It is logical to assume that they didn't park their own car just to use a shared car. Our estimation is that they used their own bike or used public transport

2022

Proposition was not tested as we hoped. Data we collected through contact with applicants appears to show that there is quite a lot of interest from car owners to test if a SmartHub can provide suitable substitute for owning a car. Reasons to participate were mainly financially, applicants told they used their car infrequently and wanted to test if it was financially beneficial for them to substitute shared mobility for owning a car.

2.5. Lessons learned and best practices

2021

As expected, the main problem for a viable SmartHub is attracting enough customers. Situation of a SmartHub in a private area creates extra threshold for customers to find the location. The first year confirmed that is essential to keep promoting the SmartHub and be very active to attract new customers. Due to the SmartHub being a private venture and not being part of a city branded network, it was very difficult for city of Amsterdam to help promote these SmartHubs. After attracting customers, the customer must be convinced that the SmartHub can service his or her needs and even replace the need to buy/use/keep a private car. In order to convince users to do so, a steady, dependable and grown network of SmartHubs need to exist in the city to help achieve the goal of the city: shared mobility as a suitable alternative for the private car (besides active modes of mobility (walking and biking) and public transportation). Amsterdam is not yet at that level. Helping people making the more sustainable choices and providing them with suitable alternatives is most pivotal.

2022

- There is lots of interest in trying out shared mobility as a substitute for owning a car. We found the number of website visits and registrations above our expectations. However, the high number of interest did not result in actual usage of the SmartHubs (proposal).
- Feedback we received in contact about motivation to apply was to test if it was financially beneficial to use shared mobility. Applicants cited that: they disliked the costs of owning a car and were interested to try out what cost shared mobility would be for their situation. Freeing up parking spots for public space was mentioned a secondary consideration.
- Our registration process proved quite cumbersome. Due to privacy regulations and considerations, we designed a marketing and registration process with registration at City of Amsterdam. The registration and transfer of contacts to other partners proved to take time and multiple contacts with applicants. It also led to confusion for applicants. This probably resulted in applicants dropping out, but the exact reasons are unknown.
- Applicants gave feedback that they did not fully understand the proposition and/or had doubts about parking their car further away during the duration of the experiment. Verbally we provided explanation about rules of pilot and assurance that they would be able to access their car 24/7. Even though temporary, parking their car further away was a big hurdle. This sentiment is important to note in further experiments/research.

- The usage of a single SmartHub as a means of shared mobility for this pilot was a hurdle for applicants. This meant limited access to mobility and dependency on mobility on offer at a single location. Feedback we received was that people might be confronted with the unavailability of any vehicle in the hub. The usage of a single SmartHub also limited our area of selection of participants. There were applicants who lived too far away from the SmartHub to consider serious applicants.

2.6. User group

2021

The Student Hotel SmartHub was aimed at residents from the hotel and the neighborhood around the SmartHub. Secondary group of users were visitors to the area. This could be tourist of people arriving through the subway. For the Fashion Hotel City the target group was different: the SmartHub was aimed at visitors (both leisure and business) coming into the city by car; business guests in the local business area; city residents who use the SmartHub to get out of the city. residents from the neighborhood of the SmartHub. There is limited data on these personal demographics of the users. Generally, speaking, people use the SmartHub more often in the weekend, assumably for leisure trips.

2022

For testing the new business model, the group we aimed for had following characteristics:

- Residents of Amsterdam
- Live near the Student Hotel SmartHub (max 500m, selection based on postal code)
- Owns a car and has a permit
- Infrequent car user (less then every week)

2.7. User experience

2021 and 2022

The users are positive about the service. The customers who used the SmartHub were very positive. The only negative reviews we have received were related to a dirty car or referring to a malfunctioning bike. Out of 700 rides, 187 received a 4- or 5-star rating, 28 rides received a 2- or 1-star rating. 435 received no rating which is a usual percentage compared to other SmartHubs.

2.8. Service improvements

2021 and 2022

In the first year the SmartHubs functioned as planned. There we no large service improvements only a minor addition to the fleet. We added a cargo bike on demand but unfortunately it was not very successful (yet), numbers remained low.

3. Eindhoven

3.1. Pilot plan

2021

The ambition of the city is to create a multimodal traffic network, and smart hub facilities are expected to serve an important role in this ambition. The hub location (P+R) in the South of Eindhoven will be finished by the end of 2020 and will be the pilot hub location for this project. The hub will have over 600 parking spaces and is located next to one of the main entrance roads of Eindhoven. This hub is also part of the EIT SOUL project in which a DSS for planning and operation of mobility hubs is being developed. In 2020 analyses are being performed on the requirements and stakeholders. These insights serve as input to this project as well. In addition, Eindhoven is launching one of the seven national MaaS pilots in 2020. The MaaS platform enables travellers to consider their full range of transfer possibilities, including the hub and its modalities. Incorporating shared mobility at the hub in the MaaS application (via TOMP-API) as quickly as possible is therefore key. Not only for the Eindhoven case but for the development of other (regional) MaaS platforms as well. Research questions are focused on the exploitation of the hubs: what combination of locations, services, (shared) modalities and travellers work, and what can we learn from this for future hub locations? This includes the business case for the industry, behavioural change, the implementation of additional services at a hub location, and what can be the role of MaaS and shared mobility.

2022

Continue to pursue an increase in usage of the hub in order to generate user experience and data. Qualitatively we aim to incorporate the Hub into our MaaS environment to make the hub more digitally accessible and investigate how a larger variety of mobility options can help to get more people to travel via the Hub.

3.2. Reflection

2021

Conceptual model

In order to stimulate use of the hub, and to identify what the factors are that determine the success of the hub, we collected an overview of all the elements we can alter at the hub. Our research then focuses on

the central research question: What are the factors of success for P+R (smart hub) Genneper Parken and how do they contribute to the mobility transition?

This conceptual model is an overview of all the elements/factors we found relevant to do research on, in both 2021 and 2022. We translated the different elements into a data plan, a marketing strategy and a pricing plan. The pricing plan is something we want to put into practice in 2022. Since the opening of the

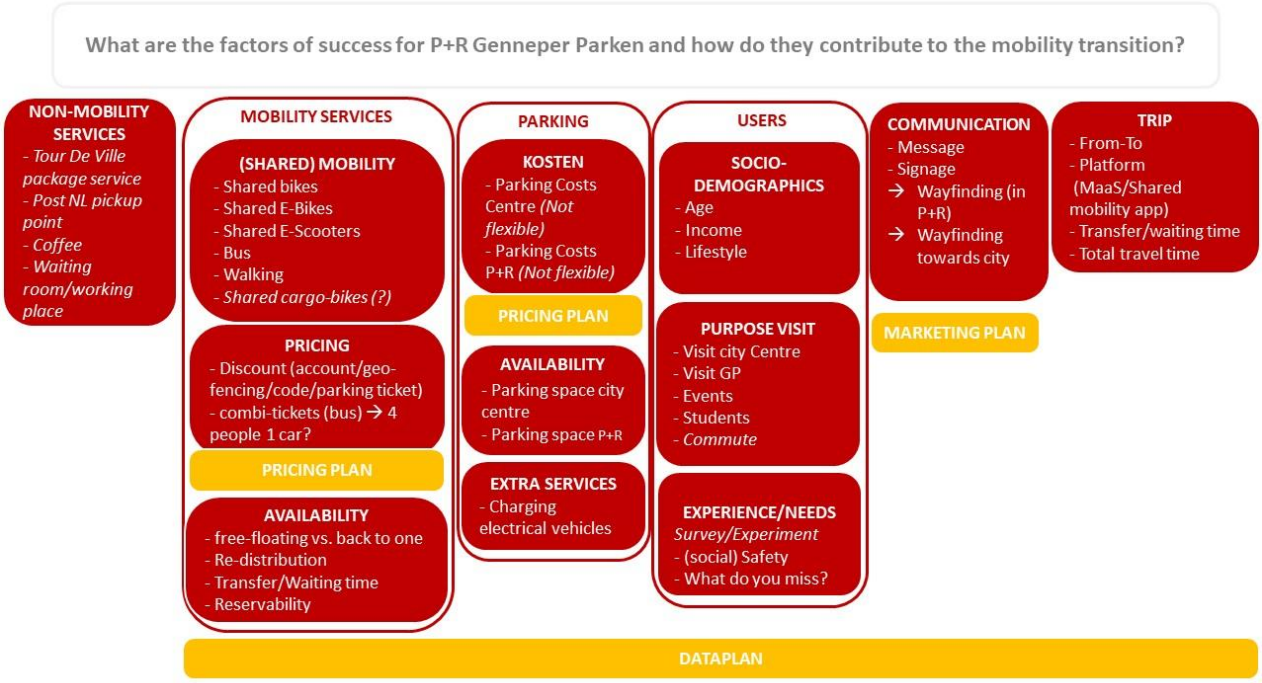


Figure 5: Success factors at P&R Genneper Parken

hub was delayed in the beginning of 2021, we decided to keep the prices stable at the start of the hub in order to see how the status-quo situation would work out.

The data plan was the basis for defining the smart hub indicators, which we collectively sharpened to a shared set of indicators which we will present below. Many of the factors we find relevant for research as stated in the model, have been operationalised into the data-collection and the survey.

The marketing plan was the basis for all the communicational actions we put into place in order to stimulate use of the hub. As a city, we take great interest in stimulating use of the hub as a whole, with the first concern being: how can we get people to park at the hub. The next steps are related to get people to use certain modes of follow-up transport. Together with Hely we have had talks on how to combine our communication efforts to meet both our ambitions.

The pricing plan was put on hold for 2021. The idea of the pricing plan is to do research into how changes in the price of shared mobility, the ticket price for parking at the hub and the price for the bus ticket affect the choices people make. It is one of the factors we can manipulate, and a factor which is one of the three main factors that influence the choice of travel for people. The three factors being cost, time and comfort. We put the plan on hold due to the delay in the opening of the hub. We first need a time period to gather

data on the use of the hub in a 'status quo' price situation, as a benchmark. Afterwards, we will put the plan into practice in 2022.

2022

During 2022, the hub has seen a steady but slow increase in its use and in the use of shared mobility. However, considering the scale of the hub and the use, it has been too low in general. We have seen that the hub in combination with the shared mobility and public transport (Bus rapid transit) can be a good alternative for people, but only a handful feel that the value is large enough to outweigh the alternative. More on that in section 7 and 8b.

During the year we have done research, committed resources to communication and improving general services at the hub in a pursuit of increasing the use. One of the studies was done on general visitors to the city and the motives to park where they do. The other study was a student thesis on visitors approach and the role of a hub in that.

As a general reflection, we feel the hub has a lot of potential. The service options are welcomed to some, and can therefore be welcomed by others if the conditions are favourable. These conditions are not favourable yet. The city is still too easily accessible by car in general. The majority of people make the choice to skip the hub and drive all the way to their preferred destination. We need to work on making the conditions different in the coming years. Not just because we want to, but because of the hard necessity of a mobility transition due to the growth the city will face.

3.3. User data

2021

The following paragraphs present the analysis on the performance of the Smart hub Genneper Parken. In these paragraphs, we will present data on the total amount of travellers, the amount of bus-tickets sold to Smart hub users, the amount of shared mobility trips made from and to the smart hub as well as share results from a study done under parking visitors in the city centre. Within this research, we specifically targeted some of the questions to the Smart Hub Genneper Parken to get a feel of the sentiment of city centre visitors towards the smart hub as an alternative option of travel.

Since the hub opened in June 2021, the number of users is increasing gradually as can be seen in Figure 6. These numbers contain both the people that use the facility of Park + Ride and people that only use the hub for parking. Those are probably people working at or visiting the GGD (Municipal Health Services), visitors of the Genneper Parken (sporting and cultural facilities), or visitors of the Van der Valk Hotel, which are both located near the hub. The data requires some explanations:

- In November we see a drastic increase of parkers at the hub. A possible explanation is that parking was free of charge during GLOW (6 – 13 November). GLOW is a free light festival in the city of Eindhoven that attracted almost 600.000 visitors last year.
- In addition, parking was also free in the period of 26th of November up and until 9th of January. However, due to the lockdown from 19th of December until 26th of January, it is difficult to draw any conclusions from this measure. However, unfortunately we don't have data on the total users of the P+R for the period it was free. We only have data on the bus usage from the P+R (since people still had to pay €0,50 per person for the bus). Therefore, the data of November and December is missing in the Figure.

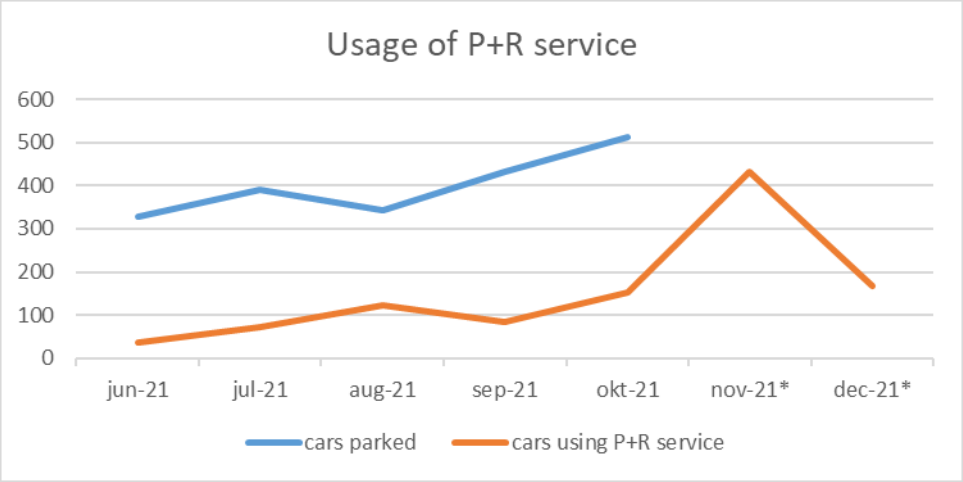


Figure 6: Usage of P+R service
** Data of cars parked is missing in November and December because parking was free during a large part of these months.*

As could already be seen in Figure 6, only a part of the people parking their car at the hub use the bus as a last-mile modality. It could be that the other visitors had a destination in the proximity of the hub (sports facilities, hotel), or that they have used shared mobility for their last-mile trip. Figure 7 shows the relation between the number of cars that used the bus service and the number of bus tickets. Which tells us more about the number of people per car. As expected, during November (GLOW) the number of people per car increase drastically as well. People often visit this event with their family. What is interesting to see is that in general the number of people per car is also increasing over time. It might be the case that people go shopping with friends or family in the center more often now the lockdowns are past-time, and the weather is improving.

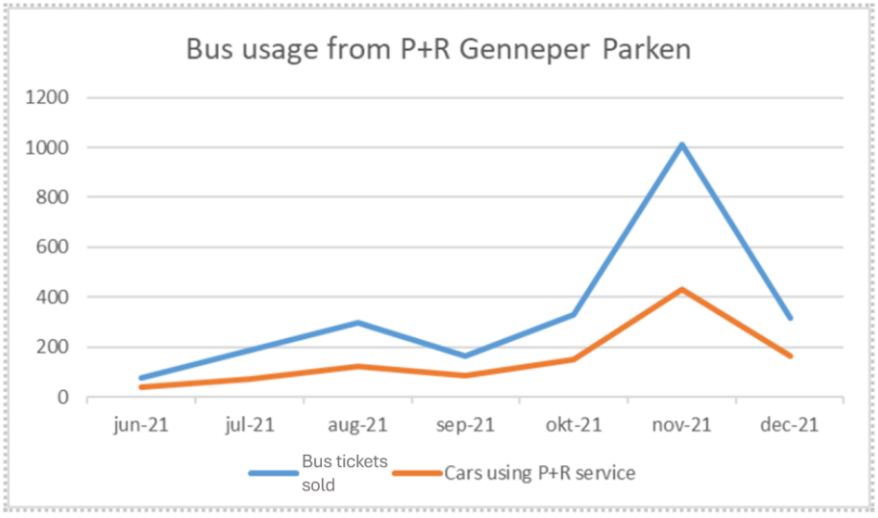


Figure 7: Usage of bus

Hely shared bikes and e-bikes

The shared bikes and e-bikes of Hely haven't been used much the past months (see Table 1). Only three trips have been made by e-bike in March. There can be thought of multiple reasons why this is the case:

- This is the only location in Eindhoven where the Hely bikes can be used, in contrast to the e-mopeds and e-bikes of the other shared mobility providers in Eindhoven. People have to sign up to Hely especially for using these bikes, this can be a barrier.
- Moreover, it is difficult to organize marketing campaigns specific for the Hely bikes. For us as a city it is most important get people to use the P+R facility and not drive with their car to the city center, and that's where we focus our marketing on. When people get to the hub they have to be tempted to use the Hely bikes, but there are also still the other shared mobility options as well as the bus.
- Another reason might be that the tariffs are quite high. The bikes can be used for €1 per hour, and you continue paying when the bike is parked, and you are in fact not riding the bike. Especially compared to the tariffs of the bus (€0,50 per person two-way ticket) the bike prices are quite high. When compared to the e-scooters, the Hely (e-)bikes are in the same price range depending on the duration of the visit. The costs for a one-way trip with an e-moped are approximately €3.00, making it around €6.00 for a two-way trip.
- The bikes of Hely are less flexible than the other shared mobility modes, which is an advantage and a disadvantage. An advantage, because the bikes offer certainty of availability. Disadvantage, because the cost of the bike rental keeps running while you visit the city which people might find put pressure on getting back fast.

	07/21	08/21	09/21	10/21	11/21	12/21
Number of subscriptions	22 in total					
Number of trips e-bike	3	2	0	2	0	0
Number of trips regular bike	0	0	0	0	3	0
Average rental duration (min)	223	133	-	12	100	-
Number of attempted reservations vs. number of successful reservations per month	100%	100%	-	100%	100%	-
Time of reservation (hours/days ahead)	0	0	-	0	0	-
Number of broken-down vehicles / month	0	0	0	0	0	0

Table 1: Usage of Hely bikes

Free-floating shared e-mopeds and e-bikes

In Eindhoven we have free-floating shared mobility of Felyx, Go Sharing and TIER. Felyx and Go Sharing are operating shared e-mopeds (both 25 km/h and 45 km/h), Go Sharing and TIER are operating e-bikes since October. Agreements have been made on the availability of e-mopeds at the P+R Genneper Parken. Felyx, Go Sharing and TIER have a service area at the hub from which users can start and end their trip with a shared e-moped or e-bike. Moreover, the providers installed discount codes for the hub users. Due to business sensitive information, we can only share information that all three providers are able to share with us. This limits our data to the number trips ending at the hub for the entire period, and the trips starting at the hub from October 2021 onwards (see Figure 8). Good to mention is that the e-bikes were only launched in the beginning of October.

It is striking to see that the amount of trips starting and ending at the P+R corresponds quite well. It could be the case that the same people starting their trip at the hub also take a shared vehicle for their return trip. It might also be the case that there are different use cases for these two types of trips, and these coincidentally add up to the same number of trips. What can also be seen in Figure 8 is the total amount of trips declining drastically in the winter period.

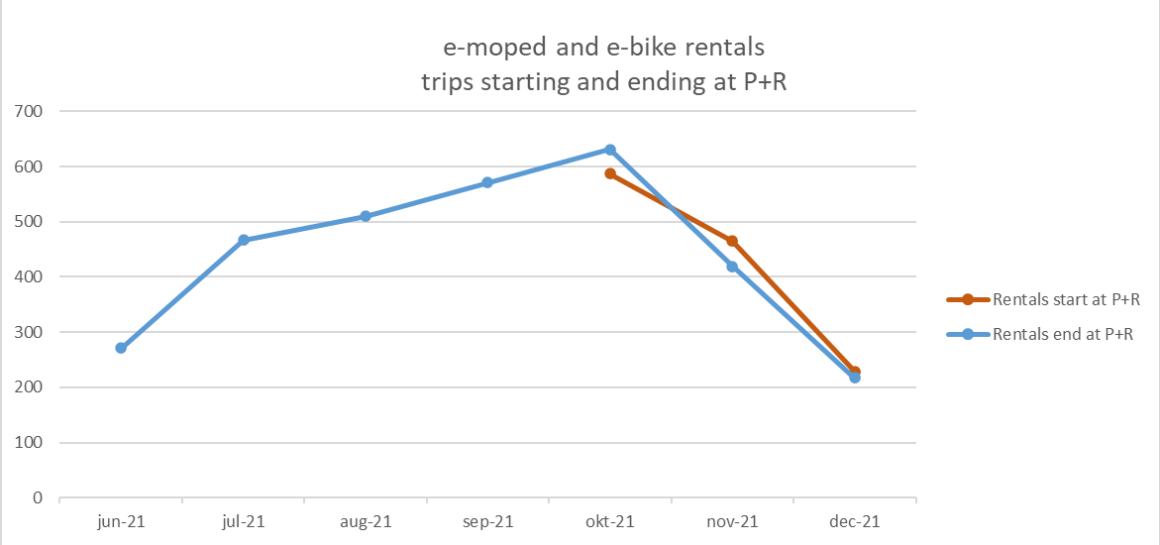


Figure 8: E-moped and e-bike rentals starting and ending at Smart Hub Genneper Parken (e-bikes starting from October)

2022

The data shows the usage of the Smart Hub Genneper Parken during the pilot period of June 2021 till October 2022.

Users Park & Ride

The number of users of the hub is increasing gradually, this can be seen in the data of cars parked at the hub. These numbers contain both the people that use the facility of Park + Ride and people that only use the hub for parking. In Figure 6 the data can be seen on people using the P+R bus service. The figure shows only a part of the people parking their car at the hub use the bus as a last-mile modality. It could be that the other visitors had a destination in the proximity of the hub (sports facilities at Genneper Parken, Van der Valk Hotel. Another possibility is that they use shared mobility services to travel their last-mile.

A start-up period was expected for a new parking facility like the Smart Hub before people get used to the service and experience using it. Note: parking was free during the period of 6-13 November (light festival GLOW), and 26th of November up and until the 9th of January. Due to the lockdown from 19th of December until 26th of January, it is difficult to draw any conclusions from this measure. This is also noticeable in the data; during GLOW the amount of bus users increased drastically (GLOW) and we can see a gradual increase of users since the lockdown ended by the end of January. Unfortunately, we don't have data on the total cars parked at P+R for the period it was free. We only have data on the bus usage from the P+R (since people still had to pay €0,50 per person for the bus).

During the summer period, the number of car parkers declined again, but the usage of the bus service from the P+R remained quite similar. This could indicate there are quite some regular users of the P+R.

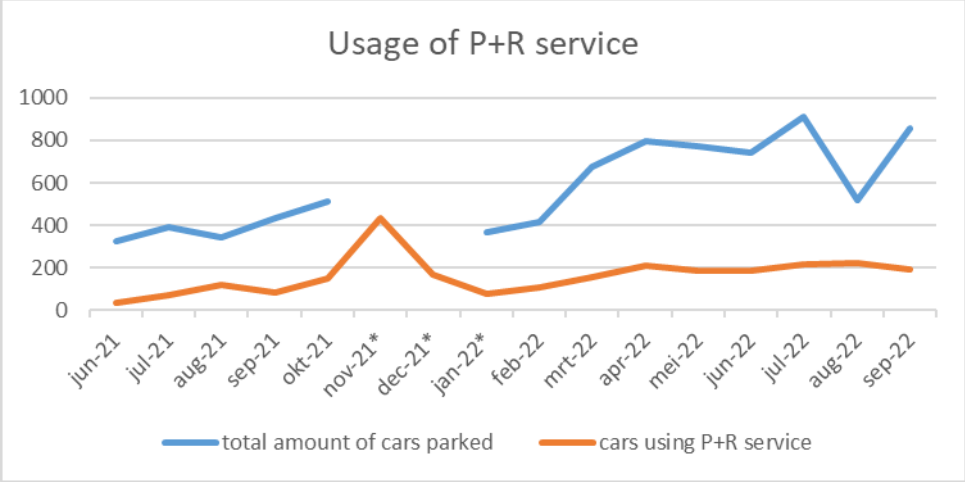


Figure 9: Usage of P+R service

** Data of cars parked is missing in November and December because parking was free during a large part of these months. Data January of 'cars parked' is from 10th till 31st of January 2022.*

Figure 10 shows the relation between the number of cars that used the P+R service and the number of bus tickets. Which tells us more about the number of people per car. As expected, during November (GLOW) the number of people per car increase drastically as well. People often visit this event with their family. What is interesting to see is that in general the number of people per car is also increasing over time, especially during the summer period. It might be the case that people go shopping with friends or family in the centre and the weather is improving.

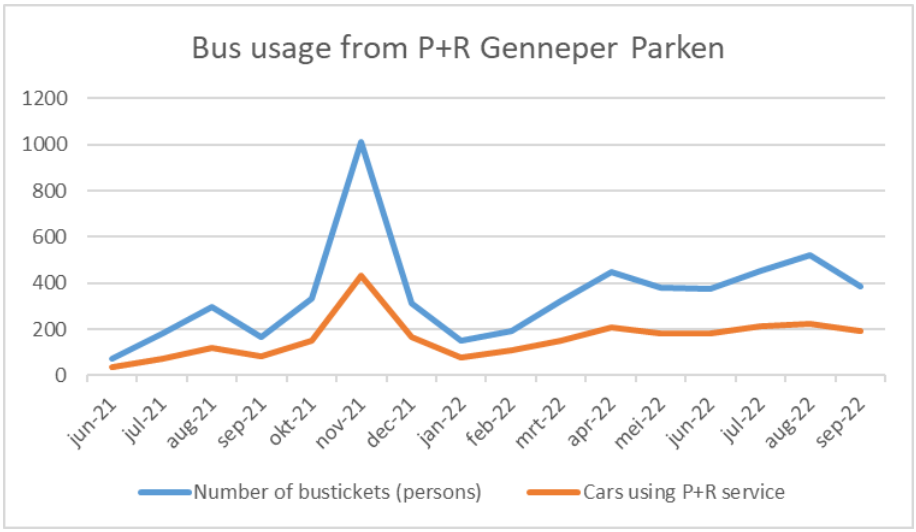


Figure 10: Bus usage originating from P+R Genneper Parken

Hely shared bikes and e-bikes

The shared bikes and e-bikes of Hely haven't been used much during the pilot period. Only fourteen trips

have been made by Hely bikes during the pilot period. There can be thought of multiple reasons why this is the case:

- This is the only location in Eindhoven where the Hely bikes can be used, in contrast to the e-mopeds and e-bikes of the other shared mobility providers in Eindhoven. People have to sign up to Hely especially for using these bikes, this can be a barrier.
- Moreover, it is difficult to organize marketing campaigns specific for the Hely bikes. For us as a city it is most important get people to use the P+R facility and not drive with their car to the city center, and that's where we focus our marketing on. When people get to the hub they have to be tempted to use the Hely bikes, but there are also still other shared mobility options as well as the bus.
- Another reason might be that the tariffs are quite high. The bikes can be used for €1 per hour, and you continue paying when the bike is parked, and you are in fact not riding the bike. Especially compared to the tariffs of the bus (€0,50 per person two-way ticket) the bike prices are quite high. When compared to the e-scooters, the Hely (e-)bikes are in the same price range depending on the duration of the visit. The costs for a one-way trip with an e-moped are approximately €3.00, making it around €6.00 for a two-way trip.
- The bikes of Hely are less flexible than the other shared mobility modes, which is an advantage and a disadvantage. An advantage, because the bikes offer certainty of availability. Disadvantage, because the cost of the bike rental keeps running while you visit the city which people might put pressure on getting back fast.

