

# Re-thinking Housing and Mobility – A European Living Lab for Sustainable Mobility in Munich

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## 1 ABSTRACT

This paper aims to describe the vision and implementation approach of a sustainable and innovative mobility and housing concept of a city district at the pericentral edge of Munich. Within the European CIVITAS initiative, the ECCENTRIC project demonstrates an innovative approach to mobilize residents by offering intermodal mobility and mobility on demand. With around 8000 new inhabitants and 12,000 new employees within the next years, the transport system in the Munich living lab Domagkpark and Parkstadt Schwabing needs an integrative and innovative approach to ensure a functioning, ecologically compatible and socially acceptable mobility supply. Central objective is to increase quality of life in the district through a substantial roll-out of innovative mobility solutions, that reduce the use (and number) of private cars. With the implementation of various project measures in the field of sustainable and shared mobility, mobility management, city logistics and road security, a new model quarter for sustainable urban development and compatible mobility will be development. Successful research findings aim to be implemented in future newly-built quarters of Munich and replicated in other European cities.

Keywords: Civitas Eccentric, European Living Lab, Mobility on Demand, Shared Mobility, Munich

## 2 CIVITAS ECCENTRIC – SUSTAINABLE MOBILITY IN SUBURBAN CITY DISTRICTS

In the CIVITAS ECCENTRIC project, Munich aims to demonstrate innovative solutions that show potential for upscaling and embrace multimodal and demand-oriented mobility. Positive impacts on the utilization of public space, housing and urban mobility are expected to be multiplied beyond the borders of the living lab. Just as various other major cities in Europe, Munich is facing serious challenges in terms of population growth, transport demand and lack of space. Various transport modes compete for the limited urban space available – cyclists ride their bikes on sidewalks, cars park on cycle paths, delivery vehicles block roads and parking space etc. The dominance of motorized individual traffic is particularly emphasized in conflicts for the use of street and public space. Purely additively, high-quality and functional solutions for the public space can hardly be realized against this background. The gain of one type of use means loss for another. At the same time, the freedom of mobility and movement in public space is a basic requirement of civil society. More courage is needed to test and roll-out alternative models that help improving urban mobility and reducing car ownership. The establishment of alternative mobility solutions is faced with the challenge to reduce the existing motorized individual traffic in order to gain space for better solutions and – one of the most important points - to win back space for its people. Therefore, Munich creates its new ECCENTRIC living lab in the North of Munich that is foreseen to fulfill all the different mobility needs without having a car that occupies unused space. A range of demonstration measures in the field of sustainable and shared mobility, mobility management, city logistics and road security are developed and tested.

## 3 DEMONSTRATION MEASURES IN THE LIVING LAB

All demonstration activities within ECCENTRIC are organized into four common phases in order to ensure (i) process comparability, (ii) a common evaluation base and (iii) consistent transferability for the foreseen uptake and measure replication in other cities. The project implementation scheme is shown in Figure 1.

In the following, all ECCENTRIC demonstration measures taking place in the Munich project area ('living lab') are shortly presented within the respective topic frames. Above mentioned activity phases are only considered summarized or strongly reduced due to the frame of this paper.

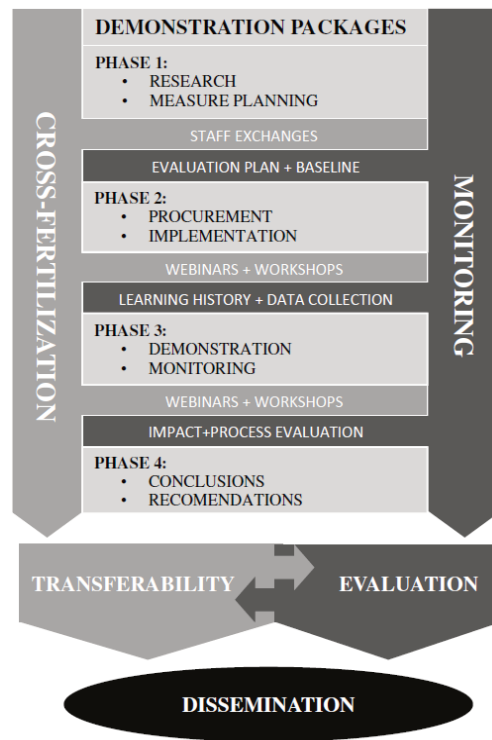


Fig. 1: CIVITAS ECCENTRIC measure implementation scheme

### 3.1 Sustainable and shared mobility

An integral part of sustainable mobility concepts intended to reduce parking pressure and high traffic volume in suburban city districts is the extensive roll-out of shared mobility services. Only easily accessible and user-friendly offers for any purpose at any time are a real alternative to individual car ownership. Nobody is forced to give up the private car if it is not desired - but everybody should have the opportunity to do it. The goal is to enable higher living quality and entired mobility, without the basic necessity to own a private car.

