INTEGRATED CITY ASSESSMENT: OSLO

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MOVE21 – Multimodal and interconnected hubs for freight and passenger transport contributing to a zero emission 21st century

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Project Executive Summary

The main objective of MOVE 21 is to transform European cities and functional urban areas into climate neutral, connected multimodal urban nodes for smart and clean mobility and logistics. MOVE21 will do this through an integrated approach in which all urban systems are connected, and which addresses both goods and passenger transport together. As a result, MOVE21 will improve efficiency, capacity utilisation, accessibility and innovation capacity in urban nodes and functional urban areas.

The integrated approach in MOVE21 ensures that potential negative effects from applying zero emission solutions in one domain are not transferred to other domains but are instead mitigated. It also ensures that European transport systems will become more resilient. Central to the integrated approach of MOVE21 are three Living Labs in Oslo, Gothenburg, and Hamburg and three replicator cities Munich, Bologna and Rome. In these, different types of mobility hubs and associated innovations are tested and means to overcome barriers for clean and smart mobility are deployed. The Living Labs are based on an open innovation model with quadruple helix partners. The co creation processes are supported by coherent policy measures and by increasing innovation capacity in city governments and local ecosystems. The proposed solutions deliver new, close to market ready solutions that have been proven to work in different regulatory and governance settings. The Living Labs are designed to outlast MOVE21 by applying a self-sustaining partnership model.

MOVE21 partners

The MOVE21 consortium consists of 24 partners from seven different European countries, representing local city authorities, regional authorities, technology and service providers, public transport companies, SMEs, research institutions, universities and network organisations.

- **Norway**: City of Oslo, Viken County, Ruter, Urban Sharing, Mixmove, Institute of Transport Economics, IKT-Norge
- **Sweden**: City of Gothenburg, Rise Research Institutes of Sweden, Business Region Gothenburg, Volvo Technology, Renova, Parkering Göteborg
- **Germany**: City of Hamburg, City of Munich, Hafencity University Hamburg, Deutsche Bahn Station & Service
- **Italy**: Metropolitan City of Bologna, Roma Servizi per la Mobilità, Roma Tre University
- **Belgium**: Eurocities, Polis
- **The Netherlands**: TNO
- **Greece**: Hellas Centre for Technology and Research

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Deliverable executive summary

This deliverable describes the updated development of the Oslo Living Lab in MOVE21. Firstly, it summarizes the context assessment that describes the social and special considerations, governance, and potential for technological integration. Secondly, it detects and describes the main priority topics and fields of action. Finally, the deliverable presents an action plan of development, along with a tentative time plan.

Key words

Integrated City Assessment, Living Lab Oslo, knowledge brokerage process

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1 List of abbreviations and acronyms

Acronym	Meaning
DDP	Incoterm Delivered Duty Paid
DRT	Demand Responsive Transport
EC	European Commission
FSULP	Freight Sustainable Urban Logistics Plan
GA	Grant Agreement
KPI	Key Performance Indicator
ICCP	Innovation Co-Creation Partnerships
ITS	Intelligent transport systems and services
LL	Living Lab
MaaS	Mobility as a Service
NGO	Non-governmental organisation
NPRA	Norwegian Public Roads Administration
STOR	Smart transport in the region of Oslo
TF	Task Force
WP	Work Package
ZEZ	Zero Emission Zone

2 Purpose of the deliverable

The Integrated City Assessment is based on deliverables D3.1, D4.1 and D5.1 and provides first insights in the contextual factors that need to be considered or altered for the development and deployment of the MOVE21 solutions. Special attention is devoted to the urban social layer (WP3), governance (WP4) and technological solutions and integration (WP5). They are relevant for the current and future socio-technical contexts in the LL test sites and for improving the innovation capacity in the cities. Thus, the LL processes of co-creation, implementation, and upscaling activities should be supported with a continuous knowledge brokerage process related to these three topics. Based on the input from WP3, WP4 and WP5 and the co-creation process so far, the Oslo LL has identified priority topics and crossovers involving WP3-6, WP 8 and WP10. An innovation agenda is developed on how these topics and crossovers will be taken up in the knowledge brokerage process.

2.1 Attainment of the objectives and explanation of deviations

The objectives related to this deliverable have been achieved in full and as scheduled.