Free-floating

In Eindhoven we have free-floating shared mobility of Felyx, Go Sharing and TIER. Felyx and Go Sharing are operating shared e-mopeds (both 25 km/h and 45 km/h), Go Sharing and TIER are operating e-bikes since October 2021. Agreements have been made on the availability of e-mopeds at the P+R Genneper Parken. Felyx, Go Sharing and TIER have a service area at the hub from which users can start and end their trip with a shared e-moped or e-bike. Moreover, the providers installed discount codes for the hub users.

Due to business sensitive information, we can only share information that all three providers are able to share with us. This limits our data to the number trips ending at the hub for the entire period, and the trips starting at the hub from October 2021 onwards (see Figure 11).

It is striking to see that the amount of trips starting and ending at the P+R corresponds quite well. It could be the case that the same people starting their trip at the hub also take a shared vehicle for their return trip. It might also be the case that there are different use cases for these two types of trips, and these coincidentally add up to the same number of trips.

What can also be seen in Figure 11 is the total amount of trips declining drastically in the winter period and are rising again from February onwards. This is probably influenced by the weather conditions as well as the covid measures, since the lockdown ended by the end of January.

Moreover, the amount of trips during the summer period decline as well. A possible explanation could be that these free-floating services are used for driving to school or work, and during the months July and August they have holidays. The hub is located at the edge of the city of Eindhoven, and it is the first bus

stop in Eindhoven from the Southern direction. People from villages in the neighborhood might travel the first part by bus to Eindhoven (first stop is P+R), and then switch to a free-floating service since they are faster at school or work by driving directly instead of switching to another bus in the city centre.

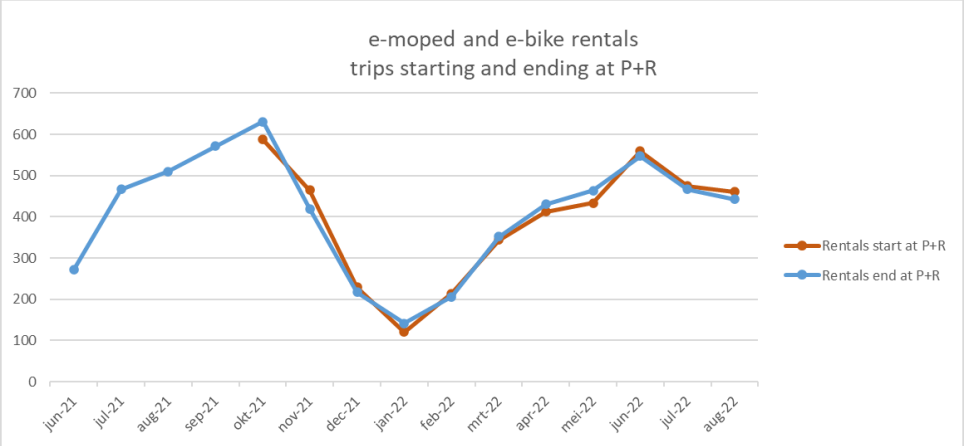


Figure 11: E-moped and e-bike rentals starting and ending at Smart Hub Genneper Parken

Looking at Figure 12 it shows us the average duration of trips starting at P+R Genneper Parken, this duration is quite long and enough to travel to the city centre of Eindhoven by e-bike or e-moped.

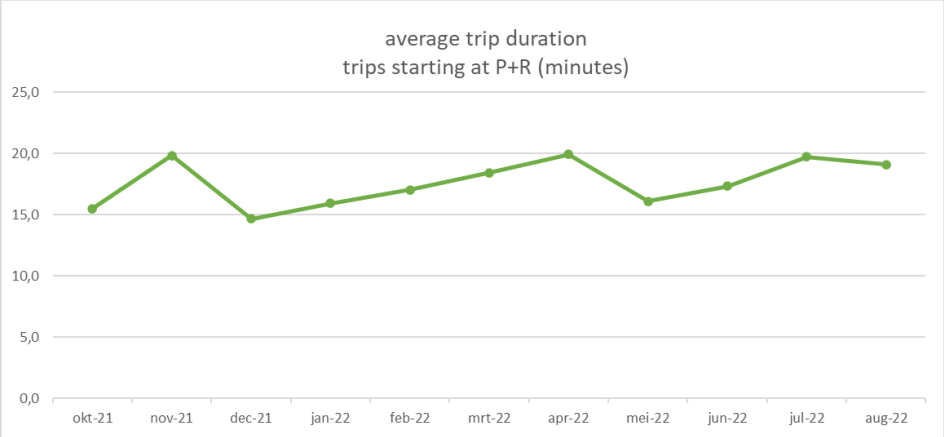


Figure 12: Average duration free-floating trips starting at P+R

Lastly, Figure 13 shows the comparison of bus trips and free-floating shared mobility trips originating from P+R Genneper Parken. Again can be seen that GLOW had an enormous impact on the usage of the bus service. We don't see that same effect on the free-floating shared mobility trips. Moreover, what is striking to see is that during the months of May and June, the free-floating shared mobility options are being used more often than the bus service. Weather conditions might have played a role in this, since it's more attractive to cycle or drive on a moped.

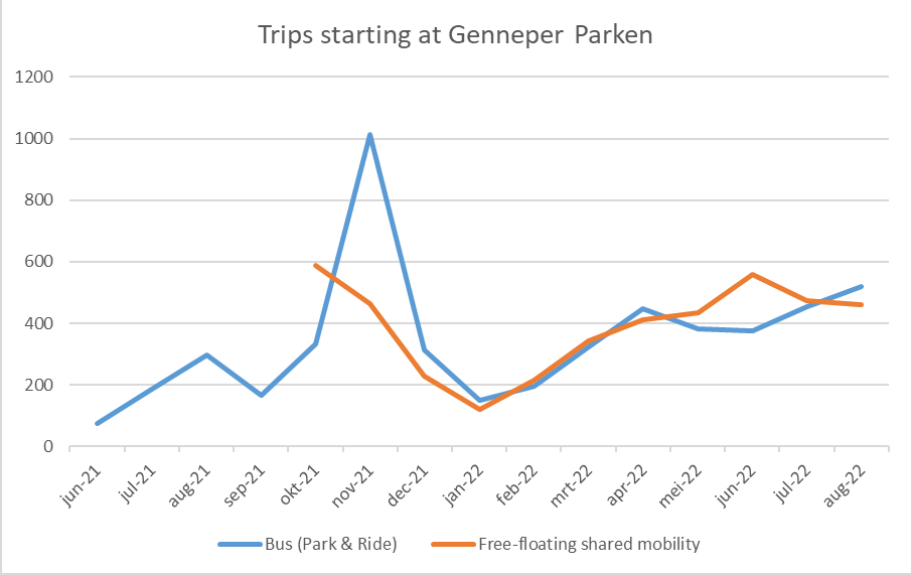


Figure 13: Bus and shared mobility trips start from hub

3.4. Additional indicators

2021

1. User experience shared mobility at permanent P+R location.

   Please see section: user experience.

2. Distribution usage from vs. usage toward P+R location (nr of trips initiated from vs nr of trips ended at P+R location).

   Please see section: user data. From the shared mobility data we see that almost the exact same number of trips start at the P+R as the number of trips that end there.

3. Reduction traffic congestion on southern access road into city center.
   No relevant data due to covid

4. Average difference travel time to city center cars vs hub users, per mode per weekday.

   No relevant data due to covid

2022

1. Evaluation of MAAS-integration.
   The idea of MAAS-integration into the project was based on the MAAS pilot in Eindhoven. As one of the seven pilot cities in the Netherlands, Eindhoven worked with Turnn as the MAAS platform provider to test and develop a working ecosystem. Part of the roadmap of development stated that the integration of P+R locations/hubs as travel options was planned in Q2 2022.
   The integration of Maas has not been the added success we hoped for. At the start of 2022, the Maas pilot in Eindhoven with Turnn was ambitious and promising regarding its integration in the mobility system and the mobility service providers. However, the development of the tool has run into a number of issues regarding legal and technical aspects, resulting in the delay of Maas. This meant that the shared mobility services have not been able or willing to become part of the Maas ecosystem. The further integration of the hub in the Maas system was therefore also suspended.

2. Evaluation of additional mobility options and its effect on usage.
   At the end of 2021, the city of Eindhoven added shared E-bikes from TIER and Go Sharing. As part of a free-floating fleet of 250 e-bikes for both of the service providers, totalling to 500 e-bikes, the hub became a hotspot of departing and arriving trips. The increase however was not linked with people using the hub to park their cars and transferring over to shared mobility but rather use the hub as a place to switch from public transit (bus) to shared mobility.

3.5. Lessons learned and best practices

2021 and 2022

The added value of shared mobility at the transfer hub is not 100% certain, but there are signs to support the idea. What is mostly the lesson we learnt, is that the conditions for success to really compete with private cars lie in:

- Parking ease in the city center
- Parking costs in the city center
- Pleasant and easy route towards the city center.

The hub is still seen as a good investment towards the future we want for the city, however the conditions need to be addressed together with creating hubs in order to make the shift feasible on all occasions.

3.6. User group

2021 and 2022

The visitors of Eindhoven city center who where asked to fill in the survey are:

- 58% Female
- 40% male
- 2% Non binary

Of these visitors:

- 23% are 55 years or older
- 35% are between 35 and 54 years old
- 42% are 35 or younger.

The average travelled distance to visit Eindhoven is 34.9km in which:

- 22% is between 1 – 5 kilometers
- 27% is between 5 and 15 kilometers
- 28% is between 15 and 45 kilometers
- 24% is more than 45 kilometers

3.7. User experience

2021

Following the survey done in 2021 at the smart hub Genneper Parken, the most notable results are:

- The results show that for the majority of respondents (78%) this was the first time they visited the smart hub and almost all of the respondents came from a city or village in the Southern region of Eindhoven. One came from Western part of Brabant and one from Germany.
- In addition to the purpose 'event', other purposes that were mentioned are 'working', 'shopping' and 'recreational purposes'.
- Most people knew about the existence of the smart hub via websites (Municipality of Eindhoven, parking in Eindhoven and GLOW) or social media.
- All respondents drove by car to the smart hub and then took the bus towards the city centre (and back), except for one respondent for whom the smart hub was his final destination. People that used the bus all gave their experience 4 or 5 stars.
- Most respondents thought it was easy finding their way inside the smart hub and also most people thought the payment went smooth. Some thought the process of getting a bus ticket was somewhat difficult to understand.

- The majority thought the tariffs for parking were quite low. The same applies to the tariffs of the bus. Two people indicated that they thought the tariffs for shared mobility were quite high, despite they didn't use it.
- All respondents indicate they would recommend others to use the P+R facility at the smart hub. Positive feedback they provide is that it is cheaper than in the city centre (especially with the promotion campaign of free parking). Respondents also see it as a plus that it is close to the highway, and that you know there are parking spots available.

2022

To get a good feeling for how the user experience of our hub users is, we did a survey. We focused the survey in the city center parking garages to ask 302 respondents about their experiences on visiting the city. Part of the research was focused on why people choose the location they parked over other options and also asked if they have used P+R in Eindhoven before. From the people that did, around 75, we found that people didn't use the hub because:

- 44% say the hub is not on route
- 26% say the hub is too far from city center
- 21% say additional travel time is too long
- 13% do not see the added value
- 11% find it too complicated
- 9% find the hub too expensive
- 8% say that due to covid, they don't use public transport
- 11% other

3.8. Service improvements

2021

Suggestions we got for improving the hub services (via the survey we also used to identify the user group) were:

- Translation of the information at the hub into more languages.
- The process of getting a bus ticket was not clear.
- Information about the price of parking and shared mobility outside.
- Information about bus-stops for return trip. From where in the city can we get the bus back to the hub?
- Better signage towards the entrance of the hub facility.
- Broaden payment options for health facility.
- Integrate payment for parking ticket and E-bikes into 1 app.
- A warm waiting spot for the bus.

- The toilets are not functioning.

2022

From the same survey and the survey that explored our user group, we found that from the people who have experience using P+R, the most heard service improvement suggestions state:

1. There should be more possibilities for group travels
2. The parking costs on the hub should be lower (Currently 4 euro's per day)
3. More payment machines
4. More P+R locations in general to give options
5. No clear entrance to the hub. It feels closed from the outside

4. Helmond

4.1. Pilot plan

Figure 14: SmartHub at Brandevoort

2021

In 2019 Helmond planned to run a pilot hub at "Brainport Smart District" (BSD), a new smart living and working district and testbed for innovations in various fields, including mobility. The district will include1500 homes and a business park of around 12 ha and was to be built from 2020 to 2028. Well-functioning mobility hubs are crucial for the development of BSD because citizens will not be allowed to park their cars in front of their homes. Instead, they will leave their cars at a mobility hub and enter the district by for instance foot, bike, or public transport.

However, the development of BSD was delayed and therefore the neighbouring district "Brandevoort" was chosen to run the pilot in.

The goal of the pilot did not change and is to develop knowledge on how to develop hubs, their scalability, and business case. The BSD mobility hub was built at the south of the train station of Brandevoort and

opened in July 2021. With the help of citizen engagement, the city wanted to investigate which combination of services and modalities makes the hub most appealing. Some examples of services that may be implemented: a logistic hub for parcels and groceries, energy generating facilities to power electric vehicles, and a bike repair service.

2022

Focus further on behavioural change by testing various incentives (promotion, price, location) and investigating underlying motives and blockages. Secondly, Helmond is open for testing new business models as proposed by other (research) partners.

4.2. Reflection

2021

Final Report 2021 (and Midterm 2022): "The original pilot aimed at Brainport Smart District (BSD). However, since hardly anyone lives there yet, the project has been overtaken by reality and a mini hub has been realized in June 2021 at the Brandevoort side of the station (south) with Brandevoort now as a living lab. The extra services have not been implemented yet as the development of BSD stays behind (by the end of June the total number of occupied newly build houses in the area will be only 12)."

What we did do in 2021 were various actions on social media and the local magazines OnsBrandevoort and the Brandevoorter Courant to inform residents about the hub and attract them. Hely also conducted various marketing actions to stimulate users to use the hub more often.

2022

In 2022, the following actions were carried out regarding the Smart Hub pilot: research on underlying motives and blockages and we (actually Hely) tested various incentives (promotion, price, location). We did not test any new business models as (research) partners were interested to do so.

Research

The research was carried out in close cooperation with the research department of Helmond and results were shared with the other Smart Hub project partners. Unfortunately, the cargo bikes at the hub attracted a lot of vandalism and over the summer of 2022 they were both removed from the hub. We did move one cargo bike to another location (Telkesveld) but encountered so many difficulties (mainly technically) there that it did not work out and the bike was taken away. Then we tried to move it to another location, closer to the centre of Brandevoort but there also were delays in getting the electricity needed. Lastly, we planned a campaign to create more awareness and knowledge about how to use an EV (electrical vehicle) as we know from research that the better people are informed, the higher the chances are that they will actually

use / do something new. However, in the end we decided not to follow through as it became clear that the hub will probably close by the end of the year and we did not want to confuse the inhabitants. So instead of that we wrote a memo on behavioral psychology aspects that might influence the success of smart hubs.

Promotions

In Brandevoort all approved users have received all the promotions of Hely during the pilot. These promotion consists of temporarily discounts on ebikes (50% off during a sunny weekend) or 10% discount on the car-tariff for a week during a holiday period. In total Hely ahs offered over 8 promotional discounts. In this hub users didn't respond to discounts on price or information compared to other hub-locations. We think this is because price or availability is less of a motivator to travel then for example in the city where shared mobility can be seen as as alternative for public transport. When the costs are low, people tend to use an individual mode of transport vs. public transport.

No other partners came to us to test any other business models.

4.3. User data

2021 and 2022

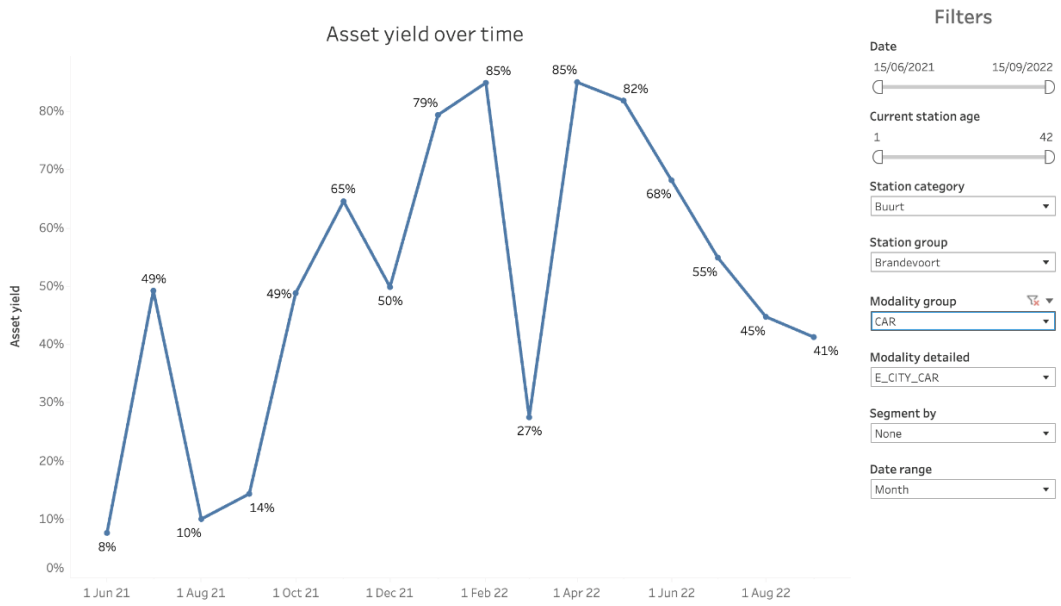


Figure 15: Usage of the e-City car in Brandevoort

This graph shows the usage of the e-City car in Brandevoort. By May 2022 the yield looked promising but after that, it dropped again. When we looked into the user data we found out that the yield depended largely on the usage by just 2 regular users. Still a very fragile situation after 1 year.

Target-audience are families living in the neighborhood. There is not statistical evidence found for preferred days or periods. The duration of the rides are above average when compared to other hub-locations of Hely. This can be explained that when a resident of Brandevoort chooses to use a cargobike or ecar, they have a destination which is further away and a car or electric cargo bike is necessary.

4.4.Additional indicators

2021

Additional indicators for 2021:

1. Effective 'catchment area' of hub near train station – how long are residents willing to travel to access the hub?

2. Distance residential address & knowledge of hub's existence.

3. Acceptance of hub as alternative to owning a second car.

More details about the first indicators can be derived from the heatmap below that Hely has provided. All users of the Helmond Brandevoort hub live within 1.72 km (excluded one outlier) and most users (11 of 18 = 61%) live within a 800m radius from the hub.

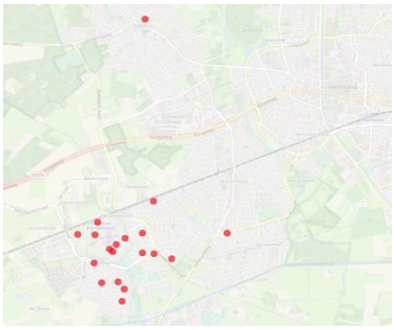


Figure 16: Home address of users of the SmartHub

In 2021, we carried out two questionnaires to learn more about the hub users and about the population of Helmond Brandevoort in general. These are the results (and we also provided the University of Lisbon with our data to use in the greater research).

Users who completed the questionnaire 20/190 (11%):

- Are generally satisfied with the hub and its' accessibility and safety
- Are unsatisfied – neutral with the information offered at the hub
- The majority has no need to use shared mobility on a daily basis but would rather use it 1-2 times a week or even a few times a year. This might indicate that the shared mobility is replacing the second car in the households.
- In the remarks they often mention that the cargo bike wasn't always available because of vandalism

Sample of inhabitants of Brandevoort (1900 out of 11K inhabitants, respondents: 190 / 10%)

Not a representative sample. People who are older (60+) and higher educated people responded more often than others. Some results:

Knowing about the hub's existence

- Half of the respondents knows about the hub at Brandevoort station, the other half was not familiar yet (despite quite some efforts by the project team)
- 4 out of 10 respondents know about the hub from a local newspaper (Brandevoorter Courant) and also 4 out of 10 just saw the hub at the station.

Reasons / motives to use shared mobility (or not)

- One third indicates that they never have used shared mobility and have no need or wish either. Another 50% however is interested although they never used it yet.
- Most of the people (75%) who indicated that they have never used shared mobility yet, didn't do so because they have their own private means of transportation.
- One out of 5 respondents think it is too much of a hassle and quite some respondents say that they need more information.

Together with the group of people who have used shared mobility (12%), two-thirds indicate that they are open to using shared mobility. We asked this group why and for what purpose they (would) use shared transport:

- Sustainability and convenience are the two most important reasons (over one third of the group)
- Others indicate that it is convenient to have an extra means of transportation on hand.
- The respondents in this group would use it mostly to visit family and friends and for leisure / trips (50-60%) and another 40% would use it to commute to work.

Needs and requirements for shared mobility

- 4 out of 10 respondents indicate that of all shared mobility modes, they prefer to use an electric car.
- They are willing to pay an average price of € 6,80 / hour for the car.
- The other modes are less wanted in Brandevoort.
- 1 out of 10 respondents would like to rent an electric Cargo bike at an average price of € 3,90 / hour.

- Current prices are € 8 / hour for the car and € 4,50 / hour for the bike. Respondents tend to choose the lowest possible price (€ 5 and € 3 / hour). Maybe we should change the question next time.
- Respondents who want to use shared mobility indicate that this should be available within a range of 500m – 1 km from their homes.
- 6 out of 10 respondents indicate that the current location at Brandevoort Station is a good location, another 3 out of 10 indicate that the square "DePlaetse" would also be a great location.
- About 25% of the respondents would like to use shared mobility but only a few times a month or year. So it looks like if there is not a huge demand in this area.

Sources: our (BSD and Helmond) research

Users https://infogram.com/1pqmkldmrz76mgaqrve597y2p9f0xlwym2j?live

Sample Brandevoort population https://infogram.com/1p6l1my9z3rdppb57y7zll0110h3wg7xqy9?live

2022

Evaluation of behavioral change by testing various incentives (promotion, price, location) and investigating underlying motives.

In Brandevoort all approved users have received all the promotions of Hely during the pilot. These promotion consists of temporarily discounts on ebikes (50% off during a sunny weekend) or 10% discount on the car-tariff for a week during a holiday period. In total Hely has offered over 8 promotional discounts. In this hub users didn't respond to discounts on price or information compared to other hub-locations. We think this is because price or availability is less of a motivator to travel then for example in the city where shared mobility can be seen as an alternative for public transport. When the costs are low, people tend to use an individual mode of transport vs. public transport. Check out our memo on Behavioral motives for more information.

4.5. Lessons learned and best practices

2021

1. Involve local police and district managers from a very early stage onwards and make them aware of the goal of the hub and the possibilities of vandalism.
2. Always check the specific needs and requirements of the target group before setting up a mini hub with limited modes where users have limited choice.

2022

1. Make sure the municipality develops a clear policy on shared mobility with clear rules about the provision of electricity and so on. This way one does not have to struggle for electricity (in case of station based hub) on every new location.
2. If the policy as mentioned under 1 is not yet there, consider a floating system of shared mobility instead of stationary.
3. For the success of mini hubs in suburban areas it seems to be of vital importance to create some push and pull factors that make the ownership of 1 (or more) care less attractive. Push factors could be: less parking lots, paid parking only, parking lots further away from the homes. Pull factors: attractive looking shared mobility solutions, easy and affordable in use, close to the homes, local role models using shared mobility.

4.6. User group

2021 and 2022

Target-audience are families living in the neighborhood. There is not statistical evidence found for preferred days or periods. The duration of the rides is above average when compared to other hub-locations of Hely. This can be explained that when a resident of Brandevoort chooses to use a cargobike or e-car, they have a destination which is further away and a car or electric cargo bike is necessary.

4.7. User experience

2021 and 2022

Please also see section: additional indicators.

Users who completed the questionnaire 20/190 (11%):

- Are generally satisfied with the hub and its' accessibility and safety
- Are unsatisfied – neutral with the information offered at the hub
- In the remarks they often mention that the cargo bike wasn't always available because of vandalism (which is true)

4.8. Service improvements

2021 and 2022

In general, there is not much demand for shared mobility and neither is there for related services in this (Brandevoort) area. However, the people who did use them (a bunch of enthusiast early adapters), would appreciate it if two Cargo bikes would be available again at the railway station and/or at DePlaetse. If the municipality decides to provide them, it would be helpful to provide more information at these locations (f.e. via a QR-code).

5. Sant Cugat de Vallès

5.1. Pilot plan

2021

Bicibox is a network of free bicycle parking services (for a maximum of 48 hours), which presents a unique opportunity to incorporate active mobility into any transport station. The Bicibox pilot project was implemented next to the Mira-Sol FGC railway station in Mira-sol Shopping Centre in the Municipality of Sant Cugat del Vallès. Furthermore, the Mira-Sol pilot hub includes facilities such as FGC railway station, bus stations, parking areas and Bicibox station. The Bicibox station contains 18 secure bike racks, 2 shared cargo bikes, 12 sockets for charging electric bikes, a repair desk and an inflator. The hub also contains non-mobility services such as multiple grocery stores, restaurants, a dance and fitness centre and a library.

Sant Cugat was selected as the location because it is a rapidly growing municipality in the Metropolitan Area of Barcelona, with a population of approximately 91.000 inhabitants. The municipality is expected to grow constantly, as it contains a university campus and business district.

The goals of the pilot are to boost the local economy, foster a modal shift to sustainable urban transport systems by offering new mobility services and parking services to SmartHub users and promote the use of cargo e-bikes among the business owners and residents of the area. The pilots will be able to test different micro-mobility options such as e-bikes, e-scooters and cargo bikes.

Similarly, business models to promote e-commerce and local shop distribution by cycle logistics will be also tested. Furthermore, these pilots will also help to assess the establishment of an interlinked urban network at the metropolitan and local levels as well as to define an urban design toolkit focused on universal accessibility to multi-modal transport nodes.

2022

The pilot plan for the year 2022 is similar to 2021, with the goal to offer sustainable alternatives to mobility, which are added to the existing public transport.

- Increase the use of bicycles among commuters in combination with public transport.
- Increase the use of cargo e-bikes among local residents visiting the shopping mall.
- Foster the use of cargo e-bikes by the shopkeepers of the shopping mall.

5.2. Reflection

2021

During 2021 Bicibox had 40 unique users who utilised the service 213 times since the Mira-Sol Pilot hub launched its operations in July of that year. The customers of the Bicibox service used the parking service for a total of 6158:47:16 hours and on average 24:58:55 hours during the year 2021. Additionally, between October 18 and October 20, 2021, a survey of Bicibox users was administered in order to determine their level of satisfaction, motivations, and usage patterns regarding the Mira-Sol Pilot SmartHub.

