Interreg
EUROPEAN UNION
North-West Europe
eHUBS
European Regional Development Fund

# Joint methodology for eHUBs

## DELIVERABLE 2.2

02 december 2019
Liselotte Van Gils (Stad Leuven)

## Summary sheet

| | |
|---|---|
| **Project Name** | **eHUBS** |
| **Title of the document** | Joint methodology for eHUBs |
| **Deliverable** | D 2.2 Joint methodology for eHUBs |
| **Work Package** | T1 eHUBs pilot demonstration |
| **Programme** | Interreg North-West Europe |
| **Coordinator** | City of Amsterdam |
| **Website** | http://www.nweurope.eu/projects/project-search/ehubs-smart-shared-green-mobility-hubs/ |
| **Author** | Liselotte Van Gils |
| **Status** | Draft |
| **Dissemination level** | Public |
| **Reviewed by** | Project partners |
| **Submission date** | January 2020 |
| **Starting date** | January 2019 |
| **Number of months** | 36 |

## Project partners

| Organisation | Abbreviation | Country |
|---|---|---|
| **Gemeente Amsterdam** | AMS | The Netherlands |
| **Promotion of Operation Links with Integrated Services aisbl (POLIS)** | POLIS | Europe |
| **Taxistop asbl** | Taxi | Belgium |
| **Autodelen.net** | Auton | Belgium |
| **Bayern Innovativ GMbH** | BI | Germany |
| **Cargoroo** | CA | The Netherlands |
| **URBEE (E-bike network Amsterdam BV)** | URBEE | The Netherlands |
| **Gemeente Nijmegen** | NIJ | The Netherlands |
| **Transport for the Greater Manchester** | TfGM | Great Britain |
| **Stad Leuven** | LEU | Belgium |
| **TU Delft** | TUD | The Netherlands |
| **University of Newcastle upon Tyne** | UN | Great Britain |
| **Ville de Dreux** | DR | France |
| **Stadt Kempten (Allgäu)** | Kemp | Germany |
| **Universiteit Antwerpen** | UAntwerp | Belgium |

# Document history

| Version | Date | Organisation | Main area of changes | Comments |
|---|---|---|---|---|
| **0.1** | 10.11.2019 | Stad Leuven | Full draft | |
| **0.2** | 18.11.2019 | Stad Leuven | Full draft | |
| **0.3** | 02.12.2019 | Stad Leuven | Full draft | |

# Table of Contents



# List of figures

## 1. Introduction

The objective of the work package pilots includes the development of a joint methodology, which will enable the creation of the blueprint for other cities (WP LTE). This document sketches the general approach, but there will be local variations depending on the local situations in the different pilot cities. Every pilot city will create there individual method, procedure for selection and implementation approach. Together these will create deliverable 2.1 This document, deliverable 2.2 Joint methodology, creates the general framework, used by every pilot city.

Implementing an eHUB is a combination of steps and decisions to be taken using specific decision-making strategies.

The implementation approach will consist of description of the strategies used when

- Selecting location
- Planning an eHUB's offer of shared mobility (and additional services)
- Starting the eHUBs

## 2. Implementation approach

The pilot cities from 5 countries will realize and promote eHUBS. The hubs will differ for each pilot city and also between hubs. At every eHUB space and infrastructure need to be made available to the shared mobility providers.