#### 3.1.1 Intermodal E-Mobility stations

Important backbone of the new mobility concept in the living lab is the development of four intermodal E-mobility stations, providing a combination of different types of (shared) mobility services, ensuring that suitable means of transport are available for any purpose at any time. The mobility stations will be integrated in public space and accessible to all residents of the living lab and beyond to everyone who is registered customer of the service providers integrated within the mobility station. The new and innovative aspect is to combine several sharing mobility technologies (car-sharing (stationary, free floating, electric), (e-) scooters, cargo- and normal bikes) in connection and complementation with the use of public transport like trams and buses. A great challenge but also essential part of the mobility stations, is the provision of one common booking service where all sharing services are available. Consequently, the aim is to bundle all relevant stakeholders within an interactive service pillar at the station. Further on, the existing mobility app of MVG (Munich Transport Corporation) will integrate all mobility services provided at the station and guarantee an easy mode of booking from anywhere online.

Furthermore, the selection of services provided at the different mobility stations is foreseen to be completed in the future by two newly developed (prototypic) vehicles: an E-Trike for physically impaired people and an Electric light-weight vehicle, as presented in the following.

#### 3.1.2 E-Trike-Sharing

This demonstration measure consists of developing a prototype of an E-trike and analysing barriers and drivers for its later integration into the existing bike sharing system in Munich (MVG Rad). The ultimate goal of this measure is to provide a concept of an alternative prototypic mobility service for elderly people and/or those who are physically impaired.

The development concept is based on a multi-level approach: a questioning of potential users is the basis for a needs assessment and tailored construction plan. In parallel, several master thesis with topics related to

power units, frame constructions and user apps will define further details of the concept. The construction of the prototype in the innovation and founder centre of the Technical University of Munich (TUM) will enable comprehensive user tests and evaluation processes.

### 3.1.3 Electric light-weight vehicle

Until now, the field of electric mobility has to deal with several severe problems: the need for several hours of battery charging time, higher investment costs for the vehicle purchase and the costs and needed space for the installation of an area-wide battery charging system. In fact, a rentable business model especially for the use of electric vehicles in services and logistic usages has not been developed yet. In addition, new solutions are mostly limited to vehicle construction concepts – the integration within a future orientated mobility system is not taken into account as well as the problem of inefficient utilization and space consumption of cars that are only in use for 10-20 % of their time.

The Adaptive City Mobility (ACM) vehicles provide a new solution within the field of e-mobility and fit directly into the idea of the evolving “sharing economy” and provide a new form of “urban commons”. ACM offers a new designed E-light-weight vehicle that only weights 450kg (batteries excluded). In addition, the vehicle is based on an innovative manual battery change system that reduces the standing times of the vehicles. It is a completely new designed vehicle concept in a newly developing market niche. The multimode software makes multipurpose usages possible: “One for all” - for passenger transport, delivery services / logistic and freight, as tourist car and for car sharing as well. By that, it helps reducing car ownership and car density within cities which means in turn more space for a liveable city. In addition, through the battery swapping system, long charging times can be avoided and the cost efficiency of electric mobility is increased.

This measure consists of organizing test trials and demonstration events in which people from different target groups can try the vehicle for multiple uses. Based on the feedback from the users, a business model for its wide uptake will be developed.

## 3.2 Mobility management

Mobility management is a comprehensive measure that embraces all mobility services and offers in the neighbourhood, promotes these to the target groups, and encourages an intensive and enduring, demand – oriented use. Within ECCENTRIC, a comprehensive mix of mobility counselling initiatives, supporting tools and training offers for various target groups are foreseen to be implemented in the living lab.

### 3.2.1 Mobility counselling

The most extensive demonstration measure comprises information, communication, marketing and mobility counselling about all sustainable mobility options and multimodal mobility services available in the Domagkpark and Parkstadt Schwabing living lab. Pilot actions will focus on the target groups living, working and moving in the living lab area, i.e. private households, local childcare facilities and schools, and local companies.

