AmsTErdam BiLbao cItizen drivEn smaRt cities

Deliverable 4.6: Shared cars platforms evaluation

WP4, Task 7.2

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Contributions of Partners

The following list depicts the main contributions from project partners in the development of this deliverable.

Partner short name	Contributions
AMST	Overall content to all sections

Table 1. Contributions of Partners

Abbreviations and Acronyms

Acronym	Description
eHUB	Name of the Interreg project on shared electromobility
SDG	Sustainable Development Goals
KIM	Knowledge Institute for Mobility-policy
MaaS	Mobility as a Service
CDS-M	City Data Standards-Mobility
WP	Work Package
PED	Positive Energy District

Table 2. Abbreviations and Acronyms

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0. Executive Summary

This report is based on the Amsterdam experience with developing shared e-mobility hubs. The objectives of the work can be described as:

Build, test and validate functioning of car sharing platforms. Including the governance and legal aspects of such platforms with the following impact:

- Better air-quality
- Transport related CO_2 emission reduction
- Less occupation of public space by cars

The work described is based on activities on different levels as the city of Amsterdam is involved in various projects that each focus on different aspects of mobility. In the ATELIER project with its target of realizing and investigating positive energy districts (PED), this is mainly the energy use of mobility, determined by amount of km travelled, modality and fuel used. On the other hand there is the Interreg eHUBS project, that has a specific goal of implementing and investigating all important aspects of shared e-mobility hubs. The projects come together in the experience with the Buiksloterham shared e-mobility hub, that is both an element of ATELIER and eHUBS.

An overview of all the hubs is provided, together with their characteristics. This is followed by the Amsterdam approach to e-hubs, which can be characterized as a bottom-up approach. Amsterdam considered this to be the right approach for this city, but other approaches may be more applicable depending on the local situation.

The experience with the e-hub in the ATELIER PED is described in detail, together with some reflections on the concept of e-hubs that have appeared in the national press, to give some context to the findings and lessons that form a major chapter of the report. A selection of important lessons is given below:

- e-hubs are not an end in itself and it is important to always keep in mind that they should be of added value to the society and the environment. Therefore, it is necessary to assess whether e-hubs reach the goals and have an actual (positive) impact.
- It is important to always keep in mind that you want to replace trips made by (fossil fuel) car and not trips made walking or by public transport.
- To create both economic (revenue) and environmental value (modal shift), Mobility Service Providers and Local Authorities need to collaborate to develop schemes that prove to be viable for all parties.
- Digital access to shared vehicles is an important requirement to ensure a good user-experience and easy uptake of the e-hubs.
- In the relatively new and dynamic market that is evolving around Shared Mobility, regulators tend to lag mobility innovations and struggle to keep up with the pace of technological and market developments. The EU-funded GECKO-project has conducted extensive research on the issue of regulation and governance of Smart Mobility innovations.

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- A regulatory framework for e-hubs cannot only be focused on providing favorable conditions for shared mobility services, but it should also incorporate measures that reduce the convenience of private car use and ownership.

Main conclusions are that:

- There is significant growth of shared mobility in Amsterdam, but compared to private mobility volumes it is still a niche
- It is expected that shared e-mobility will only become significant if the traditional car-owner solution will become particularly unattractive
- The role of behavior change (with respect to choices in mobility options) should not be underestimated
- It is important to avoid exclusion of inhabitant groups that are particularly dependent on nearby, easy mobility solutions, e.g. people with disabilities, elderly people.

1. Background

Our planet is heating up. A disbalance in CO_2 uptake and emissions due to excessive burning of coal, oil and gas and the cultivation and destruction of natural ecosystems is currently leading to higher temperatures[2]. There is ample evidence that the increasing temperatures will have large negative consequences for human mankind, and that it will seriously affect the livability on earth. Scientists also agree: humans are the dominant cause of the current global warming[3]. To slow down and prevent exceeding temperature rises, it is crucial that we reduce our CO_2 emission. The goal is set on carbon neutrality by mid-21st century.

Transport is one of the most polluting sectors regarding CO_2 emissions. It accounts for approximately one-fifth of global emissions, with three quarters of emissions coming from road travel. Almost half of the emissions come from internal combustion engine passenger vehicles, such as private cars. As transport demands are still increasing due to a growing global population and an increase in average wealth, private car ownership and CO_2 emissions are likely to grow even further. To retain and reduce CO_2 emissions by passenger vehicles, action is needed.

[2] IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 3−32, doi:10.1017/9781009157896.001

[3] IPCC, 2022: Summary for Policymakers. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001

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Electric shared mobility is seen as one of the solutions for the reduction of CO_2 emissions by passenger traffic[4]. Shared mobility is defined as a transportation service in which vehicles are shared between users. This can be either through a private construction, in which a fixed user group shares responsibilities and costs, or via a commercial provider with a vehicle fleet. Electric shared mobility has two environmental advantages over private owned fossil fuel cars. First, electric engines of electric shared cars lead to less CO_2 emission per kilometer traveled. Second, shared mobility leads to volume reduction in terms of vehicles and distance traveled. Research shows that a shared car can remove up to 23 cars from roads, leading to less cars on the streets. Furthermore, after switching to shared mobility, on average less kilometers by car are traveled[5].

One particularly important aspect of electric shared mobility is that it should replace more polluting trips with less polluting ones. This means e.g. replacing fossil-fuel car trips by electrical ones (Electric car, moped or bike). To illustrate, the following graphic shows the desired hierarchy in transportation.

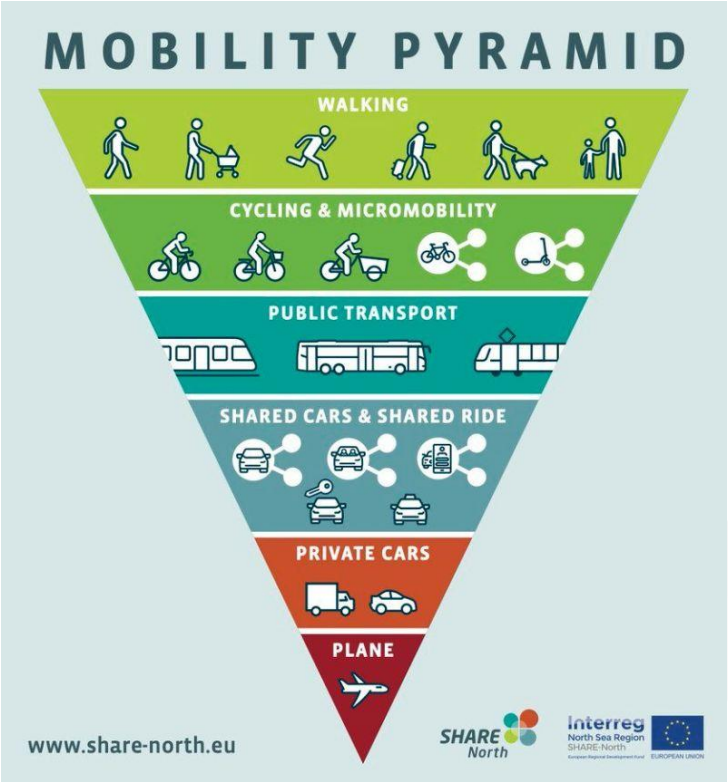

Figure 1-1 Mobility pyramid

[4] Chen, T. D., & Kockelman, K. M. (2016). Carsharing's life-cycle impacts on energy use and greenhouse gas emissions. Transportation Research Part D: Transport and Environment, 47, 276-284.

[5] Martin, E., & Shaheen, S., (2016). Impacts of car2go on Vehicle Ownership, Modal Shift, Vehicle Miles Traveled, and Greenhouse Gas Emissions: An Analysis of Five North American Cities. Transportation Sustainability Research Center, Berkeley, CA.

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2. Objectives and Expected Impact

2.1 Objectives

The objective of task 7.2 on: “Electromobility/shared cars platform” is given in the ATELIER Annex 1 as:

Build, test and validate functioning of car sharing platforms. Including the governance and legal aspects of such platforms. The city of Amsterdam is planning an electromobility sharing hub in the PED. Discussions with operators are taking place. Expansion of the facility to include smart charging and/or vehicle to grid pilots are under consideration.

2.2 Expected Impact

The following qualitative impacts are expected from e-hubs.

