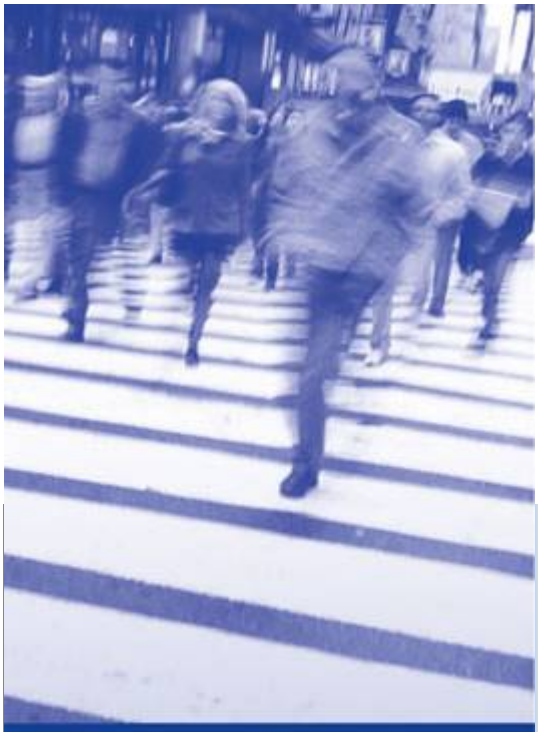

ECCENTRIC

Replication Package: Reorganising public transport network

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CiViTAS

Cleaner and better transport in cities

ECCENTRIC

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Abstract

This report is focused on upscaling and replication potential of the WP5 demonstration measures dealing with ***Reorganising of public transport network***. The document includes a short description of each measure, an overview of lessons learned and conclusions, as well as main drivers and barriers encountered during the implementation phase, from Cluster 1 measures and specific experiences and recommendations for two different measures.

CLUSTER 1, Reorganising public transport network

Measures MAD 5.1, STO 5.2, RUS 5.3, RUS 5.4, TUR 5.5, MUC 5.6 and MUC 5.10

Project Partners

Organisation	Country	Abbreviation
Ayuntamiento de Madrid	Spain	AYTOMADRID
Grupo de Estudios y Alternativas 21 SL	Spain	GEA21
Consorcio Regional de Transportes de Madrid	Spain	CRTM
Empresa Municipal de Transportes de Madrid SA	Spain	EMT
Universidad Politécnica de Madrid	Spain	UPM
Avia Ingenieria y Disegno SL	Spain	AVIA
Stockholms Stad	Sweden	STO
Kungliga Tekniska Hoegskolan	Sweden	KTH
Flexidrive Sverige AB	Sweden	FLEXI
Carshare Ventures BV	Sweden	CARSHARE
Ubigo Innovation AB	Sweden	UBIGO
Mobility Motors Sweden AB	Sweden	MM
Cykelconsulterna Sverige AB	Sweden	CYKEL
Gomore APS	Sweden	GOMORE
Landeshauptstadt Muenchen	Germany	LHM
Münchner Verkehrsgellschaft mbH	Germany	MVG
Domagkpark Genossenschaft EF	Germany	DOMAGK
Green City EV	Germany	GC
Green City Projekt GMBH	Germany	GCP
Technische Universitaet Muenchen	Germany	TUM
City of Turku	Finland	TUR
Varsinais-Suomen Liito	Finland	VSL
Turun Kaupunkiliikenne OY	Finland	TUKL
Western Systems OY	Finland	WS
Turun Ammattikorekeakoulu OY	Finland	TUAS
Gasum Biovakka OY	Finland	GASUM
Obshtina Ruse	Bulgaria	RUSEMUN
Club Sustainable Development of Civil Society Association	Bulgaria	CSDCS
ICLEI European Secretariat GMBH	Germany	ICLEI
FM Logistic Iberica SL	Spain	FMLOG

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Disclaimer: The views expressed in this publication are the sole responsibility of the CIVITAS ECCENTRIC consortium and do not necessarily reflect the views of the European Commission.

Table of Contents

List of Figures

List of Tables

List of Acronyms

ACM	Adaptive City Mobility, Light electric vehicle for car-sharing or logistics
BHLS	Buses with a high level of service
BSS	Bike sharing system
ca	*circa* (around)
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
D	Deliverable
EC	European Commission
EU	European Union
EFV	Electric Freight Vehicle
ESS	e-scooter shared
EV	Electric Vehicle
FCEV	Fuell Cell Electric Vehicle
e.g.	*exempli gratia* (for example)
H2020	Horizon 2020

i.e.	*id est* (that is to say)
LEV	Light Electric Vehicle
MIT	Motorised Individual Transport
ML	Measure Leader
NGO	Non-Governmental Organization
NOx	Nitrogen Oxides
PR	Public Relations
PT	Public transport
TCO	Total Cost of Ownership
SM	Site Manager
SUMP	Sustainable Urban Mobility Plan
VKT	Vehicle-Kilometer travelled
WP	Work Package
WPL	Work Package Leader

Executive Summary

This document includes guidelines for the replication of the measures demonstrated within the cluster ***Reorganising public transport network***, including recommendations and lessons learned, as well as success factors and barriers at different level.

The measures presented in this report are examples of the improvement of public transport networks in peripheral areas as well as of the introduction of new, integrated and accessible shared mobility services complementing public transport in the cities.

All the measures highlight the role played by the City Councils regarding the provision of financing, regulation and policy instruments, public land, necessary recharging infrastructure to support electric vehicles and communication campaigns. Also, the European Commission funding (through CIVITAS ECCENTRIC project) has been a key point.

Cluster 1 includes seven measures implemented in the cities of Madrid, Munich, Ruse, Stockholm and Turku.

Detailed background of the measures, as well as results from Tasks 5.1 and 5.2, are explained in deliverables D5.1 “Preparing for an efficient and clean public transport system” and D5.3 “Reorganising public transport network”.

The following chapters outline the upscaling and replication potential of the demonstration activities for efficient and clean public transport solutions in Madrid, Munich, Ruse, Stockholm and Turku as well as conclusions and recommendations regarding success factors and barriers at different levels.

1. Introduction

1.1. Purpose of this document

In CIVITAS ECCENTRIC, five cities (Turku, Stockholm, Ruse, Madrid, Munich) have implemented in total 50 innovative sustainable urban mobility measures. The measures were addressing a variety on urban mobility challenges, organized in different thematic clusters. This document is intended to equip practitioners and decision makers with the information needed if they want to replicate measures of the thematic cluster “Testing and operating clean and silent vehicles” or aspects of these measures.

Replicability refers to the possibility of transferring results from a pilot case to other geographical areas. These areas have, of course different local contexts and conditions. When a specific measure proved to be successful in one area of a European city, it should be possible to transfer it to another city (or another area of the initial city), considering, the local conditons and conditionalities.

1.2. Target group

This document is tailored following the practical needs of project developers and planners / technical staff fom cities to develop innovative measures, to consider potential barriers and to be able to select the appropriate solutions to match their contexts. This document provides evidence that particular measures have been sucessfully implemented in a city and have a good replicability potential.

2. Summary of the Cluster: Reorganising public transport network

In the last decade European cities have made significant steps forward in the delivery of sustainable urban mobility policies, proving that major impacts in terms of congestion and reduced emissions can be achieved through ambitious measures.

At the same time, peripheral districts remain largely unaddressed, with the effects of flagship projects being rarely transferred to these areas. Recent or expected urban growth processes are posing additional pressure to peri-central areas. The main common challenges are to relieve central areas through clean and efficient urban logistics, as well as to increase the attractiveness and sustainable mobility of suburban districts.

To tackle these common challenges, the cities of Madrid, Stockholm, Munich, Turku and Ruse have formed the CIVITAS ECCENTRIC consortium. The overall objective of the CIVITAS ECCENTRIC project is "t*o demonstrate and test the potential and replicability of integrated and inclusive urban planning and sustainable mobility measures that increase the quality of life of all citizens in urban areas, with a particular focus on suburban districts and new developments and the clean organisation of urban freight logistics"*.

The main objective of WP5 is to demonstrate, in the outskirts of the different Living Laboratories, efficient and clean public transport solutions in order to increase attractiveness and conditions for sustainable mobility in peripheral districts. To achieve this goal, these Living Labs will implement different measures with the following specific objectives:

- Increase the use of public transport in the consolidated districts out of the city centre.
- Increase the efficiency and environmental performance of the public transport fleet, and consequently reduce energy consumption and associated emissions.
- Accelerate the introduction of e-mobility in cities.

WP5 will implement ten measures in the cities of Madrid, Munich, Stockholm, Ruse and Turku, that could be grouped into two main clusters:

- **Cluster 1, Reorganising public transport network**: high level PT services corridors, speed up core bus routes, reorganisation of bus lines and provision of new lines and services (adaptive public transport priority and night services).