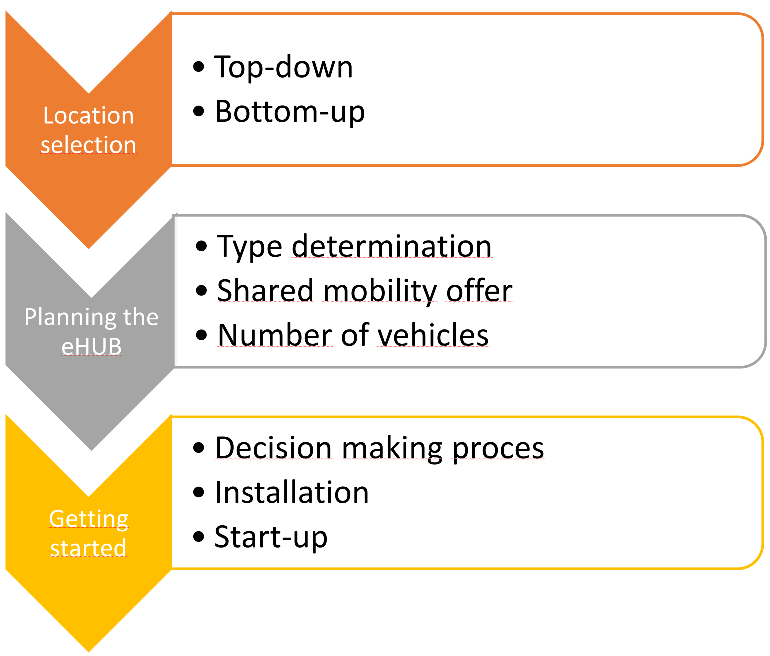


*Figure 1: Implementation methodology*

There are different selection strategies for location determination as well as deciding on the starting configuration of each individual eHUB (size and offer of shared mobility). All pilot cities will differ in approach, target groups and size.

This document will focus on the theoretical framework mentioned in the project description of INTERREG. The review of this framework can be done after implementation and when the adjustment phase is finished for the implemented eHUBs.

Largely there is a distinction between the Top-down and Bottom-up approach.

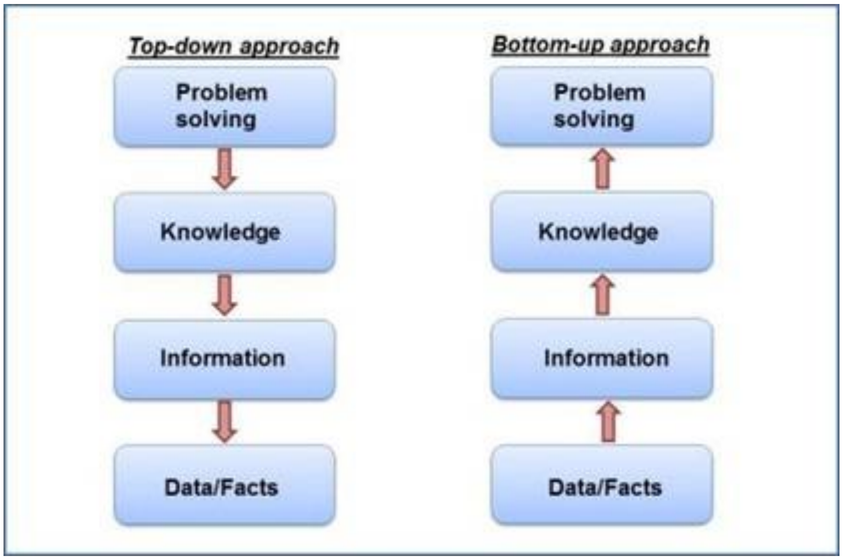


*Figure 2: Top-down versus bottom-up (www.nestler.com)*

Top down is often referred to as a strategic selection of decision-making method. It starts with theory. At the other end of the spectrum, bottom up selection is regarded as being more operational. It starts with reality, standing at a specific location or within a specific situation.

Talking about a strictly top-down eHUB selection (location and configuration) approach, the starting point is the existing public authority. The public authority can be seen as one entity but in reality, it also exists of different layers and stakeholders:

- Regional or possibly national public authority
- Local public authority: this also includes the different departments (mobility, public domain, signage, communication …)

Public authority should try and make a selection based on general public interest. The focus is not on the best outcome for every individual, but a trade of where most stakeholders have most benefits and least disadvantages possible.

Bottom-up can have a lot of merit because you are starting in reality, the situation as is. The focus is on the stakeholders, who ultimately hold the key to the success of the implementation. The end-user has a determining impact in the success of implementation. This methodology relies on the identification of stakeholders to be taken into account. Through involvement and participation identification of potential locations, shared mobility offers and size is done.

Stakeholders that can be taken into account for the bottom up approach are:

- Public transport providers
- Shared mobility providers

- End-users: inhabitants, commuters, visitors, students, tourists…
- Public authorities

The downside of the bottom-up approach is that different stakeholders do not always take into account the bigger picture. The best option for one individual does not always coincide with the most optimal solution for largest group of people. This is even more difficult when the expected result requires a behavioural change of potential end users. In these types of situations, the end result is often invisible or not important enough for the individual at the starting point.

Both ways of working have advantages as well as disadvantages: Within the context of eHUBs, the advantages of a new way of traveling will need time to ripen within the population. The top-down approach can have a focus on the overall situation and overall objectives (for example the targeted end behaviour and how to get there, starting from current behaviour). On the other hand, it are individual decisions that drive the success, so it makes sense to involve these individuals up front.