- Better air-quality
- Transport related CO_2 emission reduction
- Less occupation of public space by cars

The expected impact of the Buiksloterham e-hub related to the PED activities are:

- Reduction of the amount of privately owned cars in the PED.
- Better understanding of the drivers for people to participate in e-hub mobility schemes.
- Providing a mobility solution for the Schoonschip floating neighbourhood

The Buiksloterham e-hub consists of about 7 electric cars and some cargo bikes and e-bikes. The direct impact on air quality in a neighborhood of thousands of dwellings is small and difficult to measure. On the other hand, the Schoonschip community has 46 dwellings. So, if the e-hub can evade private car possession in the 46 households, this would be a significant reduction.

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3 Introduction

The purpose of this deliverable and the work behind it in the ATELIER project is to address an important element of a Positive Energy District (PED), which is mobility and its associated energy use. Furthermore, PED's have the goal to be pleasant and comfortable living spaces. This touches upon clean air, a safe and uncluttered public space and on the pressure on public space at all, which is an issue in ever more densely populated cities.

The work described in this report is based on activities on different levels as the city of Amsterdam is involved in various projects that each focus on different aspects of mobility. In the ATELIER project with its target of realizing and investigating positive energy districts (PED), this is mainly the energy use of mobility, determined by amount of km travelled, modality and fuel used. On the other hand, there is the Interreg eHUBS project, that has a specific goal of implementing and investigating all important aspects of shared e-mobility hubs. The projects come together in the experience with the Buiksloterham shared e-mobility hub, that is both an element of ATELIER and eHUBS

3.1 Purpose and Target Group

The purpose of the deliverable is to summarize recent work on shared electromobility in Amsterdam and more particularly that in the PED. This should provide future parties involved in PED development with main insights in the do and don'ts related to shared e-mobility hubs (e-hubs) and offer them a head start when planning to incorporate e-hubs in their PED. Main target area is Amsterdam as most of the examples, surveys etc. come from this area. The lessons from eHUBS however, are more comprehensive as they e.g. touch upon differences in approach by the different eHUBS cities (bottom-up versus top-down or mixed), on the implementation process. Lessons learned on the various aspects can be found in this report.

3.2 The eHUBS project in short

eHUBS are on-street locations that bring together e-bikes, e-cargo bikes, e-scooters and/or e-cars, offering users a wide range of options to experiment and use in various situations. The idea is to give a high-quality and diverse offer of shared electric mobility services to dissuade citizens from owning private cars, resulting in cleaner, more livable and pleasant cities.

eHUBS can vary in size (minimalistic, light, medium, large), type of location, and type of offer. They can be small and located in residential areas, with just one or two parking spots, or bigger and positioned close to stations and major public transport interchanges, but, in the end, the key is that they should always be where supply and demand meet.

Actions

Six partner cities from five different countries realise and promote eHUBS and pave the way for others to do the same. The eHUBS implementation approach will differ according to the size and needs of the respective cities.

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In doing so, it will develop knowledge, best practices and a blueprint that would lead to replication of the experiences in other cities and regions, as well as a consistent reduction of air pollution, congestion and CO_2 emissions in the cities and a growing market for commercial shared e-mobility providers aligned with local policy goals.

Long term effects

By kickstarting the mobility transition in 6 pilot cities the project will set an example for other cities in Europe, which will be able to benefit from applying the blueprint and copying best practices. A large-scale uptake will cause a leverage by significantly reducing CO_2 emissions in the cities and creating a growing market for commercial shared e-mobility providers.

The different aspects

- Clean air
- Governance
- Behavior change
- Policy
- Stakeholder management
- Communication

3.3 The Amsterdam eHUBS

At the following link you can find where the 17 eHUBS are located (situation summer 2022): https://duurzaamamsterdam.net/vervoer/buurthubs-elektrisch-deelvervoer/

See the map:

Figure 3-1 The location of the Amsterdam eHUBS

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Each BuurtHub offers a different combination and quantity of partial transport, which has been put together in consultation with the neighbourhood. Below, a brief description of the various hubs can be found. In general, the service area for the BurtHubs is up to 500m around the hub. The composition of the hub fleet is frequently changing based on actual demand .(Between brackets the provider is indicated)

There are two hubs in Amsterdam North:

- Buiksloterham, Papaverweg 37: electric cars, electric bicycles and electric cargo bicycles (Hely).
- J.H. Hisgenpad 2: e-scooter (Check), electric cargo bike (Cargoroo), electric car (SHARE NOW) and electric bicycle (Sharing bicycle Netherlands).

Six hubs in South:

- Daniël Stalpertstraat 28: electric bicycles (Urbee) and electric cargo bicycles (Cargoroo).
- Gerard Doustraat 13: electric bicycles (Urbee) and electric cargo bicycles (Cargoroo).
- Quellijnstraat 39: electric bicycles (Urbee) and electric cargo bicycles (Cargoroo).
- Parnassusweg 126-128: electric car (SHARE NOW), electric cargo bike (Cargoroo) and electric bicycles (Bondi).
- De Boelelaan 30: electric car (SHARE NOW), electric cargo bike (Cargoroo) and electric bicycles (Sharing bicycle Netherlands).
- De Boelelaan 769: electric cargo bike (Cargoroo) and electric bicycles (Sharing bicycle Netherlands).

Four in East:

- Wibautstraat 129: electric cars, electric bicycles and an electric cargo bike (Hely).
- Science Park, on the corner of Kruislaan and Carolina Macgillavrylaan: electric bicycles (Bondl), electric scooters (felyx) and electric cargo bicycles (Cargoroo).
- Science Park, Carolina Macgillavrylaan 1672: electric bicycles (Bondl), electric scooters (felyx), electric cargo bicycles (Cargoroo) and electric cars (SHARE NOW).
- Science Park, along the facade near the Faculty of Science corner USC: electric bicycles (Bondl) and electric scooters (felyx).

Three in West:

On the corner of Lumeijstraat and M.H. Trompstraat: electric bicycles (Bondl), electric scooters (felyx) and electric cargo bicycles (Cargoroo).

On the corner of Admiralengracht and Pieter van der Doesstraat: electric bicycles (Bondl), electric scooters (felyx) and electric cargo bicycles (Cargoroo).

At the Chassékerk in the Chassébuurt: electric bicycles (Bondl), electric scooters (felyx) and electric cargo bikes (Cargoroo).

Two hubs in New West:

- Hendrikje Stoffelsstraat 1: electric cars, electric bicycles and an electric cargo bike (Hely).

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- Osdorpplein: electric scooter (felyx), electric cargo bike (Cargoroo), electric car (Amber) and electric bicycle (Sharing bicycle Netherlands).

One in the Center:

- Marineterrein, Kattenburgerstraat 5: electric bicycles, electric cargo bicycle and electric car (Hely).

There are two cases in Amsterdam in the Buiksloterham, of which one (Papaverweg) is involved in the ATELIER positive energy district (PED) project.

3.4 The Buiksloterham (Schoonschip) eHUB

This hub was one of the first to be implemented. Its location was determined with the Schoonschip floating neighbourhood as one of the main drivers, Schoonschip is the initiative of a group of entrepeneurial citizens that developed their own floating neighbourhood which is meant to be the most sustainable floating neighbourhood of Europe. Realisation was a tedious and time-consuming effort for which the first ideas were sketched in 2008 and final realization was completed in 2019. As the dwellings do not have any property on-shore, a solution needed to be designed for (sustainable) mobility This solution was found in the eHUB at the Papaverweg. Details on this hub and experiences follow in chapter 5.

4 Amsterdam Overall Approach to e-hubs

4.1 Initiation

The city of Amsterdam has ample experience with participation processes and adopted a bottom-up approach to the implementation of e-hubs in the city. This draws heavy on stakeholder management capacity from the municipality and the approach limits the influence on adapting the hubs to the mobility system of an urban area, But the benefits of a bottom-up approach seemed to outweigh this. When interested citizens work together in realization of an energy solution for themselves, this will enhance the chances for success. An example is a city street experiment the “proeftuin Weesperzijde” where citizens experimented with a car-free zone in their neighborhood as part of the neighborhood redesign process. The following map has been created by the municipality of Amsterdam to help with the assessment of mobility solutions in different parts of the city.