2.2 Intended audience

The intended audience of this deliverable are:

- Task Force of the Oslo LL, informed by the report summaries and incorporating the outcomes of this deliverable into their internal decision-making process.
- Knowledge transfer with stakeholders within the Innovation Co-Creation Partnerships (ICCPs), which contain a wide spectrum of stakeholders who might be interested in the information of this deliverable.
- WP-Leaders as an up-to-date version of the activities and plans of the LLs.
- The general public and the academic community in particular, as this deliverable constitutes a body of knowledge that will be shared and replicated.

2.3 Structure of the deliverable and links with other work packages/deliverables

The deliverable D6.2 is structured in the following way: First, the purpose of the deliverable, intended audience and its structure as well as related WPs are explained in chapter 2. An introduction to the concepts and test sites in the Oslo LL follows in chapter 3. Chapter 4 summarizes the first findings from D3.1, D4.1 and D5.1 on, respectively, the urban social layer, governance, and draft technology solutions. Based on the discussions in the Oslo LL and the context analysis from WP3, WP4 and WP5, the identified priority topics are explained, also considering the social layer, governance and technological solutions and integration (chapter 5). Potential crossovers between WP3, WP4, WP5 are elaborated. In chapter 6, the innovation agenda with the knowledge brokerage needs for the LL Oslo is described to make expert input and discussions as specific as possible at this stage of the project. The timing of the knowledge brokerage process is linked to the timeline of the Oslo LL. Chapter 7 presents final conclusions of the Integrated City Assessment for Oslo and next steps.

This deliverable is connected to other work packages and deliverables as follows: WP6 coordinates and facilitates learning, testing, deployment and upscaling activities in the LL. An initial context analysis was performed in WP3, WP4 and WP5 which delivered input to D6.2 of WP6. Therefore, deliverable 6.2 is connected with Deliverables D3.1, D4.1, and D5.1 as they provide the main input for chapter 4 about the context description and situational analysis. Deliverable 6.2 is also aligned with D6.3 and D6.4, as they have a shared structure and methodological framework, each of them applied in one specific living

lab. WP6 again will provide solutions, data and insights for WP7 replication & take-up as well as for WP8 impact assessment. Deliverable D6.2 will be used as an input for D8.2 by incorporating specific strategic indicators to the KPIs in the Urban Mobility Monitoring System. It is also connected to work done in WP3 and WP10 (D10.3) on local citizen and stakeholder engagement.

3 Introduction

3.1 The City of Oslo

Oslo is the capital city of Norway and has a parliamentary system of governance. The City Government is responsible to the City Council. The City of Oslo holds both municipal and county functions. The highest decision-making body in Oslo is the City Council, which has 59 members, and is chaired by the Mayor of Oslo. The City Council decides on the City budget and overall policies for the City of Oslo. The City Government is the executive body of the City of Oslo and is headed by the Governing Mayor. The City Government has substantial decision-making powers delegated by the City Council. The city is divided into 15 districts, each run by locally elected district councils. Their mandate is limited to the provision of social and health care services. Each City Government Department is responsible for several agencies which execute decisions made by either the City Council or the City Government.

Oslo is a relatively large port city and the larger Oslo metropolitan area stretches beyond the municipal borders of Oslo into Viken County.

3.2 Approach

In MOVE21, Oslo has a strong ambition to lower emissions by developing innovative new solutions, particularly combining persons and goods. To achieve this, the Oslo LL has commenced work on concepts that can be applied in several places, rather than at the test sites as they are described in the Grant Agreement of MOVE21.

Within the concepts, the Oslo LL has identified sites that will be used for implementing and demonstrating concepts and solutions helping the City of Oslo to meet its climate targets of reduced traffic and reduced emissions. These are:

3.2.1 The City Centre (including Filipstad area).

The motive for selecting this combination is that the city centre is planned to be converted into a zero-emission zone (ZEZ), meaning that only emission-free vehicles will be allowed to enter the area. The mobility point of Filipstad will serve two purposes:

- Be one of the consolidation hubs for enabling people and freight to enter the ZEZ efficiently and effectively, while making the best possible utilisation of the vehicles that need to move within it.
- Be the consolidation centre for the Filipstad neighbourhood that is under development and where sustainable mobility is one of the priority areas.

At present time there are many initiatives in Oslo for the ZEZ. One of them is within freight distribution. The Agency for Urban Environment has initiated a project to investigate how to best facilitate cargo distribution within the zone. In order to avoid duplication and potential conflicts, The Task Force of the Oslo LL decided to put activities related to Filipstad on hold until relevant studies have been completed.