Reflecting on the first year of the pilot through the user's data and survey:

During the first six months of the pilot hub, Bicibox has been successful in drawing users from the Mira-Sol area. Similarly, it has also managed to attract some users outside its catchment area, as the following QGIS map (Figure 1, appendix) shows. In the map, the yellow dots represent the Bicibox station in Mira-Sol and the purple isochrones represent a ten-minute bicycle ride radius, which is an acceptable travel time from home to the transit station. This ten-minute bicycle ride isochrones can also act as the catchment area of the Mira-Sol railway station. Finally, the orange circles with various radiuses illustrate the number of users of Bicibox stations. The size of the circle represents the number of uses per user of the Bicibox station. The greater the radius of the circle, the greater the usage of the Bicibox station, and vice versa. Bicibox in Mira-Sol was able to attract about 12.5% of its users from outside of its 10mins isochrones. Therefore, with this map, it can be concluded that Bicibox was able to enhance bicycle use among commuters in combination with public transport, thus achieving its goal.

Furthermore, to answer the research questions, a survey was carried out to figure out the user's profile, the purpose of use, the types of bikes used and user satisfaction. The survey received responses from 16 Mira-Sol pilot SmartHub users.

Regarding the user profile of Bicibox, 62.5% of the respondents are male and 37.5% female. Regarding age, the average is 41 years old. 43.75% of those surveyed are between 46-55 years old, followed by 31.25% between 36-45 years old, 18.75% between 26-35 years old and only 6.25% under 18 years. The large majority of users are active working adults. Regarding the academic level of the respondents, 68.75% have a university degree, followed by 18.75% with only secondary school studies and 12.5% with a professional school. Regarding their current occupation, 62.5% are employees, and both self-employed workers and students have an equal percentage of 18.75% each.

Concerning the origin of the Bicibox users, 37.5% are from Mira-Sol (the neighbourhood around Mira-Sol Pilot SmartHub) and 50% live in other areas of Sant Cugat del Vallès. Only 2 are from neighbouring municipalities (Rubí and Cerdanyola del Vallès) and both are among the regular users. Besides, it is important to note that almost all respondents have a driving license (93.75%).

Furthermore, in relation to the estimated distance travelled by bicycle by those polled when using the Bicibox, most of them (87.5%) travel from 3 to 5km. The rest travel up to 1.5km (12.5%). The use of the Bicibox is a local one. Moreover, it is important to note that all the respondents have only used a single

Bicibox service, which is private bicycle parking. The other services which have not been used to date are plugs for charging electric bikes, a repair desk and an inflator.

Additionally, for the business model of the Mira-Sol Pilot SmartHub, the hub in Mira-Sol has a wide range of services since it is located in a shopping centre that constitutes the mixed-use facility (Market, Shopping Centre, Supermarket, Library and Housing) of the Mira-Sol neighbourhood, which is mostly residential. The newly opened Bicibox has become a place for safely parking private bikes, self-maintenance tools and plugs for charging electric bikes.

Regarding the reasons why users use the Bicibox service, the majority of reasons are work (29.6%) and shopping (29.6%), followed by secondary studies (14.8%). This reflects that the hub has a remarkable added value to the economic activity of the users involved and can also contribute to improving local purchases as well.

Moreover, along with the managers of the shopping centre, the partners involved in the Mira-Sol Pilot SmartHub are working on the possibility of placing smart lockers near Bicibox. Users can do their shopping online and have it delivered to the smart lockers to pick it up at any time, even if the shopping centre is closed. Some of these lockers would even be refrigerated to allow for the option of having groceries delivered. That aim is to encourage local purchases.

2022

Bicibox data from January to October of 2022 was provided. In these 10 months, 92 additional unique users were registered, who made 698 total uses of the bicibox service. In addition, 40 Sant Cugat hub users were interviewed between October 20 to 26 of 2022 in order to determine their level of satisfaction, motivations, and usage patterns.

Cargo bikes were the chosen activities/services to be developed in 2022. The aim was for residents of the Municipality of Sant Cugat to use cargo bikes for local micro-logistics. Exhibitions were held in the Mira-Sol shopping centre to advertise the cargo bike. Interested applicants were given access to a theoretical and practical course on using the cargo bike.

However, these exhibitions and courses on cargo bikes were not very successful in attracting users. During the week of exhibitions, there was not much use of the cargo bike or interest in information about it. However, 1 user used the cargo bike to deliver groceries back to their home on a weekly or biweekly basis. It can be concluded, small towns like Mira-Sol still needs some time to start using cargo bikes. Furthermore, it can also be said, cargo bikes would be much more effective if they had been piloted in a city like Barcelona, which already had adequate cycling infrastructure and connections

5.3. User data

2021

The following statistics show the number of users that utilised the mobility services at the Mira-Sol Pilot SmartHub in Sant Cugat del Vallès between July 2 and December 2021:

The Mira-Sol Pilot SmartHub was installed in July of 2021, hence that month had the newest users with 10 in total. August, the hottest month of the year was also capable to attract 6 new users. September has the second-highest number of new users with 9 new users. Furthermore, October and November have the simultaneously lowest number of new users with 4 and 3 users each. At the end of the year, December was able to attract 8 new users. Figure 2 in the appendix below shows a chart with the evolution of the new users engaged over the year:

It is evident that weather and seasonal festivities have a big impact on the public transportation demand, thus the dips in usage can be attributed to the seasons of Barcelona. The use of Bicibox has fluctuated over the pilot test period, in a similar way to the bus and train, which are the alternative ways of transport (see Figure 6, appendix). This fluctuation can be associated with the summer vacation in August combined with the Christmas and New Year holidays at the end of the year. During the first month of the Mira-Sol Pilot SmartHub, the service was used for just 19 times, before gradually increasing in August to 24 times. Furthermore, September marks the busiest month of the year, with uses up to 58 times. After these busy months, usage falls sharply to 24 in the month of October. Utilizations did, however, increase in November and December, with 41 and 47 uses, respectively.

A similar trend can be noticed in both total usage hours and the number of uses. July marks the modest start, with September serving as the pinnacle. Deeping in October, only to see a spike in the months of November and December.

This illustrates that Bicibox is slowly gaining the confidence and trust of the users since they are using the service for a longer period (see Figure 3, appendix). Similarly, the trend of the number of uses and usage time duration keeps improving as we move into the year 2022.

Furthermore, comparing the number of users and average usage hours (Figure 4, appendix) to total usage hours (Figure 3, appendix) for the year 2021 it can be noted that they follow a similar trend. Beginning at a low point in July, peaking in September, declining in October, and then abruptly climbing once more in December (see Figure 4, appendix). This trend also leads to the conclusion that consumers are becoming more confident and comfortable when parking their bicycles in Bicibox parking.

In Mira-Sol, Bicibox was used 213 times by 40 different people from July to December of the year 2021. Regarding the frequency of use of the service, 33 (82.5% of the total) people used Bicibox from 1 to 5 times in the year 2021. However, there are also groups of people (7 users) who used the Bicibox services 10 to 45 times in the year 2021. Similarly, 1 person used Bicibox 45 times, and another used it 30 times in the second half of the year 2021 (see Figure 5, appendix). This implies that there is a group of users who use the Bicibox service frequently.

A logarithmic comparison has been developed to analyse the usage trends of the Mira-FGC Sol's railway, bus, and Bicibox services for the year 2021 (see Figure 6, appendix). This figure shows that all three types of transportation uses have similar trends. All three modes of transportation experience a decline in demand in Barcelona's vacation months of August and December. Other than these 2 months, demand largely holds steady with only minor variation.

- 6,149 people have taken the municipal bus at the bus stop Joan Borràs square / FGC Mira-Sol
- 282,207 citizens have used the train station FGC-MIRASOL.

2022

The following statistics show the number of users that used the mobility services at the Mira-Sol Pilot hub in Sant Cugat del Vallès between January and October 2022:

The Mira-Sol pilot hub was effective in bringing 92 additional unique users of bicibox, who used the service 698 times as the year 2022 got underway. It is clear from the graphs that there are certain fluctuations in the number of new users (see Figure 9, appendix). January starts strongly with 23 new users, which is the highest for the year 2022. However, the month of February sees a dip in new users with just 11 new users per month. Then, with 8, 9 and 10 new users respectively, the months of March, July, October, May, June and September had roughly similar numbers of new users. As previously stated, weather and seasonal festivities have a big impact on the public transportation demand in Barcelona. The effects of weather and festivals can also be seen in this graph, summer vacation and the hottest month of the year August has just 1 new user.

Similar patterns of declining demand in the months of April and August are also shown in the number of users and total hours of usage (see Figure 10, appendix). Months of January, February and March witness a gradual increase in the uses of the bicibox with 86, 91 and 100 respectively. There is a sudden drop in the demand in the months of April with just 55 uses. After this, there is a gradual increase in use until the month of June with 85 uses. There is again a second slum of the year in demand but this time it is due to the hot weather of the month of August, which sees the uses drop down to the lowest of the year with just 27 uses. Demand recovers in the months of September and October with 60 and 68 use respectively. Total usage hours also follow similar trends. Comparing total usage hours with 2021, it looks very encouraging and usage hours are much higher. This indicates users are comfortable parking their bicycles in Bicibox stations.

Furthermore, comparing the number of users and average usage hours for the year 2022 (see Figure 11, appendix). The graph shows the average usage hours, in which there are small fluctuations until June. After June the average usage hours increase dramatically in the month of August, then again rapidly decline until October. The number of users has increased in 2022 compared to 2021, average use hours remain decent. This is a positive sign, it can be concluded that users are using bicibox for a longer period of time on average.

Between January and October of 2022, 92 different people used the Mira-Sol Bicibox station 698 times. In the 10 months of the year 2022, bicibox was used between 1 and 5 times by 70 out of 92 users, more than 76% of all users (see Figure 12, appendix). However, 18 individuals used the bicibox service 5–25 times throughout these 10 months. On the other hand, the service was used 70-85 times by 4 users over this ten-

month period. This implies that there is a group of users who use the Bicibox service frequently even while the majority of users in Mira-Sol do not use the Bicibox service on a regular base.

Using this logarithm table (see Figure 13, appendix), we compare Mira-FGC Sol's railway, bus, and Bicibox users for the year 2022. The comparison between the railway, bus and Bicibox could not be completed because data for September and October for the railway station is missing. Similarly, five months of data from June to October is missing for Bus. From all the data there are available, we can observe railway, bus and Bicibox data have a similar trend and can conclude all three services are interconnected.

- 4,329 people have taken the municipal bus at the bus stop Joan Borràs square / FGC Mira-Sol
- 166,809 citizens have used the train station FGC-MIRASOL.

5.4.Additional indicators

2021

1. Number of bike parking spots in use (over time) / measure timeslots that are relevant for your use case.
   The graph (see Figure 7, appendix) displays the daily demand for Bicibox at the Mira-Sol pilot SmartHub in 2021. The busiest times of the day are 21:00 and 19:00, during these two hours 46 and 32 total users used Bicibox during the months of July and December 2021. Mira-Sol Pilot SmartHub data indicates that people used Bicibox mainly for parking during nighttime.
2. Increased acceptance and use of bicycles in the residential area.
   According to the survey, the two main reasons for which respondents have used Bicibox are work (29.6%) and shopping (29.6%), followed by studies (14.8%). Furthermore, leisure, sports and nightlife activities occupy third place with 7.4% each. And finally, the reason for visiting friends and/or family with 3.8%, leaving this motivation in the lowest position.
   The deployment of the Mira-sol hub (especially with the integration of the Bicibox service) supposed an increase the acceptance and use of bicycles in the area, which can be observed with the raise in the number of hours in which the service was used (see Figure 4, appendix).
3. Usage of hub for visiting the shopping mall.
   The survey indicates that using the Mira-Sol pilot SmartHub to visit the Shopping Centre and commuting to work /office are the top reasons, tied in first place.
4. Increased train usage and decreased car usage due to hub.
   All the respondents to the survey affirm that, by using the new Bicibox service created in Mira-Sol pilot SmartHub, they have reduced the use of private cars.

2022

1. Evaluation of adding possible new services and/or establishing a network of hubs in order to improve the existing hub and its usage

The new service that was selected to be implemented in 2022 was cargo bikes. Residents of the Municipality of Sant Cugat were encouraged to use cargo bikes for small-scale local micro-logistics. In order to promote the cargo bike, exhibitions were conducted in the Mira-Sol Shopping Centre. Interested candidates also had access to a theoretical and practical course on cargo bike operation.

5.5. Lessons learned and best practices

2021

The survey shows that the Mira-Sol pilot SmartHub has contributed to multimodal practices: 75% of users combined the use of the bike with the railway, 6.25% with the bus and 6.25% with the car parking of the shopping centre. Some users answered that they have used several transportation modes depending on the occasion. The 18.75% of users asked, have only used the bike and no other transport mode. It's important to highlight that 50% of the surveyed users wouldn't use any mode of shared mobility if it was available. The 31% that answered positively to that question, would like to use a motorcycle, car and scooter (in order of preference).

Furthermore, it was also discovered that the type of bicycle most used was the electric bicycle (87.5%), while only 12.5% use conventional bicycles. It could be because the Mira-Sol pilot SmartHub is located in an environment with some steep slopes within a high-income neighbourhood. Furthermore, it could also be said that people owning the electric bike prefer the safety of the bicibox for parking. Due to the safety of the bicibox, average parking hours have been increasing dramatically, indicating the acceptance of the service.

2022

From the QGIS map (Figures 1 and 14, appendix), we can learn that Bicibox is able to attract users beyond its catchment area and encourage active mobility usage and enhance intermodality. In the year 2022, the hub was also able to attract users from the Barcelona area, where one user used the service 79 times a year. Furthermore, the hub offers remarkable added value to the economic activity of the users involved and can also contribute to improving the local economy as well.

5.6. User group

2021

The respondents' gender distribution was 62.5% men and 37.5% women, which can be used to identify the primary user group of Bicibox. Additionally, we can observe that the vast majority of users are adults who are actively employed. This is further supported by the fact that the Bicibox service is predominantly used for work (29.5%) and shopping (29.5%). This survey's conclusion is further supported by graphs that demonstrate that Bicibox usage is substantially higher during the week than it is on the weekends, as shown in Figure 8 in the appendix.

The Figure 8 graph (appendix) illustrates the Biciboxs' frequency of use per day of the week of 2021 (from July 2 to December 2021). From the graphs we can understand that the demand of Bicibox varies throughout the week. On weekdays, Mondays have the lowest demand with just 24 uses, followed by Thursdays and Tuesdays with 29 and 31 uses. The demand, however, does not significantly change between Wednesday, and Friday, with 39 and 41 uses respectively. Similarly, on the weekend, even though most of the stores, shops, and museums are closed on Sunday; there is not much shift in the demand, with 23 uses on Sundays and 26 uses on Saturdays.

2022

40 Sant Cugat hub users were interviewed between October 20 to 26 of 2022. It was noted that the gender distribution of the respondents was nearly similar, with 45% women and 55% men, indicating the gender balance in the use of the hub. Just 2 respondents out of 40 were in their teens. Similarly, 13 people (32.5%) were between the 20-40 years old category. Whereas, 9 responders were in each of the 40-50 and 50-60 years old categories. Furthermore, there are 7 responders between the age group of 60 and 80.

Among these respondents, 75% of users are employees, which indicates the biggest group of users are employees. This statement is further supported by Figures 15 and 16 (appendix), as the usage of Bicibox is much higher at 7:00 am and at 6:00 pm and 7:00 pm during the week. Similarly, weekday uses are much higher compared to weekends. Furthermore, 30 respondents (75%) obtained a university degree. We can conclude, most of the hub users are employed and highly educated.

To specify the user period, the frequency of the use per day and per hour was analysed. From Figure 14 (appendix) we can notice, the demand for Bicibox varies throughout the weekdays, however, it is notably lower on the weekends. Mondays, Wednesdays and Fridays have similar uses with 121, 116 and 117 respectively. Tuesdays marked the highest uses with 145 and Thursdays with the lowest of weekdays with 96 uses. On the other hand, weekend demands are significantly lower with just 80 and 23 uses during the ten months of the year 2022.

Similarly, from Figure 15 (in the appendix), we can understand the busiest time of the day are 7:00 am and 6:00 pm, further indicating that the user groups of the Mira-Sol pilot SmartHub in 2022 are primarily employees and students.

5.7.User experience

2021

The majority of surveyed users (62.5%) are fully satisfied with the Mira-Sol pilot SmartHub, while 31.25% are generally satisfied. The vast majority of users (93,75%) consider that the accessibility to the Mira-Sol pilot SmartHub is good, both by walking and cycling. Furthermore, some users requested to improve the bike parking time, proposing a new service for residents, with no time limit. Additionally, other recommendations for the service included to improve the computer system to speed up the locking process and to fix the access doors for specific individual parking slots that are not working correctly in Bicibox.

2022

According to the respondents, the hub is enhancing intermodality. 20 respondents (or 50%) said they used trains, while 3 said they drove their own cars and 2 said they took a bus while using a bicibox in hub service. Two sets of 16 respondents each stated that they commute between 0 and 2 km and 2 and 5 km each. Furthermore, the majority of surveyed responders are satisfied or totally satisfied (31 and 8) with the Sant Cugat hub as a whole. The vast majority of users (90%) consider that the accessibility to the Sant Cugat hub is accessible on foot and the sidewalks around it are in good condition. Similarly, 80% of the responders agreed the Sant Cugat hub is accessible by bicycle and the cycle paths in the neighbourhood are in good condition. Furthermore, respondents were also fully satisfied (11) to satisfied (27) with the non-mobility services allocated at the Sant Cugat hub.

5.8. Service improvements

2021

The Sant Cugat hub has a wide range of services since it is located in a shopping mall that constitutes the only mixed-use facility in the Mira-Sol neighbourhood, which is highly residential. The newly opened Bicibox has become a place for safely parking private bikes, self-maintenance tools and power plugs for charging electric bikes.

The hub collects recommendations from active users as well as from owners of the local shops. For instance, with the aim of enhancing local purchases, together with the people responsible for the shopping centre, the partners involved in the Sant Cugat hub pilot are working on the possibility of placing smart lockers near Bicibox. Users can do their shopping online and have it delivered to the smart lockers to pick it up at any time, even if the shopping centre is closed. Some of these lockers would even be refrigerated to allow for the option of having groceries delivered. That aim is to encourage local purchases.

2022

Most of the respondents (11) asked to improve the connection or add more hubs in different locations. 8 users also suggested improving the technical aspects of the Bicibox service. While others suggested improving accessibility or connectivity through the cycle path with the hub.

6. Lisbon

6.1. Pilot plan

2021

Under the SmartHubs project, EMEL worked on a new concept of mobility hubs for short distance trips within the city of Lisbon, aiming to improve the current docking stations of the Lisbon bike-sharing system (GIRA). To this end EMEL planned to improve the docking stations into mobility hubs to support and boost the use of public and shared transport, providing citizens with more multimodal solutions, which facilitate the last-mile, including the use of bicycles. The GIRA bike-sharing system currently (October/2022) has 139 stations in the city of Lisbon and provides regular bicycles and electric ones (EPAC, electrically power assisted cycles), in a total of about 1600 bicycles, 2/3 of which are electric bicycles.

Besides the ambition to create a network of shared mobility hubs at in-city and neighbourhood level in long-term, EMEL's key objectives in this project were to:

- Promote the use of shared mobility services by offering a variety of services in a single location;
- Facilitate multimodality, such that local commuters take their bicycle or use a shared mobility service on their trips in the city;
- Promote the use of low-carbon transport solutions.

Recognising there is no “one-size-fits-all” solution for what this "mobility hub" should be, as well as the need for flexible solutions based upon a citizen-centric approaches, EMEL explored different combinations of services.

Therefore, the work carried out during 2021, which is detailed on DEL06 Mid-Term evaluation report, focused on:

1. Selecting the best location for the implementation of the pilot mobility hub, by using a multi-criteria methodology;
2. Exploring, through a co-creation process, different combinations of mobility and value-added services to upgrade the mobility hub at a later stage;
3. Monitoring the use of the pilot mobility hub.

2022

For 2022, besides monitoring the use of the pilot mobility hub, EMEL has set two goals:

1. To upgrade the pilot location with value added services which arose from the cocreation process carried out in 2021. Specifically, and given the physical constraints of the site (such as the available

space or compatibility with other pre-existing infrastructures) EMEL planned to set-up a bicycle repair station;

2. To study a rebranding strategy for the bike sharing stations that would be upgraded to "SmartHubs" with new value-added services offered.

6.2. Reflection

2021

Selection of the location for the implementation of the pilot mobility hub

At the beginning of 2021 there were 85 operating GIRA docking stations in the city of Lisbon. Taking into account that it was expected that by the end of the year the number of docking stations would increase considerably, it was necessary to develop a methodology to support the selection of the best location.

Thus, and seeking to respond to EMEL's key objectives, the methodology developed aimed to identify locations that correspond to areas of the city with greater need for mobility services and with greater potential for the implementation of a local-level mobility hub.

The full methodology and its application is detailed on DEL06 Mid-Term evaluation report.

The methodology allowed us to identify a location for the pilot: GIRA docking station ID no. 550, located in Lumiar parish, with a capacity for 20 bicycles, both regular and electric. The site has good accessibility through cycle paths and has in its surroundings an underground station, city bus stops, and is next to one of the city's main bus terminals, the Campo Grande terminal, which is one of the main city entry point for daily commuters from the North and West of the Metropolitan Area of Lisbon. Nearby there is also a school with students between 10 and 18 years old and a language school.

Below (Figure *1*17) we can see the location selected for the mobility hub pilot (the station 550 of the GIRA bike sharing system).

Figure 17: Selected location for pilot mobility hub - Campo Grande - GIRA Station no. 550

Co-creation process for the evolution of the pilot mobility hub

In order to explore what different combinations of mobility services, or other value-added services that could be incorporated into the pilot mobility hub, EMEL promoted and implemented a co-creation process to identify and address citizens' needs, preferences and expectations.

The aim of this process was to support the definition of the services and infrastructures that a mobility hub could offer to citizens and what should be the development for the Lisbon pilot.

In summary, the methodology was structured in three stages:

1. Desk Research- which aimed to explore a selection of modules (i.e. services or infrastructures) that could be considered in the mobility hub, based on the knowledge acquired through the exploration of case-studies;
2. One co-creation session - which aimed to select which modules were most relevant for the potential users of a mobility hub in Lisbon;
3. A public engagement action - which aimed to collect input from current users of GIRA station no. 550 and people living in its surroundings to define the modular composition to be tested in the pilot.

The public engagement action (Figure *18:*18) was a key stage of the whole process and was attended by 274 participants. Of these, about one third (92 participants) were users of the GIRA bike-sharing system.

Figure 18: Public engagement action for the co-creation of a mobility hub

From the analysis carried out the following modules were identified as more desirable by the citizens:

Mobility modules:

- micro mobility charging station;
- bicycle repair station;
- bicycle parking;
- micro mobility parking;
- kiss&ride;

Complementary services modules:

- Wi-Fi;
- WC;
- outdoor seating;
- co-working/studying area with electric plugs for electronic devices;
- charging lockers for electronic devices.

The full methodology and its application is detailed on DEL06 Mid-Term evaluation report.

2022

Due to other constructions works at Lisbon's pilot surrounding area (as a result of the expansion of Campo Grande bus terminal), only in the last quarter of 2022 did the surrounding area became available for the implementation of hub upgrades.

Despite the reduction space available, EMEL is still working with the municipality of Lisbon to set-up a bicycle repair station at the location (this hub upgrade will be available in 2023). Due to the uncertainty that the construction works at Campo Grande brought to the pilot, also the study for the rebranding strategy was suspended.

6.3. User data

2021

To monitor the performance of the mobility hub in 2021, EMEL used the data available from the GIRA system. Below is presented a set of indicators that characterize the use of GIRA station no. 550, the trips to or from it and its users, in the period between its opening (5 August 2021) and 31 December 2021.

In this period a total of 10.704 trips were made to and from this station (see 19). Regarding the distribution of trips between electric and regular bicycles, there is a clear preference for travelling on electric bicycles, as they represent 93% of the trips[1].

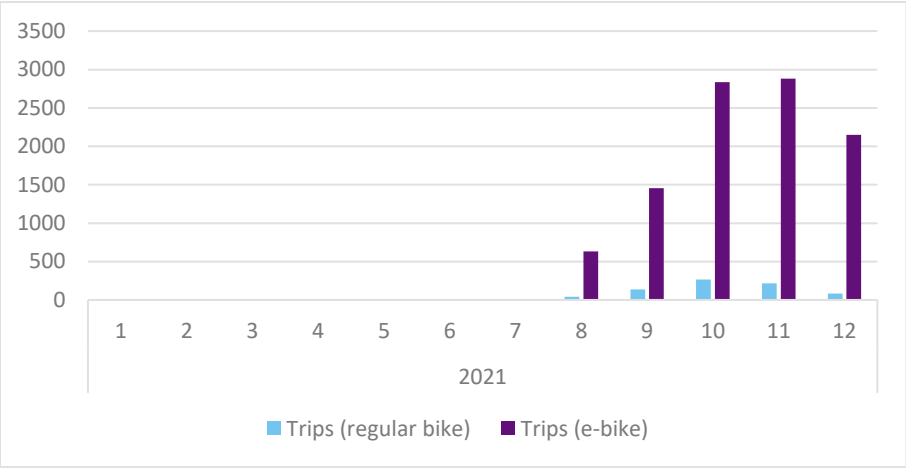


Figure 19: Trips per bike type and per month (2021)

Regarding the trips to and from this station, they are mostly made on weekdays (see Figure 20), which reveals the commuting nature of the trips, for example, in the month of October there were on average 128 trips per day on working days and 42 trips per day on weekend days (three times more on working days).

[1] The GIRA system fare is the same both for the use of electric or regular bicycles, and the usual behaviour of the system users is to only use regular bicycles when there are no electric ones available at the station. In the total number of trips of the system in the same period, trips on electric bicycles represented 92% of the trips.

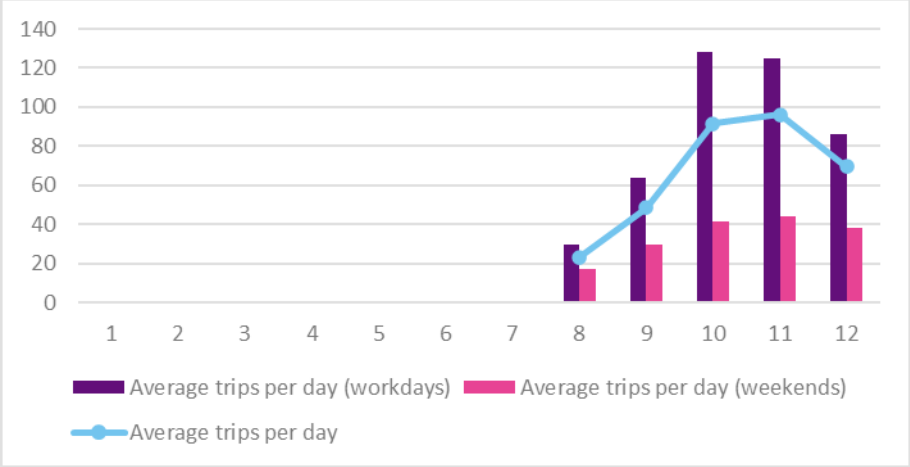


Figure 20: Trips per type of day and per month (2021)

Analysing the distribution of trips throughout the day for both weekday and weekend day (see Figure *21:*21), also here the commuter travel profile is suggested, with the identification of a morning peak hour by 8am, a slight peak at lunchtime and a longer peak period in the afternoon, as is known in other modes of transport.