  This cluster also includes the provision of bike-sharing, car-sharing and scooter schemes as elements of the public transport chain, as well as the development of a prototype of an electric cargo bike for elderly and impaired people.
- **Cluster 2, Testing and operating clean and silent vehicles** (fully electric, Hybrid and CNG buses) in normal operation conditions.

This cluster also includes the implementation of (e-)mobility stations, by combining public transport, car-sharing and bike–sharing in a new housing area of one of the demo cities.

Cluster	Measure	City	Partner(s)
1	MAD 5.1	Madrid	CRTM, EMT
1	STO 5.2	Stockholm	STO
1	RUS 5.3	Ruse	RUSEMUN, CSDCS
1	RUS 5.4	Ruse	RUSEMUN, CSDCS
1	TUR 5.5	Turku	TUR, VSL, TUAS
1	MUC 5.6	Munich	LHM/MVG
1	MUC 5.10	Munich	GCP, EMMY, LHM/KVR

Table 1: Overview of the cluster 1 measures included in WP5

Transport is essential for economic growth and well-being, as well as for the quality of life in urban and metropolitan areas, to encourage social cohesion, addressing health problems and adapting to demographic changes.

Traffic jams, air pollution, safety and noise pollution are examples of problems commonly shared in European cities. In addition to the direct impact of traffic, urban transport also affects social development, social exclusion, and accessibility for people with reduced mobility. The need for sustainable transport is increasingly recognised and receives more and more attention. Therefore, in a context like the current one, an integral approach to mobility, as well as the main factors that condition it, is needed.

The promotion of sustainable forms of movement inevitably goes through to guarantee a system of efficient public transport, which represents a real alternative to private vehicles, as well as the promotion of non-motorised modes (on foot and by bicycle) and new mobility services (car, motorbike and scooter sharing, MaaS, etc.).

European cities face the challenge of improving mobility, guaranteeing accessibility, and creating transport systems of high quality and efficiency, while reducing traffic jams, pollution and accidents.

In this regard, it is worth highlighting the European Parliament Resolution on a European Strategy in favor of low-emission mobility, adopted in December 2017 in which it is stressed the need for a greater contribution of the transport sector to climate objectives (UE transport policy: by 2030, goal of reducing greenhouse gas emissions by 20% with respect to the levels of 2008).

In this context of change, the CIVITAS ECCENTRIC project and specifically the Cluster 1 measures regarding reorganising public transport networks and services are an exceptional opportunity to share valuable experiences (and tested in the living laboratory areas) with other cities allowing them to improve their sustainable mobility strategies.

Four of the measures presented in this report are examples of the improvement of public transport networks in peripheral areas and the other three are regarding the introduction of new, integrated, and accessible shared mobility services complementing public transport in the cities.

3. From ECCENTRIC cities to replication in other places

When talking about replication, demand must match supply: the measures implemented by the ECCENTRIC cities should provide effective processes, methodologies and technological packages to cities interested in replication.

WP5 cluster 1 is focused on reorganising public transport networks. It includes seven measures to be implemented in the cities of Madrid, Munich, Ruse, Stockholm and Turku:

3.1. Brief summary of the respective measures

- **MAD 5.1: High level PT service corridors in peripheral districts in Madrid**

  Currently, standard bus services provided in the peripheral areas of Madrid show speed data well below the city average, due to traffic congestion and illegal parking. There is significant potential to increase commercial speed through traffic light optimisation as, on average, some 25% of the journey time is stopped waiting for a green light and other actions.

  This measure is in fact the first step for the implementation of high level of service bus corridors in the outer city areas, partly included in the city lab (South-East Corridor). The measure will be critical for the subsequent design and implementation of the whole corridor. Therefore, a pilot section of approximately 3.7 km had to be implemented connecting the living lab with the districts of Moratalaz, San Blas-Canillejas and Ciudad Lineal, all of them in the Eastern periphery of Madrid.

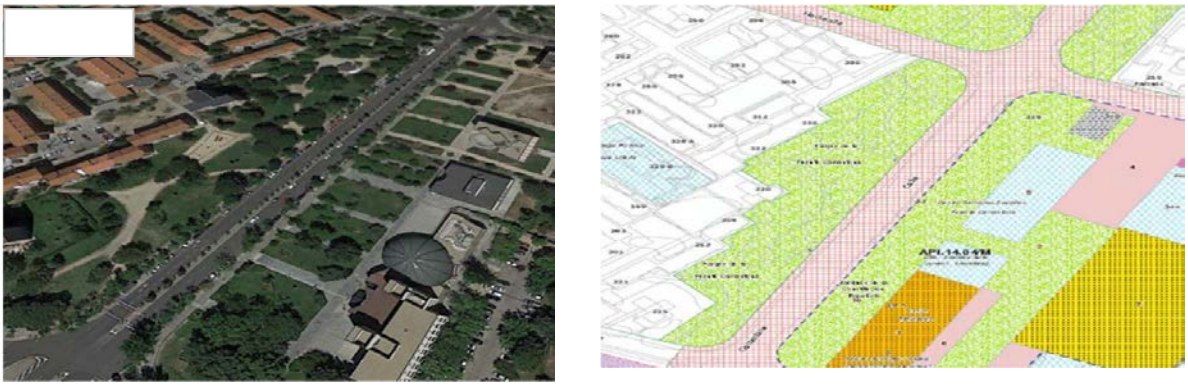

Figure 1: Madrid Corridor Area

The construction project was finished and delivered by the consultants in September 2018. It provided a complete redesign of the cross section of the corridor, including reserved bus lanes and bike lanes, and re-arranging on-street parking.

However, the pilot section did not receive the financial resources from the city council to be built. Accordingly, the scope of the final demonstration stage of this measure changed. The CIVITAS ECCENTRIC measure team decided to

dedicate the resources initially budgeted for the implementation stage to a detailed analysis of the corridor, including the users' and residents' practices and priorities. This detailed analysis provided a better understanding of the lack of priority given by the local decision makers to the implementation of the priority corridor and served to identify some lessons for better consideration of these issues at the initial stages of project design of such corridors. In this way, CIVITAS ECCENTRIC measure MAD 5.1 will contribute to a more detailed review of the feasibility of implementation of the BHLS service in tangential corridors in Madrid.

As the infrastructure has not been constructed and operated, the measure's objectives have not been achieved. However, it is still possible to take into consideration the new evidence provided by the survey completed in September 2019 and the technical study delivered by CRTM in December 2019; this information allowed to reasonably assess the measure's potential:

- The potential for modal shift from car use is estimated to be below the 4% measure objective. This is due to the low time savings achieved by the buses, and the lack of restrictive measures to car use (such as reduction in the number of general traffic lanes or in the number of parking places in the corridor). The low time savings achieved are due to the relatively short distances driven on the corridor by the different bus lines (2 km at most of the 3.6-km long infrastructure) and the virtual lack of demand for trips that would make use of the whole north-south connection that could be provided by a new bus line.
- Bus commercial speed could increase substantially during the peak hours, reaching a maximum value of 14.0 to 14.5 km/h depending on the trip direction. The relatively high number of bus stops in the 3.6 km section prevents the buses to reach higher commercial speeds.
- Public transport users' satisfaction would be likely to increase in a moderate way in case the project would be implemented.
- The potential for emission reduction is low, compared to the investment mobilised, due to the modest number of trips changing from private car to buses.
- The estimated investment cost for the construction of the corridor is €4.25 million. Operational costs were not expected to change significantly, as the speed increase is not too significant, and the additional demand does not require to introduce additional buses.

The following lessons can be highlighted:

- The actual implementation of innovative measures requiring physical interventions in the public space with significant public investment require to build up in advance strong support among decision makers and potential beneficiaries.

- Such support seems more difficult to build up in the case of tangential corridors, like this one, in which in contrast with traditional radial corridors, there is a lack of a clear image and most users only travel on a short section of it.
- Car restrictions on the corridor are likely to significantly improve the performance of such measures: on the one hand, encouraging more car users to look for sustainable mobility alternatives; on the other hand, by reducing the road space required in the corridor, and the investment resources to be mobilised.

The measure benefited from the strong cultural know-how in CRTM and EMT (PT operating company). Indeed, the experience and commitment of the CRTM and EMT staff participating in the measure team was instrumental to complete the construction project documents within tight deadlines.

The key transport institutions at the regional (CRTM) and local (EMT) levels provided a strong support to the bus corridor concept. However, this institutional support was insufficient to convince decision-makers at the municipality to provide the necessary resources for its construction.

There are no concrete plans to implement this corridor or to revise the construction project developed by CIVITAS ECCENTRIC. However, it can be expected that the results of this measure will influence the approach of CRTM and EMT towards the design and implementation of bus corridors following the completion of the local SUMP revision in 2020.

The potential for upscaling the measure at the city level, analysing other tangential corridors is uncertain at this stage. The position of local decision-makers is unlikely to change at least until the revision of the local SUMP is completed.