The initial activities from Oslo LL regarding Filipstad included dialogue with land owners and developers in order to secure areas necessary for later configuration of a mobility point that will serve the purpose for MOVE21.

These projects will be concluded later in 2022. Viken County is conducting a reference project called ViV (Goods logistics in the Western corridor) which is about groupage terminals in the municipality of

Bærum (Fornebu) within the Oslo metropolitan area. This will also provide the Oslo LL with knowledge relevant for development of such terminals at Filipstad.

In order to maintain progress and momentum in the Oslo LL while issues surrounding Filipstad are resolved work commenced in the area of the city called Lilleakerbyen (see Figure 1), in immediate proximity to the neighbouring municipality of Bærum in the Viken County.

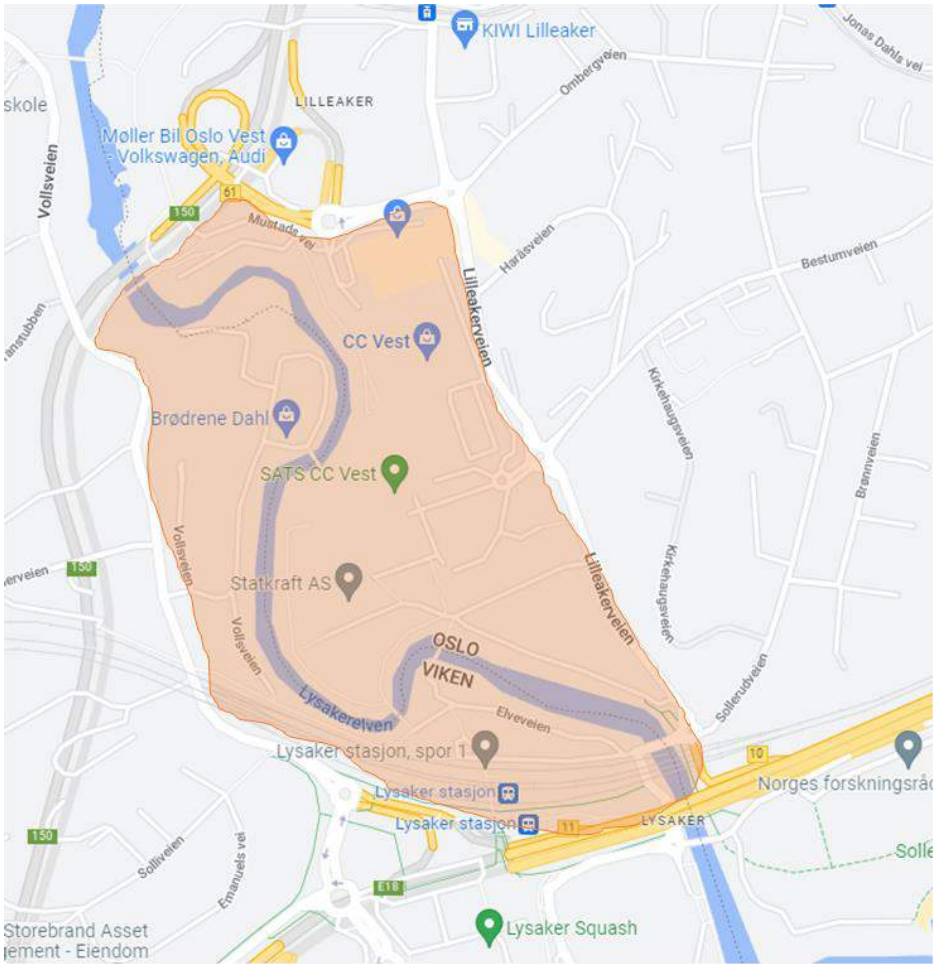

Figure 1 Lilleakerbyen

Lilleakerbyen is undergoing a similar transformation and urban development to the one which is planned for Filipstad. Sustainable urban distribution of people and freight is central in the Lilleakerbyen development. The work and development at Lilleakerbyen has progressed further than the urban development of Filipstad. Many of the challenges are the same in both areas, therefore experience and knowledge gained through testing in Lilleakerbyen will be relevant for Filipstad and beyond.