In order to ensure familiarization with and acceptance of the new offerings, a marketing campaign is required which is customized to the target groups and related to specific occasions. In this context, the measures of the successful and award-winning (‘URBACT 2017’) Munich action program for mobility management “München - Gscheid Mobil” for local issues of concern (target groups, offers and occasions) will undergo continuing evolution and implementation as community-related mobility management:

- The core is formed by extensive direct and dialog marketing which addresses individual households in a personal and individualized manner. It provides information, consultation and services about the mobility offer in the area in a multi-level dialog.
- Based on the Munich approach of mobility biography, a concept for mobility training and management will be developed for the school that is located in the community as well as for daycare facilities. This concept is intended to, on the one hand, reduce delivery and pick-up service by car, both for improving traffic safety and for ecological and social reasons. On the other hand, this approach will help parents, teachers and children to also design their everyday mobility in a sustainable manner. The focus will be aimed at increasing traffic safety on the way to school.

- In order to optimize and use the full capacity of the mobility offerings provided by the residential community of Domagkpark and the commercial area of the adjoining southern Parkstadt Schwabing, all companies will be provided with an opportunity for mobility consultation. Interested companies can receive expert advice on mobility management with the objective of reducing commuter traffic of staff members and customers and shifting such traffic to sustainable means of transport as well as dedicating parking space to other usage.

### 3.2.2 Interactive mobility training

Exchanging communication and information technology for everyday mobility between generations is the content of a measure, where teenagers aged between fourteen and eighteen years old will teach senior citizens how to use internet, smartphones and applications for organising their daily mobility.

In a first phase, students will be trained by mobility experts about technologies and devices for mobility planning and their use. This will contain using applications on smartphones and tablets, using the internet in general and mobility services in particular. In addition, pedagogical training sessions will be conducted where students will be taught in the interaction with elderly people and knowledge transfer.

A second phase will comprise the knowledge transfer to senior citizens who will join the project at this point. The students will now be in the role of a teacher, supervised by mobility experts of ECCENTRIC project partners.

This approach is intended to facilitate daily mobility of senior citizens (e.g. by travel planning using mobility-apps) and to motivate them to intensify walking, cycling, using public transport and car sharing models instead of using own cars or taxi services. At the same time, the students will improve their soft skills and abilities in communicating complex technical issues to an older generation.

### 3.2.3 Mobility-App for the Living Lab

This measure consists of implementing a mobility-app with real time information (e.g. availabilities, schedules) on offered mobility services in the Munich living lab in combination with real time measurements of local air pollution. The app will provide an opportunity to create a personal 'green' profile, e.g. by using tracking functions for the estimation of individual carbon footprints. Additionally, a network of automated, easy-to-use air quality measurement nodes will be implemented in the city lab. Automatically generated air pollution heat maps will be available in order to promote sustainable travel behaviour and to increase the quarter identity.

### 3.2.4 Mobility-App for deaf and blind people

In order to achieve a mobility system that is truly inclusive and attractive to all users, the adaptation to the increasing and at the same time changing demand for seamless door to door mobility should reach not only the "ordinary" people, but also people with special needs. New mobility offers should not limit their scope to be simple, fast and flexible to use. They should also be adapted to specific target groups. In this demonstration measure, the focus is on special needs of deaf and blind persons.

The goal is to implement a routing application for deaf and blind persons, based on existing services of the Munich Transport Corporation (MVG). This will be managed due to the implementation of beacons, which will give needed information to facilitate the mobility of this target group. Currently it is only possible to navigate and route outside through the public transport, but it is not possible to navigate passengers indoor in order to switch mobility services, route to the next connection or find the exit. During the development phase the beacons will be temporarily installed in a public testing-place close to the Munich living lab in order to test the application in cooperation with the local association of deaf and blind persons. As a result of this measure, the opportunities of beacons for indoor routing in public transport station in Munich will be evaluated.

## 3.3 City logistics

In the last years, the volume of traffic caused by delivery services has increased rapidly with the success and rapid growth of e-commerce. Main effect, especially in inner city areas, is a tremendous increase of delivery trucks often combined with dangerous situations and conflicts between the trucks, pedestrians, cyclists, cars and other road users. Effects on air pollution and living quality don't need to be mentioned separately at this

point. Within ECCENTRIC, two measures will be implemented in order to substantially reduce the delivery traffic in the living lab but also in the Munich city center.

### 3.3.1 Neighbourhood-oriented Concierge System

The residents of the Munich living lab Domagkpark are suffering from a large number of delivery tours by the various delivery services (usually including a first delivery attempt and if unsuccessful, a second and sometimes even a third attempt). The provision of a concierge service, managing packages sent to and from residents of the Domagkpark, will contribute to reduce vehicle kilometres travelled by the delivery trucks in the covered area. Residents will be able to walk to the concierge service, send goods or pick up delivered goods or even get their goods delivered by the local concierge on the 'last mile' with an eco-friendly electric cargo bike (100% carbon free energy). To increase the attractiveness of the concierge business concept and to support the mobility concept of the neighbourhood, further manual services (e.g. electrician and painter services) are foreseen to be imparted by the concierge service.