- **STO 5.2: Speed up core bus routes**

  Stockholm is a growing city and in spite of a high public transport modal split of almost 80% during the extreme peak, more people need to change to public transport to prevent the increase of congestion levels. Although inner city residents already use PT or walk, most car users come from outside the inner city.

  To increase the speed and attractiveness of PT, this measure tests the effectiveness of physical modifications to the roadway geometry, with a focus on corridors where fully segregated bus lanes are not feasible. In this measure, geometric improvements have been made along two trunk bus lines through the northern suburban districts of the City of Stockholm. Improvements included, for example, adding lengths of bus-only lanes, relocating and lengthening bus stop areas, and improving curbs for boarding and alighting.

Figure 2: Bus route 178

The measure now work with two of the core buses in the outer urban area, bus lines 178 (Mörby station–Jakobsbergs station) and bus line 179 (Vällingby–Sollentuna station), focusing on increasing the speed and attractiveness of public transport, in terms of improved regularity, prioritisation of buses, reduced travel and dwell time, etc.

An earlier pilot project (carried out during 2014) showed that it would be possible to improve accessibility with minor measures at low costs if they were systematically implemented. The pilot project on one of the four core bus routes tested several measures to speed up the buses. The results of the pilot have been developed and implemented on all inner-city core bus routes.

The innovative character of this CIVITAS ECCENTRIC measure is that this idea for speeding up the bus lines will be tested in the outer urban area. The challenging part is that when it comes to peripheral areas there is a totally different environment. The length of the whole routes, as well as the distance between stops is much higher. The three main ring roads of Stockholm County, E4, E18 and E20, are in most cases congested especially during peak hours incommoding the regularity and the travel times of public transport.

What is also innovative in this measure is the process and the methodology used for the implementation. Instead of having predefined issues to be tackled by the project, the main problems / priorities were realised through a workshop organised in June 2017. A wide range of different stakeholders related to the selected bus lines (representatives from the City of Stockholm, the public transport authority -SL-, bus drivers, public transport users, etc.) were invited to discuss focusing on the main problems (drawbacks, analyses of buses driving times, stop times, etc.). As a result of this workshop an action plan was set up by the measure leader in each action area. The findings of the workshop set the basis for the measures to be implemented.

The bus lines 178 and 179 will be more attractive if the goals of this project are achieved: decreased congestion on the buses, faster speed and regularity.

The measure has been evaluated based on the bus lines' operating characteristics, finding that dwell times and reliability improved, though not to the point of the initially set goals. Overall speeds improved on one line but not the other[1].

Regarding expected long-term impacts, the corridor improvements will continue to have some effect, but these are likely to be rather overshadowed by other, larger-scale changes in the road network.

This measure can be upscaled by extending to the full lengths of both bus routes and by expanding to other bus routes that have not yet been improved in this way. An extension to the full route might produce more-than-linear improvements in the effects, if the hypothesis is correct that the unimproved sections undermined the improved sections' effects to some extent. Expanding to other routes will have bring various degrees of improvements, but without examining their characteristics in detail, we can assume the improvements would be linear with the number of routes added.

- **RUS 5.3: Analysis of PT demand and reorganisation of PT network in Druzhba**

  The public transport service connecting the peripheral district of Druzhba with the centre of Ruse and its industrial zones (around the city centre) is rather slow and unreliable. A large share of people living in the peripheral districts like Druzhba use their own cars or taxi services to travel to the city centre or to work.

  This measure will provide demand-oriented, fast, regular, and reliable public transport services to and from the city centre to the district of Druzhba (one of the entrances to the city centre with high volumes of traffic). Implementation of the measure involves redefining and reorganising public transport lines (trolleybus and bus), to improve the balance between demand and supply of public transport services. The analysis of public transport demand provides data for passenger flows and enables local transport planners to establish a new transport scheme for the targeted area with appropriate timetables to meet the needs of more passengers. Finally, the new transport scheme will be promoted.

[1] Commercial speed gives ambiguous results, with an overall increase in speeds on line 178 from 27.1 to 27.9 km/hour, but an overall decrease on line 179, from 27.1 to 26.9 km/hour. Perhaps worth noting is that route 178 fully falls within the study area while 179 extends beyond the study area in both directions, including into municipalities other than Stockholm. The reported data here are obtained only from portions of the route within the city of Stockholm. Hence, there could have been other developments along the portions of Bus Route 179 outside the city of Stockholm that counteracted any overall improvements in speeds.

Figure 3: Current Trolleybus Network in Ruse ©□ Ruse Municipality

This measure implemented by the City of Ruse aims at increasing the use of public transport by 20% in the outskirts of the city in the long term, to create a new transport system in the medium term and to collect relevant data about PT demand on short term. It also aims at decreasing the use of private cars by 20% and the associated emissions produced by these cars (10% CO_2 emissions reduction).

What is innovative in this measure is the new approach for collecting information about the PT demand using modern interviewing and questioning methods (for the first time in Ruse) and also that the data collection and recommendations will be part of the Ruse SUMP 2016 – 2026 (SUMP will be implemented for the first time in Ruse). The new transport scheme will be the core of the SUMP and all the measures are parts of its infrastructure or new mobility measures.

The key challenges in this measure are represented by the final citizen and relevant stakeholders' acceptance of the updated municipal transport scheme. This challenge has been tackled by raising awareness about the importance of the measure during meetings with the citizens in the district, during information events and through social media.

Another important challenge is represented by the need to meet the requirements of the different stakeholders. This is solved by carrying out surveys, interviews and focus groups with representatives of the different stakeholder groups – citizens, NGOs, companies, schools, hospitals, public transport service providers, experts from the transport and spatial planning departments in the municipality, representatives of the local council, etc.

Regarding Implementation phase, there are no deviations from the original plans. However, because of the analysis made in the research and planning phase the decision of upscaling the measure to encompass the whole territory of the municipality was taken. Thus, reorganisation of the public transport lines in Druzhba is financed by the CIVITAS ECCENTRIC project, while the

Municipality is financing the work being carried out for the rest of the territory of Ruse.

- **RUS 5.4: Introduction of "Good Night" line to Druzhba**

  This measure was planned for the first time in the city of Ruse in order to provide demand-oriented, fast, regular and reliable public transport service during the night for the Druzhba citizens (about 20% of Ruse population live in this district). There was a high demand for such a service and numerous letter from citizens have been received in the Municipality suggesting and asking to provide public transport during the night.

  In Ruse, there was no option for people to use public transport to or from the district of Druzhba after 21:00h. Most people either opted for using their own cars or rely on taxi services. For many people, taxis were not a feasible option - leaving them with feeling isolated and discriminated against properly accessing the other areas of the city.

Figure 4: Interior of "Good Night" line (© Fachy Marín on https://unsplash.com/)

For this purpose, a new PT line named "Good night" was established in the frames of the CIVITAS ECCENTRIC project connecting the peripheral district with the city centre. A large promotional campaign was launched for informing citizens about this initiative and inviting them to use it with the aim to decrease the use of cars and taxis for moving during the night.

Before launching the new service, a huge research took place aiming at establishing the most convenient itinerary of the new line served by a trolleybus. The route is from Druzhba district to Central Railway Station with 14 stops (the distance between the stops is approximately 300 m) and passes through the main streets and boulevards connecting the peripheral area with the central part of Ruse.

The bus service started to operate in May 2019 and runs from 0:30h to 3:10h. The single-use ticket costs 1 BGN, as is the case with the other lines that run throughout the day. There is currently no provision for the introduction of separate monthly passes that apply only to the night line but citizens with travel passes for daily lines passing this route will be able to use them.

Figure 5: The itinerary of the “Good night” line

One of the main outputs of this measure is the PT service during the night for the first time in Ruse (second in Bulgaria after the capital); the other one is to improve livability in the peripheral district of Druzhba (people will feel less isolated in their peripheral zone and equal to the citizens living in the centre).

The expected impacts are a decreased use of private cars and taxi services (impact on society) as well as a decreased air pollution from private cars and taxis (impact on environment).

There will be an important interaction with the Ruse SUMP implemented in the moment outside of CIVITAS ECCENTRIC. The night line is part of the new Ruse transport scheme having as a main goal to better serve the Ruse citizens with PT for decreasing the use of cars for short trips, as well as to achieve better social equity and inclusion.

The main challenges faced while developing and implementing this measure so far have been to find the best solution for the vehicles to be used for operating the new line, and to identify an appropriate solution to award the operation of the service. As the municipality did not have enough resources for purchasing e-vehicles during the project lifetime, it has been decided to use the existing trolleybuses. This decision solved the problem with the operator –the service was assigned to the municipal trolleybus company.

The quality of the air was improved that is partly due to the combination of new mobility measures. CO_2 emissions decreased with 33% (data from measure evaluation results CO2 decrease from 10 mg/m3 to 6.7 mg/m3). We registered 2.5 % less car usage thus providing a decrease by 10.4% comparing to the

initial value. We also registered 2 % more use of PT thus providing an increase by 4% comparing to the initial value.