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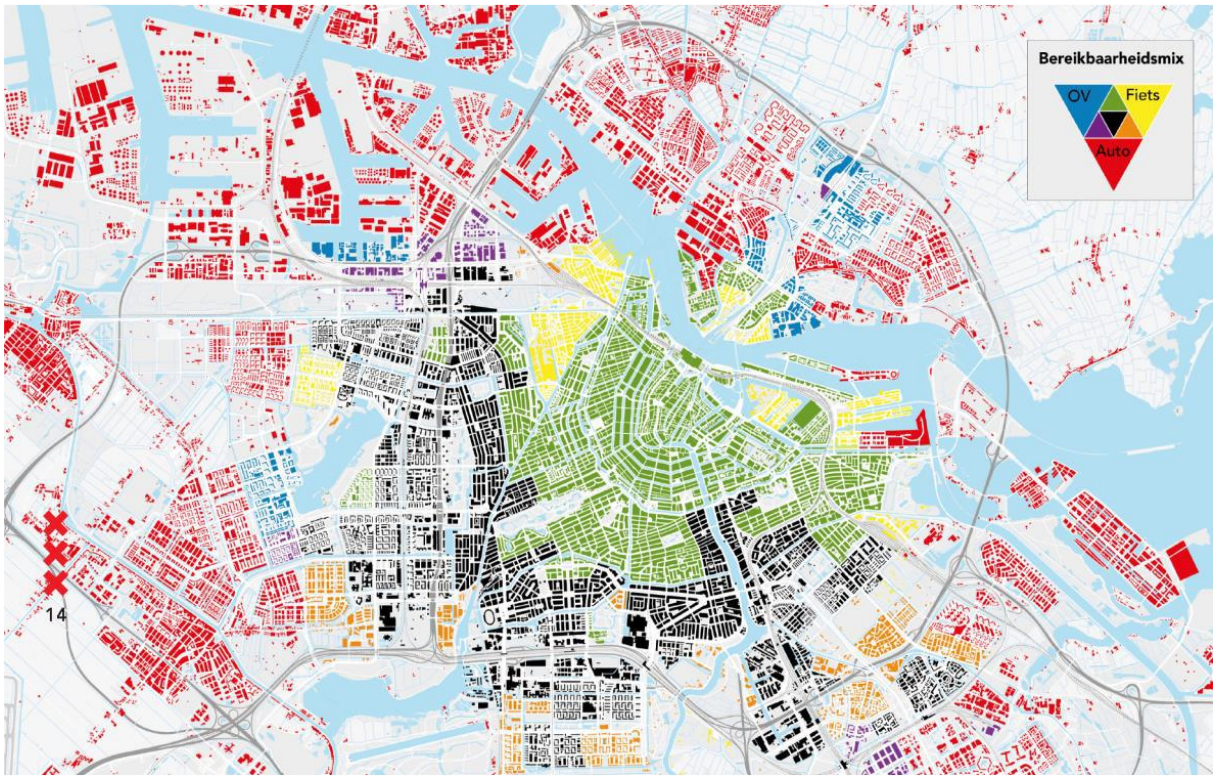

Figure 4-1. Accessibility by mode of transport in Amsterdam.

Colors indicate which mode of transport characterizes areas in the city. Blue is public transport; yellow is bicycle; red is automobile; black denominates that an area is well accessible by all three modes of transport. Source: Gemeente Amsterdam, 2015.

5 Experience and Evaluation of the Buiksloterham (Papaverweg) eHUB

5.1 Setup of the hub

The Buiksloterham hub can be characterized as a local/neighborhood hub to strongly promote the usage of micro-mobility and shared vehicles as an alternative to privately owned cars. Initially the hub consisted of 5 electric cars and 7 electric bikes, available exclusively for the Schoonschip community.

As a mobility solution was urgently needed in 2019, the Municipal project office in Amsterdam Noord assisted with finding a suitable location and issued a tender for contracting a mobility provider. As there is huge demand for space in the city, it was not possible to provide a permanent solution right from the start. The current location of the hub at Papaverweg 37 will need to be abandoned as further development of the Buiksloterham area takes place. The site is currently co-occupied by the construction office of Republica and the development of this building block was delayed by more than a year by various COVID related effects (Job security

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of possible apartment buyers, affecting apartment sales and financing issues around the construction of the hotel). The delay there means the site is longer available for the hub. The Municipality has agreed with Schoonschip that they will assist in finding a new location in due time.

The urgency of the mobility solution in 2019 resulted in a tender in which complicating factors were avoided, so the were no requirements for e.g. local renewable energy generation by means of a PV-carport.

The visibility of the hub was limited during the pilot as it is a bit hidden behind the construction offices of Republica. Not ideal, but as the original target group was the Schoonschip population, it was not a major issue.

Figure 5-1 eHUB at Papaverweg in Buiksloterham, spring 2020

5.2 Operational experience of the hub

5.2.1 Quantitative

In June 2020, an internal (user) evaluation of the Papaverweg hub was conducted, based on one year of operation. Based on private communications, it can be concluded that there were teething troubles, that can be traced back to various causes that will be discussed in the next section.

Based on Schoonschip's own assessment, the use of the hub was below expectations that were based on a survey in 2018. Only 60% of the adult inhabitants registered. Of those, only a handful use the hub frequently (8 or more trips per month). It appeared that only 4 cars would mean a 95% availability. The fear was that the amount of vehicles would be reduced if usage would not increase. See the quantitative data in the Annex "Analysis 3 years of shared e-mobility hub Papaverweg".

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As for possible reasons, the following ones were identified:

- In 2019, Schoonschip was not fully inhabited the entire year
- In 2020, when utilization seemed to go up, COVID kicked in (week 10 of 2020).
- Cost considerations
- People kept the cars they already had and which could be parked free of charge at a distance of a few km.

The data of 2022 now show that the hub and its utilization go up now the COVID period seems over and the hub is opened to a wider group of people.

5.2.2. User experience

Complaints are always earlier expressed than good experiences and many of those existed from happy users. A few elements of the hub were mentioned that would enhance the user experience.

- User friendliness of the app to use the vehicles.
- Choice in types of cars (with towbar, stationwagon)

In the course of 2020, it became clear that the operator HUUB would be taken over by HELY, a mobility provider linked to the national railway company. This opened the outlook for an app that combined the best of the apps of HUUB and HELY.

Further, now that more was known on the actual usage of the hub by Schoonschip, a start was made early 2021 with opening up of the hub for other inhabitants in the neighbourhood in order to be able to keep the hub and increasing the attractiveness for the operator. (The situation around summer 2020 was not profitable at all).

Early in 2023 it still seems to be a struggle to strike the right balance between availability of transport vehicles (attractiveness for users) and the profitability of the e-hub. The development in the future depends a lot on municipal policies around public parking availability and pricing.

5.3 Shared mobility hubs in the Dutch press

In November 2021, The newspaper "Het Parool[6]" published a critical article on the carsharing "hype" that according to them started in 2015 but failed to meet expectations. It was claimed that 80% of (almost one million at the time of the article) subscribers never used a shared car and the decrease of car ownership was negligible. Yet, this article was followed up by one[7] that told the public that Amsterdam was an exception, mainly because of the lack of space in the inner city and the high parking fees.

In general, it is expected that shared electro-mobility will grow because of the following developments:

- Pressure on public space, especially in cities, and high parking fees

[6] https://www.parool.nl/nederland/deelauto-s-nauwelijks-gebruikt-verwachte-populariteit-blijft-uit~b11b929a/
[7] https://www.parool.nl/amsterdam/in-amsterdam-is-de-deelauto-wel-populair-met-zo-weinig-parkeerplek-zoeken-mensen-alternatieven~b26408d6/

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- The desire for cleaner air in cities

In order to replace a significant amount of the privately owned cars it should become unattractive to own one because of good public transport, attractive conditions for the shared mobility (nearby, available and ease of use) and cost lower than the private car. As for the latter, the price for using shared mobility is frequently considered high, because when you own a car already, the additional cost directly attributed to a ride is often perceived as being only fuel cost. This, together with the feeling of freedom that people have when your own car is always available to you, will be a tough challenge.

As will be seen in the next chapter on lessons learned: Target groups are the current car owners (to be convinced that shared e-mobility is more attractive) and younger people not yet having a car (to provide them with attractive and competitive alternatives, before they buy their first one).

As desired societal developments are also looked at as having the need for being inclusive, this will be a challenge for Mobility as a Service (MaaS) services. Research being done by KiM (Knowledge Institute for Mobilitypolicy) and reported by AT5 shows that these services are mainly attractive for highly educated, younger people and not so much for families with children and older people[8].

> *KiM conducted research into the target group for Mobility-as-a-Service (MaaS), a mobility concept that focuses on integrating and offering various modes of transport in one platform. With this, users always get the fastest and most efficient route. With MaaS, in which partial transport plays a major role, it would be possible to search, book, reserve and pay for multiple means of transport within one app. One time with public transport, the other time with a shared scooter.*
>
> *According to the research, young people are the most opportune target group for shared transport and MaaS. Especially if they come from a high economic class, are highly educated and environmentally conscious. "There are entire segments of people that we exclude with this," says Ploos van Amstel. "People who have a family want the car in front of the door where they can easily get the child seats in and out. That is not yet possible in a shared car." A car in the neighborhood is also often a requirement for seniors who are less mobile.*

[8] https://www.at5.nl/artikelen/211821/verkeersexpert-deelvervoer-is-per-definitie-elitair

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 864374.