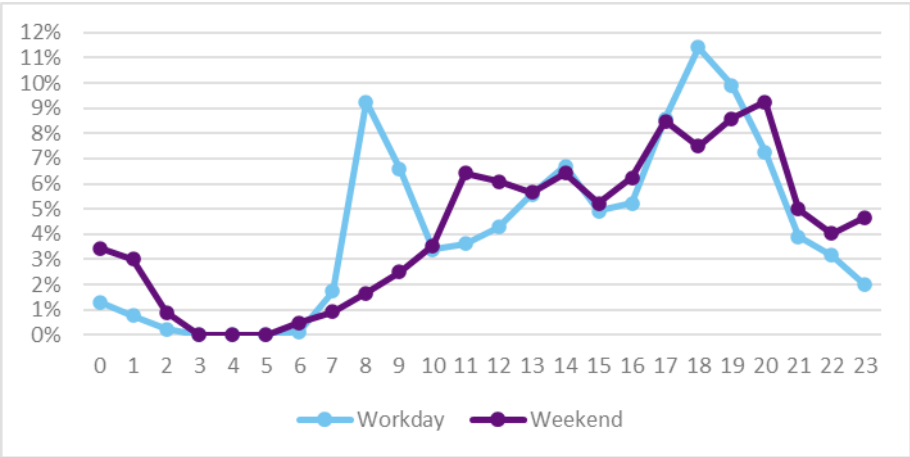


Figure 21: Trips (beginning and finishing at the GIRA no. 550) per hour of the day and per type of day (workday vs weekend) (2021)

Figure 22 presents the duration and distance[2] of the trips made to and from station no. 550. The average trip in electric bicycle had the duration of 15 minutes and distance of 2.7km, while in regular bicycle was 12 minutes and 1.9km, which reveals the greater range that electric bicycles give to users of the mobility

[2] Distance between origin and destination station, the value of the indicator could be underestimated; distance was determined using GoogleMaps, selecting bicycle as the mode of transport.

hub. Figure presents a heat map, by month, of the bicycle trips to and from station no. 550, which shows that the trips to and from this station have been increasing their range over time.

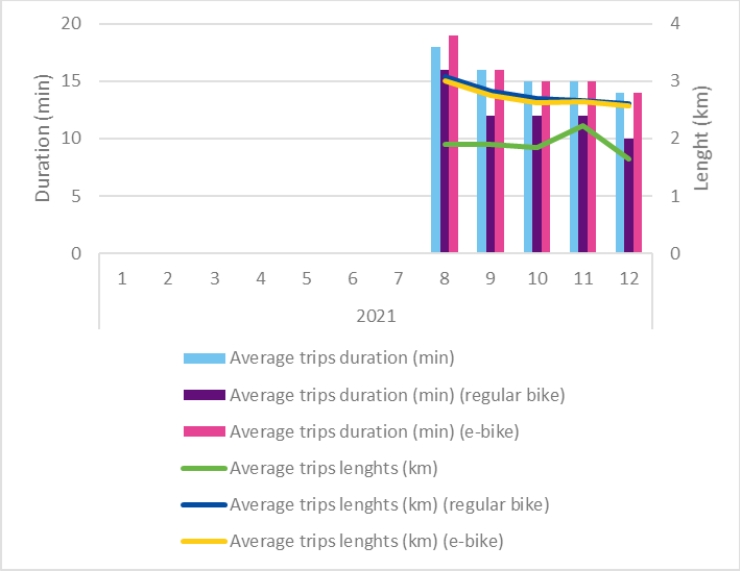


Figure 22: Trips length and duration per bike type and per month (2021)

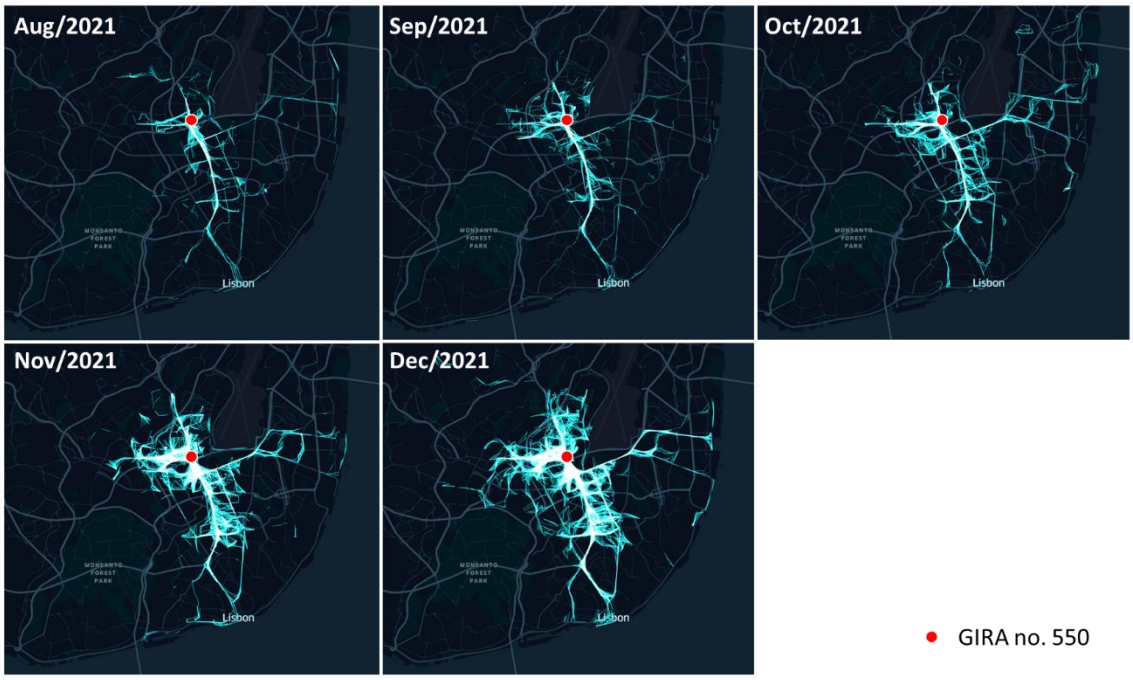


Figure 23: Heat map of trips to and from GIRA docking station no. 550 per month (bicycle GPS tracking) (2021)

Regarding vandalism, there is no record of bicycles vandalized or stolen at this station during 2021. The fact that it is a high-traffic location with many commuter trips may help explain this.

2022

Between January and September of 2022 the pilot has registered 30.1910 trips (see Figure). Regarding the distribution of trips between electric and regular bicycles, there is a clear preference for travelling on electric bicycles, as they represent 97% of the trips, which has increased from 93% in 2021.

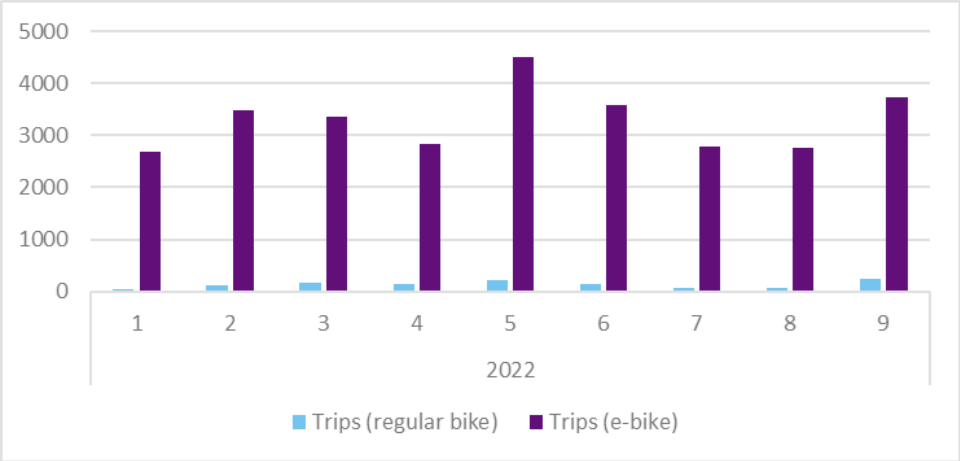


Figure 24 - Trips per bike type and per month (2022)

Regarding the trips to and from this station, they are mostly made on weekdays (see Figure 252), which stills to reveals the commuting nature of the trips as were seen in 2021.

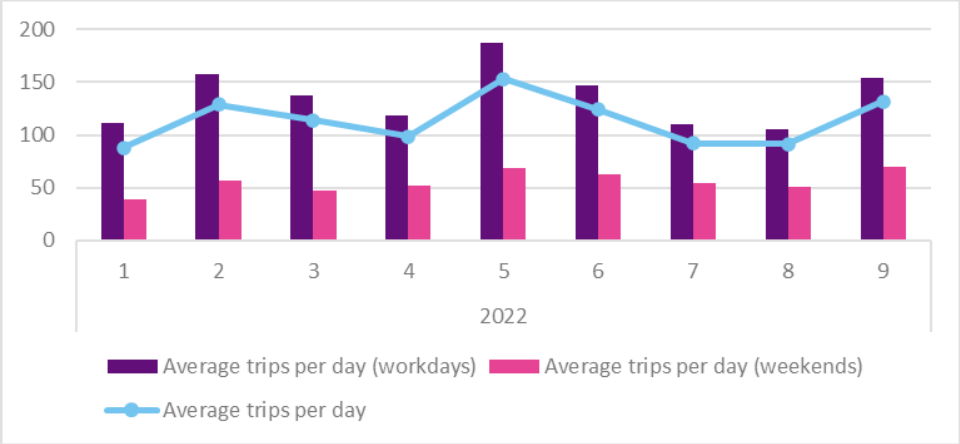


Figure 252 - Trips per type of day and per month (2022)

Analysing the distribution of trips throughout the day for both weekday and weekend day (see Figure), also here the commuter travel profile is suggested, with the identification of a morning peak hour by 8am,

a slight peak at lunchtime and a longer peak period in the afternoon, as is known in other modes of transport.

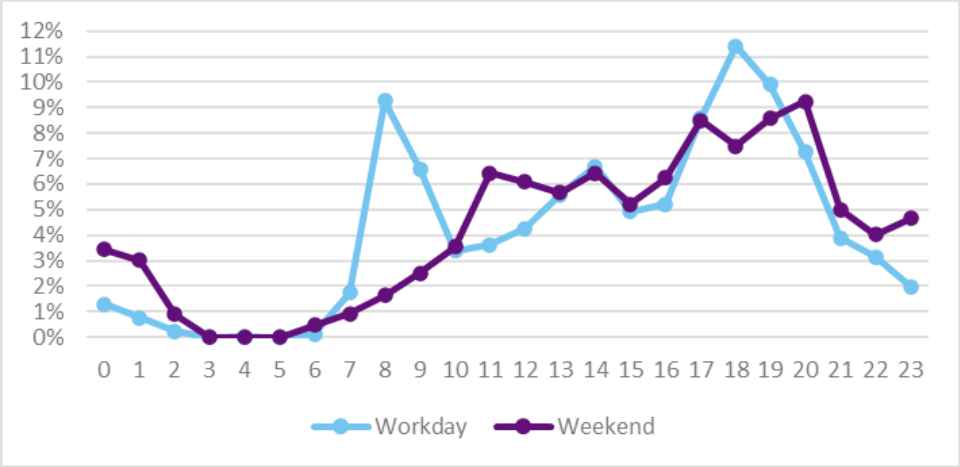


Figure 26 - Trips (beginning and finishing at the GIRA no. 550) per hour of the day and per type of day (workday vs weekend) (2022)

Figure 273 presents the duration and distance[3] of the trips made to and from station no. 550. The average trip in electric bicycle had the duration of 15 minutes and distance of 2.8km, while in regular bicycle was 11 minutes and 1.8km, which reveals the greater range that electric bicycles give to users of the mobility hub. Figure presents a heat map, by month, of the bicycle trips to and from station no. 550, which shows that the trips to and from this station have stabilized their range since December 2021.

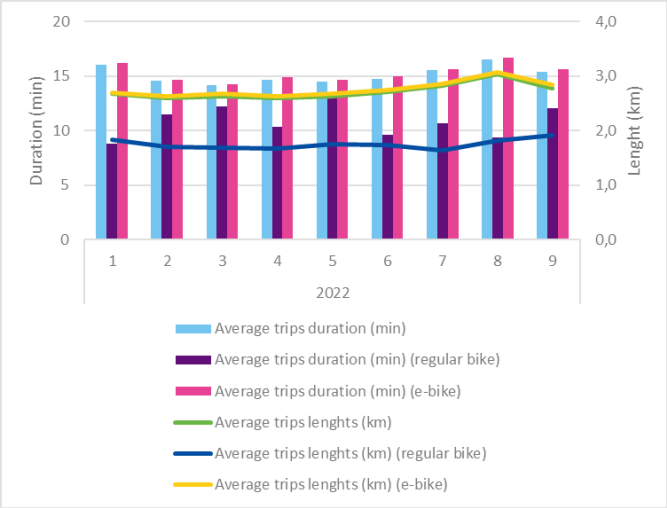


Figure 273: Trips length and duration per bike type and per month (2022)

[3] Distance between origin and destination station, the value of the indicator could be underestimated; distance was determined using GoogleMaps, selecting bicycle as the mode of transport.

Figure 28: Heat map of trips to and from GIRA docking station no. 550 per month (bicycle GPS tracking) (2022)

Regarding vandalism, there is no record of bicycles vandalized or stolen at this station during 2022. The fact that it is a high-traffic location with many commuter trips may help explain this.

6.4. Additional indicators

2021 and 2022

Please refer to section: user data

6.5. Lessons learned and best practices

2021

The pilot location obtained with the application of a multi-criteria methodology was a winning strategy, judging by the significant number of trips - 10.704 bicycle trips between August and December of 2021. It is important to notice that this fact greatly contributes to cope with EMEL objectives in this project, namely: to promote of use of shared mobility services, to facilitate multimodality, and to acquire knowledge for an evidence-based policy strategy on shared mobility hubs, to name a few.

Regarding the use of the bike-sharing service, one can notice a clear preference for travelling on electric bicycles (93% of the trips), revealing the greater range that electric bicycles give to the users, which is also supported by the trips which are about 40% longer than the ones in regular bicycles.

In 2021 a total of 1.832 unique users have ride a bicycle to or from the mobility hub, and most of the users (85.7%) live in the city of Lisbon. 31% of the users were women, showing us that there is a gender gap in the bike-sharing usage. Moreover, the selected location has a high number of young users, which is a particularly relevant fact, evidencing that the sustainable mobility behaviours are being promoted among the younger people in the local community.

Overall, despite its recent opening to the public, this mobility hub reveals a high demand and the trips are mostly related with commuting (44% to work, 26% to school).

Regarding the co-creation process that allowed us to explore with the local community –274 citizens - different combinations “modules” (mobility services, or other value-added services) to upgrade the pilot mobility hub in the future, it is interesting to notice that in the top 5 four of the most desirable “modules” are value-added services that are not directly related with the mobility needs, such as Wi-Fi or a co-working/studying area. Regarding the mobility “modules” the top 4 ones are related with cycling and micro mobility.

2022

In 2022 the pilot continued to show high usage with 30.910 trips and about 133 trips per day on average. However, due to the constraints that have made impossible to upgrade the pilot until October/2022, EMEL weren’t able to collect and assess data about users’ satisfaction with the improvements. Nonetheless, the

methodology developed and carried out to cocreate a mobility hub has proven to be an excellent way to engage with the community in the design of future services and it could be scalable and replicated in the creation of a future network of shared mobility hubs in Lisbon, contributing to ensure that the specific (mobility) needs of each neighbourhood are met.

6.6. User group

2021

Regarding the number of users of this station, between August and December, the station was used by 1832 unique users. The highest number of unique users per month was recorded in November (913 users) and the average number of trips per user per month was 3.2 trips (see Figure 24a).

Of these 1832 users, 69% are men and 31% are women, which is the same distribution as for the overall system users. Regarding the age of the users, station 550 has a higher weight of younger users (18-24) than the system as a whole (see Figure 29b), which may be related to the proximity of the station to the Campo Grande bus/underground terminal and to an area with several universities about 1.5km away.

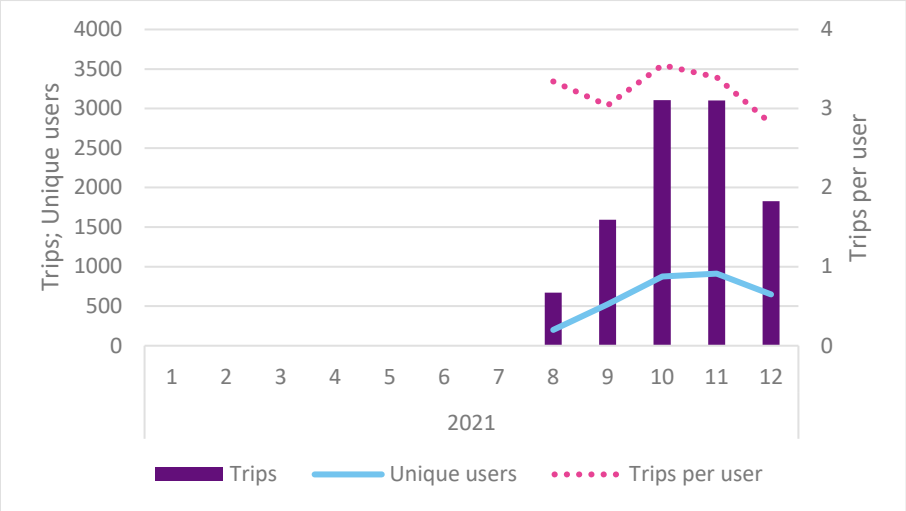


Figure 24a: Unique users per month vs number of trips to and from GIRA docking station no. 550 (2021)

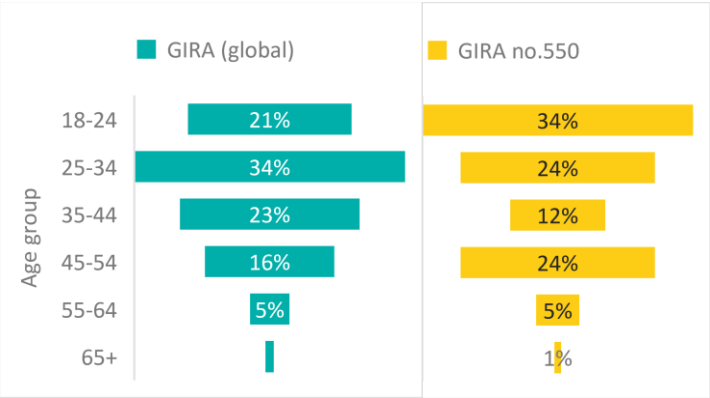


Figure 29b: Users' age group (GIRA no.550 vs GIRA global) (2021)

As for the place of residence of the users travelling to and from station no. 550, 85.7% live in the city of Lisbon, the next municipalities with more users are Loures (3.1%) and Odivelas (2.3%), both located in the North of Lisbon Metropolitan Area, which have several public transport connections to the Campo Grande station (bus terminal and underground station). Of the users living in Lisbon, most live in Lumiar (31.5%), the parish where the mobility hub is located, and in Alvalade (16.3%), an adjacent parish.

Carrying out a multifactor analysis of the trips to and from station no. 550, it is possible to infer the reason of the trips: there is a strong expression of commuting trips (70%), a value that is slightly higher than the one registered globally in the system (63%), as shown in Figure30.

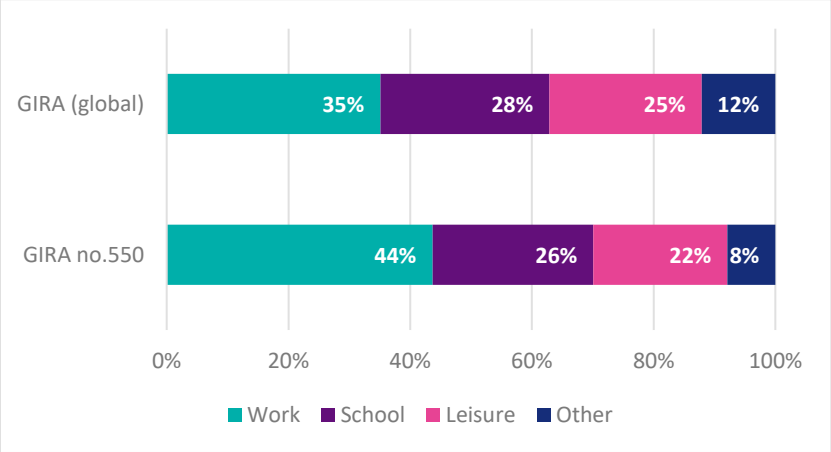


Figure 30: Travel profile (GIRA no.550 vs GIRA global) (2021)

2022

Regarding the number of users of this station, since August/2021 until September/2022, the station was used by 4500 unique users. The highest number of unique users per month was recorded in

September/2022 (1287 users) and the average number of trips per user per month in 2022 was 5.2 trips, which increased about 60% comparing to 2021 (see Figure 31).

Of these 1832 users, 68% are men and 32% are women, values similar to 2021. Regarding the age of the users, station 550 has a higher weight of younger users (18-24) than the system as a whole - 31% - as the data of 2021 reveals, which once again may be related to the proximity of the station to the Campo Grande bus/underground terminal and to an area with several universities about 1.5km away.

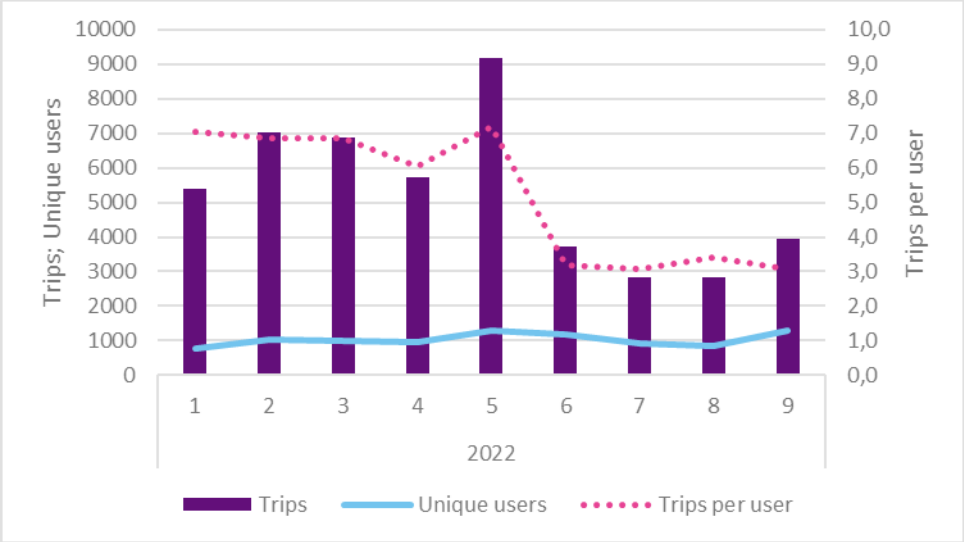


Figure 315 - Unique users per month vs number of trips to and from GIRA docking station no. 550 (2022)

As for the place of residence of the users travelling to and from station no. 550, 81.3% live in the city of Lisbon, the next municipalities with more users are Loures (4.1%) and Odivelas (1.8%), both located in the North of Lisbon Metropolitan Area, which have several public transport connections to the Campo Grande station (bus terminal and underground station). Of the users living in Lisbon, most live in Lumiar (29.6%), the parish where the mobility hub is located, and in Alvalade (15.6%), an adjacent parish.

Carrying out a multifactor analysis of the trips to and from station no. 550, it is possible to infer the reason of the trips: there is a strong expression of commuting trips (77%).

6.7. User experience

2021

According with GIRA system, each trip could be rated (between 1 and 5 stars) by the user at GIRA App after parking the bicycle at the destination station. The average rating of the trips to and from GIRA station no. 550 in 2021 was 3.15.

2022

According with GIRA system, each trip could be rated (between 1 and 5 stars) by the user at GIRA App after parking the bicycle at the destination station. The average rating of the trips to and from GIRA station no. 550 in 2021 was 3.08.

Since the hub upgrade is not in place yet, there are no data regarding the hub improvements.

6.8. Service improvements

2021 and 2022

Please refer to section: reflection.

7. Setúbal

7.1. Pilot plan

2021

The mobility hub in Setúbal was planned with the purpose of promoting the use of public transport and micro mobility among residents that commutes to Lisbon and visitors of the city. It is located near to a multimodal station in which both bus and train services are available and was initially designed to provide the following facilities for private bikes:

- Bicibox – 1 closed parking structure for 12 bicycles.
- Sheffield stands – 9 open parking structure with lower bar for two bicycles fixed to the pavement.
- Repair station – 1 self-service bicycle repair facility that includes an air pump and nine tools. This station will allow bicycle users to carry out minor repairs on their bicycles autonomously.

Since the beginning of the project, a shared e-scooter services started to operate in the city and a dock station (10 places) was planned to be included in the hub. The city also started to plan the operation of shared e-bike services for the beginning of 2022 and their integration into the hub is also intended.

2022

The Setúbal hub started to operate only on June 2022 due to a series of issues mainly related to delays in the multimodal station construction as well as in the delivery of one of the equipment's acquired, namely the Bicibox.

In its final configuration (Figure 32) the hub includes not only the private bike facilities such as the Bicibox, the sheffield stands and the repair station, but also a charging dock station for e-scooters and allows the parking of e-bikes from a free-floating service. Therefore, the hub integrates both shared services (e-scooter and e-bikes) as well as parking and repair facilities for private bikes near to a main public transport station where both train and bus services are offered.

Figure 32 - Setúbal hub final configuration

The delivery of bus services information via panel information near to the hub was also planned. However, it became clear that this would not be possible due to delays in the starting operation of the new bus services.

Also, one of the main features tested with this hub was the integration of public transport with micro-mobility services/facilities by allowing free access to Bicibox by PT users that hold a monthly pass. For this, a technological solution was tested which allows using the PT card Navegante to open the Bicibox.

With this, the original main goal for the hub of promoting the integrated use of public transport and micro mobility services was achieved.

7.2. Reflection

2021

The hub was not able to enter in operation during 2021 due to delays in the construction of the multimodal station as well as due to municipal elections in September, which slowed down the progress of the project. Delays in the delivery of the equipment acquired, namely the Bicibox (expected to be delivered by the end of January 2022), also contributed for not having the hub deployed in this year. Nonetheless, the Sheffield stands were installed as well as the basic infrastructure for the installation of the remain equipment (power connections, etc.).

2022

Many challenges had to be overcome during the progress of the project. As the hub implementation was done with the close participation of the Setúbal municipality, many of the procedures needed to be approved by different departments (Mobility and Transport Department, Communications Department, etc.) as well as by the city council, making the decision process slower.

One specific issue of this pilot was the fact that parking facilities were acquired by TML and not by the Setúbal Municipality. This required the establishment of a protocol for the collaboration between these two entities. In this document all the conditions for the acquisition, maintenance, monitoring and future ownership of the equipment were defined. This procedure added more delays in the process.

Another challenge was to put together different suppliers for the acquisition of the Bicibox with an integrated card reader. For this, two local suppliers had to work together to provide the solution that TML was looking for.

Lastly, after the official opening of the hub in June 2022, a technological issue with the card reader in the Bicibox prevented users to have access to it. This issue, however, was solved by the end of August 2022.