# 3. Location selection

Utilisation value of an eHUB location is dependent on the location itself. The location determines the demand for transportation. The potential for additional or future transportation demand is determined by proximity of activities with sufficient density at the location and its connection to the existing network. Location selection is the basis and most determining factor of the eHUB and its future potential.

The location selection is critical for the potential success of shared mobility. Theoretically there are different types of logics that can be applied, such as the network versus the proximity location logic. Theoretically they both have specific advantages in geographical development, or in this case deployment of potential eHUBs. Proximity is of importance when looking at the potential for first and last kilometre of travel. Multimodal travel is more influenced by its network logic. How it is complementary to exiting transportation potential. Preferably there is a combination of both as to have the biggest impact on transportation situation as a whole.

The Top-down approach is complementary to location selection based on network logic. Bottom-up complies more with the logic of proximity.

## 3.1 Top-Down

A top-down approach starts with the bigger picture, a vision on mobility and its future development. It is a design method that should start with objective principles. The selection of eHUB locations is embedded within local mobility and sustainability political policies (possibly national and regional as well as local).

For example:

- Lowering emission rates
- Sustainable mobility options
- Stimulating multimodal transport
- Diminishing traffic pressure in the city centre
- Stimulating shared mobility
- …

With regards to location selection, different spatial characteristics can be selected and collected. The spatial component offers the ability to layer the different characteristics on top of each other. This way nodes in between the different layers become visible and can be localised in space (see figure 2).

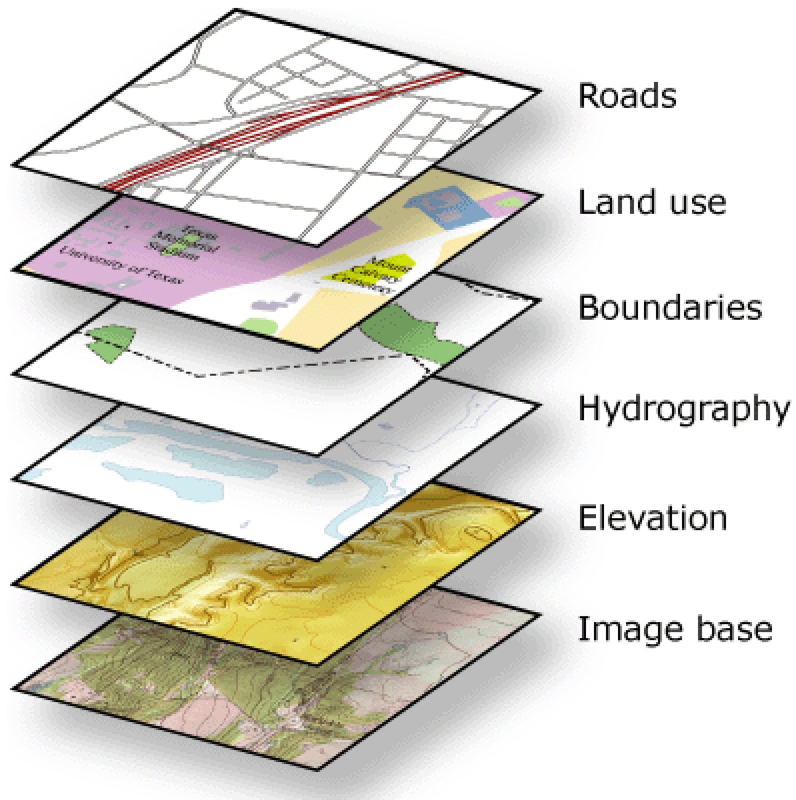


*Figure 3: Map layer combination (desktop.arcgis.com)*

The basic layer is the geography of the city and maybe even its larger geographic region. Visualisation of the size of the city and its relation to cities or communes in the larger region. What are the interdependencies, how do the travel currents go from and towards different (city) centres and within the region?