The measure strongly contributed to the social inclusion and livability in Druzhba. 90% of the citizens accept it and estimate that it will improve their living conditions. 90% are satisfied with the “Good night” line because it gives allows them to move during the night and to have access to the Ruse evening attractions thus decreasing the social inequality and improving the quality of life in the peripheral district.

Although the number of passengers increased 5 times since the beginning of the service, their total number is small and is not sufficient to support the service after the end of the project.

- **TUR 5.5: Bike-sharing and Car-sharing schemes**

  Bike share schemes offering affordable short-term rentals on a predefined geographical area have sprung up in many cities during the recent years. In Finland, Helsinki was the first city to implement a bike share system in 2016 and Turku followed with the system implemented in measure TUR 5.5. The system was to be integrated to the public transport Föli’s IT-platform, providing a quick and easy way of getting around the city centre.

Figure 6: Bike sharing system in Turku was launched in May 2018

The main objective of the bike sharing system (BSS) is to complement public transportation services in Turku. Furthermore, another objective of this measure is to encourage and enable car sharing systems to be offered in the city.

A pilot BSS with 300 bicycles (initially 100 were foreseen) and 37 stations was designed, procured, and implemented. Integration with Public transport adds value to the system especially co-operation with customer service, marketing and IT. This needs new way of thinking and efforts towards common understanding should be highlighted.

On the other hand, car-sharing companies are currently offering their services in Turku, to be attributed to CIVITAS ECCENTRIC effect to a great extent.

The implementation of BSS was expected to contibute to increasing the share of PT considering that the system was to complement Turku's public transport services and to be integrated to the public transport Föli's IT-platform, providing a quick and easy way of getting around the city centre. Cycling becomes more attractive and as a competitive alternative to the private car. Renting or sharing a car will be perceived as a more attractive alternative than owning a car.

The innovative aspects in this measure are related with the BSS procurement. The procurement model of the city bike-sharing system is a novel way of doing the procurement since it included bikes, stations, operating and balancing[2] but not the customer service, marketing, or IT-side. The marketing side was tendered separately.

The measure has achieved half of its main goals. The bike share system is in place and several car share companies are offering their services for companies and housing companies. The city is working on parking policies to facilitate this process. However, the city bikes are not as attractive as it was expected, and it is inconclusive whether the system implementation has led to a growth in cycling shares. Nevertheless, the system satisfaction is rather high. To sum up, despite lower system usage than expected, the measure has reached its goals somewhat satisfactorily and, importantly, served as a valuable learning process for implementing a novel system with some unique characteristics.

Long term impact of the measure remains to be seen. To be able to properly affect choice of travel mode, the station network needs to be widened and some system elements altered. Currently, discussions about the future of the system are held and there is a preliminary decision not to continue with the current bike-sharing system provider but to put out the tender again and set a maximum budget per year. The measure has, in any case, served as a valuable model for other cities in their efforts to set up a bike sharing system (e.g. Tartu in Estonia, Joensuu, Kuopio and Tampere in Finland).

Upscaling plans have been devised on city-level, with a suggested extension plan. A pilot with electric city bikes was foreseen to take place in the Spring 2020, with additional CIVITAS ECCENTRIC funding.

- **MUC 5.6: Conception and development of an integrated e-bike sharing scheme**

  In Munich, the current public bike-sharing systems do not fit the needs of senior citizens (60+) or physically impaired people. The current bicycles (public sharings systems) do also not allow users to transport heavy loads. The chosen alternative in these cases often tends to be the private car.

[2] Operators of public bicycle sharing systems (BSSs) have to regularly redistribute bikes across their stations in order to avoid them getting overly full or empty. There are two main objectives with regards balancing process: on the one hand it is desirable to reach fill levels at the end of the process so that the stations are likely to meet user demands for the upcoming day(s). On the other hand, operators also want to prevent stations from running empty or full during the rebalancing process which would lead to unsatisfied customers.

To offer an alternative for this target group, an electrically powered trike ("eTrike") with sharing capabilities was developed. The measure includes the development of the actual vehicle, charging infrastructure, an app to enable sharing of the trike, and the testing of the resulting prototype in the Living Lab.

Figure 7: the MVG eTrike (left) and the MVG eTrike App Icon

A focus was on the integration of the eTrike in a bike-sharing scheme (MVG Rad) as part of a multimodal public transport system and solution for medium distances in a city as well as its surrounding area.

The concept for the prototype of the MVG eTrike was planned and built together with an international and interdisciplinary team of the Technical University of Munich. On this basis, a second prototype with different suppliers was built. Also, the target group was involved. To get a better knowledge of the needs of the main target group (people with physically impairments), the measure team had a close exchange to the Disabled Advisory Committee and organised interviews with the target group.

On the other hand, it was challenging to find manufacturers for the engine and the battery that support open interfaces.

As the eTrike is a new product development (no existing system), the key challenge is to coordinate the various stakeholders and suppliers involved. That leads to long communication channels. The interaction and integration of all

technical and software components was also not easy. Finally, due to close cooperation, most challenges could be solved. Therefore, the collaboration improved a lot and the technical problems seem to be tackeld as well.

Some stakeholders had to be involved much earlier, for the whole integration of the system to have a chance in being implemented. In addition, the delivery of batteries takes time due to the market situation.

Finally, to develop an e-Trike which should meet different needs (target group, Integration in existing hardware and software, compatible for a public sharing system) it is quite complex and comparatively cost-intensive. The questions are:

- Will there be enough users and potential partners to justify this effort?
- Will the system finally work as a whole?

The main requirements to implement a technological measure as MUC 5.6 are as it follows:

- A motivated team with good project management skills and technical expertise.
- A good and timely stakeholder involvement.
- Good competent and trustful suppliers – not too many, to lower complexity and coordination effort.
- Market available products / components when needed (e.g. battery).
- A thorough and precise planning as much as possible before the project starts.

Regarding replicability, eTrikes use a modular sharing system scheme (from charging station, app, back end system and the bord computer) which is partly and as a whole transferable for all electrical mobilities. This means, it could be extended to other forms of mobility.

The main output of this measure will be a best practice solution based on the Munich case not only for the eTrike development but for the integration of the e-Trike in ”MVG Rad” also. This will enable and facilitate the implementation of the eTrike in the public bike sharing scheme MVG Rad in Munich and other cities are planning to replicate this solution.

- **MUC 5.10: Sustainable mobility via E-scooter sharing**

  As of end of February 2020 it was decided to include this measure “emmy” into Work Package 5 as MUC 5.10 (former WP6 measure).

  This measure focuses on introducing, understanding, and optimising the E-scooter sharing (ESS) “emmy” (the scooter sharing operator company) service in Munich Living Lab in order to broaden and optimise the local sustainable mobility options. The goal of the sustainable optimisation aims at identifying approaches to counterbalance possible surplus trips by ESS and substitution effects that can cause additional emissions and an increased road usage.

Figure 8: Sustainable mobility via e-Scooter sharing

The “emmy” ESS concept is a sharing system for free-floating motor scooter. However, within the Living Lab, the two CIVITAS ECCENTRIC (e-)mobility stations (measure MUC 5.9) in Gertrud-Grunow-Straße and Marianne-Brandt-Straße were chosen to be included into the “emmy” business area. Therefore, ESS in the Living Lab can be considered a hybrid between a station-based and a free-floating scooter sharing. Its starting and / or ending point in the research area are station-based, while other starting points / destinations outside the Living Lab are free-floating.

The ESS service aims at periodically placing three scooters on the premises of each of the selected (e-)mobility stations for ESS to be accessible for local customers. Besides, scooters are placed there by customers ending trips within the research area. Introducing ESS in the Living Lab was accompanied by up street signs that allow ESS parking on the mobility station premises. An ESS scooter can carry one to two people and can be booked via app.

The measure was introduced in October 2018 and is currently scheduled to continue indefinitely. ESS market developments and existing scientific approaches to sustainably introducing ESS in (sub-)urban spaces were researched in the first project phase. No new technology developments were necessary to implement the measure.

An in-depth study to understand the usage, motivations, and substitution effects of ESS has been carried out with the aim at developing managing solutions to ensure ESS sustainability (e.g. strengthening favorable substitution effects, counterbalancing other unwanted substitution effcts). Inspired by current governance research, a focus group with decision makers from the ESS service can be a means of finding sustainably effective and economically acceptable solutions.

Regarding innovative aspects of the measure the following can be highlighted:

- New spatial approach: free-floating sharing mobility offers tend to be situated in city centres where the density of probable starting points and targets is high and attracts many potential users. Positioning ESS in an eccentric space enables a Living Lab approach to optimise the mobility offer to ensure sustainable mobility effects.
- Developing ESS mobility management approaches in cooperation with political and business decision is a promising tool contributing to sustainable mobility. So far, German municipalities have few options to manage the introduction of free-floating vehicles in order to optimise sustainability effects.