6 Lessons learned

Both from the more comprehensive eHUBS activities as from the local experience in the Buiksloterham, lessons can be drawn. These lessons are on different aspects of the e-hubs but also on different levels, ranging from individual user experience to the impact of e-hubs on municipal mobility policy. As this report covers both the experience with an individual hub as with larger scale experience in the city, also lessons on these different scales will be covered here. The main organizational order is by topic. The key messages are in **bold** typeface.

On participation:

- **In a participation approach the results with the e-hubs (or other interventions) are probably better if it is possible to have this driven by local stakeholders and "ambassadors"** as compared to an approach where the municipality appoints an organization to implement desired developments. There will be little benefit in social cohesion and public support in the latter situation. See page 9 of the Toolbox e-hubs[9]
- A shared e-hub or neighbourhood mobility hub is often a difficult concept to grasp for citizens. The organized trial days aimed at the shared mobility experience in the eHUBS project were well received and seem to be important for successful shared mobility.
- **It is important to always keep in mind that you want to replace trips made by car and not trips made walking or by public transport.**

On vision and goals:

Before opting for e-hubs it is important to make sure they fit with your overall mobility and/or urban development strategy. Therefore, at the stage of vision development it is very important to find the answers to the following questions:

- What is your goal?
- Why is this goal important?

Amsterdam piloted the bottom-up approach to the implementation of shared e-hubs. This draws heavy on stakeholder management capacity from the municipality and the approach limits the influence on adapting the hubs to the mobility system of an urban area. In a top-down approach to hubs, communication with involved stakeholders is key. The risk of miscommunication with citizens for example is bigger than in the bottom-up approach. A mixed approach could bring the best of both worlds, bur compromises are frequently unavoidable.

Depending of the type of e-hub, attention should be paid to parking possibilities for the private vehicles with which users arrive. These are likely to be bicycles. It is more an issue for regional than for neighborhood hubs.

On charging infrastructure:

Amsterdam has a concession for charging infrastructure. However, in these contracts the concession holder decides where to put down the charging infrastructure. This means that in the end of participation they can decide to put the charging infrastructure in a completely different area or not at all.

[9] https://assets.amsterdam.nl/publish/pages/1017837/toolbox_buurthubs_english.pdf

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Finding and selecting the right Mobility Service Providers to fit the needs associated with an e-hub can differ from city to city according to their size, culture and topography.

On procurement:

It has become clear that many procurement models are possible for the implementation of e-hubs. The Interreg Project Mobi-Mix has identified several procurement types with different pro's and cons depending on the local situation, as is visible from the following graphic:

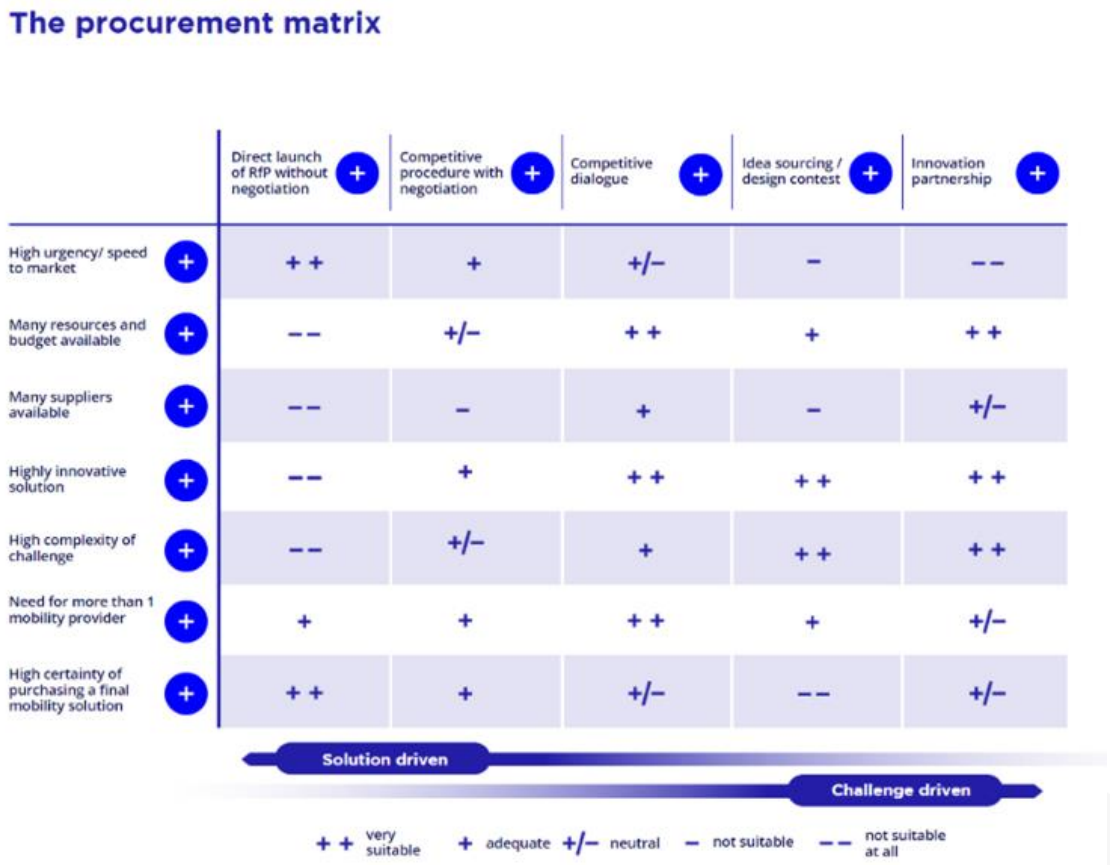

Figure 6-1 Procurement matrix from the Interreg Mobi-Mix project

On business models:

In order to create both economic (revenue) and environmental value (modal shift), Mobility Service Providers and Local Authorities need to collaborate to develop schemes that prove to be viable for all parties. This seems to be obvious but it is still a struggle to harvest the societal benefits of shared e-mobility in a model that satisfies all stakeholders

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On the impact of delays (that almost always occur in implementation of e-hubs):

- **Go for a minimum viable e-hub at the start.** Trying to design the perfect hub all from the beginning is both time consuming and you can get into trouble with stakeholder management
- A minimum viable e-hub has the potential to get your project into action relatively fast and to create a buzz around the new mobility service.
- Get feedback on your eHUBS right from the start!

On data needs and use (monitoring)

- **Digital access to shared vehicles is an important requirement to ensure a good user-experience and easy uptake of the eHUBS.** But the integration goes beyond that point. For municipalities, getting exact information about their transport infrastructure is key knowledge in order to make data-based decisions on future developments in the local mobility system.
- **The CDS-M (City Data Standards-Mobility) is a data exchange standard that was created with a focus on the metrics that municipalities need and sets "must-haves" of data that a transport operator must share.**

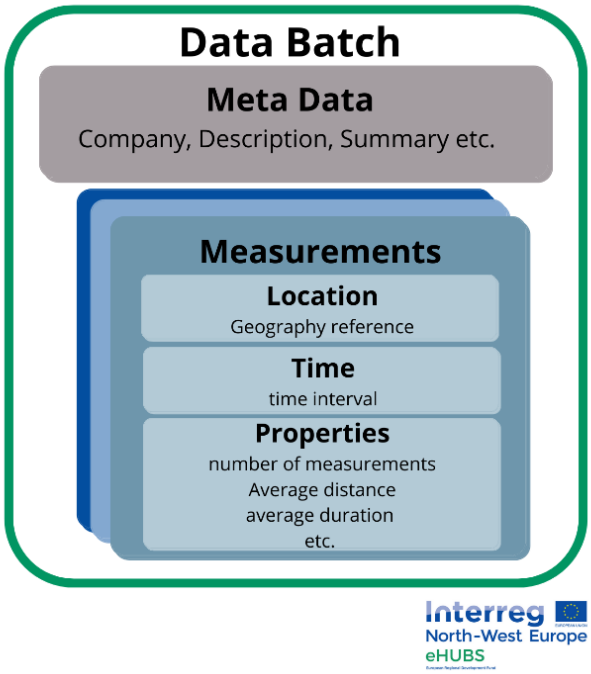

Figure 6-2 The data structure of the CDS-M framework

- There is a lot of analysis that can be done with the data. This includes use of parking space, car reduction, demand for public space, modality specific route development, clustering and curbside management and many more. More on this topic can be found in report D.7 Monitoring facilities electromobility sharing hubs.