Take in to account the transportation situation at present:

- the existing transportation currents; in general
    - towards activity centres at the start of the day
    - outside of activity centres end of the day
- the existing transport infrastructure
    - public transport network
    - network of cycling routes (routes for low impact mobility)
    - transport barriers like railway crossings
    - road network

On top of this can be a number of other characteristic layers with differing importance:

- Public transportation network: where are the large, medium and small nodes

- Transport infrastructure (soft mobility trails and their crossings, large access roads, transfer roads): where are the large, medium and small nodes
- Car-free (or shy) zones
- Pools of activity (residential, commercial, business or combinations)
- Locations with city development plans (residential, commercial or business development)
- Car-parkings (and their current utilisation)
- Bicycle parkings (and their current utilisation)
- Electricity network
- Locations with large transport pressure (congestion, traffic jams, long travel times for short distances)
- Locations where there are already shared mobility options available
- Transferium (park and ride or park and bike) locations
- …

It is up to the planner to determine which of the sub-aspects are relevant for the city's (or commune's) specific situation and the importance of each of them. An aspect that is more important can have a bigger impact on the network determination then other less important aspects. Importance is depending on different factors such as:

- Target users
    - Inhabitants
    - Commuters
    - Visitors
    - Students
    - …
- Targeted behaviour
    - Stimulation of multimodal travel
    - Stimulation of last or first (mile) kilometre travel towards PT network
    - Stimulation of low impact mobility use in centres
    - Stimulation of shared mobility options
    - …

These aspects can be taken into account when selecting the layers and their importance.

All layers combined create specific intersections, with different weight of importance. Each node has conditions related to every layer applied. These conditions together with the present spatial context and its possibilities, can lead to specific locations, types and sizes for eHUBs, in relation to their purpose.

This way of working also makes it easier to identify and implement a specific density of eHUBs and cross-reference the different locations with the larger space, region, other cities etc., taking into account the entire (potential) network.

## 3.2 Bottom-up

A bottom-up approach starts at the most local level possible. What are local strengths, possibilities, weaknesses and threats? What is the demand and/or potential at a local level?

Here the process starts with initiatives from or at least in cooperation with the potential end-users and/or other stakeholders. Instead of looking at the bigger picture it focuses on the conditions, opinions, feelings on a local level, at a specific location. It is based on local perceptions.

Different stakeholders can provide input for possible locations. The role of local governance is creating a context so that the stakeholders, such as end-users, can provide ideas and initiatives, collecting them and through participation, identifying locations with the potential present and/or required.

The local support for an eHUB is intrinsic within this way of location selection. There is not a theoretical user base, but an actual one. This way an offer can be more accurately identified due to knowledge of the actual demand.

In the way that different layers with different weights can be applied using top-down, in this case specific requirements can be set to be taken into account for possible selection.

It is based on public-private cooperation in order to collect possible locations and determine their potential. These collaborations can be set-up in numerous different ways and different phases:

- It is possible to start a governance driven campaign to mobilise groups of peoples. Groups can be one or more companies or commercial players, groups of neighbours, specific neighbourhood foundations or organisations.
    - Motivate proposals for innovative experiments
    - Possibilities to register for a described proposal (government present one of more proposals)
    - A more hybrid form of a set structure with specific aspect to be estimated or proposed in the request
- Next to this the government can also actively search for locations where the probability of support is likely
    - Places where activities or interest in sustainable changes are present (for example locations with communal living arrangements, presence of privately organised vehicle sharing, people pro-actively asking for sustainable measures…)
    - Research and communicating with specific groups to determine likelihood for a support base
    - Using experience of shared mobility providers to select potential locations

## 3.3 Hybrid or combination of selection methods

A top-down and bottom up approach are two extremes on a continuum. This continuum can have unlimited possibilities of combinations on the spectrum.

Results for the top-down as well as the bottom-up approach for location determination can be geographically situated. Because of this reason it is easy to combine methods.

- It is an option to use the bottom-up location determined within the analysis of the top-down aspects selected.
- Next to this it is also an option to select a specific location based on top-down approach and other using bottom-up methods.
- You can use either or selection method and use the other one to adjust, validate the selection or not

# 4. Planning at the location

It is important to have a clear view on the current travel information at the potential eHUB location. Which types of travel, arrivals, departures, passers-by and how. What is the available traffic infrastructure and how is it utilized?

The space required depends on the station's sizing:

- This depends on the type of eHUB it is
- The space available
- Means of shared vehicles offered

Examples of places where an eHUB can be integrated are:

- On street parking spaces
    - Advantages are that the focus towards shared mobility is emphasized and discouragement of private car parking is established.
    - A parking space for one car, can provide parking for over 6 low impact mobility options
    - Disadvantages are that public opinion is more often negative, at least at first.
- In space in between existing landscaped areas of existing infrastructure
    - Advantages of these location are that they are visible
    - Disadvantages are possible when the public domain is already very occupied, that it becomes overwhelming. Other possibilities are infrastructure blocking existing walking lines or reducing the accessibility of the location
- Dead spaces
    - Advantages are that it usually it unused space. There are few walking lines.
    - Disadvantages can be that it is less visible or even less safe for the potential users.