7.3. User data

2021

As the hub was not yet in operation, there was no information about the use per shared mobility mode or per parking facilities to share. However, the shared e-scooter services were already in operation in the city and presented expressive numbers:

- Maximum of vehicles available for use: 355
- Total number of trips (7 June – 13 September): 308,087 rides
- Average distance: 2 km
- Average minutes per trip: 13 min
- Total kilometres travelled: 580,491 km
- Total users registered: 13,089 (approximately 10% of the total population of Setúbal)
- Average number of daily trips per scooter: 10 trips per scooter

2022

For estimating the parking usage of the Bicibox a total of 187 Navegante card validations were considered from the beginning of September 2022 to the middle of November 2022. After data depuration i.e., removal of repeated validations from the same card within an interval of less than 5 minutes, 131 validations were considered valid. From this, 66 pairs of successive validations at up to 48 hours intervals

made by the same card were identified, resulting in 33 valid parking uses. The remaining 65 unique validation were from 53 other people that seemed to swipe the card to just test how the Bicibox works.

The 33 parking uses of the Bibicibox are characterized by an average of 1,2 uses per day, with a maximum of 2 uses per day, all done by 13 unique users (Figure 33). The average parking time is of 8,7 hours, with a maximum time of 30 hours and a minimum of 9 min. In relation to the combined use of the Bicibox with public transport, 91% of the parking uses were followed by the use trains (60%) or buses (40%). Also, the most common PT monthly pass used by Bicibox users is the metropolitan pass (69%), followed by the Setúbal urban pass (15%) and their student versions for the ones between 4 and 18 or under 23 years old (16%) (Figure 34).

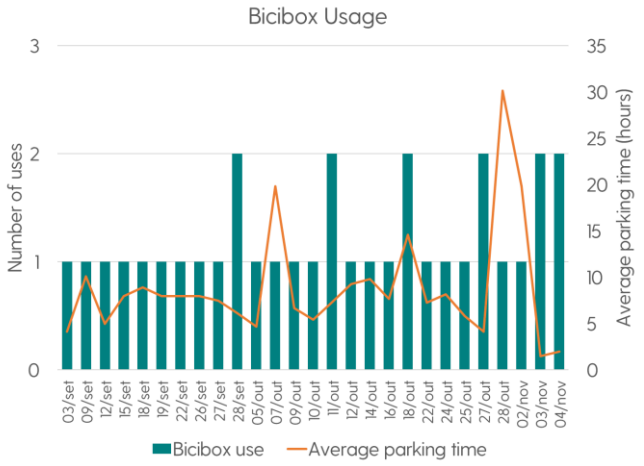


Figure 33: Bicibox usage

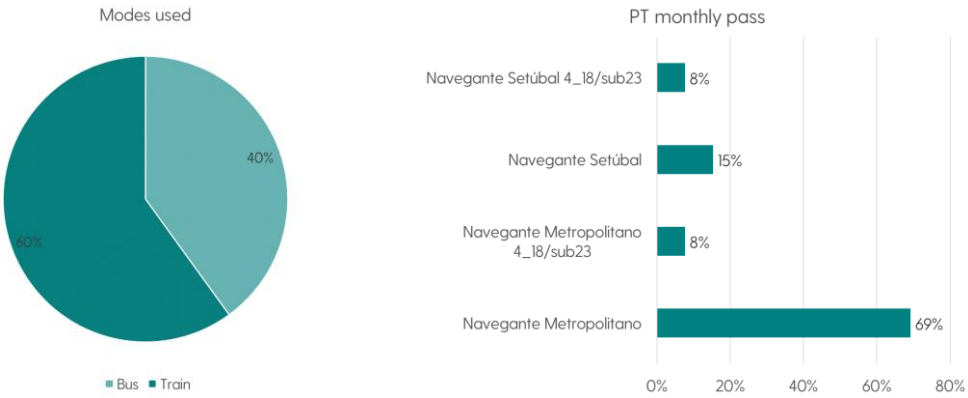


Figure 34: Modes and monthly pass used by the Bicibox users

Regarding the use of the shared micro-mobility service available, the hub had a total of 2223 unique users and 6122 rentals per month, which indicates an average of 2,8 rentals per person per month (Figure 35). This indicates a superior usage of these services in comparison to the use of the parking facilities.

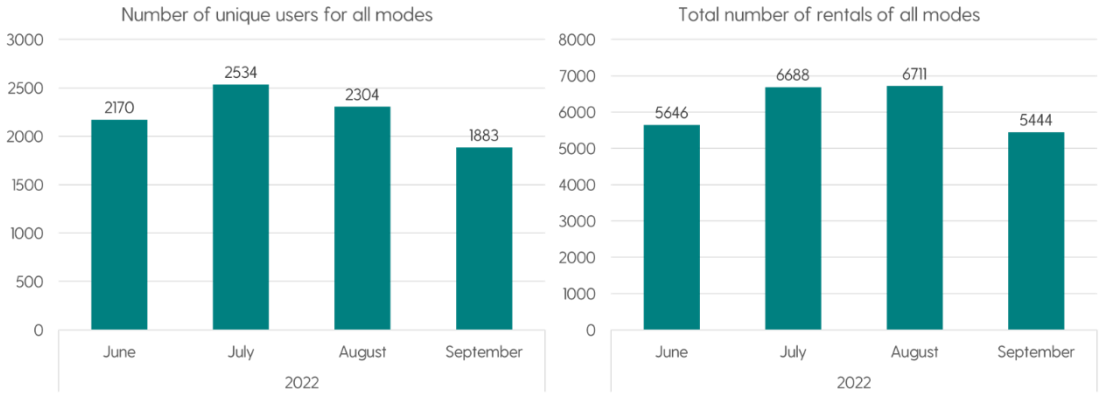


Figure 35: Unique users and number of rentals for the shared services

Considering the performance of the shared services in the hub per type of modes, it is possible to note that e-scooters had a more expressive use compared with e-bikes, with the former being responsible for than 50% of the hub rentals every month (Figure 36). Also, the usage of the e-bikes has being decreasing over the months, showing that e-scooter are the preferred mode among the hub users.

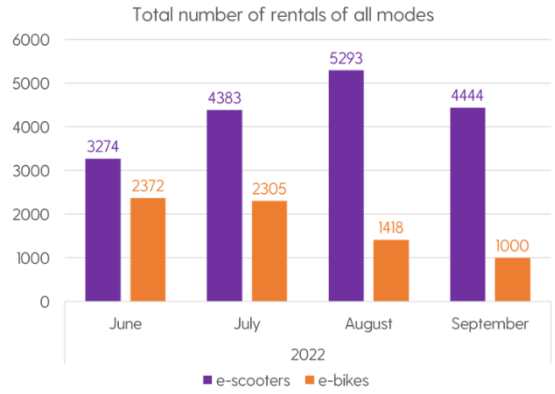


Figure 36: Number of rentals per shared services

Regarding the rental time, e-scooters rentals had an average duration of 7,4 min while e-bike rentals took 11,5 min (Figure 37). In terms of rental length, the distances travelled with e-scooters were in average shorter, 1,4km, then with e-bikes, 1,9km. Important to note that both the average rental time and length for the e-scooter are stable since the hub opening, while for e-bikes this numbers have been decreasing, with the bike users performing shorter trips compared with scooter users.

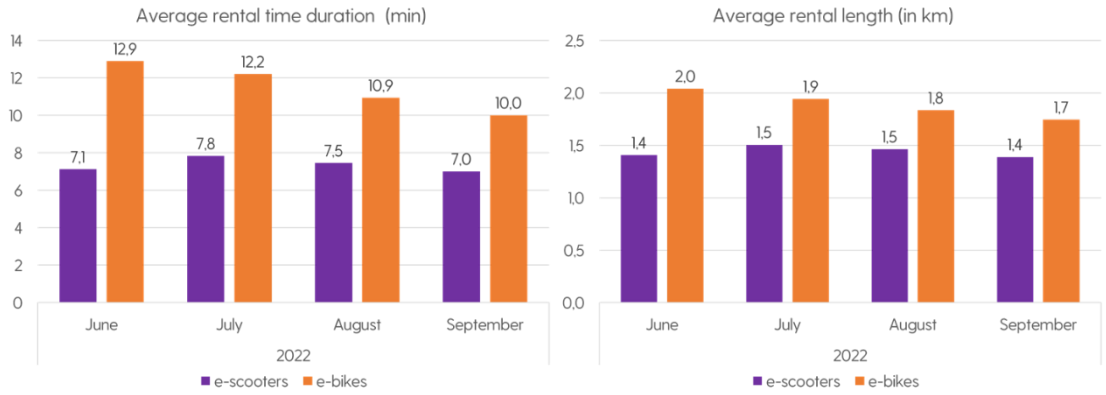


Figure 37: Rental duration and length per shared services

7.4. Additional indicators

2021 and 2021

From the survey carried out with hub users, other interesting indicators could be estimated:

- 52% of interviewed users don't have a Navegante card, which means most of them probably don't use public transport frequently (Figure 38).
- 46% of the one that owns a Navegante cars have charged it with a monthly pass in the last 3 months, mostly with a metropolitan monthly pass (95%) (Figure 38).
- Only 27% of interviewed users have a driver's license. This is in line with users age, as many of them are part of a generation (57% of them are less than 24 years old) that don't value much have a driver's license (Figure 39).
- Cars are the most frequent mode available in the user's household, with 72 of them (82%) saying that they have at least 1 car available. The second mode most available are conventional bikes with 25 users (28%) indicating that they have at least one available at home (Figure 39).
- Apart from walking, the most frequent used modes (every day or 5-6 days) are buses, cars as a passenger and shared e-scooters. With a medium frequency of usage (3- 4 days) are buses and cars as a passenger, but also trains and shared scooters. The least used modes are metro, shared cars, shared bikes and motorcycle (Figure 40).
- The most frequent trip purposes referred by users are commuting, shopping and leisure activities, followed by going out and sport activities. Car as passenger is frequently used not only for commuting, shopping, leisure activities, but also for visit family/friends. Public transport is used mainly for commuting and visit family/friends. Shared e-scooters are mostly used for commuting and leisure activities. Users also indicated to frequently use bicycle for sports activities and taxi/ride hailing for going out (Figure 40).

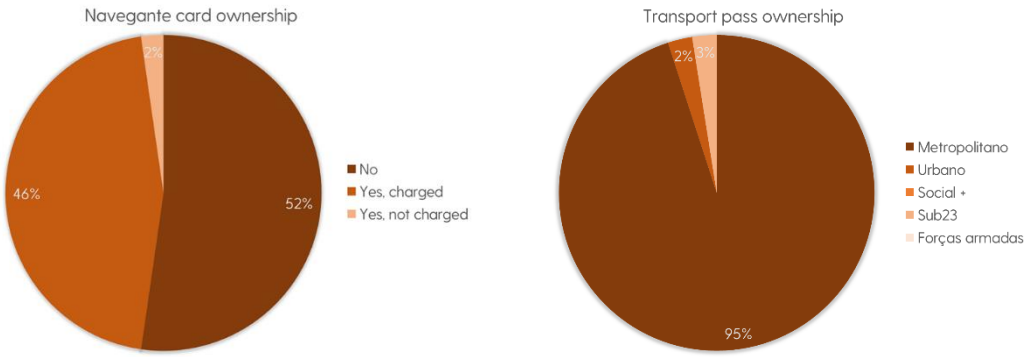


Figure 38: Number of rentals per shared services

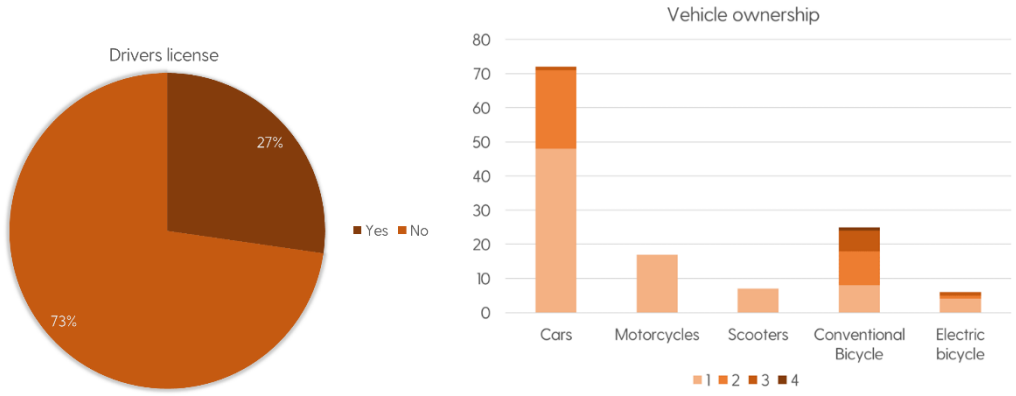


Figure 39: Driver's license and vehicle ownership

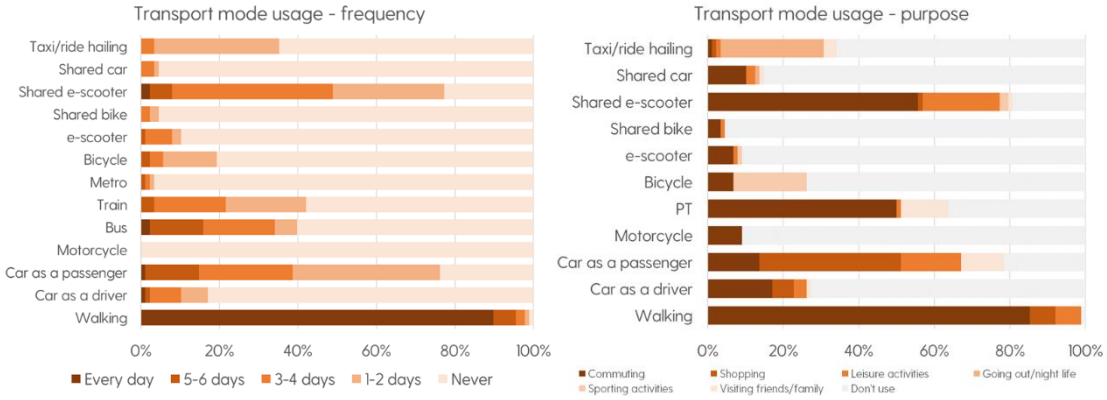


Figure 40: Transport mode usage per trip frequency and purpose

Another important indicator is the number of marketing actions carried out by TML and the Setúbal Municipality. A total of three actions were implemented as follow:

- TML website (https://www.tmlmobilidade.pt/comunicacao/noticias/inauguracao-da-bicibox-navegante-na-interface-de-transportes-de-setubal-no-dia-mundial-da-bicicleta/)
- Navegante Instagram (https://www.instagram.com/p/CeVfPGeDSup/). In this case a promotional video was produced and publicized receiving 876 visualizations.
- Setúbal Municipality website (https://www.mun-setubal.pt/nova-era-nos-transportes-comeca-em-junho/)

7.5. Lessons learned and best practices

2021 and 2022

The main lessons learned from this pilot includes:

- Need for establishing a cooperation protocol between TML and the Setúbal Municipalities to define the rules for the equipment acquisition as well as for its maintenance and monitoring. In case of replication of this kind of mobility solution in other municipalities of the Lisbon metropolitan area, a protocol will always be needed.
- Difficult to locate the hub within the multimodal station. As the original project of the station didn't include the hub, it had to be placed in the best local possible, which was near the bus stops in front of the station. It was not ideal in terms of space, but it was perfect in terms of visibility to the public.
- Difficult to find in the market a ready-to-use Bicibox solution that allowed access through RFID card. TML had to ask two different suppliers, one for the optical card reader and another for the Bicibox, to provide a single solution together. That way, TML was able to acquire a Bicibox with a RFID card reader integrated. However, another important piece of equipment to be integrated was a modem to allow the transfer of card validation information automatically to TML. Unfortunately, this was not possible, and the information about the validation still needs to be extracted manually. A permanent solution for this will be implemented in a near future.
- Intensive use of the shared services available in the hub compared with the parking facility for private bikes. Two main reasons are possibly behind this: i) most of the Setúbal citizens did not own bikes and benefited from the new shared services available in the city, and ii) the campaign about the hub existence and the integration of the Bicibox with the Navegante tariff system was not enough and needs to be carried out again.

7.6. User group

2021 and 2022

According to the survey applied with 88 hub users between October 27 to 29 of 2022, they are mainly male (69%) with an average age of 25.7 years. Most of them have secondary school level completed (55%), followed by an expressive group of users with university degree (22%). In terms of occupation, most are students (45%) or have a professional occupation (43%). Only 12% are retired, unemployed or do not have a professional occupation (Figure 41).

Hub users live mainly in Setúbal (74%) or in neighbouring municipalities (17%) and their average household size of the is of 3,3 members, with the largest household having 7 members.

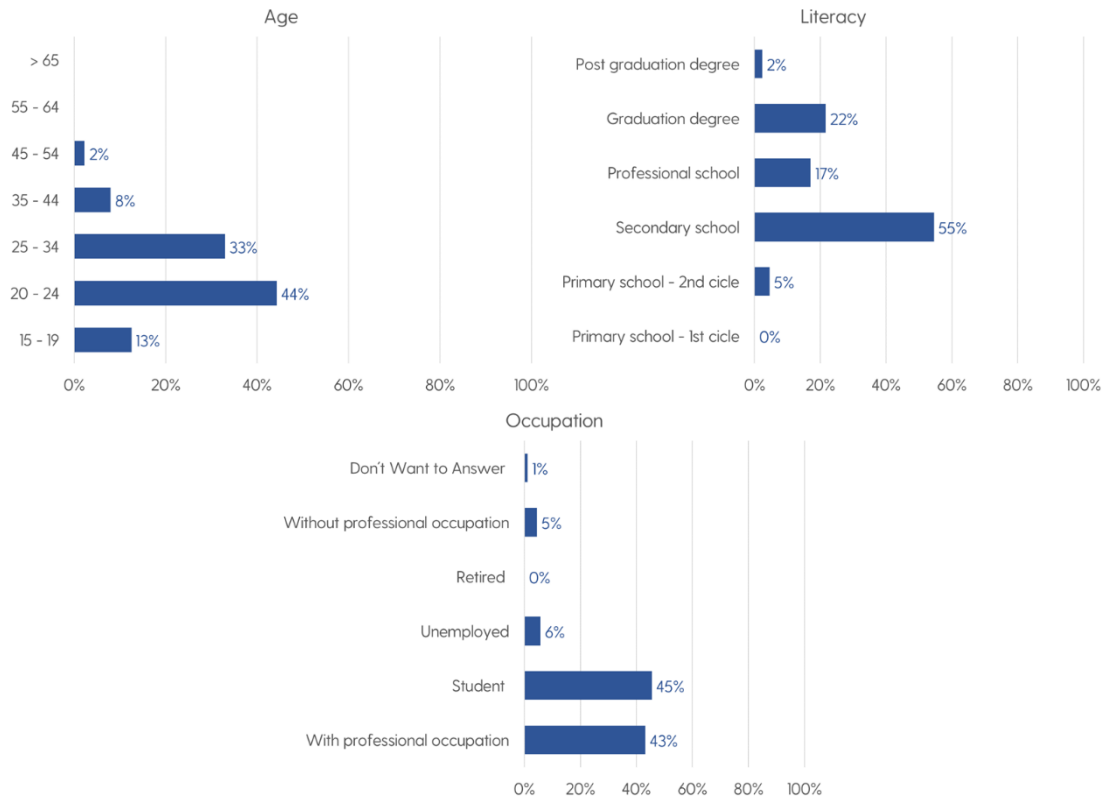


Figure 41: Hubs users characteristics: age, literacy and occupation

Another important group of users are the ones that uses the Bicibox. They are mainly male (62%) with an average of 22 years old, with the oldest being 49 and the youngest 13. The age of the youngest user seemed to be not usual, as the pattern of trips he/she performs after using the Bicibox is not compatible with a students' trips, especially because they were made during weekends. Therefore, it is believed that someone must being using the Navegante card from another person. In relation to the type of monthly pass that these user owns, it is most the metropolitan pass, which as in accordance with the type of trips performed in general by the Bicibox users that has Lisbon as their main destination (Figure 42).

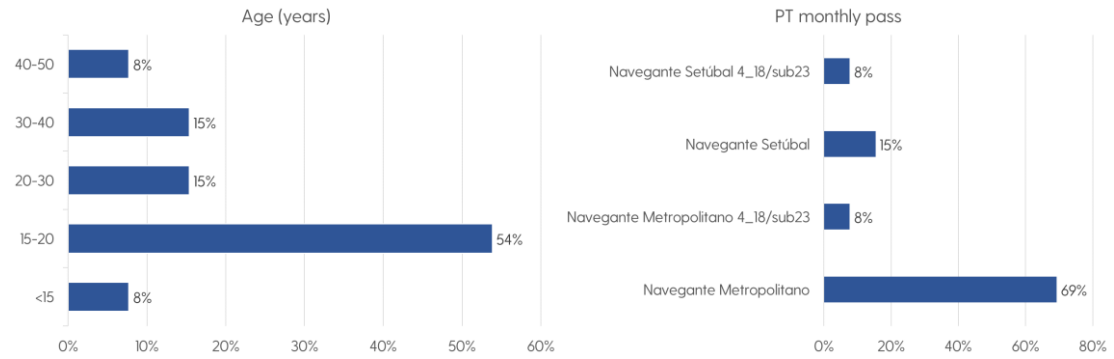


Figure 42: Bicibox user characteristics

7.7. User experience

2021 and 2022

According to the hub users survey, the hub is used mostly 3 to 4 days a week (51%), followed by a frequency of 1 to 2 days a week (38%). Everyday usage is not so frequent among the hub users (2%). They use the hub both on weekdays and weekends (43%), with also expressive usage only on the weekdays (41%). Regarding the modes and equipment available in the hub, users have a massive usage of shared scooters (91%), followed by the repair station (16%), shared bikes (15%) and the Bicibox. None of the users indicated to use only the Bicibox and, interestingly, 7% have said to use shared scooters and the repair station, probably to fill the tires (Figure 43).

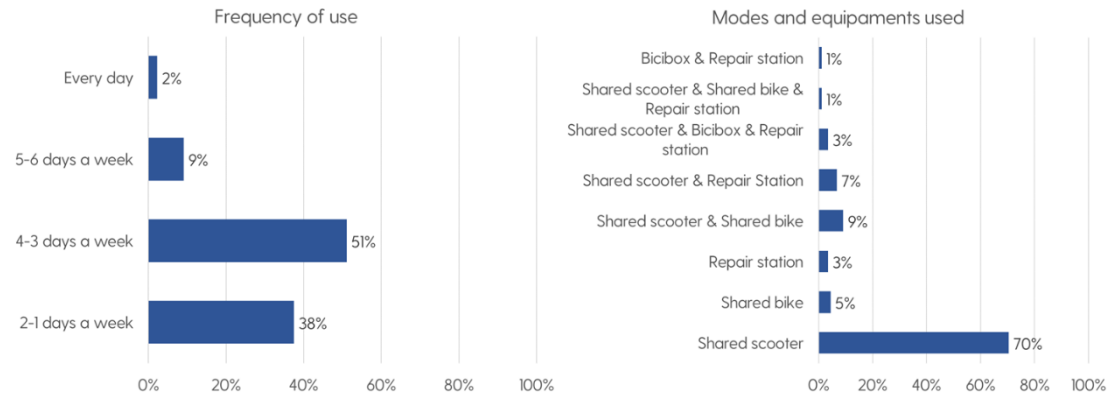


Figure 43: Hub frequency of use and main modes&equipament used

Regarding satisfaction with the hub, the overall rating was of 5,5 points considering a scale of 7 points where 1 indicates total dissatisfaction and 7 total satisfaction, with 86% of hub users saying that they were

at least slightly satisfied with it (Figure 44). Therefore, it can be said that users are generally satisfied with the space and the services it provides.

From the twelve aspects assessed the four with the highest average ratings were “the easiness to use different modes and services” (6,2 points and 98% of satisfied users), “the location and the easiness of access” (5,6 points and 84% of satisfied users), “the safety perception during the day” (5,6 points and 91% of satisfied users), and “the cleanliness level of the HUB and its immediate surroundings” (5,4 points and 80% of satisfied users).

On the other hand, the aspects with the lowest average ratings were “the easiness of access for people with reduced mobility” (3,4 points and 37% of satisfied users) and “the hub level of comfort and suitability of seating spaces” (3,8 points and 41% of satisfied users).

The remain aspects received average ratings above the 4 points with at least 70% of the users saying that were at least slightly satisfied. The only exceptions were the aspects “the easiness to get help in case of emergency” and “the quality and adequacy of the information provided in the hub” that although having been rated above 5 points have a maximum of 63% of satisfied users.

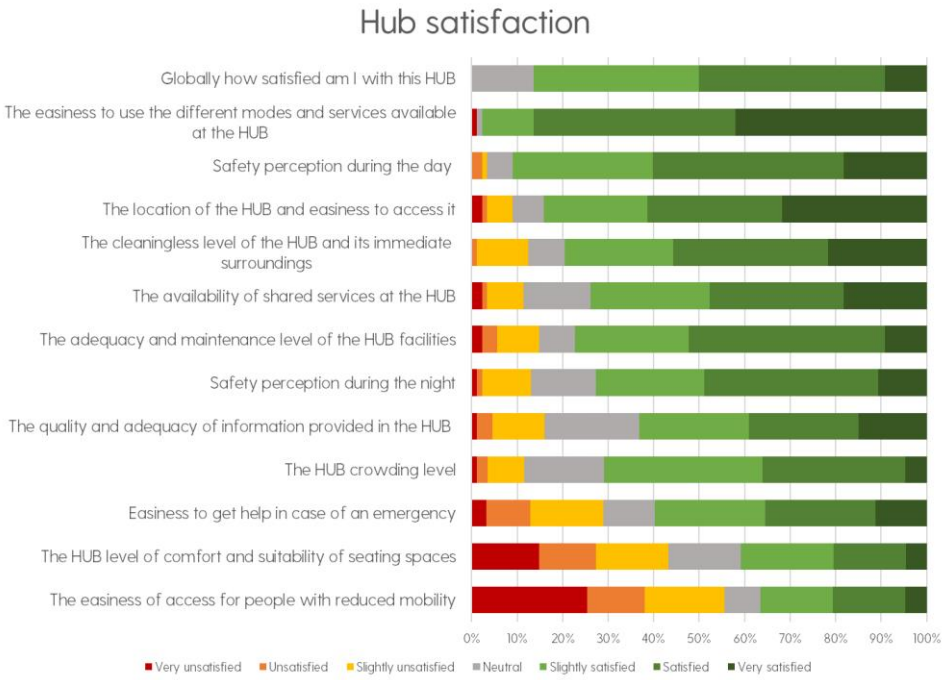


Figure 44: Hub satisfaction evaluation

The users were also asked about their attitudes and perceptions about important topics that reflect their behaviour. The main conclusions were:

- Most of hub users have a negative attitude regarding the aspects related with multimodality. They agree that transfers make PT trip planning more complicated (78%) and that PT transferring (86%)

and waiting for PT (93%) are annoying. They also agree that travels that include transfers are not attractive (86%) (Figures 45).