User satisfaction with the ESS service has been high. Most trips by ESS have replaced trips formerly taken by public transport as well as by foot and by bicycle in a motorised, locally emission-free way.

The measure evaluation shows how the introduction of ESS has reached its intended effects:

- Ever since ESS was introduced in Domagkpark / Parkstadt Schwabing, the number of households using the services there has increased by 5,19%. The strongest annual usage per month to/from the research area in 2018/2019 was in July.
- The measure has enabled the ESS vehicle-km travelled starting / ending in the research area to strongly increase seeing that its baseline of trips starting / ending in the research area was nil beforehand: 24.029 km were travelled to / from the research area in 2018/2019 after the introduction of the measure.
- Most mode shifts (≥ once a month) towards ESS come from public transportation followed by trips formerly taken by foot, by bicycle and by car. This requires further research beyond the project as to whether ESS has contributed to making space for new public transportation users and furthering sustainable modes of transportation in the long run.
- The introduction of ESS has directly reduced CO_2 (-2,95 t in 2018/2019), NO_x (-0,0085 t in 2018/2019) and PM emissions (-100g). Understanding the total reductions within the entire Munich mobility system requires to develop a modell for the effects of the ESS modal shifts from public transport.

The measure MUC 5.9 ((E-)Mobility Stations) could increase the use of ESS by contributing to a higher awareness of the ESS offer. Since the ESS parking areas within the Living Lab are part of the (E-)Mobility stations, potential customers using those stations can increase awareness of the ESS while using other mobility offers. This could enhance the potential usage group of ESS and contribute to obtaining a higher response rate. Nevertheless, the relevance of measure MUC 5.9 for residents' and employees' awareness of ESS was not examined in the surveys. Therefore, its relevance cannot be corroborated.

The measure is already continuously being upscaled as ESS services are expanding their business areas as well as the number of scooters they are offering. Since the beginning of the CIVITAS ECCENTRIC measure implementation, the ESS business area has been expanded to include relatively peripheral neighbourhoods of Munich. At the same time, the number of scooters has been increased from 50 to 400 (beginning of 2018).

3.2. Evaluating the replication potential of measures

3.2.1 Drivers and barriers to be expected

Urbanism and mobility have a direct effect on the quality of life of citizens, so they are relevant aspects in public administrations strategies and policies. A livable and friendly city is one where shared mobility, active modes and public transport play a leading role in front of the private vehicle.

Public Transport is a good way to reduce congestion and emissions in urban areas improving the environment and citizens' health, especially when alternative and cleaner fuels are used for running. The European Commission strongly encourages the use of public transport as the main link of the integrated and multimodal transport chain in a city.

On the other hand, the shared mobility systems (car, bicycle and motorbike), are growing exponentially in many European cities, offering a transport alternative tailored to the new citizens' needs. In addition, being electric vehicles or low emissions, are contributing greatly to improve the cities' air quality.

The seven measures of Cluster 1 outlined in Section 3 are being developed in five European cities (Ruse, Stockholm, Turku, Munich and Madrid) and are useful examples for other cities facing the same problems: the reduction of the individual car use and the availability of multimodal mobility for everybody.

In general, the actions on transport systems are high visibility actions and in most of the occassions will change the city in many ways. That is because it is of great interest considering the following relevant aspects when implementing mobility measures:

Key general aspects to be considered

- It is important to have a clear concept and to start as soon as possible especially with the information and integration of stakeholders/partners.
- Political will and support are really helpful for a successful implementation of the action and the participation of the politicians in different project events (public presentations, inaugurations, technical meetings, etc.) increases the visibility of the project.
- Commitment and coperation between all the administrations and relevant stakeholders involved is a key point for the success of the action. With a close cooperation and collaboration of these relevant agents most challenges can be solved.

Main actors: City councils, Public Transport Authorities, Public transport operators, new shared mobility systems operators, suppliers, interest groups, citizens, politicians, etc.

- As a key challenge is to coordinate the different actors involved, long communication channels are needed.

  A transparent process and good stakeholder involvement are very important and is an iterative “to do” if you want to meet the requirements of the stakeholders involved as well as that your measure/project/product to be accepted. Existing networks to associations and politicans/staff of the City Council should be used. Regular meetings or information via mail to update relevant stakeholders should be one task in your project management plan.
- It is also a key point a clear division of responsibilities between the stakeholders.
- The action to be implemented must be in line with the general strategy of the different administrations involved.
- All partners must work in the same direction regarding the implementation of actions.
- It is also important to consult with professionals/experts/manufacturers who have experience in the field you are interested in.

  Build up an interdisciplinary team with different skills. Relevant knowledge could either come from internal team members or external "advisors"/partners. From the beginning, a clear and transparent communication, decision-making process and schedule are very important. There should always be enough time for exchange and a joint discussion. Hand out a comprehensive and complete set of (detailed) requirements to the developers and manufacturer.
- In most cases, a project has one leader/manager. It might be advisable, to establish a dual management system: one project manager and one technical project lead or have an advisory board of experts consulting the project. Moreover, existing hierarchial structures could slow the process. It is important, that the project manager/leader could make most decision on his/her own or that the hierarchical structure is flat.
- When planning the organisational structures for the project, it is helpful to consider that the different types of stakeholders have varying priorities and working styles: For instance, startups mainly focus on profitability and efficience. While sharing knowledge and data can be in their interest as well, it may only be one of their subordinate goals. It is helpful to take this into account (when planning schedules, for instance) for the project to succeed.

The importance of citizen participation: transportation designed for the user

- Integrating user perspectives into all transport aspects is key for gaining community support to the initiatives.

- All measures in this cluster highlight the importance of involving citizens and other relevant stakeholders since the early beginning, to gain support, market, increase impact overall, and to spread success stories afterwards.
- All measures highlight that it is important to clearly define why the project is needed, to gain initial support and budget, but also to design and execute it in a way that leads to goal fulfilment. That is because it is of core importance to involve the citizens and other relevant stakeholders to receive proper feedback and ideas as well as the acceptance of the measure.

Transport adapted to the new mobility needs

The design of new mobility concepts must be focused on feasibility and financing and its implementation implies redefining urban planning and mobility schemes. The shared mobility systems (car, bicycle and motorbike) offer a transport alternative tailored to the new citizens' needs.

All measures focus on shared and accessible mobility systems highlight the following topics:

- Screening existing knowledge before beginning the project and staying up to date with new publications.
- Communicating the business potential of the research area to the sharing operators in order to ensure interest on your project and financing.
- When launching a totally new shared mobility system special attention must be paid to the duration of procurement and implementation process as well as to the staff resources required.
- Make sure that there is enough time for piloting before the launch of shared mobility systems not only for testing the running of the system but also for evaluating its acceptance by the users.
- Integration of these new shared mobility services with public transport adds value to the system especially co-operation with customer service, marketing, IT. On the other hand, the integration should meet different needs (integration in existing hard- and software, compatible for a public sharing system) and this is quite complex and comparatively cost-intensive.
- Understanding sustainability effects and developing solutions with relevant stakeholders to optimise the mobility service.

Communication campaigns and actions

Communication actions informing users (citizens) about new mobility services or improvements in the public transport system of the city are very useful for raising awareness about the importance of the measure and for its final acceptance.

Therefore, it is important to plan for the communication and media visibility in advance and involve relevant actors in marketing actions. Also celebrating meetings with the citizens and information events are important.

3.2.2 Foreseeable Impacts

Regarding the improvement of public transport networks / introduction of new shared mobility services in peripheral areas the expected impacts include:

- Impact on PT operation ratios:
  - An increase in bus patronage and a reduction or operational costs per passenger.
  - An increase in commercial speed in the pilot section.
  - An increase in reliability (regularity) levels.
  - Improved accuracy of timekeeping.
- Impact on society
  - Facilitation of multimodal behaviour.
  - Reduction of Vehicle-Kilometer Travelled (VKT), on account of the modal shift to public transport and bicycle/scooter usage (increased use of public transport & decreased use of private cars).
  - Increased social equity through mobility sharing systems.
  - Increased attractiveness for the investment on complementary mobility options (Active mobility, MaaS, etc.)
- Impact on urban space and the environment
  - Better use of street and public space
  - Better management of travel flows, congestion, and other forms of capacity constraints.
  - Decreased air pollution and emissions.
- Impact on energy consumption

  Increased energy efficiency of the public transport.

The street modifications carried out under measure STO 5.2 have had several confirmed effects on bus route performance:

- Bus route regularity improved on both routes and accuracy of timekeeping improved on the one route for which a comparison could be drawn. These results indicate there were fewer disturbances to bus circulation along the routes.
- Dwell times improved on both routes, suggesting more efficient boarding and alighting.

The evaluation of RUS 5.4 highlithed the following topics:

- People are accustomed to using their cars and do not trust public transport, which has not been at the desired level for years. In such conditions the positive trend in both car and PT use is a success. It was recorded a decrease of 2.5 % of car usage providing thus a decrease by 10.4% comparing to the initial value,

as well as 2 % more use of PT thus providing an increase by 4% comparing to the initial value.