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On vehicle fleet integrity and social control:

- The pilot cities in the eHUBS project faced some unforeseen problems especially regarding vandalism and damage done to the vehicles. There are some conclusions that can be drawn from their experiences. One is that social control is an important factor meaning that locations that are e.g. in crowded places with good lightning or neighborhoods with involved citizens, vandalism tends to be less of a problem.
- **In the phase of finding the right mobility service provider you should already include the question of vandalism and maintenance during the operation stage.**

On impact assessment:

- **E-hubs are not an end in itself and it is important to always keep in mind that they should be of added value to the society and the environment.** Therefore, it is necessary to assess whether e-hubs reach the goals and have an actual (positive) impact.
- Indicators to use could be e.g. the Sustainable Development Goals (SDG) as shown in the Annex E-hubs relevant SDG's.
- Some of these indicators are relatively self-explicatory and can be retrieved from official statistics by local or national authorities (e.g. fatalities in road traffic), others require sensors, IoT (Internet of Things)- devices or other hardware (e.g. Air quality) and some need to be investigated systematically. This may be problematic on a city scale, like mortality rate due to certain diseases (3.4.1**). One of the most relevant metrics when it comes to assessing the impact of e-hubs is the modal split, i.e. the share of trips taken using a particular type of transport mode.** The modal split must regularly be assessed to make sure the e-hubs actually contribute to safer, more inclusive, healthier and more sustainable cities according to the SDGs by reducing the number of vehicles on the road and do not have the opposite effect, e.g. by replacing active or trips using public transport with trips done with shared (e-) Cars. If the envisioned change in mobility behavior is not reflected in the modal split, this could indicate the need to alter the e-hubs in terms of location, design and offer or to introduce supporting policies such as parking restrictions, congestion charges or other « push » measures.
- **Another relevant indicator for the evaluation of e-hubs, especially in light of SDG 13 (Climate Action) is the emission of greenhouse gases (CO_2) or, respectively, the reduction of CO_2 thanks to e-hubs.** TU Delft has created a study that investigates the potential for CO_2 reduction through the provision of mobility hubs and offers a methodology to assess this impact. There are several ways in which e-hubs could lead to a reduction in CO_2 emissions: it can reduce vehicle miles travelled by private car, substitute other travel modes, reduce private car ownership by lowering car reliance and suppressing expected car purchase, and reduce congestion and enable higher speed. In the study, the CO_2 emission change to travel mode substitution is considered. While local emission for electric vehicles is zero, the required electricity generation needs to be considered and this varies from place to place according to the respective energy mix. However, the approach suggested by TU Delft does not consider the entire product-life-cycle of the vehicles. The entire formula for calculating

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the CO_2-change facilitated by e-hubs can be taken from this report[10]. (Midterm reports on effects in terms of CO_2-emissions). In order to perform the equation, there are several data that you should have at hand:

Data Item	Data Source
Number and Average distance of shared vehicle trips by type	User survey, Mobility Service Provider
Energy efficiency of shared vehicles	Literature
CO2 emission factor of electricity generation	National Energy Agencies
CO2 emission of replaced trips by car or public transport	TU Delft CO2 impact calculation tool
CO2 emissions of active trips (walking, cycling)	Zero

- **Evaluation and impact assessment of the e-hubs is important to check if the positive effects of the shared mobility use come in place.** A possible result can be as well that the mobility behavior of the residents is not as expected and so the e.g. the location of an e-hub was chosen on a wrong assumption. To include some flexibility in regard to that in the project is key! Deploying the e-hubs in stages prevents from making the same mistakes with every single hub and gives time and space for quick adjustments.

Regarding communication:

As a major goal is the reduction of fossil-fuel trips, it is important to target mainly owners of such cars, that almost routinely use that mode of transport.

A communication campaign can be divided into four phases:

- Creating recognition and explore the concept of e-hubs
- Creating awareness of the concept of the e-hubs amongst different user groups
- Gaining interest, by showing the potential opportunities and making the concept relevant
- Stimulating usage, by influencing the self-image of the people and providing incentives to break their habitual behavior. A study by the Amsterdam University of Applied Science[11] gives 10 recommendations on behavior change:

[10]https://api.elopage.com/v1/cabinet/content_blocks/15847836/download_good?content_page_id=2027205&good_id=2262009&_ga=2.139122096.207757896.1673432221-109196095.1672910940
[11]https://www.nweurope.eu/media/9931/ehubs_wsmanchester_handout-10-recommendations-auas.pdf

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	Recommendation	Psychological concept
1	Make people receptive to eHUBs before they encounter them.	Persuasion
2	Optimise accessibility and minimize the hassle of using an eHUB	Law of least effort concept
3	Foster citizens belief in their ability to use eHUBs by providing them with the necessary knowledge and skills	Self-efficacy
4	Reach target group by overcoming attentional bias	Attentional bias, rational overrides
5	Break existing habits and (car) routines through prompts, ncentives or feedback	Habits, prompts, incentives
6	Design surroundings to stimulate use of eHUBs	Nudging
7	Frame eHUBs such that its associated with the needs and desires of target group	Message framing
8	Optimise fluency of the messaging	Fluency bias
9	Use social influence mechanisms to promote eHUBs	Social norms, modeling, credible source
10	Invest in customer trust	Trust

The 4 phases mentioned in the bullets are important for an effective communication campaign.

On Stakeholder management:

From a city's perspective, there are many stakeholders - both internal and external – that can be relevant to the implementation of e-hubs:

- internal: certain departments of the municipality such e.g. civil engineering, procurement, legal office, public utilities, city council, political leadership
- external: citizens, public transport operators, mobility service providers, real estate developers, business park owners, large employers, universities and more

it is important to keep in mind that stakeholder management should certainly be part of the action plan and the time investment in stakeholder management must not be underestimated.

Quote from Amsterdam

> *"One of the biggest setbacks is the fact that different departments within the organization have different mandates, different goals and work siloed. Also, political mandates differ. Our deputy mayor, for example, approved the project. However, the program Autoluw, (later Ruimte Regie) decides where we can and cannot start the participation process on eHUBS, which thereafter would come in conflict with the vision drafted by the 'city districts' (who also have political influence). Although mandate might appear clear on paper, in reality it may conflict and result in a political argument between two bodies of government"*

On governance and regulations:

- **In the relatively new and dynamic market that is evolving around Shared Mobility, regulators tend to lag mobility innovations and struggle to keep up with the pace of technological and market developments.** There are several ways in which Shared

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Mobility - and hence e-hubs - is governed. The EU-funded GECKO-project has conducted extensive research on the issue of regulation and governance of Smart Mobility innovations.

- **There is a multitude of aspects related to Smart and Shared Mobility that require regulation such as market competition, data ownership and the safety of service for customers and other road users.** A more extensive overview can be taken from the final report of the GECKO project.
- For some Amsterdam experience with governance and regulations see Annex "Amsterdam experience with governance and regulations"

On policy recommendations:

- **A regulatory framework for e-hubs cannot only be focused on providing favorable conditions for shared mobility services, but it should also incorporate measures that reduce the convenience of private car use and ownership.** Car use must become less attractive in order to entice a behavioral change in terms of mobility choices. Thus, a mix of „carrot-and-stick" or „push and pull" measures is desirable.
- **Therefore, the regulatory framework for e-hubs should be designed according to policy objectives regarding (shared) mobility as well as livability and sustainability.** Furthermore, it should propose regulations that enhance the potential of shared mobility and e-hubs, while reducing the externalities associated with these new mobility solutions. The regulations can be related to infrastructure adaptations, data sharing, use of public space, geo-fencing, free parking permits, and service level requirements. Most of these measures are directly targeted at shared services and in many cases should be part of the service level agreement between the mobility service provider and the local authority (or responsible entity for the deployment of e-hubs).
- **Generally, regulations should be discussed that require the car user to pay the true cost of using a car (use of public space, emissions, noise, etc.) by implementing measures like road pricing or city tolls.**
- In the end, the combination of policies and regulations to this end (parking fees, parking availability) will lead to car owners to reconsider the attractiveness of having/using a private car.

The work in the last couple of years has led to the preparation of an Amsterdam vision on mobility hubs in December 2021[12]. This vision has a wider scope than only the Buurthubs that are the topic of this report. Its aim is to act as a guide for the strategic mobility directions that need to be decided upon. These need to be in line with the desire that Amsterdam wants to be a livable city, with clean air, lots of greenery and low traffic congestion. Amsterdam therefore always proposes more demands on traffic and transport in the city, such as tightening up the environmental zone, parking measures and weight restrictions for heavy traffic. With hubs the city intends to provide more mobility options, with which the accessibility of the city is maintained and improved. Hubs have the potential to make better use of space in an increasingly densifying city.