- In overall hub users have a positive attitude regarding shared mobility. They feel safe when using it (69%), think that it provides more flexibility in their way of travelling (86%), but they agree that shared mobility services are expensive (74%). On the other hand, they disagree that shared mobility shouldn't be use if you already own a car (80%), it's complicated to use (85%) and that it doesn't fit their image (74%). Also, hub users disagree the about the reliability of the services (45%) and if they can fulfil their mobility needs (45%) (Figures 45).
- Hub users have a positive attitude regarding the environment. They agree that i) congestions, air pollution and noise are problems in their city (85%), ii) the usage of car in general should be reduced (94%), and iii) they feel morally obliged to reduce their greenhouse gases emissions (85%). They disagree that people should be allowed to use their cars as much as they like (77%), but they tend to agree that people who drive environmentally friendly cars should pay less to use the roads (53%) (Figure 46).
- In terms of subjective norms, hub users agree that most of their friends and family use PT regularly (75%), although the majority owns a private car (65%). They also agreed that their friends and family have a positive attitude towards the use of bicycles (56%) and shared e-mobility (58%), and that they find important to reduce emissions of greenhouse gases (67%). However, they disagree that most of their friends and family had already tried out shared e-vehicles (63%) (Figure 47).
- In terms of perceived behavioural, hub users perceived the digital environment of shared mobility as very users-friendly (92%) and that they know how to use shared vehicles (74%). They also perceived as feeling confident in use scooters (92%) and bicycles (73%), but they disagree of feeling confident to use an electric car (86%) (Figure 16).

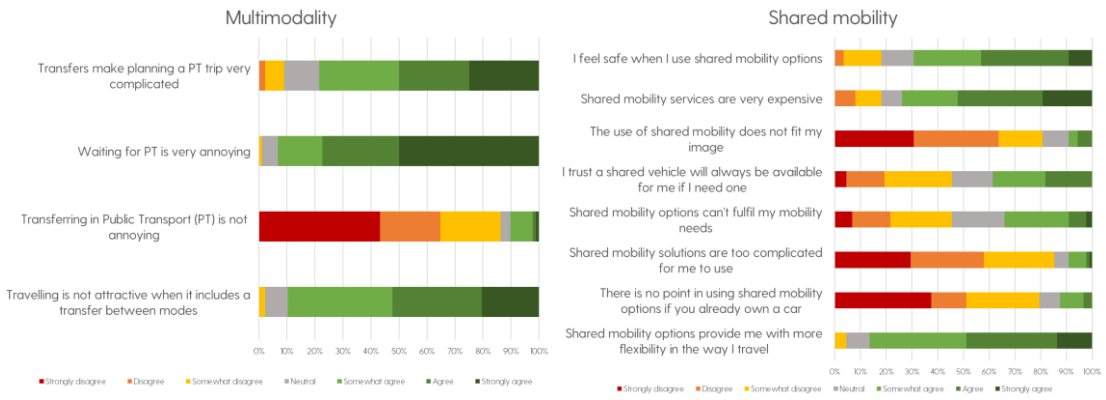


Figure 45: Evaluation of attitudes towards multimodality and shared mobility

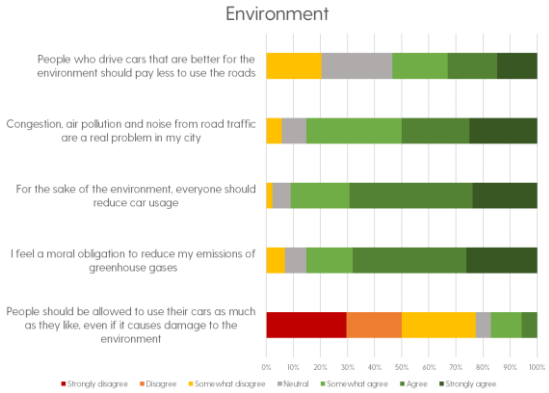


Figure 46: Evaluation of attitudes towards environment

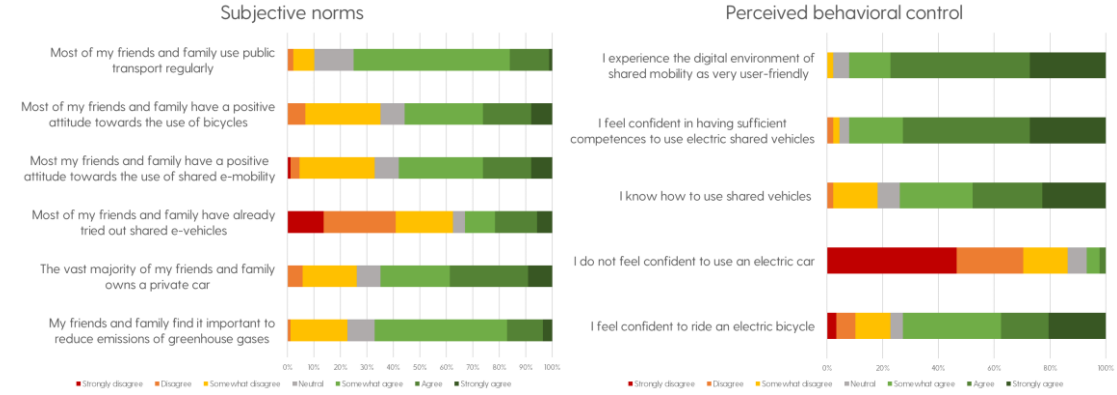


Figure 47: Evaluation of subjective norms and perceived behavioural

7.8. Service improvements

2021 and 2022

One possible improvement envisioned for the hub is the integration of the micro-mobility services with public transport. TML intends to establish partnerships with micro-mobility providers to offer discounts in their services for the passenger with monthly pass.

Also, TML is working on the development of a product that consists in offering to other municipalities in the metropolitan area the installation of Biciboxes accessed with the Navegante Card. The business model to support this product is still under development.

8. Warsaw

8.1. Pilot plan

2021

Mobilne Miasto joined the SmartHubs project in the middle of the year 2021, by replacing the Warsaw Transport Authority (ZTM) and taking over its project activities (conducting a feasibility study on implementing mobility hubs in Warsaw), but also by adding new activities – opening pilot mobility hubs in two locations: first in 2021 and another in 2022. With regards to pilot mobility hubs, the goal for 2021 was therefore to launch first such implementation, in the most multimodal (different shared mobility modalities available in the hub) and economically sustainable (hub partners contributing to hub operations) way possible.

2022

The goal for 2022 for Mobilne Miasto in the SmartHubs project was to maintain operations of the first mobility hub and to open another hub location in Warsaw. Also here, the aim was that the hub will be multimodal (different shared mobility modalities available in the hub) and economically sustainable (hub partners contributing to hub operations).

8.2. Reflection

2021

Taking into account a very short time to launch the first mobility hub in Warsaw (due to the fact that Mobilne Miasto joined the SmartHubs project in the middle of the year) it was challenging to have this goal achieved. However, it turned out to be possible due to the existence of one mobility hub in Warsaw and acquiring it for the purpose of the SmartHubs project. As a result of this market opportunity, the SmartHubs project was has been provided with the first Warsaw-based mobility hub – operated since May 2021 and

providing its users with initially 3 shared modalities: e-scooters, e-mopeds and car sharing, and later with 2 modalities (due to the fact that the e-moped operator ceased operations in Warsaw).

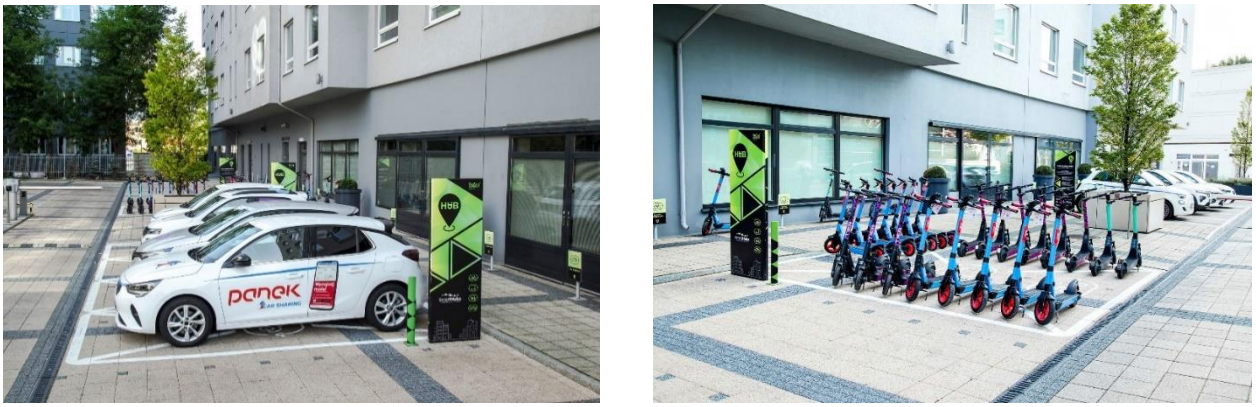


Figure 48: Warsaw's first SmartHub

2022

Speaking of the 2022 accomplishments of Mobilne Miasto in the area of pilot mobility hubs, the period from January until end of September has been taken into account. Within this period, it was possible to achieve both goals – to maintain and further develop the first mobility hub, as well as to open a new mobility hub in Warsaw. Other goals, such as establishing a viable business model, creating an added value for all stakeholders of the hubs (users, landlord, mobility providers), as well as a further analysis of the hubs' design and offer remained unchanged.

The development of the first hub was primarily based on extending the contract with the landlord, and then by increasing the number of shared mobility services (operators) available in this location. It has been achieved to double the number of shared mobility providers (from 1 to 2) for each of the represented modalities: shared e-scooters and car sharing. As a result, 4 shared mobility operators agreed to supply their vehicles to the first mobility hub in the course of 2022.

Another achievement was the opening in June 2022 of the second mobility hub, also in a business district. This contract has been acquired both quicker and on better terms compared to the hub launched in 2021. The new location contained 3 modalities: shared bikes (a closed system only for tenants of the office park), shared e-scooters (still, with only 1 provider willing to provide their shared fleet in this location) and car sharing (2 providers constituting almost 100% of the car sharing market in Warsaw), and looks following:

Figure 49: Warsaw's second SmartHub

8.3. User data

2021

In the course of the year 2021 (from May, when the hub was opened, until December), the first mobility hub generated a total of 1328 rides. In 66% of cases the users were renting out shared vehicles from the hub and in 34% of cases the users were ending their trip in the hub. All rides in 2021 represented the following modalities: 28% e-scooters, 18% e-mopeds and 54% car sharing.

2022

In the course of the year 2022 the first mobility hub generated from January until end of September (full 9 months) a total of 3278 rides. In 60% of cases the users were renting out shared vehicles from the hub and in 40% of cases the users were ending their trip in the hub. Compared to 2021, this means that the hub has been better recognized as a final destination. All rides in the first hub in the given period of 2022

represented the following modalities: 75% e-scooters and 25% car sharing. This shows a significant increase in terms of the volume of micro mobility trips.

Speaking of the second mobility hub, in the course of the year 2022 (from end of June, when the hub was opened, until end of September), the hub generated a total of 616 rides. In 70% of cases the users were renting out shared vehicles from the hub and in 30% of cases the users were ending their trip in the hub. All rides in the given period of 2022 represented the following modalities: 29% e-scooters and 71% car sharing (lack of data for bikes).

8.4. Additional indicators

2021

No indicators other than the number of rides of shared vehicles (rentals and returns) were collected.

2022

1. Evaluation of the hubs design (spatial arrangement) and the hubs offer (shared mobility services and beyond).

   An additional publication on mobility hubs (in Polish, titled “Mobility hubs: the innovation that will change cities) will be released in December 2022. This publication will also concern the issue of design/offer of mobility hubs.

2. Possible impact of the feasibility study from 2021.

   As a result of approaching the Warsaw Municipality on the topic of mobility hubs (among others, by the use the feasibility study, but also by showing the pilot hubs, as well as conducting a number of other activities) it has been achieved that the project of mobility hubs has been taken into account in a document called “The Green Vision of Warsaw”. The Green Vision of Warsaw is a Green City and Climate Action Plan. It presents scenarios of activities that should be implemented to meet Warsaw’s declaration of reducing greenhouse gas emissions by 40% by 2030 and becoming climate neutral by 2050. In the area of transport, one of the activities assumes the “development of multimodal transfer nodes”. This action is about provision of infrastructure in transport nodes enabling faster adaptation of new means of mobility (incl. bike sharing, shared micro mobility or car sharing systems) – in order to reduce the need for owning and using private cars. All this is to improve the public transport experience, e.g., by combining various transport modalities in one place, as well as by offering the possibility of introducing MaaS (Mobility-as-a-Service) platforms that integrate the collective and shared transport offers in the form of a multimodal journey planner integrated in one user interface giving access to the entire local mobility offer.

The activity on mobility hubs is recommended to be carried out in the years 2023-2030, and its financing (estimated value of almost 200 million PLN = approx. 42 million EUR) is possible from EU, municipal or external (debt) funding, as well as through arranging a public-private partnership.

Another achievement is including mobility hubs in another strategic action plan: the Warsaw Sustainable Mobility Program, which is subject to public consultations until mid-December 2022. The document says that "supported will be the organization of places and spaces, in which various mobility-related services can be offered in an orderly and effective manner (the so-called mobility hubs)."

The above can be perceived as a major success of the efforts of Mobilne Miasto resulting from the execution of the SmartHubs project.

8.5. Lessons learned and best practices

2021

The first year of running the pilot mobility hub in Warsaw showed, among others, the following issues:

- it was challenging to ensure a constant supply of vehicles in the hub by the operators
- the maintenance and repair costs have been underestimated in the initial business model
- unauthorized vehicles were often blocking the parking spaces reserved for car sharing vehicles
- not all shared mobility providers were interested in contributing to the hub (both financially and in the form of vehicle supply)
- some users were parking the vehicles not properly obstructing access to other property functions

2022

The second year of running pilot mobility hubs in Warsaw confirmed the lessons learned and best practices indicated for 2021, and additionally disclosed the following issues:

- it was challenging to both extend the contract for the first hub, as well as to sign the contract for the second hub (the landlord does not see a clear benefit from the hub, however, this approach is slowly changing in a positive way, the market for mobility hubs seems to be maturing)
- it is required to find solutions for low demand season – e.g., for micromobility operators (this has been achieved through applying a billing mechanism based on performance; if the demand is low, the monthly fee stays low too)
- mobility hubs require scale (a network of hubs) - it was extremely difficult to convince the landlords to “risk” a not well enough proven innovative solution
- mobility hubs require cooperation with public transport agencies (to address multimodality and first/last mile) and complementing public transit

8.6. User group

2021

The users of the first mobility hub are mainly people working in or visiting nearby office facilities (majority) and retail (minority). No more precise data on the users' profile were available as this data stays with the shared mobility providers. However, the utilization of the first mobility hub broken down into months has been presented on the below chart. We can see that it was most popular among the users in July and September. Micro mobility-type of vehicles, which are weather-sensitive, were also impacted by seasonality with the demand declining in the winter months. On the other hand, car sharing services, which are weather-proof, presented a more stable demand throughout the whole year.

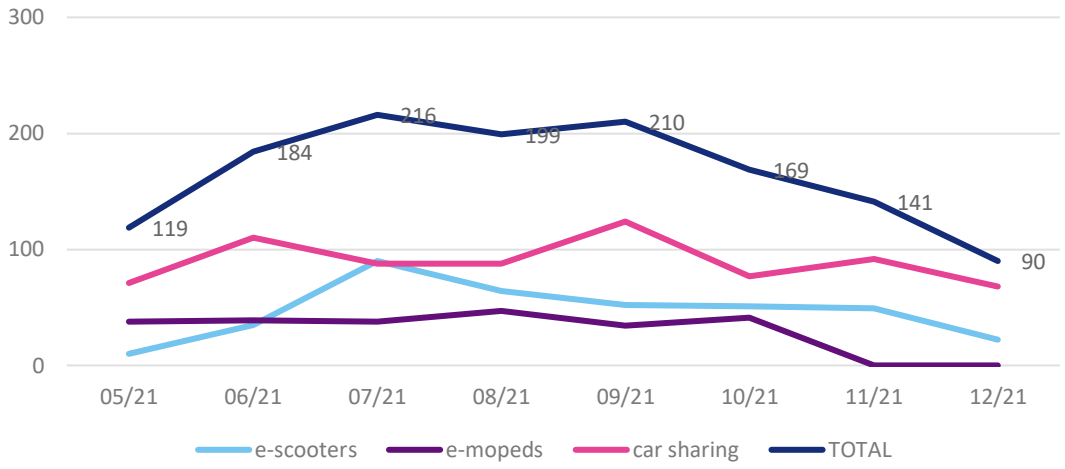


Figure 50: Users of the first SmartHub in 2021

2022

Also, the users of the second mobility hub are mainly people working in or visiting nearby office facilities (majority) and retail/services (minority). A new group of users are hotel guests, as a hotel is also a part of the office complex, in which the second hub is located. No more precise data on the users' profile were available also for the second hub as this data stays with the shared mobility providers. Still, the utilization of the second mobility hub broken down into months has been presented on the below chart. We can see a clear uptake after the hub has been opened but need to observe the trends in a longer period of time in order to make any conclusions.

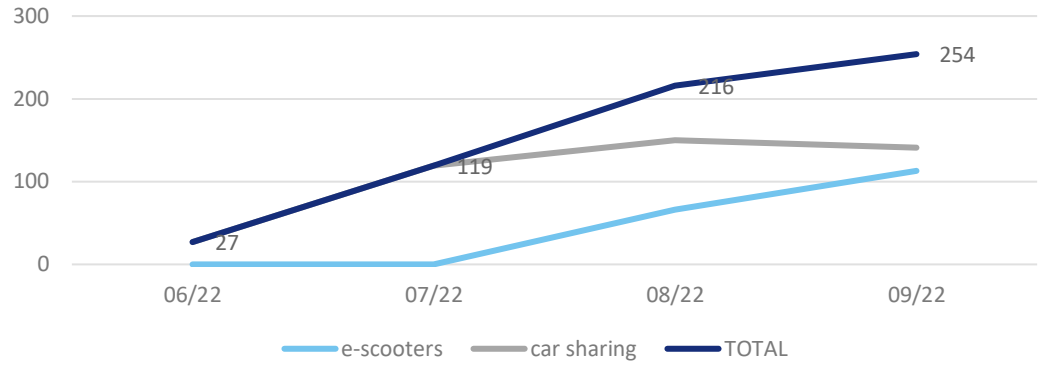


Figure 51: Users of the second SmartHub in 2022

With regards to the 2022 utilization of the first mobility hub broken down into months, is looks following:

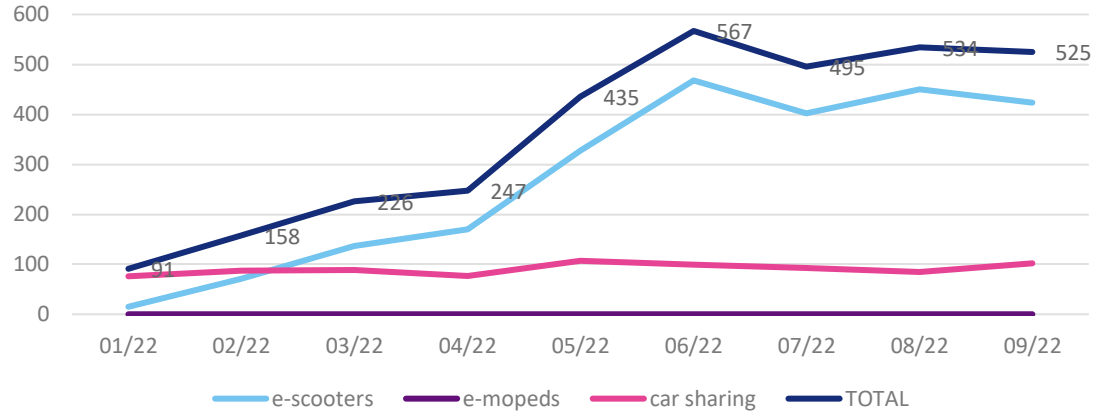


Figure 52: Users of the first SmartHub in 2022

Here we can clearly see that the car sharing demand remains steady throughout the whole year, while micro mobility demand grows significantly in the spring in order to stabilize throughout the summer.

8.7. User experience

2021

In order to ensure a good user experience, the mobility hub has been equipped with visible horizontal and vertical markings, and thus providing the users with a clear message what the hub is for. An “instruction” for the users is also a part of the informative signs located in the hubs. Also, shared mobility providers, whose services were available in the hub, introduced the mobility hub into their mobile apps – by indicating

its location on the map and even the currently number of vacant parking spaces (in the case of car sharing). No user satisfaction survey was carried out in Warsaw in 2021.

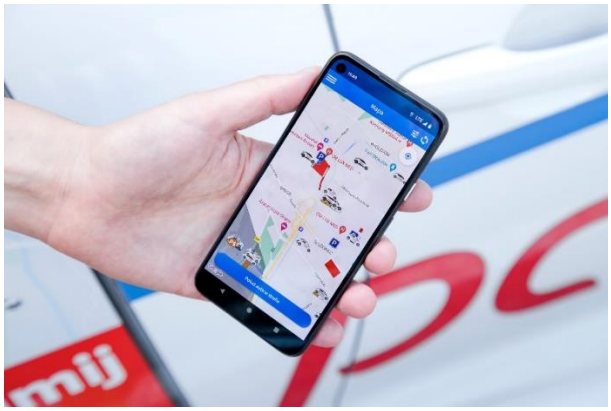
2022

In order to ensure a good user experience, also the second mobility hub has been equipped with visible horizontal and vertical markings, and thus providing the users with a clear message what the hub is for and where it's located. Also, shared mobility providers, whose services were available in the hub, introduced the mobility hub into their mobile apps – by indicating its location on the map and even the currently number of vacant parking spaces (in the case of car sharing). No user satisfaction survey was carried out in Warsaw also in the course of 2022.

8.8. Service improvements

2021

Improvements implemented throughout 2021 in order to make the mobility hub more popular included the following aspects: implementation of clearer hub branding, designation of the hub in mobile applications of the shared mobility providers (see pictures below), facility security/management staff paying attention to unauthorized use of the hub (e.g., not by shared vehicles).



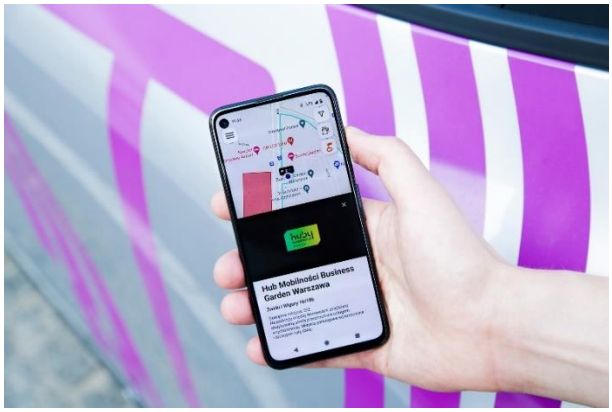


Figure 53: Designation of the hub in mobile applications

2022

Improvements implemented throughout 2022 included, among others, the following aspects: reinforcement of the mobility hub pylon's structure (damaged by strong wind), implementation of a new

billing mechanism for shared mobility players (not a flat monthly fee, but based on performance – number of rides), organizing a new photo session of the hubs and conducting PR efforts.

9. Results

At the end of the project, 7 pilot cities had 8 SmartHubs operationalized. The scale of these SmartHubs pilots differs quite a lot. The SmartHub project did take place during several COVID-19 measures, such as restricted travel and lock-downs. This is assumed to have had an impact on the results as well.

Amsterdam

Although user experience at the SmartHubs was rated very positive, the use of both SmartHubs was very limited. Several communication campaigns were used to increase knowledge and usage of the SmartHubs. In 2022 there was an increase in number of total rentals, compared to 2021. For 2022, the total number of rentals of the Fashion Hotel SmartHub was: 107 rentals by car, 11 rentals by ebike and 2 rentals for the eCargobike. For the Student Hotel SmartHub this was: 292 car rentals, 150 ebike rentals and 18 for the eCargobike. In both cases this was not enough to continue with the SmartHubs, simply since it proved too difficult to reach a viable business case on the long term. The SmartHub pilot was very helpful in understanding the preferences of car-users and developing a convincing alternative. Developing SmartHubs indoor, or on private grounds can be only successful if it depends on a stable community around the hub. At the chosen locations this was not the case.

Eindhoven

Eindhoven developed the SmartHub Genneper Parken. The hub opened in June 2021 and the number of users of the hub is increasing gradually. The shared bikes and e-bikes of Hely haven't been used much during the pilot period. In the end of 2021, Eindhoven added free-floating shared mobility of Felyx, Go Sharing and TIER. It was striking to see that the number of trips starting and ending at the P+R corresponds quite well. The hub became a hotspot of departing and arriving trips. The increase however was not linked with people using the hub to park their cars and transferring over to shared mobility but rather use the hub as a place to switch from public transit (bus) to shared mobility. Data about the usage of the SmartHub indicate there are quite some regular users of the P+R.

Helmond

Most users lived within 1.72 km away from the hub, most of them within a radius of 800m. A questionnaire reviewed that various communication efforts has led to 50% of the respondents aware of the SmartHubs existence. Other 50% of the respondents indicated that they are interested in using shared mobility, even though they haven't done so yet. The ones not interested, were not interested because they have their own private means of transportation. Respondents in the survey indicated that they would like to see the cargo bike more available. Unfortunately, this SmartHub encountered sever vandalism to their cargo bikes as well as technical problems, resulting in the removal of the cargo bike.

Sant Cugat de Vallès

The Mira-Sol SmartHub in Sant Cugat de Vallès was installed in July of 2021, that month the SmartHub had 10 new users in total. The use started to increase and in 2022, the Mira-Sol pilot was effective in bringing 92 additional unique users of Bicibox, who used the service 698 times as the year 2022 got underway. The Bicibox solution in Sant Cugat de Vallès was indeed proved to enhance bike use among commuters, combining this with public transportation. User experience was overall very positive.

Lisbon

In 2021, a total of 10.704 trips were made to and from this station. There is a clear preference for travelling on electric bicycles, as they represent 93% of the trips. This number increased to a total of 31.910 trips in 2022. Usage of the SmartHub is mainly linked to commuting trips. The co-creating process in the first year of the pilot helped identify the services and infrastructural aspects that the SmartHub needed to offer. Also, it enforced public engagement in the development of the SmartHub.

Setúbal

In 2022, The SmartHub in Setúbal recorded 2223 unique users and 6122 rentals per month, which indicates an average of 2,8 rentals per person per month. The usage of the e-bikes has been decreasing over the months, showing that e-scooter are the preferred mode among the hub users. Regarding the rental time, e-scooters rentals have an average duration of 7,4 min while e-bikes rentals take 11,5 min. In terms of rental length, the distances travelled with e-scooters are in average shorter, 1,4km, then with e-bikes, 1,9km.

The combined use of the Bicibox with PT seems promising, despite the number of users been not so expressive. A total of 13 unique users performed an average of 1,2 parking per day having used PT afterwards, mainly train. It is believed that that these number will continue to grow and to reinforce that advertising campaigns to promote the integration of bicycles with the PT will continue to be implemented.

Also, users are generally satisfied with the SmartHub rating it with 5.5 in a scale from 0 to 7 points. They said to be particularly satisfied with “the easiness to use different modes and services” (6.2) and “the location and the easiness of access” (5.6), but less satisfied with “the hub level of comfort and suitability of seating spaces” (3.8) and “the easiness of access for people with reduced mobility” (3.4).

Warsaw

In 2021, the first pilot mobility has been opened, as well as a feasibility study on implementing mobility hubs in Warsaw has been prepared. In the course of the year 2021 the first mobility hub generated a total of 1328 rides. In 66% of cases the users were renting out shared vehicles from the hub and in 34% of cases the users were ending their trip in the hub. All rides in 2021 represented the following modalities: 28% e-scooters, 18% e-mopeds and 54% car sharing. In the course of the year 2022 this hub improved its performance and generated until September (full 9 months) a total of 3278 rides. In 2022, in 60% of cases the users were renting out shared vehicles from the hub and in 40% of cases the users were ending their trip in the hub. All rides in the first hub in 2022 represented the following modalities: 75% e-scooters and 25% car sharing. This shows a significant increase in terms of the volume of micromobility trips.