- The quality of the air was improved and that is partly due to the combination of new mobility measures. CO_2 emissions decreased with 33%. It was recorded a decrease of 2.5 % of car usage providing thus a decrease by 10.4% comparing to the initial value, as well as 2 % more use of PT thus providing an increase by 4% comparing to the initial value.
- It can be reported that the measure strongly contributed to the social inclusion and livability in Druzhba. 90% of the citizens accept it and estimate that it will improve their living conditions. 90% are satisfied with the “Good night” line because it allows them to move during the night and to have access to the Ruse evening attractions thus decreasing the social inequality and improving the quality of life in the peripheral district.

Regarding the introduction of new, integrated and accessible shared mobility services complementing public transport in the cities, the TUR 5.5 expected impacts are detailed below

- The measure has achieved half of its main goals. The bike-sharing system is in place. Car-sharing companies are now offering their services in Turku, to be attributed to CIVITAS ECCENTRIC effect to a great extent.
- However, the city bikes are not as attractive as it was hoped and it is inconclusive whether the system implementation has led to a growth in public transport. There are mitigation factors and negative interference, both internal and external, that can explain the lower system usage at least to some extent: massive construction works in the city centre, problems with the users’ interface. Nevertheless, the system satisfaction is rather high.

The evaluation of MUC 5.10 shows how the introduction of ESS has reached its intended effects:

- Ever since ESS was introduced in Domagkpark / Parkstadt Schwabing, the number of households using the services there has increased by 5,19%. The strongest annual usage per month to/from the research area in 2018/2019 was in July.
- The measure has enabled the ESS vehicle-km travelled starting / ending in the research area to strongly increase seeing that its baseline of trips starting / ending in the research area was nil beforehand: 24.029 km were travelled to / from the research area in 2018/2019 after the introduction of the measure.
- Most mode shifts (≥ once a month) towards ESS come from public transportation followed by trips formerly taken by foot, by bicycle and by car. This requires further research beyond the project as to whether ESS has contributed to making space for new public transportation users and furthering sustainable modes of transportation in the long run.
- The introduction of ESS has directly reduced CO_2 (-2,95 t in 2018/2019), NO_x (-0,0085 t in 2018/2019) and PM emissions (-100g). Knowing the total reductions

within the entire Munich mobility system requires modelling the effects of the ESS modal shifts from public transport.

- User satisfaction with the ESS service has been high. Most trips by ESS have replaced trips formerly taken by public transport as well as by foot and by bicycle in a motorised, locally emission-free way.

No.	Indicator	Data units
1	Awareness	%
2	Aceptance	%
3	Satisfaction	Score (0-5)
4	Contribution to Policies, Plans and Programs	Score (0-5)
5	Operational barriers	Score (0-5)
6	Mode shift	Trips/unit of time
7	Vehicle-KmTravelled (VKT)	Km
8	System usage	Frequency (users/unit of time)
9	Commercial speed	Km/h
10	Regularity	%
11	Accuracy of time keeping	%
12	CO_2 Emissions	Tn of CO_2 per year
13	NOx emissions	Tn of Nox per year
14	PM emissions	Tn of PM per year
15	Relative Travel Cost	% (travel cost/income)
16	Investment Costs	M €
17	Operating Costs	€/VKT

Table 2: KPIs of cluster 1 to be chosen

3.2.3 Policy Recommendations

Improving public transport should be at the core of any strategy addressing Vehicle-Kilometer Travelled (VKT), and all the externalities associated to the operation of vehicles in an urban environment. Out of all the policy fields tested in ECCENTRIC, it is by a large margin the most effective way to achieve a reduction of transport emissions, improve the management of mobility needs and congestion, better allocate road and public space, increase access to opportunities and services (particularly for disadvantaged groups), and in the long term, improve urban structure.

The improvement of public transport should have the users (current and potential) at the center of the decision making process. Punctuality, reliability, speed, connectivity, etc.), are the most important levers for user satisfaction and securing high ridership levels.

The improvements in the services provided by public transport impact beyond the regular user base. They are also a key element to regulate travel flows and reallocate public and street space. If attractive, public transport can help to ease congestion and reduce delays for all travelers.

Investments in public transport are also the key to enable multimodal behavior, and secure investments in sustainable mobility, particularly in active modes. Without the

basis of good public transport, cycling, walking, MaaS, sharing, etc., will yield always to the private vehicle and high car dependency.

Some main recommendations are worth being highlighted from the implementation process:

- Involvement of decision-makers

  The involvement of decision-makers is particularly complex when the measure includes physical interventions with relatively high investments. Besides the decision-makers involved in local mobility policy, it is likely that decision-makers from the financial area and even from other areas unrelated to transport will have a say in the internal debate on the allocation of resources among competing policies and actions. For this reason, it seems that the early involvement of these decision-makers is necessary in order to get their views on the measure's contents and potential impacts: this could facilitate the adaptation of the measure to the decision-makers' priorities, so that it can be financed, or to dismiss the measure if the technical team is unable to gain the necessary support, avoiding the waste of resources in further developing a project that has no chance to be financed.

  Such involvement is associated with a broader view of the project, compared to other policies outside the transport sector that could be implemented in the targeted area. To facilitate such comparison, it seems necessary for transport professionals to gain a wider understanding of the general priorities at stake in the area, beyond mobility issues, and to provide adequate information to all decision-makers about the mobility proposal at stake. This is linked to the next recommendation below.

- Assessing the public's actual support

  The implementation of policy actions, particularly when they require significant public investment is associated with the identification and strong support of a group of clear beneficiaries. If this group is identified at an early stage, the measure is more likely to gain a broader support afterwards, including those that will benefit only marginally from the project and those that, even without getting much benefit, consider the measure as fair and consistent with broader objectives (the environment, equitable access, liveability…).

  In the absence of such network of support, the measure is less likely to receive approval from decision-makers.

- Planning is of essence

  In order to facilitate the process of procurement and implementation, the importance of planning cannot be underestimated. It is relevant both in terms of technology and procurement (contract) details, both having a critical impact on subsequent system cost-efficiency.

  Early involvement of local stakeholders and planners of the city is crucial for success of the planning process of reorganising PT networks actions as well as for the adoption of new mobility sharing systems.

With regards to the new mobility sharing services, analyzing the neighborhoods considered for such a measure based on their business and sustainability potential is a helpful ground to win over other stakeholders for the measure, to ensure demand and to contribute to the measure's success.

- When there are measures with a similar goal synergy effects can result and the projects can benefit from each other.
- Finally, as it has been stated before in this Section that communication and marketing policy of the project, as well as the feedback of the participatory processes, is a key point for the project success.

4. Example measure

4.1. STO 5.2 Speed up core bus routes

The suburban core bus routes in Stockholm play an important function in connecting places less well served by the metro and other rail networks. The buses do not have much on-street priority and are therefore affected by congestion caused by other motor vehicles. The City of Stockholm sees potential to improve the core bus routes in this outer city area to give better regularity, reduce travel times and have less crowding, etc. This can in turn relieve pressure on the rail network and stations.

This measure enables the core bus routes to move faster and more reliable by implementing several measures. The measure working with two of the core buses in the outer urban area, routes 178 and 179.

Figure 9: Bus route 179

The project systematically implemented minor measures at low costs. In summary, the actions on both of the core bus routes imply:

- Around 1,000 meters of new bus lanes.
- About 17 parking places eliminated.
- New regulation in order to increase bus priority in the street space.
- Improved monitoring of illegally parked vehicles.
- Bus priority at traffic signals.
- Revise bus stop design and modes.

The main objective of the measure is to increase the attractiveness of buses as reflected in an increase of ridership. More specifically, the actions are intended to achieve an increase of frequency and a reduction in congestion on buses; improvement of regularity in terms of predictability of trips (bus time, waiting time); generally higher operating speeds of these two core bus routes (for both the whole line and for segments between the bus stops, and for dwell time and driving time).