Every potential eHUB location needs to be analysed. The potential advantages and disadvantages need to be clear so that necessary steps can be taken in to account when designing and implementing the infrastructure.

## 4.1 Type determination

EHUB type determination is based on the scale of each individual eHUB. For this project, it was determined to utilise 3 types of eHUBs (see technical and functional requirements).

Type 1: This type of eHUB should provide possibilities to travellers to travers directly to a location that is outside of its current region. This connection is preferably a public transport connection, like a train connecting one city to another city. It is a point of large flows of people arriving, leaving and people in transit.

Type 2: The regional eHUB should have possibilities to travel within the region. It is an arrival as well as a departure station, but also some transit. It usually has a direct public transport link to a type one eHUB (or location with this type of potential). This can also be a carpool or transferium parking.

Type 3: Local eHUBs are the ones that are predominantly departure (or arrival) stations. They should be close to home locations as to lower the hurdle or limits to use them instead of private vehicle types. When located in more rural areas it often has limited or on demand access to public transport. These stations are the ones with ability to promote shared mobility ownership (not only the usage at big transfer stations). The offer close to home, walking distance, will determine its success for this local type.

## 4.2 Shared mobility offers for an eHUB

The offer of types of vehicles and their combination is dependent on a large number of different factors. It can be a useful tool contributing to the behavioural change you want to introduce on the one hand, but also to fulfil specific existing demands, if there is one present already.

A sustainable view towards planning focuses on shared mobility with empowerment of the lower impact means of transport (instead of expanding the transport infrastructure and focussing on private car transport). This requires a behavioural change from the extremes of overall private car use to multimodal traveling and shared use of low impact transport options.

**Urban centres** usually already experience large pressure on the available traffic infrastructure. Different modes of transport have a different impact on the public domain (see figure 3). In general, the offer of public transport is better in- than outside of the centre. The use of low impact mobility is very often more comfortable and sometimes even faster than using a car (or even taxi or bus).