Speaking of the second mobility hub, in the course of the year 2022 (from end of June, when the hub was opened, until end of September), the hub generated a total of 616 rides. In 70% of cases the users were renting out shared vehicles from the hub and in 30% of cases the users were ending their trip in the hub. All rides in the given period of 2022 represented the following modalities: 29% e-scooters and 71% car sharing.

Apart from the abovementioned feasibility study and opening two mobility hubs, Mobile Miasto has undertaken a number of PR and Public Affairs activities achieving, among others an additional publication on mobility hubs in Polish, as well as including the project of mobility hubs in the municipal "Green Vision of Warsaw" - a document indicating projects to be implemented with public funding in the years 2023-2030.

The uptake of SmartHubs

The demand is difficult to predict until the hub is operational. The uptake of the SmartHub went slowly in some pilot cities. Communication campaigns were used to try to increase awareness and use of the hub. Signage around the SmartHubs was improved. Research into the different motives for using shared mobility has helped cities to learn more about the characteristics the SmartHub should be.

Identifying service improvements

Service improvements mentioned where: focus on solid communication (multiple languages), better signing and information at the SmartHub location, comfortable waiting areas with facilities, more payment options. Also, SmartHubs could be further improved by better interconnectivity between hubs or other public transport options. Furthermore, the SmartHub locations could benefit from more services provided, such as package lockers, refrigerated grocery delivery, Wi-Fi, and co-working/studying. On another level: measures need to be developed that help avoid wrong use of the SmartHub, for example parking private vehicles at the SmartHub, or blocking the SmartHub.

10. Conclusions and Lessons learnt

The different SmartHub pilots resulted in different conclusions. While some proved to be successful, others demand adjustment of the SmartHub concept, some were even closed due to not resulting in the desired outcome. Many lessons were learned during this pilot, relevant for new developments in the future.

- There are several success factors that will help increase the uptake of use of the SmartHub. Promoting the hub and its multimodality options and creating supporting policies and conditions are essential. If conditions are (made) unattractive for car owners, it will help car users to switch to shared mobility. For example, ease of parking, accessibility of the city by car and the amount of parking costs will influence the decision of taking a car into the city or consider alternatives.
- Co-creating process of the development of a SmartHub really helped gaining insights that otherwise would be left unidentified.
- Communication through online websites about the (use of the) SmartHub helps people locate and use the hub.
- In cities where cargo bikes are a new mode entirely the uptake of this mode seems much more difficult than in cities where the cargo bike is already a known mode of transportation. Although the reason was not researched, this is likely to be (at least partly) explained by the Diffusion of innovations theory of E.M. Rogers. It originated in communication to explain how, over time, an idea or product gains momentum and diffuses (or spreads) through a specific population or social system.
- It's not always about money. Sustainability and convenience are important factors for users of shared mobility. A financial promotion is not the key to success of a SmartHub but can help in low demand seasons.
- SmartHubs require scale -a network of mobility hubs- but is still difficult to develop since the prove about the effect of mobility hubs is to this date not conclusive. The development of mobility hubs still requires pioneers (such as municipality or landlords willing to further help the network).
- Weather conditions influence the use of different modes, a car is proven to have more steady demand all year round.
- However promising the solution MaaS (Mobility as a Service) seems to be for the increased uptake of shared mobility, it is not something that is easily developed and ready to use.
- Be aware of which trips are being substituted for shared mobility, are these car trips or is shared mobility now competing with your 'active modes of transport' such as walking, biking or public transportation?
- SmartHubs can be a target for vandalism and theft. Besides the obvious stakeholders, it can help to involve the police and local district managers in the process of developing and location selection of the hub.

- The need for a constant supply of vehicles and maintenance and repair costs might use more of your resources than was expected. Ask around what reasonable budget to keep in mind, to avoid any surprises.
- Unauthorized vehicles will be wrongly parked or blocking your SmartHub, make sure you know what measures you can and will take when this happens.
- Be aware that developing a SmartHub is usually a complex project with many different stakeholders, for example different municipality's departments, transport operators, other service operators, such as construction company, providers of electricity, charging infrastructure etc. These stakeholders all work in their own processes. Making the deployment of a mobility hub a time consuming and complex process.
- The location of the hub is crucial and can make or break your SmartHub's use. If the hub is not on route for example, or too far from the city center it will be difficult to make the hub a success.
- One size does not fit all, be considered of the inclusiveness of the SmartHub. What target group can your SmartHub reach, considering the following typologies: location, financial, digital capabilities, language, age, gender, people with mental or physical difficulties?
- The majority of SmartHubs tend to attract more male users than female users. It is important to learn more about these causes and to try to eliminate them.
- Make sure to help people use the hub, with proper signing and help on location. It's quite a step to use a mobility hub for the first time.
- Geographical characteristics and purpose for the trip are key factors to determine whether an electric bike or a regular bike will fit your demand.

11. Acknowledgement

We would like the opportunity to thank EIT Urban Mobility for the possibility of having done this project.

Appendix I – Sant Cugat del Vallès

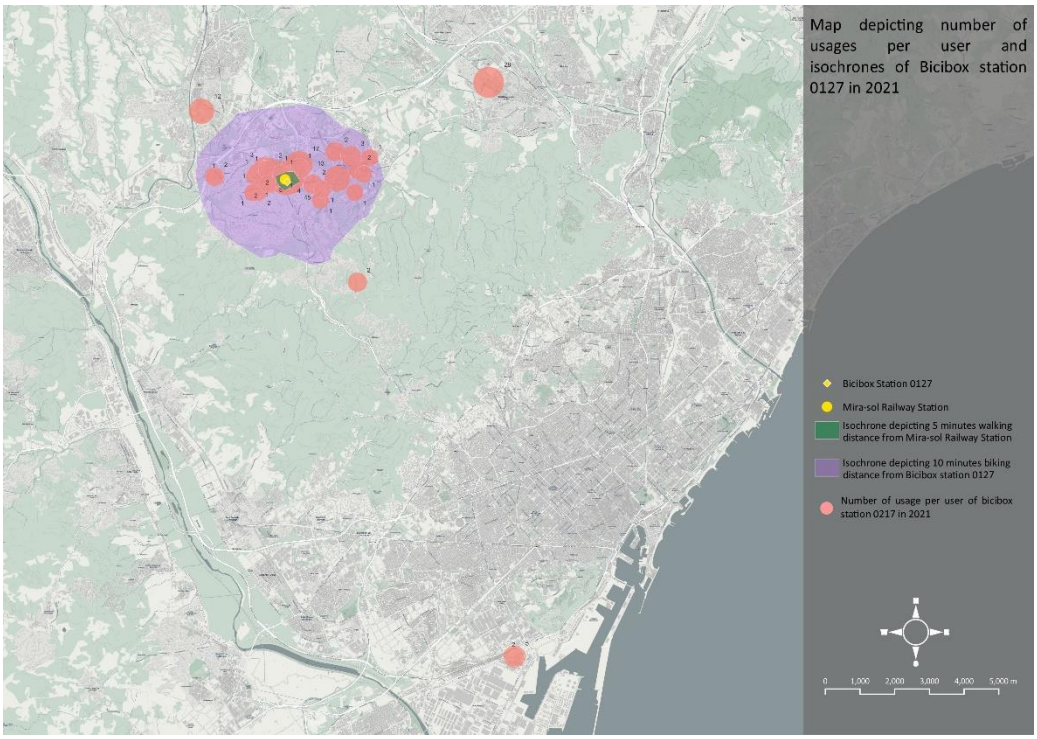


Figure 1: Zoomed-out map depicting the number of usages per user and isochrones of Bicibox station 0127 in FGC Mira-Sol.

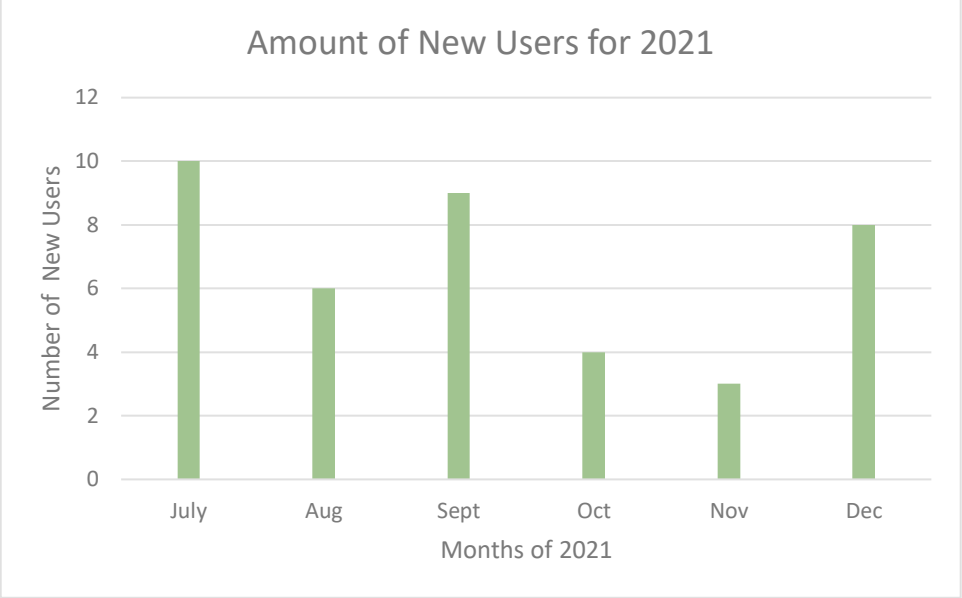


Figure 2: Chart of new Bicibox users for the year 2021.

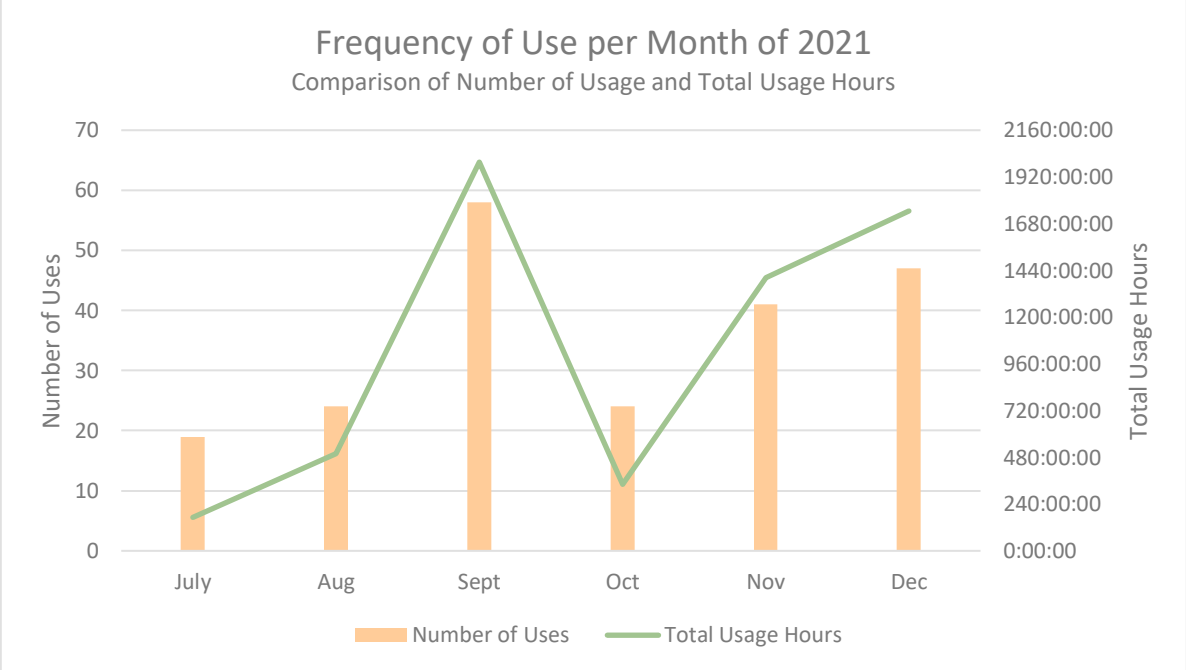


Figure 3: Chart comparing the number of uses and total usage hours for the year 2021.

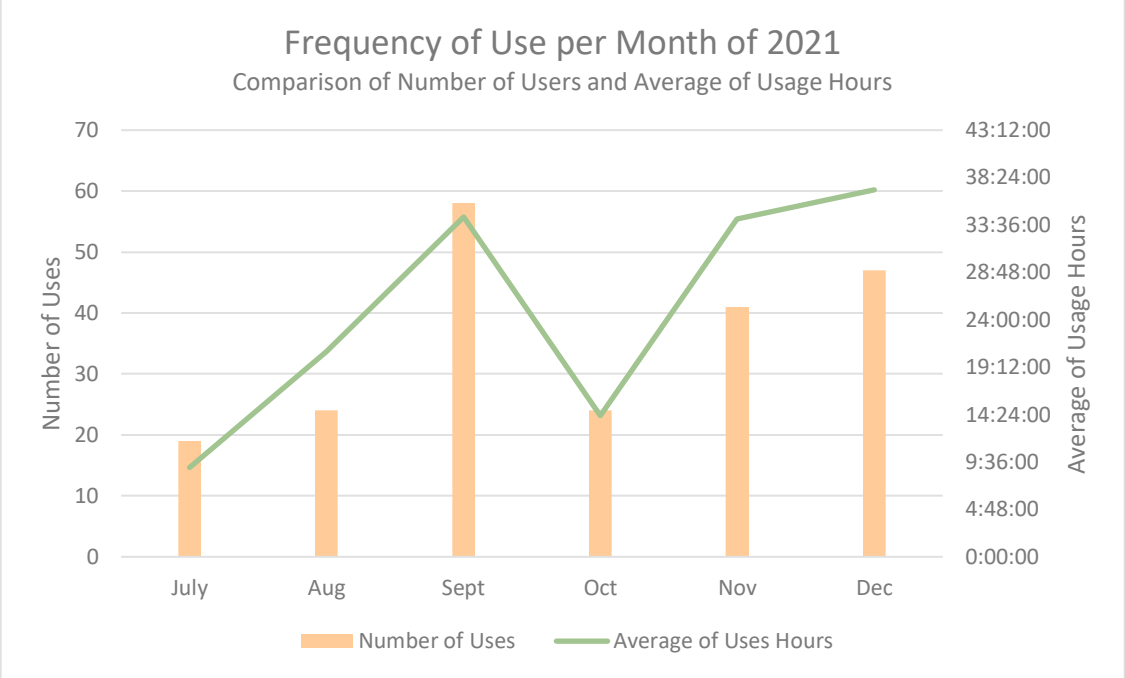


Figure 4: Chart comparing the number of uses and average usage hours for the year 2021.

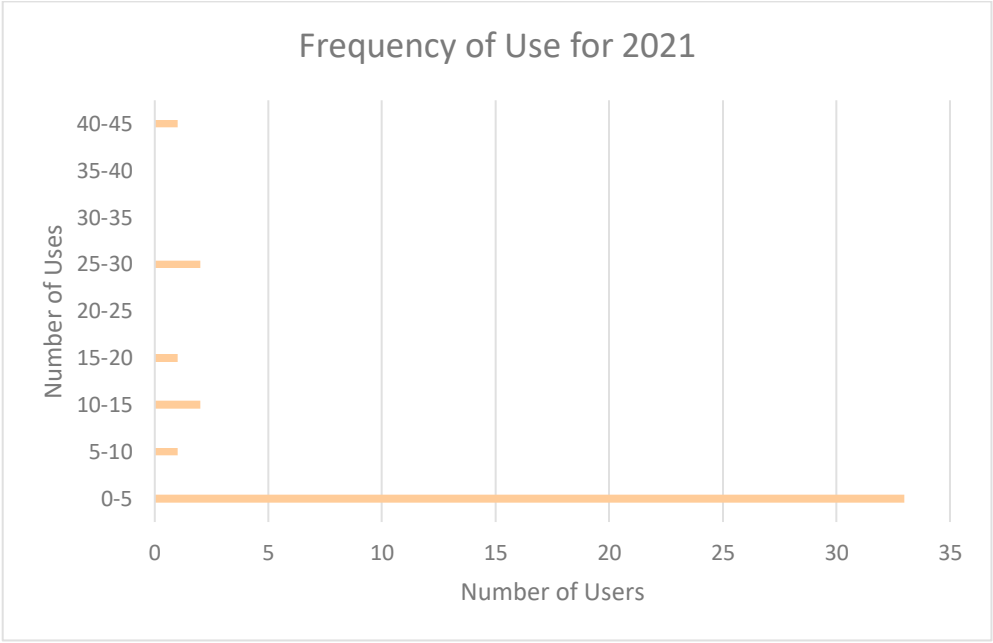


Figure 5: Chart comparing the number of uses and users of Bicibox for the year 2021.

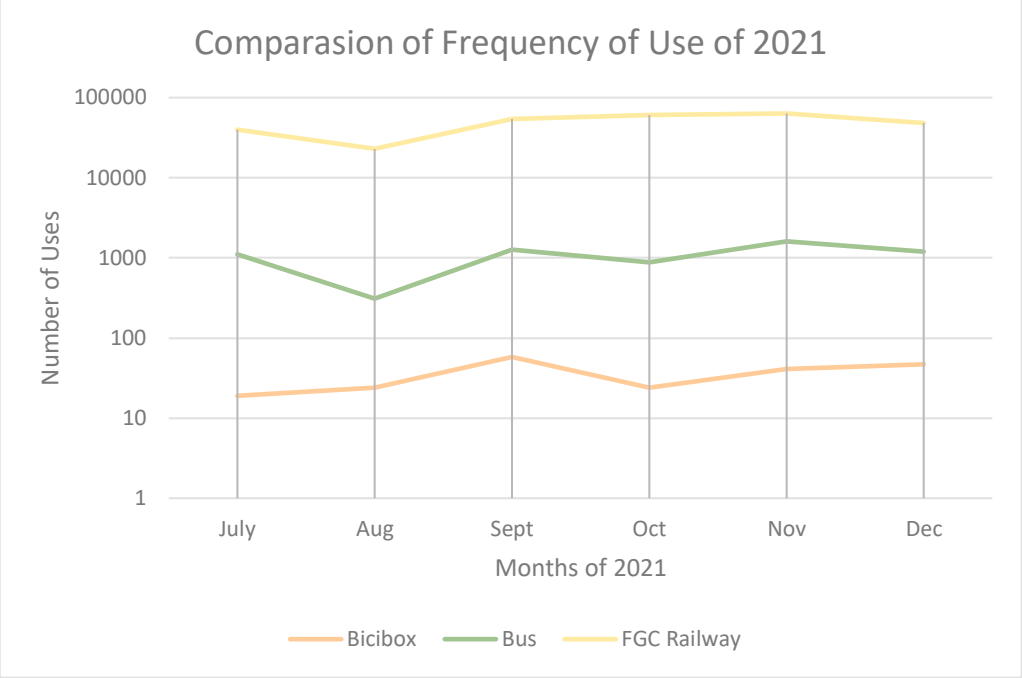


Figure 6: Logarithm chart to compare uses of FGC Railway, Bus and Bicibox in Mira-Sol for the year 2021.

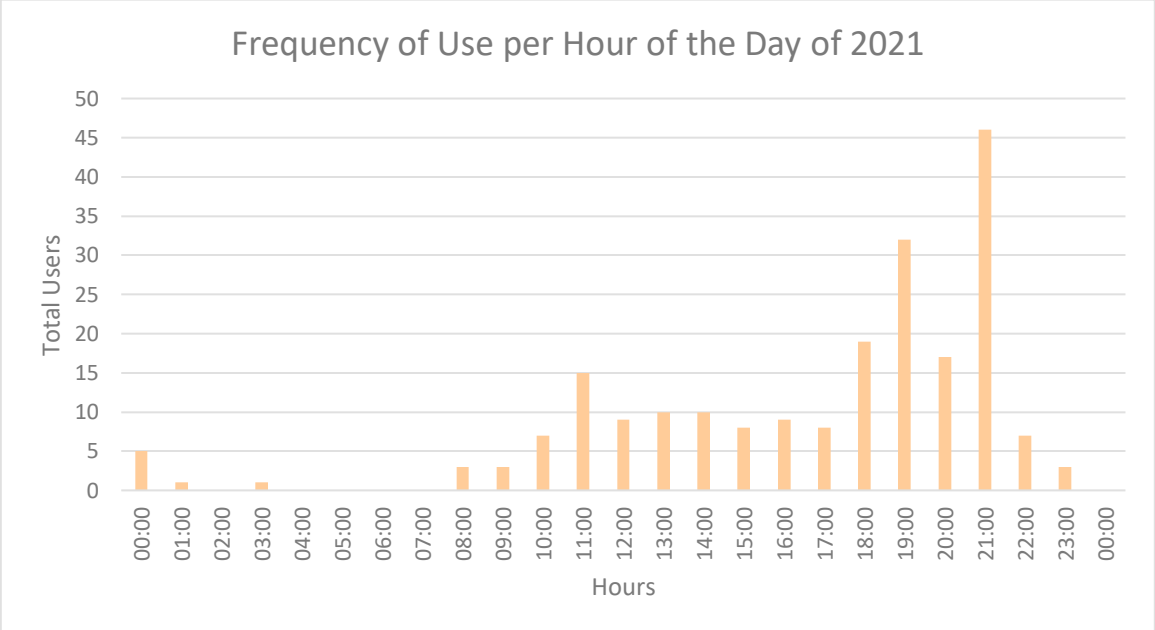


Figure 7: Bicibox Hourly Usage throughout the day

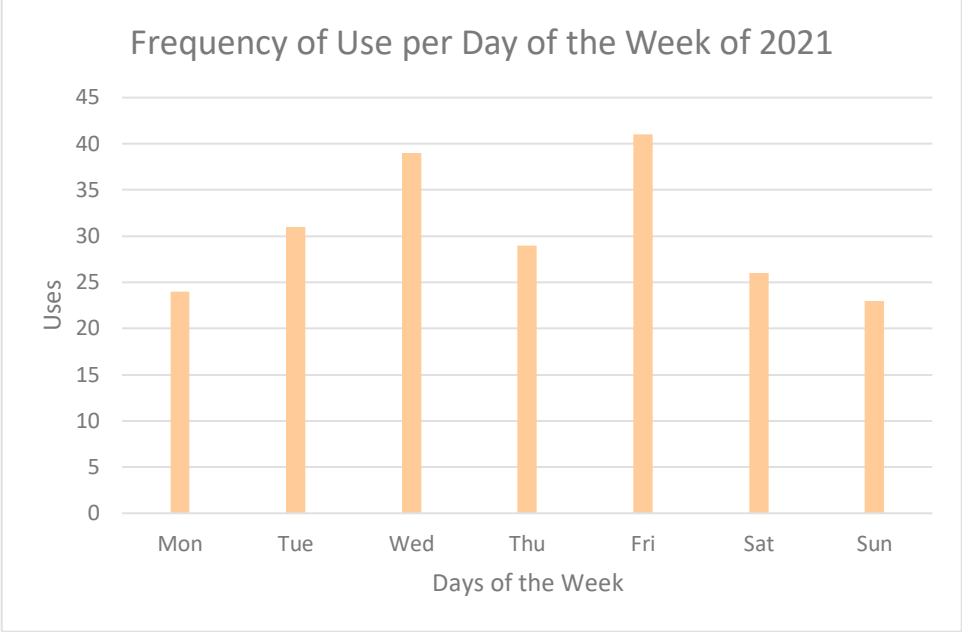


Figure 8: Demand for Bicibox service throughout the week.

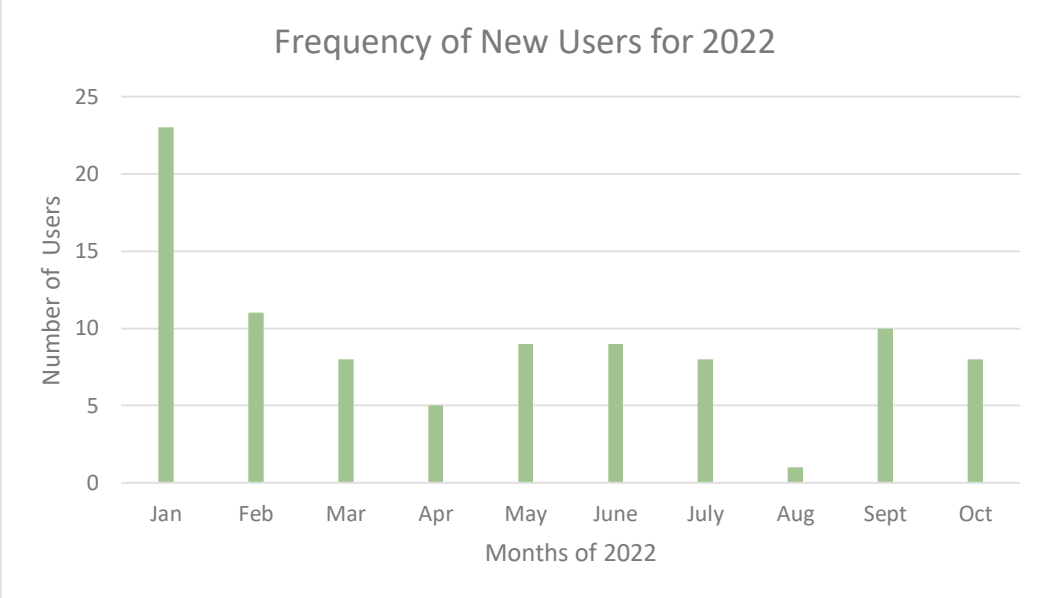


Figure 9: Chart of new Bicibox users for the year 2022.

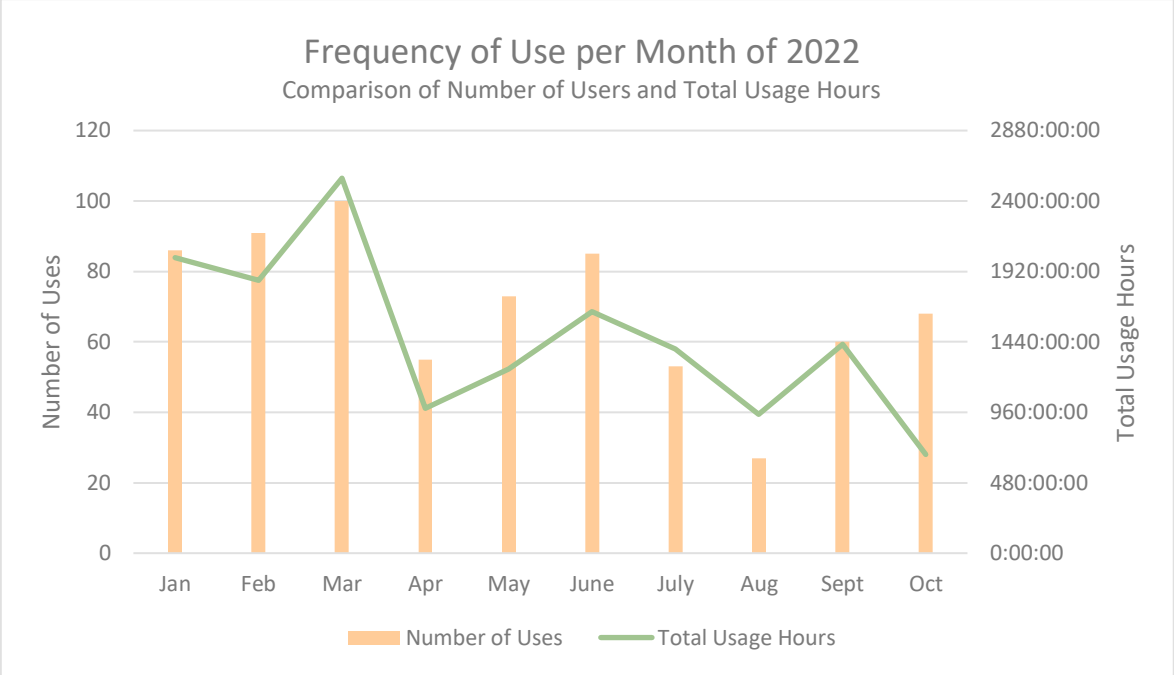


Figure 10: Chart comparing the number of usage and total usage hours for the year 2022.