[12] https://www.amsterdam.nl/parkeren-verkeer/hubs/

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Several different types of hubs are distinguished in Amsterdam, each with its own goals, target groups and use:

- Neighborhood hubs (including in-house private hubs), primarily intended for shared mobility to offer to residents.
- District hubs, aimed at partial mobility for the residents of the neighborhood and transfer point for visitors to the district.
- City hubs, intended to connect regional public transport and urban public transport.
- Regional hubs, intended to facilitate the transition between car and public transport towards urban areas.
- Hubs for logistics transhipment (these can be done on different scale levels).

The policy recommendations and lessons learned from the various investigations related to shared e-hubs in Amsterdam have been summarized in a toolbox for municipal officials, mobility professionals and other people interested in shared electromobility. This document is available here (in Dutch). It covers both a guideline on how to set up shared e-hubs and a research summary. An English version of the step by step approach to setting up a "buurthub" can be found here.

7 Conclusions

- A lot of practical experience with the implementation of shared e-mobility hubs has been collected.
- There is significant growth of shared mobility in Amsterdam, but compared to private mobility volumes it is still a niche
- It is expected that shared e-mobility will only become significant if the traditional car-owner solution will become particularly unattractive
- The role of behavior change should not be underestimated
- It is important to avoid exclusion of inhabitant groups that are particularly dependent on nearby, easy mobility solutions, e.g. people with disabilities, elderly people. There is the risk that otherwise shared e-mobility will only a solution for privileged people.

Amsterdam will move forward with upscaling shared e-mobility solutions in an Interreg North Sea project ShareDiMobiHub (Shared Digital Mobility Hubs)[13]. A new research project will pay increased attention to non-commercial (community-driven) e-mobility hubs. These may be an answer to solve the intricate balance of profitability versus attractiveness.

[13] https://www.interregnorthsea.eu/sharedimobihub

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8 Outputs for Other WPs

The results of the Amsterdam shared e-mobility activities are specifically relevant to the e-mobility activities in Bilbao (task 5.4) and the municipal organizations of the fellow cities. For the latter, the results of the work could be presented in one of the activities targeting replication in WP6. The link to the on-line course on shared e-mobility has been shared with the ATELIER partners and is given below as well[14]

[14]https://www.nweurope.eu/projects/project-search/ehubs-smart-shared-green-mobility-hubs/news/the-ehubs-blueprint-a-digital-handbook-for-mobility-planners-to-create-shared-mobility-hubs/

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Annex E-hubs relevant Sustainable Development Goals

Sustainable Development Goal	Description	Target	Indicator
Goal 3: Good Health and Well-Being	Ensure healthy lives and promote well-being for all at all ages	3.4. By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being 3.6. By 2020, halve the number of global deaths and injuries from road traffic accidents	3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease 3.6.1 Death rate due to road traffic injuries
Goal 9: Industry, Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	9.1. Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure to support economic development and human well-being, with a focus on affordable and equitable access for all	9.1.2. Passenger and freight volumes, by mode of transport
Goal 11: Sustainable Cities & Communities	Make cities and human settlements inclusive, safe, resilient and sustainable	11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilites and older persons 11.6. By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.2.1 The proportion of population that has convenient access to public transport, by sex, age, and persons with disabilities (=500 meters or less to nearest public transport stop) 11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted
Goal 13: Climate action	Take urgent action to combat climate change and its impacts	13.2 Integrate climate change measures into national policies, strategies and planning	13.2.2 Total greenhouse gas emissions per year
Goal 17: Partnerships for the Goals	Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	17.17. Encourage and promote effective public, public private and civil society partnerships building on the experience and resourcing strategies of partnerships	17.17 Amount in USD committed to public-private partnerships for infrastructure

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Annex 10 Golden Rules

1. Start with a pilot

A pilot can allow regulatory flexibility and make it easier to communicate to the public. However, once people become accustomed to eHUBS, dismantling them after a pilot can cause irritation.

2. Engage with potential users

Go out and talk to potential user groups in the vicinity of a potential eHUB! They know best what kind of mobility offer they need and what problems need to be solved.

3. Cooperate with Mobility Service Providers

Don't shy away from engaging with Mobility Service Providers. They know their products best and what works well and what does not.

4. Engage with other Stakeholders

Try to get other Stakeholders (e.g. employers, local businesses, public transport authorities, universities) on board as they can provide an important lever to the uptake of your eHUBS.

5. Digital Integration is key!

Seamless and hassle-free mobility experiences are essential to achieve a behavioral change. Providing a digitally integrated mobility offer is an important piece of the puzzle and a key enabler for multimodal and intermodal travel. Also, in order to make informed decisions, having access to the right data is key!

6. Changing mobility behaviour is hard!

For car drivers to change their mobility behavior, providing alternatives may not be enough. Consider other measures to discourage car use.

7. Invest in Usability

Potential Users, especially habitual car users, will only consider eHUBS a useful mobility alternative if their (first) use is convenient and hassle-free. Therefore you shouldn't underestimate the importance of UI/UX Design.

8. Make it visible

Try to create a recognizable brand or use an established one. This makes it easier for potential users to understand what they are dealing with and how to use your eHUBS.

9. Deploying eHUBS might take more time than you'd expect

Make sure to save enough time in your action plan for stakeholder management and other participatory processes. Also, many value chains are still disrupted and the delivery of essential parts of your eHUBS – especially the vehicles – can take a lot longer than usual.

10. eHUBS can be a tool! They are not an end in themselves.

eHUBS may be the right tool to archive your policy goals, but they may as well be counter-productive in case „clean trips" (walking, cycling, public transport) are replaced by „dirtier" trips (e-Scooters, e-Cars). It is important to monitor your eHUBS closely and critically examine them.

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Annex Analysis 3 years of shared e-mobility hub Papaverweg

Summary of internal evaluation of June 2020

An internal evaluation took place of one year of operation (June 2019-May 2020) of the shared e-mobility hub at the Papaverweg. The evaluation was between the users of the hub and the operator, HUUB.

Before going into details, it should be noted that in 2019, users still moved into the location, so the full potential was not yet available and in the last few months March-May 2020 the results were affected by COVID.

The users are happy that the system is really up and running and there are mainly stories of happy users. The utilization shows to be far less than could be expected from the first survey from 2018.

- Why do so many people not use shared mobility?
- Why do so many households still have their own car?
- And of the people who do participate; why do they drive so much less car than they previously indicated?
- Does the corona play a role?
- Is it still too expensive?
- Or do we use the e-bike / cargo bike, etc. much more often than expected?
- And the key question: is there still potential for growth?

Were the kind of questions asked.

The system needs more car use to be profitable. HUUB has committed to this pilot, knowing that it would not be immediately profitable, but the hub is now more loss-making than ever expected.

The analysis concludes with the statement that it is painful that the users have been given the opportunity for a great initiative, which almost everyone thought was an ideological fit with the user group. They intend to put more effort in the uptake of the initiative to prevent that the initiative will go back from 5 to 4 cars.

It was announced that:

- HUUB has merged with Hely (the hub operator associated with the national railways). The only consequence is that in a few months there will be a new app that combines the best of Hely with the best of HUUB. So the app will be greatly improved, and some of the features requested by many users will be implemented in the app.
- The shared mobility hub will be opened to local residents. That was always the long-term goal. In recent months, a handful of local residents have already registered themselves, as soon as the merger with Hely is complete, HUUB will actively acquire among local residents.