Implementation

Key steps from the drawing board to actual implementation:

- The demonstration routes are located in the northern, near-suburban district rather than in the central city, as initially planned. This was because when the CIVITAS ECCENTRIC project started, a comprehensive set of circulation improvements had already been implemented for all core bus lines in the central city, so the focus of the new action plan going forward was on core lines in the outer city areas. Since this is a collaboration between the City of Stockholm Department of Transport, the Swedish National Transport Administration, and Stockholm Public Transport, the choice of route was made through discussions among all parties on which we would work with.
- The main criteria for the selection of the bus lines to improve were the demand and the volumes of passengers using the lines, and the broadness of the area covered by the routes.
- Instead of having predefined issues to be tackled by the project, the main problems / priorities were realised through a workshop organized in June 2017 in wich a wide range of different stakeholders related to the selected bus lines (representatives from the City of Stockholm, the public transport authority -SL-, bus drivers, public transport users, etc.) were invited to discuss focusing on the main problems.
- After studying feasibility and considering the timeline of the CIVITAS ECCENTRIC project, different kind of actions were in fact taken: creation of bus-only lanes, traffic safety measure to reduce the risk of pedestrians on bus lanes, relocating bus stops, merging nearby bus stops to one, relocating bus stop shelters, lenghthening existing bus stops, removing curb-side parking spaces, adjusting curbs and paving, banning vehicle stopping along certain segments during peak hours, changing intersection control from yield-to-right to sign-posted yield, painting intersections as no-blocking zones and modifying an intersection to give priority to turning vehicles.
- It took about three months to implement the planned measures (summer 2018). The construction of one traffic island was delayed.
- Various departments at the municipality of Stockholm have been part of the planning, revising and implementation of the measure. One example of a department that has been involved is the department responsible for ensuring redirection signage is legally binding. Also the Public Transport Authority, the Transport Administration and primarily the company Arriva has been involved

by providing information and working out temporary traffic solutions for the construction period.

Business model and contractual partnerships

- The municipality of Stockholm owns the road infrastructure in the area the measures are being implemented and thereby also has the responsibility for maintenance after implementation. For the public transit shelters however, the ownership and therefore the maintenance responsibility lies with Arriva and the Public transport administration.
- For the implementation of measures along the street the municipality of Stockholm has procured a road contractor by calling off against a framework agreement. Arriva, the company that operates the bus services in the area, is procured by the Public transport administration, which is part of the Stockholm County Council.

  Both actors above are procured according to the Swedish Public Procurement Act.
- All measures are financed through tax revenues. The municipality of Stockholm has also sought government funds for the implementation.
- Investment costs with the measure, including contractor, signage and striping, inspection, and project management, totalled approximately 8.7 million Swedish crowns (mSEK).

Critical challenges and success factors

- Stockholm measure STO 5.2 was influenced by one main driver (political one) which is the political support and interest given by the City Council and the Stockholm public transport to the actions. Moreover, the good collaboration between all partners (Stockholm Public Transport, Swedish National Transport Administration, Bus Operators, and neighbouring municipalities) and the use of an already proven and applied method for core bus lines in the Stockholm inner area have also been important drivers for the measure.
- Among the barriers and difficulties, the most critical one has been keeping the time plan and implementing all the measures in accordance with it (particularly so that the changes would be implemented before winter). Unfortunately, the measures were not done on time so a new time plan for the implementation and evaluation had to be drawn up based on the new prerequisites. On the other hand, to clarify the division of responsibilities between the actors involved in implemented different actions was time consuming.
- The street modifications have had several confirmed effects on bus route performance:
  - Travel speeds increases on one of the bus lines but not the other.
  - Regularity improved on both bus routes.

- Accuracy of timekeeping (reliability) improved on the one route for which a comparison could be drawn. These results indicate there were fewer disturbances to bus circulation along the routes. Reliability could not be measured consistently on the other route due to a schedule change.
- Dwell times improved on both routes, suggesting more efficient boarding and alighting.

Lessons learned from implementation/replicability

- The project benefited from the use of a joint action plan, a joint working group of stakeholder representatives, and a joint steering group comprising stakeholder decision-makers, who could resolve questions where the joint action group could not agree.
- The bus lines in question operate partially outside the City of Stockholm in neighbouring municipalities, as well as on roads where the National Transport Authority is responsible. In order to succeed, all parties with some responsibility for either physical or regulatory aspects need to be represented in the working group, as well as contribute staff resources to participating.
- Police should also be involved and allocate resources to enforce new restrictions, to ensure the measures have their desired effects.
- In this case the neighbouring municipalities participated in problem scoping but not in implementation. This meant that measures were only deployed on partial routes, and we suspect that gains along the improved measures may have been undermined by the lack of similar measures elsewhere.
- Some of the potential gains for buses might have been undermined by increases in congestion for general traffic, which could have had detrimental effects for buses upstream and downstream of the measures. Also, a significant portion of drivers ignored the bus-only restrictions, undermining effectiveness.
- Some of the measures implemented were rather minor, and our data collection was not able to detect improvements in circulation attributable to these. However, these could still be motivated by other concerns such as improved comfort for passengers (and drivers) or simplifying boarding and alighting. Improvements' symbolic value should also be recognised.

Recommendations

For future reference: a **clear division of responsibilities and follow-up on measures** are important aspects which should be continuously monitored.

4.2. TUR 5.5 Bike-sharing and Car-sharing schemes

The bike-sharing system is in place and consists of bikes for public use and bike stations that serve as pick-up and drop-off points. The user can pick up and drop off a bike at any station. The bikes are available all year round and in wintertime they are equipped with winter tyres. The station network expands from the Kupittaa laboratory area along the city centre to the port of Turku. The main objective of this system is to

complement public transportation services. In addition to bike share system implementation, the measure aimed to encourage and enable car-sharing systems to be offered in Turku.

As a result of the measure, Turku has a bike-sharing system of 300 bikes (the system was planned for 100 bikes but it soon proved to be too low a figure) and 37 stations (34 stations at fixed locations and three portable and movable stations). In addition, car-sharing companies have tested their services and are now offering their services in Turku, to be attributed to CIVITAS ECCENTRIC effect to a great extent.

Figure 10: Bike sharing system launch event on May1st 2018 and the Föli-fillarit station sign

Figure 11: The bike sharing stations when the system was launched

Implementation

The key steps of this phase are detailed below:

- The Turku city execution board accepted the proposal for the bike sharing system procurement in April 2017. Procurement and implementation of this measure regarding bike-sharing system (BSS) commenced in May 2017 and was completed in April 2018. This time frame is too short for such a huge implementation action.
- Tendering of the marketing and digital side of the bike-sharing system: preparation of the income model, preparation of the tendering and contracts with the providers.
- Planning of the station locations, 34 permanent locations: there are two types of processes that need specific attention: on one hand, an internal process regarding the station plannning speaking in general terms (e.g. station design, capacity, space required); on the other hand, an external process regarding the specific station locations. After these processes, the locations were debated and decided by the politicians and all of the citizens living around the immediate location of a future bike-sharing station were contacted by post. After the locations have been decided, physical improvements of five station locations have been made. In addition to the permanent locations, the system contains 3 portable and movable stations.
- Creating a brand for the bike-sharing system: creating the identity of the system with graphical elements, website plan, marketing plan, info materials, user videos, PR-videos, news, stakeholder involvement through local sparring group meetings. This phase also included pre-marketing for the companies located

around the future bike sharing locations. The system name is copyright protected.

- Creating the pricing, ticketing system, registration system, IT-interphases in cooperation with the operator (and in collaboration with measure TUR 3.2).
- Creating the bike sharing system from the operational side of the system together with the Nextbike Polska Ab. Enabling the local maintenance to be in place.
- Planning of the customer service and the process for informing faults in the bike system. Trainings for the customer service employees.
- Planning process for the implementation of the physical marketing side of the bike sharing system and the digital side of the system with the chosen operators.
- Planning of the launch of the bike sharing system together with third parties. Recruitment of the volunteers for the launch event. PR - plans for the launch event. The launch event took place on 1st of May 2018.
- Regarding car sharing system, Turku city carried out market discussions with several operators and invited them to show their offers in mobility package presentation (that is part of measure TUR 2.2). Several car sharing companies were also presenting their offers in events organised by the project.

Some deviations from the original plans should be mentioned, as the City of Turku carried out a research in which the potentiality and the experiences from abroad were investigated. It became evident that the originally planned size of the system (100 bicycles) was extremely subdimensioned.

Based on this research a proposal to the city board was made (the proposal included annual financing of 150,000 euros for a bicycle system of 300 bikes and 37 stations) and accepted. This proposal also included an income plan from sponsoring and marketing. Based on this, a procurement for the marketing and sponsoring part was carried out. This meant a separate procurement for this part of the system.

Due to the time, resources and effort – consuming nature of setting up the bike share system (BSS) and to some heavy-weight political arm wrestling (specially on the issue of finding the locations for the bike sharing stations), car-sharing has not become a priority before the launch of BSS and has received less attention to begin with.

The development of a car-sharing system in the city was closely connected with the development of parking policies. A process to modify these policies took place during the project and has resulted in permit-based parking policies allowing a better operating environment for shared cars via more flexible parking possibilities. This development has been essential for the future of car sharing in the city.

The stakeholders involved in the different implementation steps have been really numerous. To highlight just few of them:

- The chosen operators regarding bike sharing system, Nextbike Polska Ab, Clear Channel Suomi Oy and Laulava Ovipumppu Oy.

- Different internal departments in the City of Turku – transport planning, maintenance, museum department, free time, education division, communication, marketing, tourism, regional public transportation department, etc.
- Politicians, media representatives, interest groups, companies and citizens living around the bike stations.