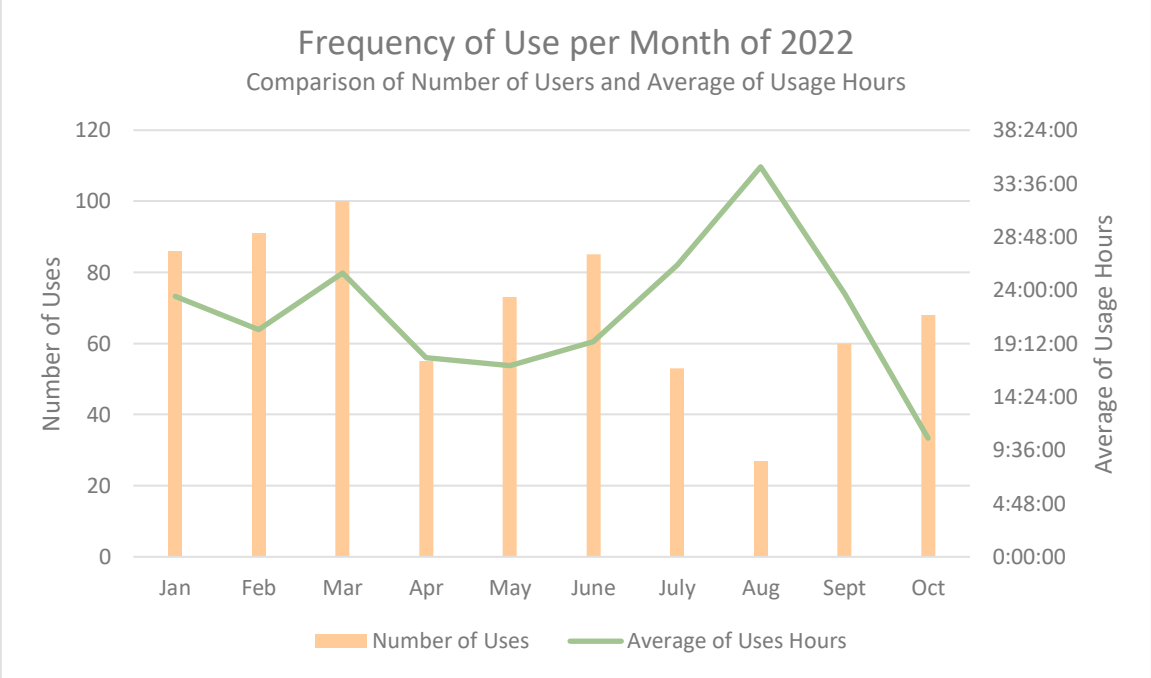


Figure 11: Chart comparing the number of uses and average usage hours for the year 2022.

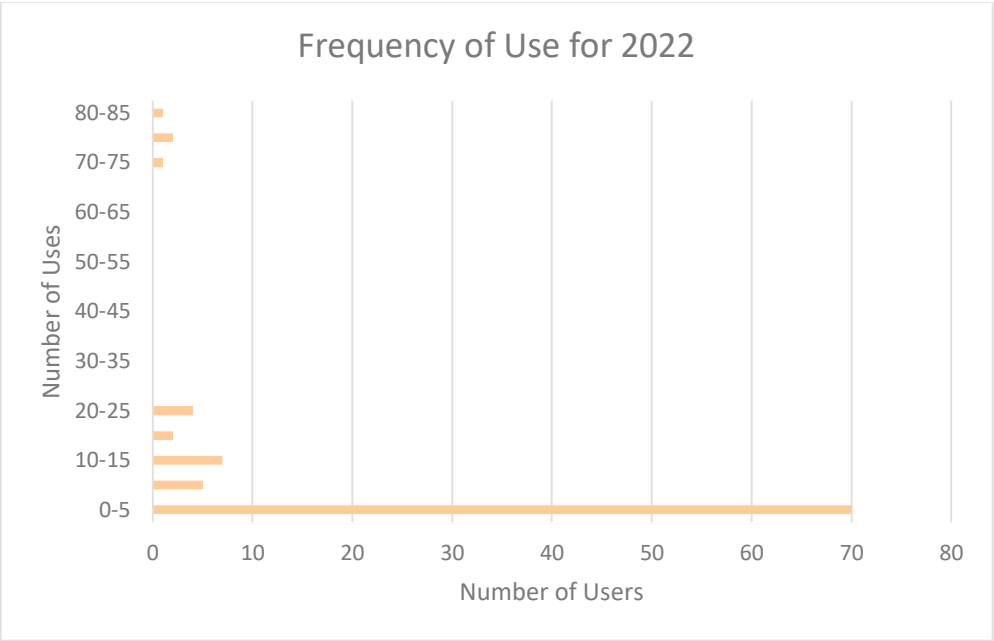


Figure 12: Frequency of Use of Bicibox for the year 2022.

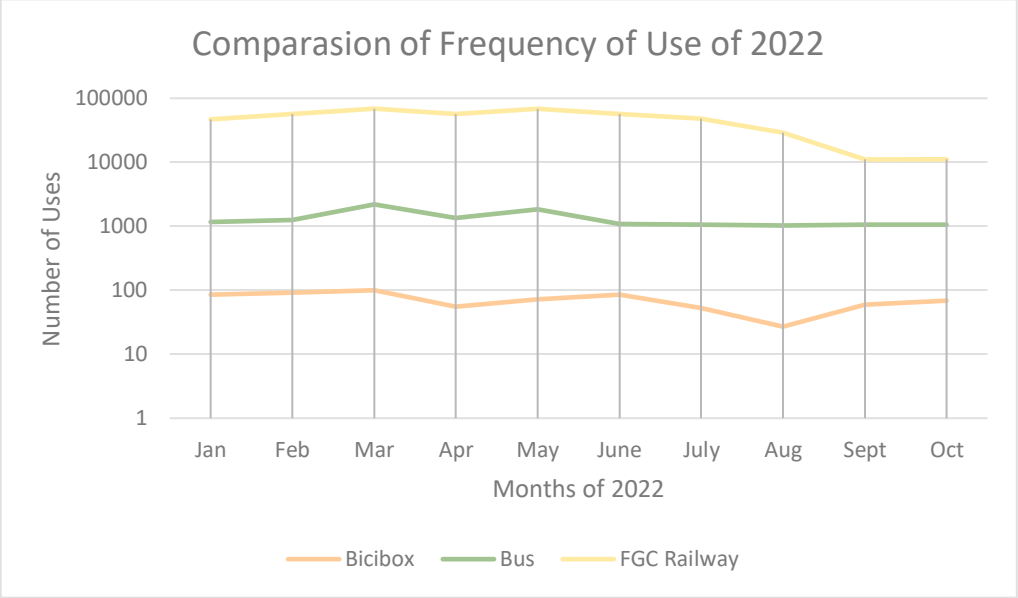


Figure 13: Logarithm chart comparing uses of FGC Railway, Bus and Bicibox in Mira-Sol for the year 2022.

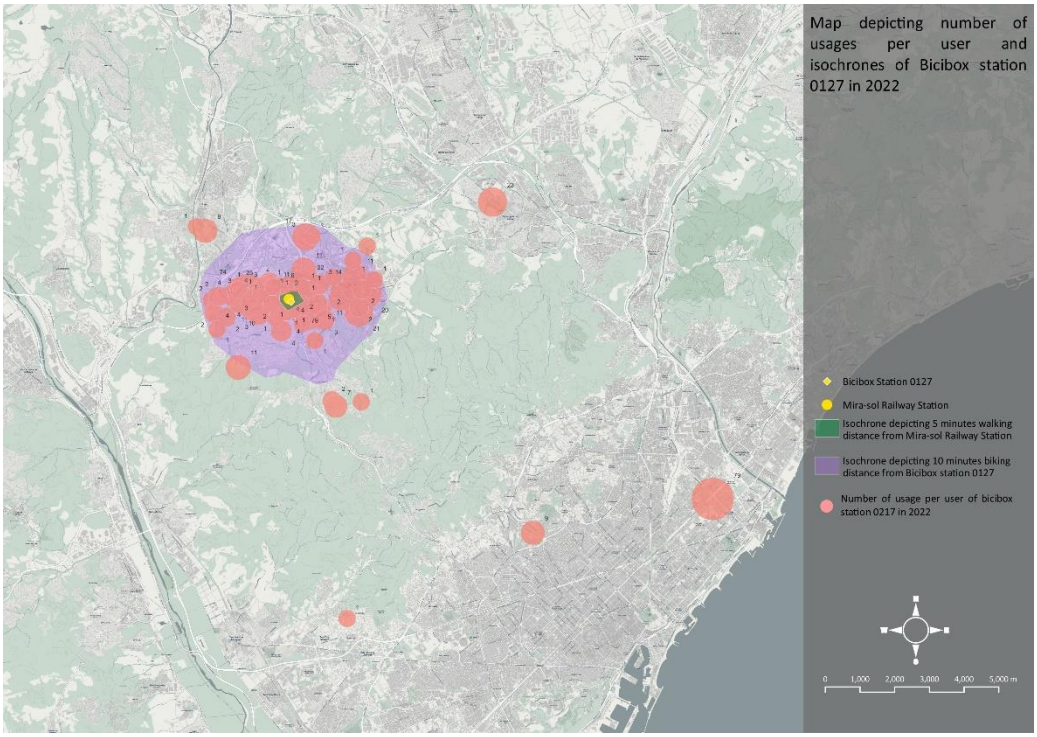


Figure 14: Zoomed-out map depicting number of uses per user and isochrones of Bicibox station 0127 in FGC Mira-Sol.

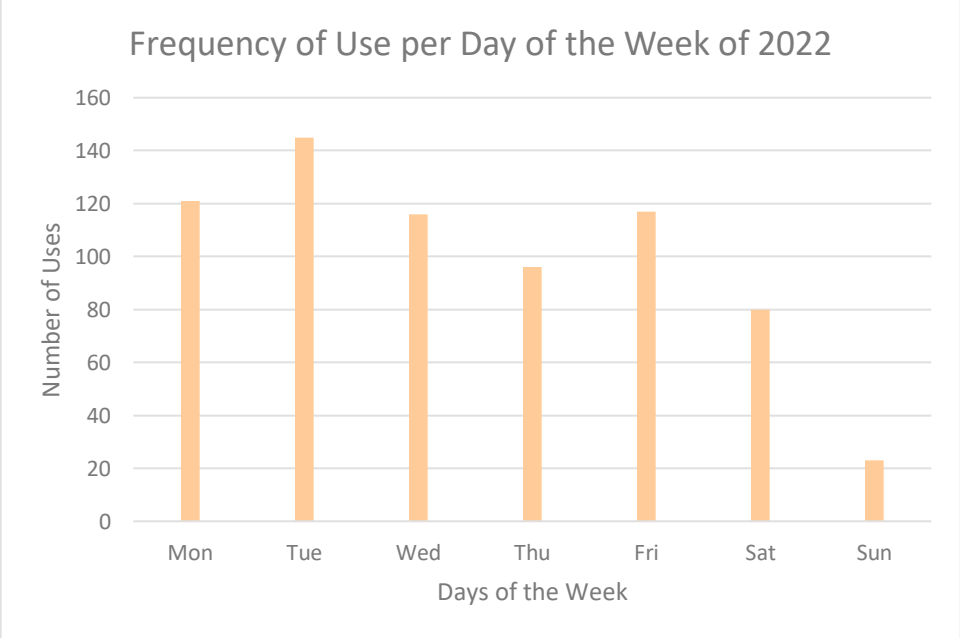


Figure 15: Demand for Bicibox throughout the week.

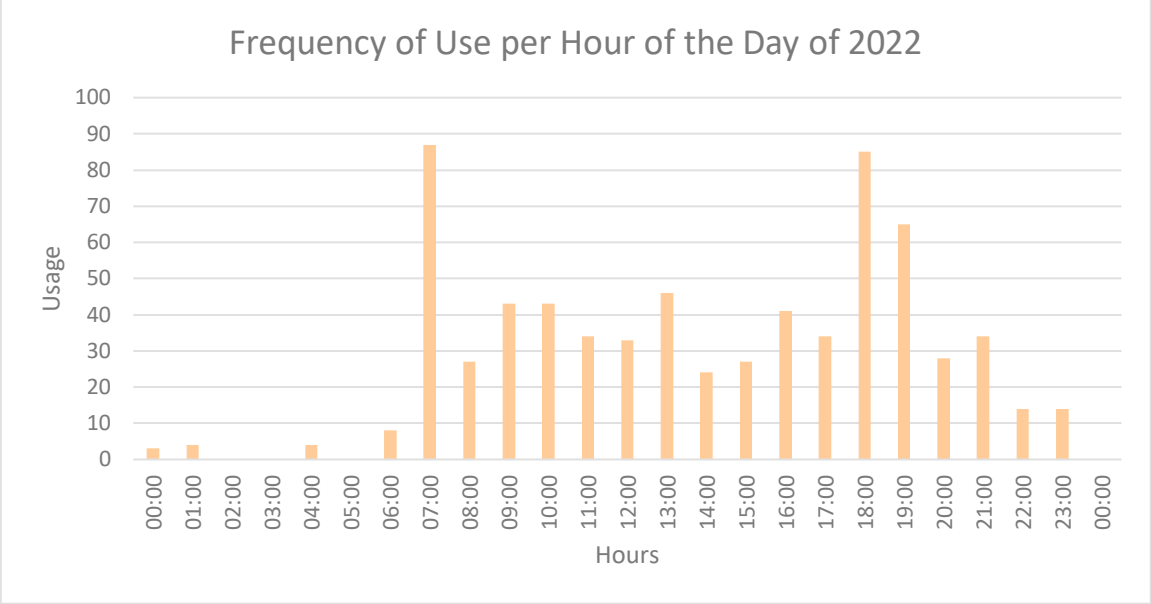


Figure 16: Demand for Bicibox throughout the day.

Appendix II – Memo Behavioural motives in Helmond

8 November 2022

Introduction

In this memo we compare the insights from some scientific literature on psychological behavioral factors involved in shared mobility as compiled by behavioral psychologist Thomas Bast (at the Municipality of Helmond) with the results from the EIT Smart Mobility pilot in Helmond - Brandevoort.

Value mapping the motives

The available literature turned out to be mainly about shared cars. A scientific study by Schaefers (2012)[4] investigated what motivates people to use or not to use **shared cars**. In a so-called 'hierarchical chain analysis', it has been mapped out which factors are involved and how strong the mutual relationship is. For example, look at the value map below. The multiplicity of relationships already indicates how complicated psychology and behavior can be.

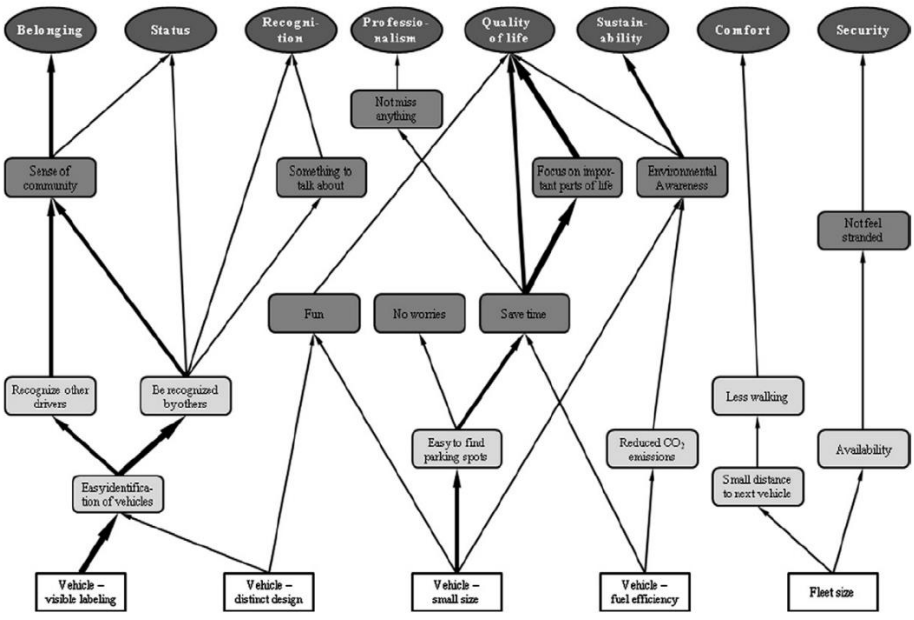


Fig. 2. Hierarchical value map for vehicle attributes.

[4] Source: https://www.sciencedirect.com/science/article/abs/pii/S0965856412001632

In short, this figure shows that certain characteristics that the shared cars have can be traced back to certain basic human needs, like **belonging** , **sustainability** and **quality of life** .

The same chain analysis was done for the terms of service of the car-sharing provider. See map below.

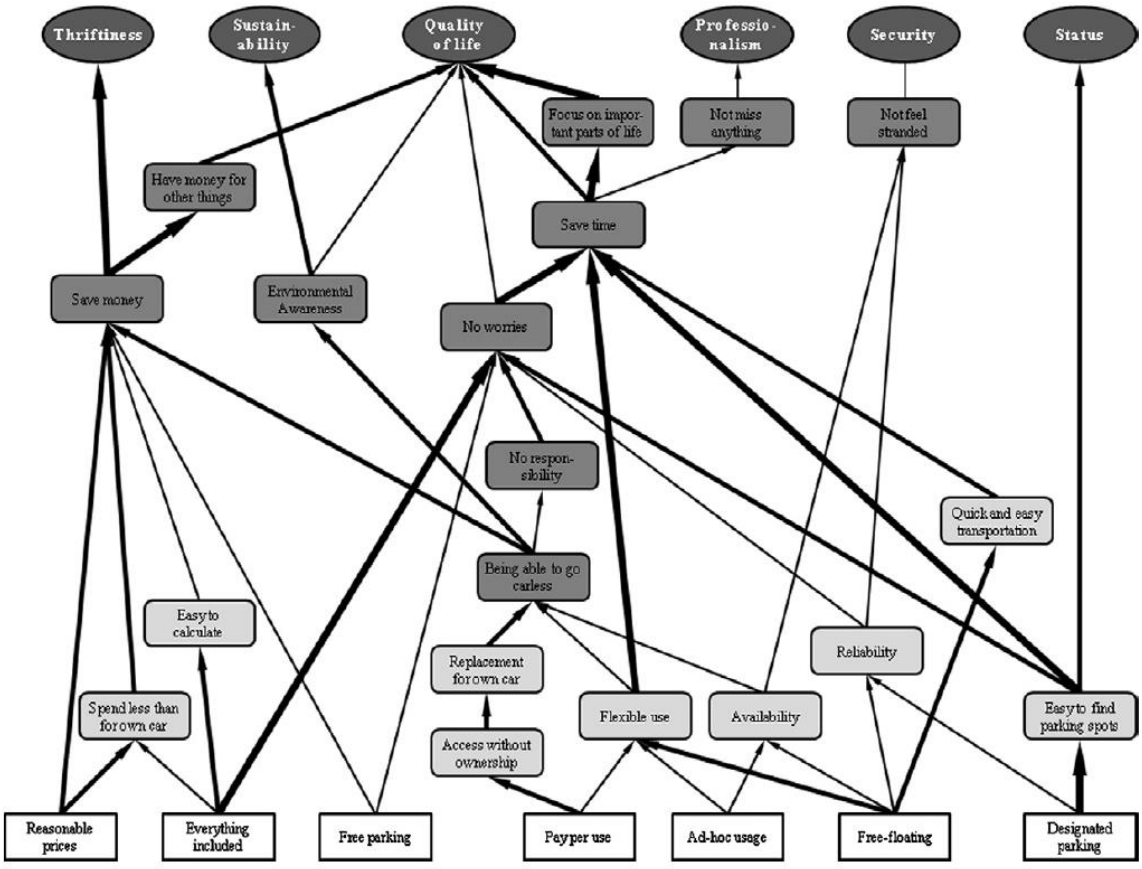


Fig. 3. Hierarchical value map for service attributes.

How could we use this value map?

One should read this value map from bottom to top. The thicker the arrow, the stronger the relationship.

For example, take **designated parking** at the bottom right. Reserving designated parking spaces for shared cars in public space makes it relatively easy for shared car users to find a parking space. This contributes directly to the fundamental psychological need for **status** ("I can park quickly and easily at my destination in a reserved place. That puts me in a position of luxury") and being able to easily find a parking space **contributes to time savings.** That in turn

ensures that people have more time for fun things, such enjoying a coffee before their appointment. In the figure this is called **focus on important parts of life** and **quality of life**.

Everyone has different values/thinks other things are important

In the study, the motives that have to do with car sharing could be divided into four different motivational patterns, taking into account the above relationships.

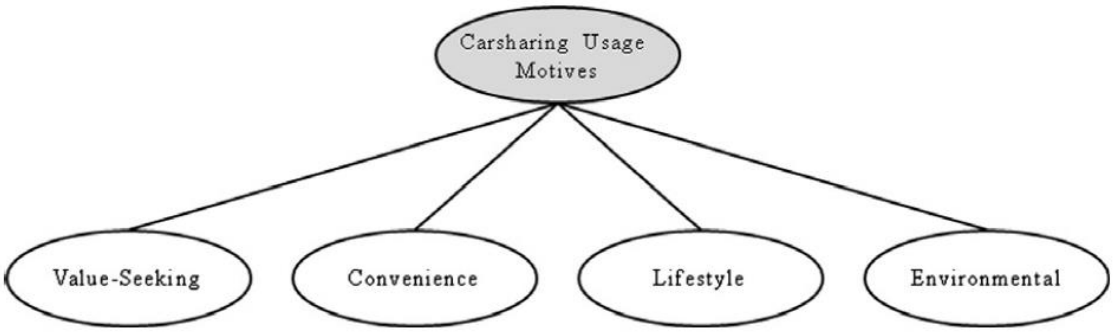


Fig. 4. Motivational patterns of carsharing usage.

Value-seeking: one is focused on the benefits associated with cost savings. One has the strong psychological need for thrift with the aim of using this money for things that improve quality of life.

Convenience: in a shared car provider, people mainly look for convenience and unburdening. Making life easier and organizing it efficiently; no hassle with searching for parking spaces, few responsibilities in the field of, for example, maintenance and insurance, flexible use possibility, easy payment and a clear price model.

Lifestyle: shared cars are used in a symbolic way as a form of self-expression. One gets satisfaction from showing others that they are part of a group. People find the things associated with how you come across to others more important than the benefits associated with car sharing. Think of status, the possibility to inform others and make them enthusiastic about car sharing and thus make the *blitz*. And the pleasure one can have in driving in different small cars.

Environmental: altruism is central to this. Car sharing is more sustainable and better for the environment. Less environmental impact contributes to a better quality of life in the longer term.

What is good to mention is that the study is qualitative and exploratory in nature. This means that there are no hard statistical figures behind it, but that it does offer some insight. The 2021 study '*Behavioural perspective on car owners' uptake of shared e-mobility: Car owners' motives for, and barriers to, trying out a vehicle from a Smart Shared Green Mobility Hub'* by the

research group Psychology for Sustainable Cities[5] (Amsterdam University of Applied Sciences) comes to more or less the same conclusions.

How does this relate to the pilot in Helmond – Brandevoort?

The hub in Brandevoort was not a big success. We tried hard to get more users but hub users in this area didn't respond much on discounts in price nor on extra information, compared to other hub-locations. Hely indicated that they think this is because price or availability is less of a motivator to travel in a more rural area like Helmond Brandevoort than for example in the city where shared mobility can be seen as an alternative for public transport. When the costs are low, people tend to use an individual mode of transport vs. public transport. When we look at the scientific literature we can agree that inhabitants of Brandevoort simply lack motivation to use shared cars:

- Value-seeking: is probably not much of an issue as this is a high income area;
- Convenience: in our own research sustainability and convenience are the two most important reasons (over one third of the group) mentioned for using shared transport, with other users indicating that it is convenient to have an extra means of transportation on hand. However, most households in the area already own one or two cars which they can park conveniently and for free on a short distance from their homes and thus have an even more convenient option.
- Lifestyle: the inhabitants in this area are more conservative and probably derive more status from the cars that they own exclusively. The users of the e-car used it instead of using a second car, it did not seem to have anything to do with status. The cargo bike however did fit into the lifestyle of certain inhabitants and at least one household bought their own cargobike after using the shared model;
- Environmental: in our own research sustainability and convenience are the two most important reasons (over one third of the group) mentioned for using shared transport. It was clear that the early adopters in the neighbourhood were definitely aware of the smaller environmental impact of shared cars and a shared cargo-bike and this has been a good starting point for the introduction of the vehicles in the area.

Conclusion

The pilot was carried out in Brandevoort instead of Brainport Smart District (BSD) because the latter neighborhood's development was delayed and there were not enough inhabitants. We think that the pilot had been a greater success if the original plan had been carried out because the BSD inhabitants have much more motive to use shared transport;

1. Value-seeking: the average income will be lower than in Brandevoort so more room for value-seekers;

[5] Kreemers, L.M., Tamis, M., Brecht, J. van, Gent, M. J. van (2021)

2. Convenience: it is going to be a neighborhood where people own less cars and where cars can not be parked very near of their homes so it will probably be more logical and convenient to use shared mobility (if offered in a convenient way);
3. Lifestyle: people who opt for BSD embrace more sustainable and joint/communal lifestyles; using the same shared mobility can make them feel part of their community / group which can be a motivation to use it;
4. Environmental: see 3.

Distance

Last but not least we would like to stress the fact that 'The smart hub' does not exist. An important component is the range of facilities on the hub. One to a few shared cars in combination with some (electric) (cargo) bicycles have a smaller catchment area than a hub with a larger and more diverse range of modalities. The former is usually called a neighborhood hub (like the one in Brandevoort), the latter an area hub. At the area hub, there is often room for other facilities that fulfil a (social) function[6]. The report shows that people are willing to walk to a small-scale hub about 300m (variety between 200 and 500m). The Dutch institute CROW states that people are willing to walk 100 to 350m to a specific shared car. The fact that the Brandvoort neighborhood is not a very densely populated area could therefore be another factor that explains the lack of interest in the hub; the distance might also have made the hub less attractive to people (less convenient).

The statements in this memo are based on our own observations and the limited available data that we had. More research on 'rural' neighborhood hubs is recommendable.

Thomas Bast and Francine Linssen- November 2022

[6] Report *space claim shared mobility Helmond Centrum*, AT Osborne 2022.