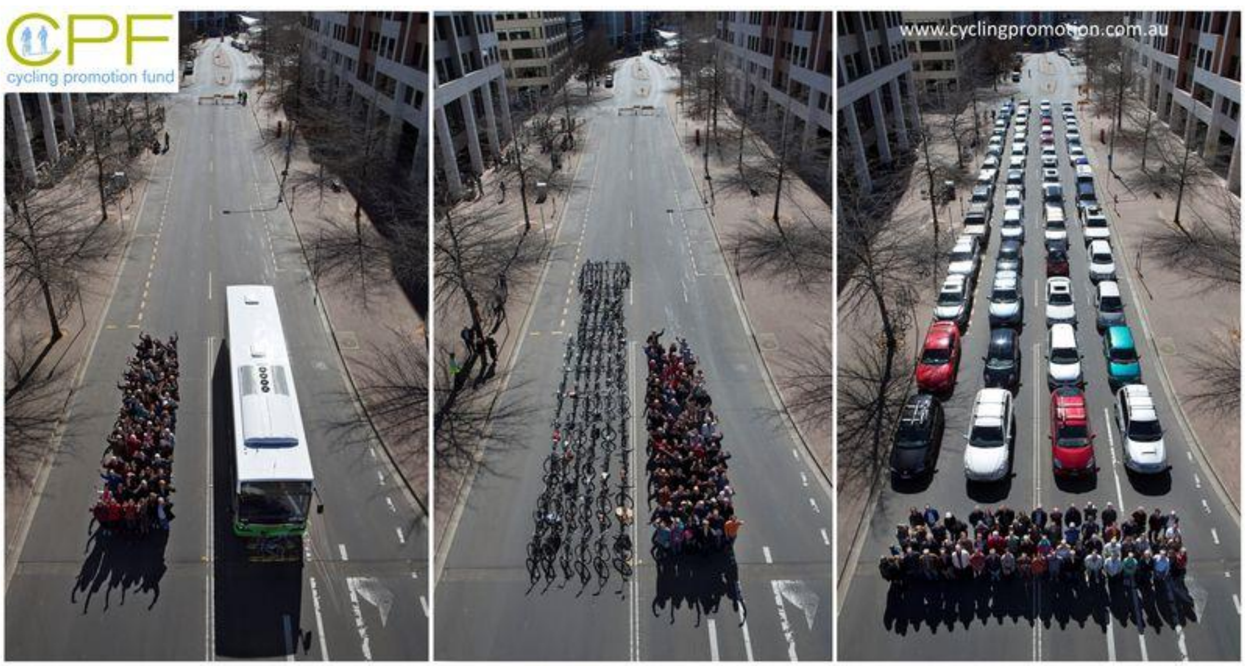


*Figure 4: Comparing the pressure on public domain – (source www.cyclingpromotion.com.au)*

Within an urban centre it would make sense to offer low impact mobility options, preferably complementary to the offer of public transport. This provides first or last mile solutions for transit travellers.

Next to this the general policy regarding mobility in busy city centres is more and more directed toward **car-free (or car-shy) zones**. This forces the end-users to rely only on public transport or soft forms of transport. So these zones should only provide these types of mobility options and have ample and safe parking options for these. The soft transport infrastructure should dominate this space.

**Large nodes of public transport** are prime location for the offer of low impact mobility options. A lot of travellers arrive and the radius of the users' potential end location increases significantly with a shared mobility offer. According to Kager & Harms (2017) is increases times nine when there are other travel opportunities then walking to their destination (see figure 4). Low impact mobility is often sufficient to bridge the gap created by the first or last mile towards the connection to public transport.

Figure 1. **Mechanism of increased catchment areas**

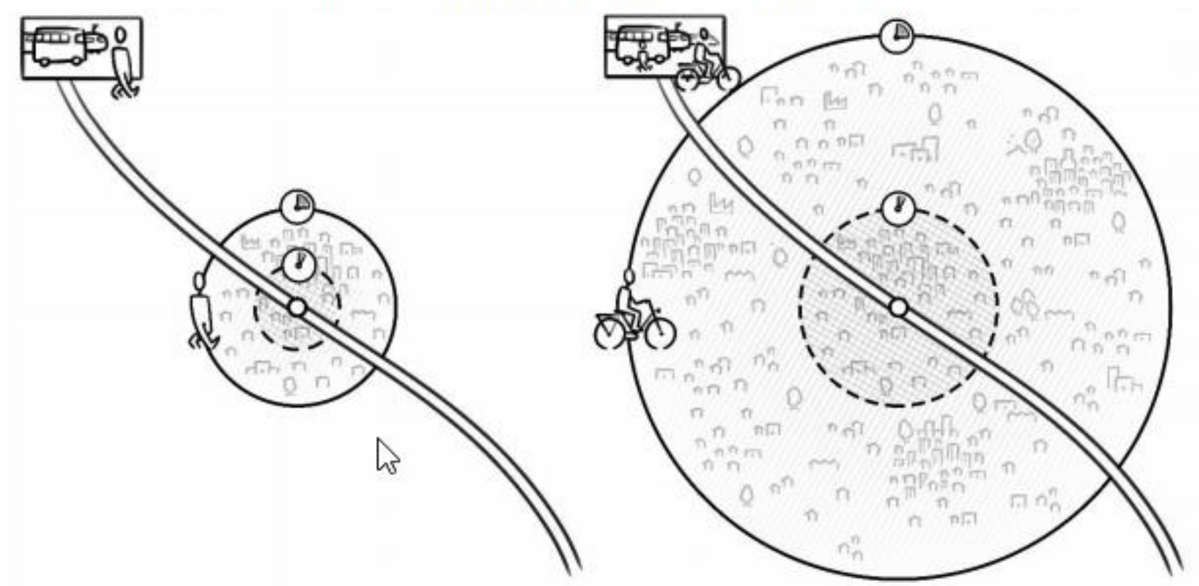

*Figure 5: impact of offer shared low impact mobility options at a node of public transportation (Source: Kager & Harms, 2017)*

This certainly is the case when the centre has other sub-centres with a lot of activities on its border (at a distance too large for walking). An offer of shared means of transport can have a large influence in increasing the use of public transport towards this node.