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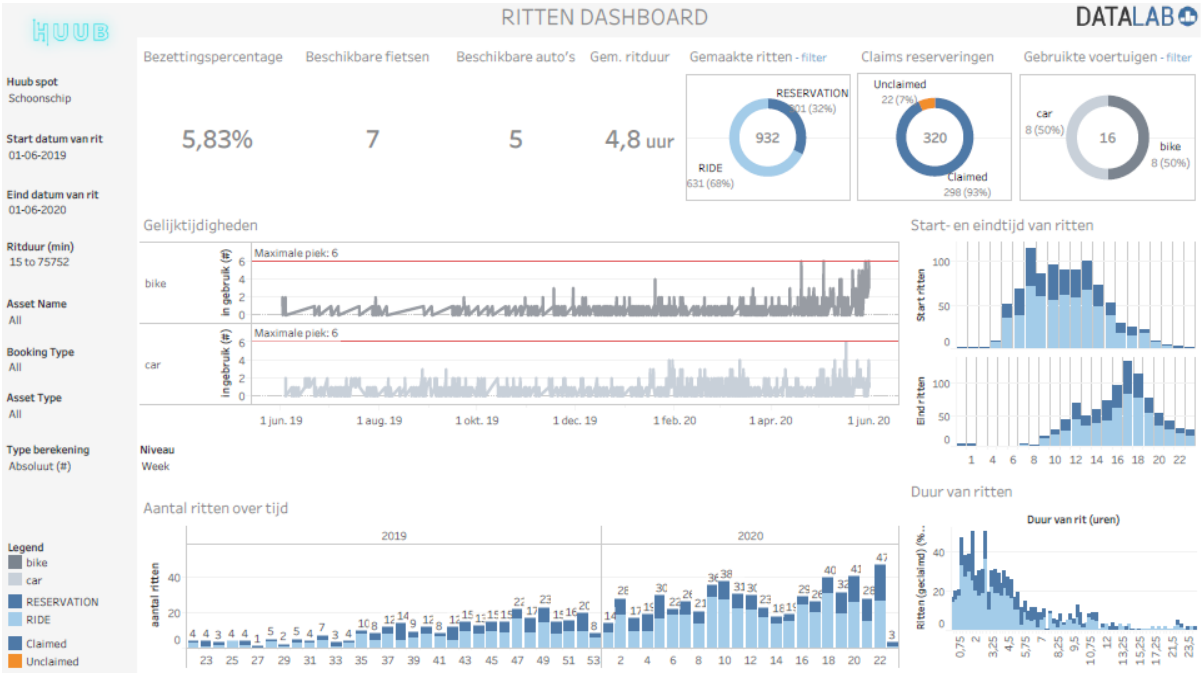
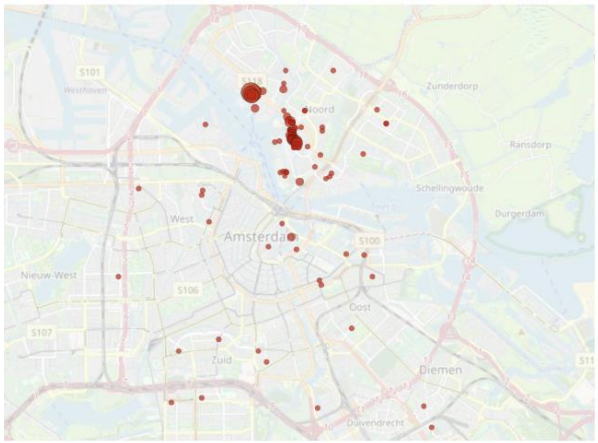
Quantitative trip data

Below, the available trip data spanning the period of June 2019 until December 2022 are provided. The way data are presented differs from year to year because of the migration to different monitoring systems.

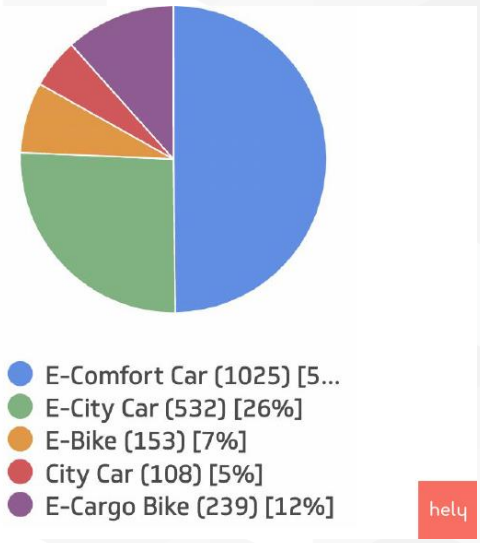
Trip data June 2019 to 2020, provided by HUUB



Trip data 2021, provided by HELY October 2021



HelyHub Buiksloterham



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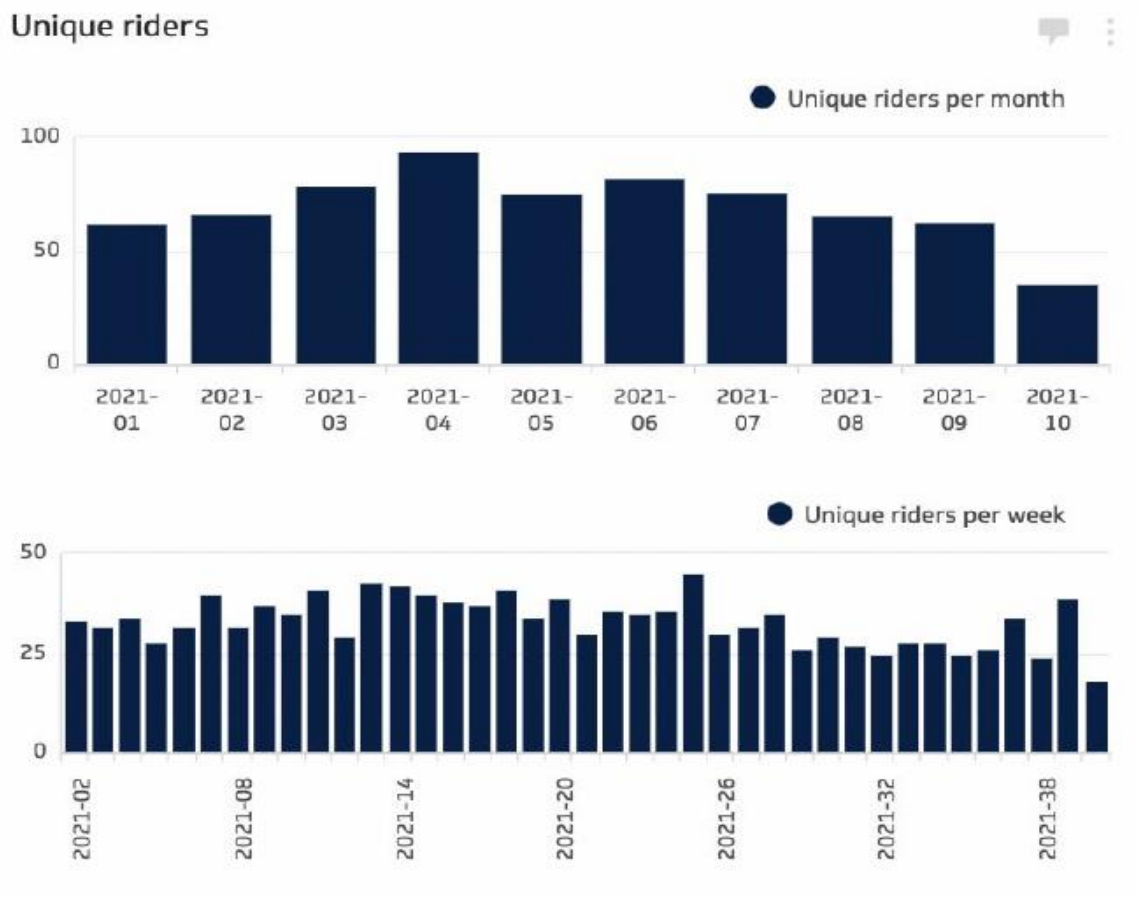

Overview of trips per month

This graphic gives an impression of the amount of people using the hub, and how often. In the upper graph, the aggregate amount of unique riders per month amounts to about 600, whereas in the bottom graph (unique riders per week) this is about 1000 this is because a rider that makes a trip in e.g. 2 separate weeks in one month, only shows once in the upper graph. The shorter the time period of aggregation of unique riders, the more you approach the number of trips.