### 3.3.2 Eco-friendly logistics

The use of electric cargo bikes for delivery services was also a key aspect for the design of a city-wide demonstration measure aiming to reduce and partly replace motorized courier services in the city centre. The delivery of goods by (cargo) bikes has a great potential to keep the city accessible for freight transport and to improve road safety. Compared to ordinary bicycles, cargo bikes have a higher load capacity and facilitate the bundling of deliveries. To extend the use of cargo bikes, a flexible storage system will serve as an interface where cargo can be handed over from cars to cargo bikes and vice versa. Due to limited space in the inner city, a system of flexible boxes will be used to help delivery services to continuously optimize their disposition. This measure will test several boxes and logistic systems in co-operation with delivery companies. The boxes will be located at the boundaries of the city center. Deliveries combining the use of cars and cargo bikes will furthermore improve the cost effectiveness of all actors in the logistic chain. Cargo bikes will be able to bundle deliveries and thereby fully use their higher load capacity. Car messengers will save time, because flexible cargo bikes will take care of deliveries on the last mile.

## 3.4 Road security

Often overseen is the fact that sustainable mobility basically starts with the guarantee of the physical integrity especially of the road users, who chose sustainable modes of transport, like pedestrians, cyclists and public transport users. Cities, which want to promote cycling, walking, the use of public transport and sharing mobility services have to improve the safety and the reputation of safety of this modes and their use. For some time, Munich and a lot of prosperous European cities are faced with a strong growth of cycling traffic, demographic change, general increasing road traffic and increasing complexity of traffic light programs at crossings. This requires new road safety strategies, concepts and innovative measures, especially considering safety needs of the most exposed road users, like cyclists, pedestrians, handicapped people, senior citizens and kids.

With the help of a new software tool, geo-referenced accident data of the past five years (approximately 200.000 accidents in Munich) collected by the police are linked to data of traffic models and other sources, e.g. infrastructure data. Based on this information, potential accident situations can be forecasted and the municipal urban and traffic planning can cooperate with the police in order to take preventive measures which significantly reduce the likelihood of accidents on the living lab's road network. A safety audit of roads in the living lab based on new IT preconditions will be further tested in Munich for the first time.

## 4 MONITORING AND EVALUATION

The multiple measures of the CIVITAS ECCENTRIC project in different local contexts explore answers to the shared challenges of sustainable urban mobility. Only a thorough evaluation on the level of the individual measures as well as across the living laboratory sites in the ECCENTRIC partner cities will enable common learning. The evaluation process is based on common objectives, comparable criteria across work packages and cities, and a robust set of common indicators. The Technical University of Munich (TUM) is responsible for a consistent process and impact evaluation of all conducted measures in order to provide sound information about all relevant project outcomes.

#### **4.1 Impact evaluation**

Several methods are used for the individual measure evaluation, comprising literature research, interviews and surveys. In order to define a baseline for the measures to be implemented in the Munich living lab, an ex-ante household survey will be carried out at the beginning of the project and will gather data on e.g. modal split, vehicle kilometres travelled and vehicle ownership as well as awareness and attitudes regarding mobility measures implemented in the framework of ECCENTRIC. Consequently, an ex-post household survey will be carried out in order to contrast the results of the first survey and determine the impact of measures in the living lab. For measures with no direct influence in the living lab, individual surveys and data collection methods will be carried out.

#### **4.2 Process evaluation**

The process evaluation aims to identify barriers and drivers for the successful implementation of the ECCENTRIC measures. It focuses on the means and procedures by which a measure is implemented throughout all phases of the project, from research and planning, procurement and implementation and demonstration or operation. For the basic evaluation level, a review of the Measure Progress Reports and the use of standardized forms will be used. For the detailed evaluation level, interviews and workshops are planned.

### **5 CONCLUSION**

Within ECCENTRIC, a model quarter for sustainable and city-compatible mobility will be developed and is supposed to be an ideal for further development areas in Munich. Therefore, a wide range of demonstration measures in the field of sustainable and shared mobility, mobility management, city logistics and road security will be implemented in the Munich living lab within the project duration. All measures are based on a consistent implementation scheme and will be scientifically attended and evaluated, in order to provide sound recommendations for the intended uptake and measure replication in upcoming development areas of Munich and also in other German and European cities.

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