**The edges of centres** have multiple roles in the sense that there are three transport flows:

- The flow towards the centre: towards the centre car use should be discouraged, low impact-mobility and public transport should be encouraged
- The flow towards the periphery: this current is preferred to be done by public transport, but when possibilities are scarce, car use should not be a problem. Preference will be shared car use.
- Transversal flow by-passing the centre: these are opportunities for carpooling, or switching means of transport in case the public transport is sufficient one way or the other.

These locations should have micro-mobility offered towards the centre (or centres) nearby, when shifting mode of transport, the setup should make sense.

Car parking should be sufficient so that people are nudged towards leaving their car behind. The parking spaces for shared cars will have the most preferred spot at the entrance and/or exit of the parking space.

**Neighbourhoods close to or in a centre** usually do not have a large necessity of car usage, because of proximity to destinations and ample public transport. The presence of multiple functions usually means the proximity of public transport. In the centre the availability of public domain is usually limited and the number of travellers is larger. It is preferable to focus on low-impact mobility options, as if it were a car free (or shy) zone. For traveling outside the city centre inhabitants or visitors preferably make use of public transport or shared cars located on the edges of the centre. Focus on parking space and (safe) traveling infrastructure for soft forms of mobility will nudge towards increased the usage of them.

**Neighbourhoods in more peripheral locations** have more of a need for a car as option for travel. More often than not public transport it limited or even only demand based. This limits transportation options. Preferably car sharing should be stimulated over private car ownership. To be able to easily share a car, there need to be parking facilities for low-impact mobility, as to make the switch. Even more important though is the proximity of the shared car to as many households as possible. It needs to be convenient to persuade people to use it.

In addition to this explanation some notes can be made:

- Note that the usage of cars through car-sharing possibilities also has an impact on the use of low-impact mobility and public transport. It has been identified that using shared cars, decreases the likelihood of buying a (second) private car and increases the use of low impact mobility, including public transport, substantially.

- The reasoning is valid for electric as well as non-electric modes of low-impact transport.

- For cars it is straighter forward. For obvious reasons electric or, as runner up, hybrid cars are preferably offered. The emission of these cars is very low and they are not as loud. On the other hand, these cars require loading facilities at the station.

## 4.3 Number of vehicles

The number of means offered should primarily depend on the number of travellers as well as the way shared mobility has been integrated in the average person's way of thinking.

There are three types of sharing systems, which also has an impact on the numbers that will need to be offered:

- Back to one: the means of transport needs to be returned to the point of departure
  This can be a constrain on the usage numbers (an average of 2 times/day)
  On the other hand it requires limited infrastructure. It is centralised and can be controlled easily, which usually leads to lower prices. There is the added security of having your vehicle available for a return trip.
- Back to many: there are a number of stations or parking zones where bikes can depart and or be returned. The station of departure can differ from the return station.
  This can increase the use-rate per vehicle per day. It requires a smart network of stations with a surplus of infrastructure as to ensure parking availability. There is a probable requirement of re-distribution to resolve problems in demand and offer. This added maintenance can lead to higher pricing.
- Free floating: this type of sharing system is out of scope when discussing eHUBs

Scalability is key. Without enough eHUBS and vehicles, (commercial) shared e-mobility solutions will not be profitable as this market is based on low margins with high volumes. If the implementation takes too much time or is too costly then there is a risk that scaling up will not happen. The implementation and project management approach and how to do it in an efficient and timely way is important. This is not only the case for the number of eHUBs, but also the offer provided.

Determination of the number of shared vehicles offered is a difficult exercise and needs to be re-evaluated along the way. When the number is too low, the user rates might be very high, but very often potential users will experience that there are no vehicles available. This leads to unreliability of the system and limits the growth of its user base. When the number of vehicles available is too high, it can lead to very low user rates and can lead to a situation that is not cost-inefficient (non-profitable).

The Bike Share Planning Guide presents best practices and case studies of the already existing successful bike sharing systems. The system needs to have a number of vehicles so that the system is efficient, reliable and cost-efficient. In other cases it's chances of survival are slim to none. The bike sharing guide provides an indication on numbers based on the number of residents. 10-30 bikes should be made available for every 1000 residents within the coverage area. Larger, denser cities and metropolitan regions with an influx of commuters into the area served by the system should have more bikes available to meet the needs of both commuters and residents. Systems with a lower ratio of bikes to residents may not meet this need during peak demand periods, reducing system usage and reliability. (Gauthier et al, 2013)

Münzel et al (2019) measured the supply of shared cars, by counting the number of cars on offer and dividing it by the population size. This resulted in 17.8/100 000 inhabitant for business to client set ups, and 34.8 / 100 000 inhabitant for pear to pear car sharing.