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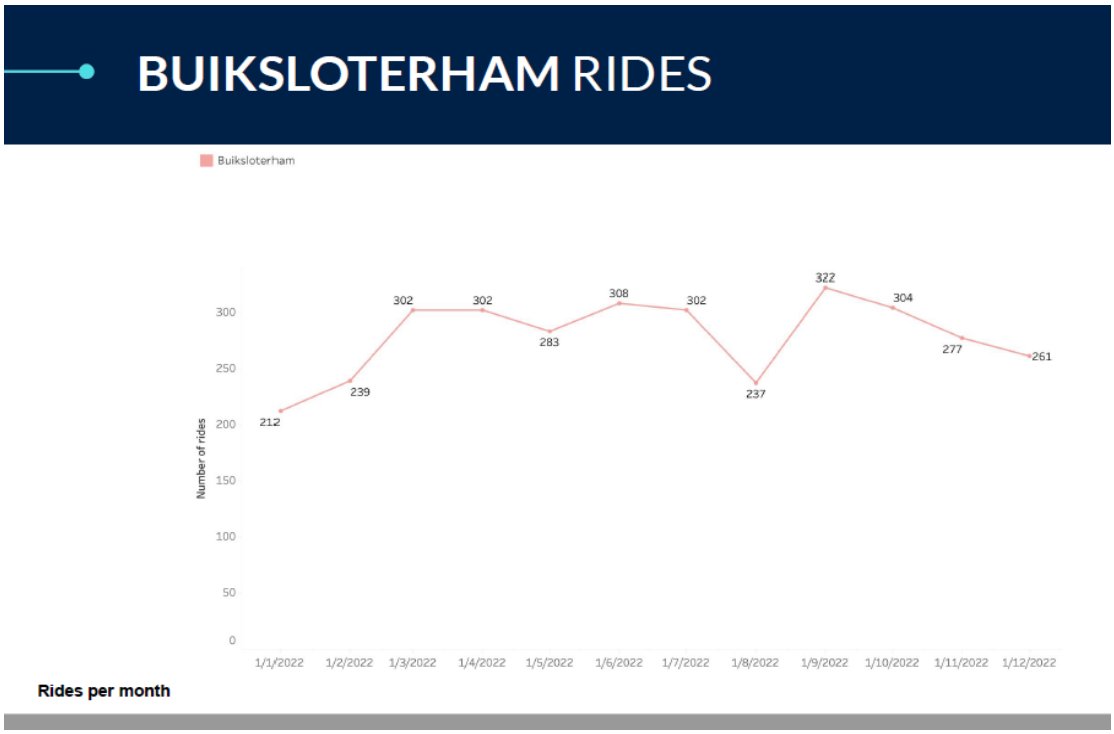
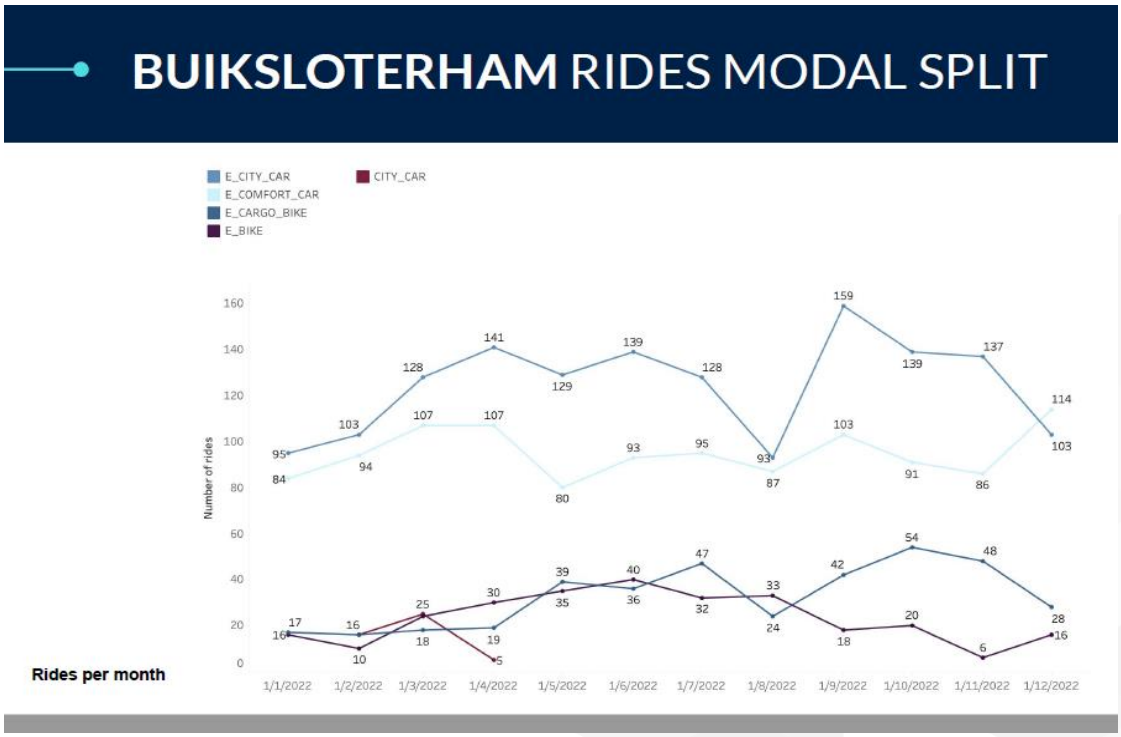
Trip data 2022, provided by HELY February 2023





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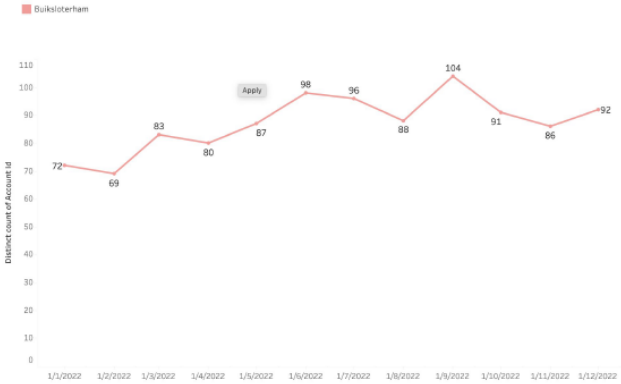
BUIKSLOTERHAM RIDERS

Market potential	500
Approved Riders	313
Approved Riders %	63%
Unique Riders	220
Unique Riders %	44%

Conversie Q4



Unique Riders per month

Hely comments to 2022 data:

There is a slight downward trend at the end of 2022. This cannot be directly attributed to less unique users. Fewer journeys, and also fewer long journeys, which appears from billing data The general trend among Hely's hubs is more stable and does not reflect this (slightly) downward trend. However, in 2021 there was also a dip around this time of year; it is expected to increase again in Q2.

Concerning the interpretation of the conversion (the ration of the number of accounts in an area to the potential) of the number of users: The potential of users is difficult to determine because it is open to the neighborhood. That is why 500 is used as a starting point. A large proportion of people with an account are also active users with Hely (more than 200 of the 313 accounts).

It is clear from the graphs that the trend in hub use is upwards, From 20 trips per week in 2020, to more than 27 trips per week in 2021, to about 70 trips per week in 2022. The modest use in 2021 is likely attributable to COVID. In 2022, the hub opened for the neighborhood, increasing the user base. COVID was on the decline. These two factors explain the more rapid increase.

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Annex Amsterdam experience with governance and regulations

When we started the (eHUBS) project, there was little to no legal framework at all. There was a car-sharing policy, but no framework for other shared services or small eHUBS in public space. We had two options: make a shared mobility policy or redefine the way we regulate public space. Since the field of micro shared mobility was rapidly evolving, there was momentum to co-write a new policy, making room for experiments. This policy made our project possible, but since it excluded shared cars (there was already a shared car permit with no room for changes) we ended up with scattered policies and regulations. Since making a policy is time-consuming and in a dense city like Amsterdam very political, this led to a delay in our project. Since we based our new policy on existing ones, we ended up with a variety of regulations dis-persed over different policy domains: parking, charging, public space, interoperability, and shared mobility. The downside of experimental policies is, however, the variety of sharing schemes in Amsterdam. This could be confusing for the user (so make sure to communicate this), but also lets us as government learn about different schemes. Hubs call for an integrated AND flexible legal framework. We learned that our project checked all the boxes from a bird's eye perspective, but when it came down to the actual 58 m² eHUB, policies conflicted. Therefore, be flexible when you are learning about mobility hubs. Make sure there is room for change (for example, by including experimental areas in your framework or work with a flexible number of permits) (...) The policies and regulations regarding shared mobility, licensing of shared mobility, regarding electrical charging, regarding communication efforts (for example the look and feel principles set by us as a city, but also the communication campaigns), terms about privacy, data sharing regulations, policies regarding procurement were found to be relevant for the project (...) In 2017 the city of Amsterdam was surprised by huge numbers of commercial, dockless shared bikes offered in the public domain. In just a couple of weeks huge numbers of bikes could be rented in the streets. The city of Amsterdam decided to temperately ban the shared bikes, while it is not allowed to use the public space as a place of issuance as well as the amount of scarce public space the bikes take in. Although intentions of this ban were highly understandable, it did become an obstacle in the implementation of eHUBS. The project required commercial bike providers to be able to operate in the streets, and this was not possible. The project solicited for a policy exemption, in which commercial bike suppliers were allowed to operate within the eHUB. In February 2020 this exemption was approved by the city's Mayor and City Council. Members and the project could go ahead.

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