Business model and contractual partnerships

- The owner of the system at the moment is the CIVITAS ECCENTRIC project. The city bike system is under head of Turku city development.
- The public authority procured the bike sharing system, physical marketing and digital marketing of the system. The bike-sharing system is procured for 3+3 years whereas the physical marketing, including 10 digital screens, has been procured for 10 years.
- The measure is financed by income from the user fees, marketing, city's annual allocation and by the CIVITAS ECCENTRIC project financing. It is hoped that the system will break even in a long run.

Critical challenges and success factors

The following barriers were identified during measure planning, implementation and demonstration:

- **Organisational**

  Personnel changes at the beginning of the measure caused minor delays to the preparation.

- **Problem-related**

  The measure proved rather overwhelming in contents. In retrospect, it would have been wise to just focus on the bike-sharing system in this measure and to leave the car-sharing one out for a later stage. The research, planning, procurement and implementation of a bike-sharing system was an immense, complex undertaking that took more time than originally estimated. Due to this, promotion of car sharing was emphasised with more effort later in the measure.

- **Planning**

  Originally the city bike system was planned for 100 - 150 bikes. This soon proved to be too small of a number. The barrier was overcome as the city board was convinced of the need to grow this amount and it was decided that the system would be implemented with 300 bikes.

- **Institutional**

  As the bike-sharing system was realised with project funding it did not have an administrational" home" in the start. Therefore, the system placement within the city departments has required some discussion. As the project nears its end,

this barrier has been overcome and the bikes will be placed under the administration of the regional transport office Föli.

- **Political / strategic**

  The question of finding the locations for the bike-sharing stations became increasingly political. There was a lot of opposition from e.g. landowners particularly when the placement of the stations would mean losing some parking spaces. The barrier was overcome as after lengthy discussions and several alternative proposals on placement of the bike share stations, the city board finally reached a decision on their number and placement.

- **Technological**

  The bike-sharing system has been ridden with technical issues ever since its launch. To begin with, the system piloting period was too short and some of the problems could have been alleviated by a longer testing period. The problems are mostly related to the ambitious goal of creating a MaaS platform through the bike share system integration. This barrier has been partially overcome but issues remain with the system.

The following drivers were identified during measure planning, implementation, and demonstration:

- **Financial**

  The fact that project funding was received for setting up the bike share system facilitated the process remarkably. Without external funding, it was estimated that the system would have been realised years later. The project funding thus assured that funding would be allocated to the bike share system in the city budget.

- **Political / strategic**

  - Originally only 100 bikes were budgeted but when this number was found to be too small extra funding had to be sought from the city. The additional funding from the city board was guaranteed rather easily in the end. The political support for the objective was thereby a clear driver.
  - Placement of bike share stations faced quite a bit of opposition, with varying views and interests of stakeholders. Discussions with key stakeholders were conducted and various rounds of consultations held. In the end, there was courage to place the bikes even in such locations that were initially opposed by some parties and landowners. So, all in all, although the issue of station placement became highly political and sensitive, there was enough momentum and will as to push through the city bike station placements.

- **Planning**

  The measure relied on meticulous planning and benchmarking of existing bike-sharing systems. There was a strong overall vision on its realisation. Measure planning utilised the right kind of expertise needed at each particular phase of planning and implementation (e.g. on tendering and procurements). The

cooperation with the Turku Region Public Transport office has been tight and there has been a strong will to break traditional operating models in setting up the bike share system.

- **Involvement / communication**

  Building the brand for the city bikes has succeeded well. The citizens seemed to develop ownership of the city bikes very quickly and soon even nicknames were given to the bikes: “Föllärit”. The brand was utilised in marketing the system. The involvement of an expert group through out the process has been significant. The group met actively during 2 years and was composed of representatives of the local Student Union, the City Centre Association, the Chamber of Commerce, the local bicycle association TURPO and the University of Applied Sciences.

The measure has achieved half of its main goals. The bike-sharing system is in place. Considering car-sharing schemes, Turku city has carried out market discussions with several operators and invited them to show their offers in the mobility package presentation (that is part of measure TUR 2.2 of the CIVITAS ECCENTRIC project). Several car sharing companies have also been presenting their offers in events organised by the project. Currently one new company has established services in the Kupittaa area.

However, the city bikes are not as attractive as it was initially hoped, and it is. And some of inconclusive whether the system implementation has led to a growth in public transport. There are mitigating factors and negative interference, both internal and external, that can explain the lower system usage at least to some extent: massive construction works in the city centre, problems with the users’ interface. Nevertheless, the system satisfaction is rather high.

To sum up, despite lower system usage than expected, the measure has reached its goals somewhat satisfactorily and, importantly, served as a valuable learning process for implementing a novel system with some unique characteristics.

Lessons learned form implementation/replicability

- Setting up a bike-sharing system is a huge task that needs to be properly resourced both in terms of personnel, time, and money. At least a minimum of 1.5 years should be reserved to a similar effort (in Turku the procurement and implementation phase of the bike sharing system was 1 year, extraordinary fast).
- Proper testing of the system is crucial to avoid (technical) problems in the first months of system launch.

  Make sure that there is enough time for piloting before the launch. In Turku, the operator was only able to deliver the stations and bikes in Turku two weeks before the launch and this reduced the testing time significantly.
- It was unfortunate but necessary due to the massive amount of resources needed for implementation of the bike sharing system that car sharing received

less attention in this measure. In retrospect, it can be concluded that it would have been wiser to focus just on the bike share in this measure.

- Integration with Public transport adds value to the system especially co-operation with customer service, marketing, it. This needs new way of thinking and efforts towards common understanding should be highlighted.
- It should be properly acknowledged that there are risks entailed in launching a system with some unique characteristics and that dealing with this risk needs some financial leeway and trust in the project manager. In the Turku case, the bike sharing is a year-round system (the first of its kind) which even increases the risk as it creates an extra layer of issues to consider. Also, integration of this system to the PT ticketing system was something not done everywhere and was not without its problems (however it was necessary for MaaS development -WP3).
- It is a must to have bike sharing system as an all-year system as this gives a strong impulse for users on the potentiality of biking.
- It is advisable to carry out studies in regards with the measures. The bike sharing system has resulted in two Master studies: tendering process and enlargement potentiality.

Recommendations

- **Create a bigger vision for new mobility services** and dare to set the ambition level higher than before. This is especially important when we are talking about high visibility actions, such as city bikes that will change the city in many ways.
- In order to implement a system such as bike share, **political agreement and will** is needed both for assuring the continuation of the system and some strategically important decisions, such as the placement of the stations. Station locations are vital for the usability of the system and often political leverage is needed to ensure that the best locations are secured.
- It is all in the **planning**: in order to assure both quality of implementation and ease of process, attention must be paid to both **technical testing of the system prior to launch and preparation of the tender**. The contract with the service provider must entail proper sanctions.
- It is important to **plan for the communication and media visibility in advance** and involve celebrities in marketing actions. In Turku we combined we created launch videos in co-operation with city theatre and local tv-celebrities. This created the base for good media exposure.

5. Conclusions

European cities are increasingly facing problems caused by transport and traffic: in many urban areas an increasing urban mobility has created an unsustainable situation with poor air quality, high levels of CO_2 emissions and noise as well as great traffic congestion. The European Commission's Urban Mobility Package and the European Parliament's initiative report on Urban Mobility both state the urgency of addressing the challenges regarding the aforementioned issues. Urban mobility is also closely related to other EU policies such as energy, climate change, air quality, economy, social equity and accessibility, innovation, IT deployment and smart cities.

In a multimodal and sustainable (social, environmental and economical) transport system approach more efficient transport solutions can be offered to the citizens taking advantage of the strengths of the different modes which will make the transport sector safer, cost efficiency and environmentally-friendly. In short, multimodality highly contributes to a real integrated and sustainable transport system.

For urban areas, this implies a modal shift to public transport modes as well as to active modes (walking and cycling) and the introduction and deployment of new shared mobility services desirably integrated to public transport to add value to the system. Also, mobility management is key.

In this context of change, CIVITAS ECCENTRIC project and specifically the Cluster 1 measures regarding reorganising public transport networks and services demonstrate the key role of actions in that field to achieve changes in individual mobility behaviour, and improvements on citywide performance indicators.

Four of the measures presented in this report are examples of the improvement of public transport networks in peripheral areas and the other three are regarding the introduction of new, integrated, and accessible shared mobility services complementing public transport in the cities. All the measures highlight the role played by the City Councils regarding the provision of financing, regulation and policy instruments, public land, necessary recharging infrastructure to support electric vehicles and communication campaigns. Also, the European Commission funding (through the CIVITAS ECCENTRIC project) has been a key point.

The main challenge for local decision makers is to get the necessary citizens' acceptance when defining their mobility strategies and regulations and implementing the mobility measures as it has been highlighted in this report. Therefore, the involvement of different interested groups and stakeholders in the planning process and the communication campaigns are key topics for the success of the measures. On the other hand, the urban fabric is one of the key factors that condition the implementation and adequacy of the mobility measures.

6. Sources

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