## 4.4 Infrastructure

Infrastructure can be divided up in to different categories:

- Parking facilities
- Charging infrastructure
- Signage

Type of parking facilities required depends on the type of vehicles offered:

- Non electric has a few advantages such as: the potential to efficiently provide cheap bicycle availability. The bikes as well as the infrastructure is easier to buy and implement at any location.
- Electric modes usually require larger parking spaces. More often it is preferable to have some form of security (or social control) and charging facilities. There are different option for charging, one more invasive towards infrastructure than the other. The advantages of electric systems are that the current status of private ownership of these means are not as wide-spread as for example private bicycles. Less mobile parts of the population are included in the end-user group and the average distance is higher.
- Some vehicles (electric or non-) use a specific docking station: usually they require more space then when using general stalling areas. The flexibility and uniformity is also less with these types of installations

The number of parkings depend on the demand, but also on the type of sharing system:

- Back to one: fixed number of parking spots allocated for shared mobility in correspondence the number of offered vehicles. This way parking space is assured.
- Back to many: more parking spots allocated for shared mobility then offered. Parking needs to be assured. Especially for busy destination locations. Not having a spot available can decrease the user satisfaction.

Electric means of transport that are charged at the station require more space as well as a connection to the electrical network. Working with systems like battery swapping requires less space and provides more flexibility.

There are two types of charging: charge station and battery exchange stations. Battery swap for a large number of widely dispersed sites is not cost-efficient. In this case charging at the location might be preferable. According to Chen et al  (Chen et al, 2018) Charging electric scooters requires a regular household outlet (115 VAC, 15A) and produces about 1.5 kW, with charge time from 7 to 30 hours Overnight charging or battery swap is preferable. (Chen et al,2018)

Electric cars require 230VAC, 30A two pole and produces about 7kW, with a charge time of 4-5 hours for a mid-sized vehicle.

# 5. Getting started

## 5.1 Making public decisions and installing infrastructure

The organisation and legal design of public-decision making is complex and specific to each one of the pilot cities. The goal is to safeguard quality and legitimacy of the decisions made by specific public authorities. There are legal principles to be followed and executed by the assigned administration using instruments that help individuals and groups to take part in policymaking and implementation as well as offer protection against arbitrary government conduct. It aims to be inclusive and fair.

This will result in legal as well as organisational procedures to be followed by the individual pilot cities in order to make decisions, get permissions, get financing and performance of public works.

## 5.2 Start-up

After all the preparation work is done, decisions have been made and infrastructure is set in place the real work begins. The shared-mobility providers get to put their products on display and available for use to the public. This part of the process lies for a large part with these providers themselves but cities and communes can have a positive, stimulating role to be played. It is in their interest that uptake and perceptions of the public are positive.

Clear communication and user stimulation are the aspects where authorities can contribute most.

User stimulation can be done through specific information campaigns, but also through financial stimulations. For example: people receive vouchers for a first free trip, or when people come by train they get a reduction for usage of shared bicycles etc.

Communication is key, so that people are aware of the possibilities. This can be online or on paper, via newsletters or pamphlets. It can be communicated as part of a broader vision on mobility within the city or municipality.

## Sources


- Kager & Harms, 2017, Synergies from Improved Cycling-Transit Integration - Towards an integrated urban mobility system
- www.cyclingpromotion.com.au
- desktop.arcgis.com
- Karla Münzel et al, 2019  Explaining carsharing supply across Western European cities
- Gauthier et al. (2013) THE BIKESHARE PLANNING GUIDE
- Chen et al, 2018, Location optimization for multiple types of charging stations for electric scooters
- Meng et al, 2019, A mixes integer linear programming model for optimal planning of bicycle sharing systems: A case study in Beijing
- ITDP, 2018; Bikeshare planning guide
- University of Antwerp, https://www.uantwerpen.be/en/research-groups/government-and-law/research-program/governance-and-publi/

## The eHUBS Consortium

The consortium of eHUBS consists of 15 partners with multidisciplinary and complementary competencies. This includes European cities, leading universities, networks and electric and shared mobility providers.

@eHUBS_NWE
#eHUBS

https://www.linkedin.com/groups/13711468/

For further information please visit http://www.nweurope.eu/ehubs