A key concept in MOVE21 is to view the movement of people and freight holistically. Project partner Ruter (public transport company) is already operating a mobility-on-demand service for senior citizens (*Aldersvennlig transport*). A plan in the Oslo LL is to test how goods also could be moved using this on-demand service (see Section 1.3.1). The shopping centre in Lilleakerbyen, CC Vest, is the most frequently visited location served by on-demand service for senior citizens. CC Vest is, therefore, seen as a very suitable location to start implementing combined mobility for people and freight, starting by enabling these mobility services to perform last-mile operations for goods procured in the shopping centre.

The technologies applied and the lessons learned through these activities will be ready for replication in Filipstad and other locations in Oslo, other MOVE21 cities and beyond.

3.2.2 Ski station (Oslo extended urban area eastwards in Viken county).

Ski is a small community of about 20.000 inhabitants. Like most other similar areas around Oslo, there is high-capacity services available to move from Ski to the centre of Oslo, but if you want to engage in activities within Ski (not along the “trunk line” to the centre of Oslo) mobility services are lacking, and the use of private cars is dominating.

The original idea in MOVE21 was to develop mobility services within Ski, so that mobility services are easily available to such an extent that the need to use private cars is minimised. This was based on the planned new high speed railway connection between Ski and Oslo (*Follobanen*), scheduled to be ready in 2022. The high speed railway is delayed, at least, until 2023. Consequently, the original plans for developing a network of mobility hubs in Ski using the station as the central point, are now changed in line with the completion of the new train service.

To try out new mobility services like the one envisioned in Ski, Groruddalen has been selected as a place to start (see Figure 2). The challenges in Grorud are the lack of mobility services “across or within” the area. As in Ski, there are good connections/trunk lines to/from the Oslo city centre. Hence, Groruddalen was considered a logical replacement for Ski in this stage of the project. MOVE21 will revert to Ski, replicating solutions and experiences from Groruddalen, when Follobanen is operational. Grorud is an area in the northeast of the city in immediate proximity to Viken county and the satellite town of Lillestrrøm in Viken County.

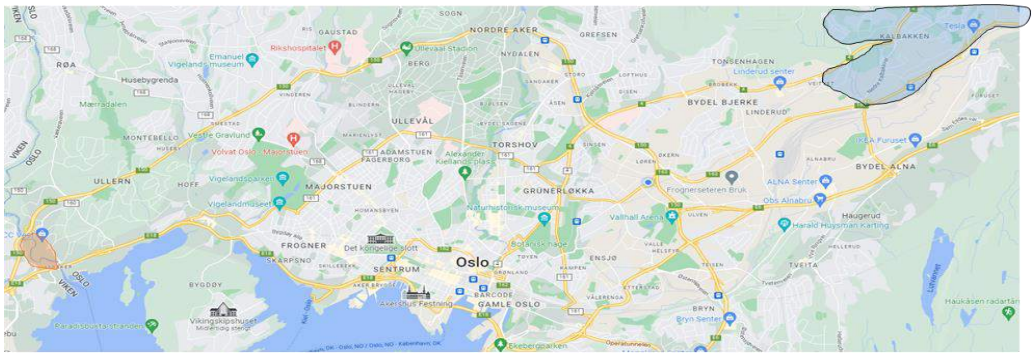

Figure 2 Groruddalen (blue) and Lilleakerbyen (orange)

The challenges in Ski and Groruddalen are essentially the same for almost all regions around Oslo. Hence, the concepts and solutions to be tried and tested in these areas are relevant for the Oslo functional urban area and will be deployed there later.

3.3 Oslo Living Lab Initial initiatives

3.3.1 Mobility on-demand for people and freight (R-MODS)

This is an existing mobility-on-demand service for senior citizens, operated by the MOVE21 project partner Ruter (public transport company) and financed through the annual city budget adopted by the Oslo City Council. It will be extended to also carry goods with the same vehicles (minibuses). The demonstration will test transportation of shopping items bought by consumers in selected shopping centres as either home deliveries or deliveries to pick up points.

The initial implementation of the R-MODS combining people and freight will be cargo originating inside the R-MODS catchment area, that means cargo purchased in stores – inside or outside shopping centres and cargo purchased using eCommerce platforms.

Figure 1 illustrates shopping centres inside the R-MODS catchment area (green dots). Ultimately all of these will be included in the new services. If the R-MODS service is being extended to cover Oslo proper, many more shopping centres and other hubs will be included. The implementation aims to begin at the shopping centre marked 1, CC Vest. Later, the test site of Filipstad (marked in dark blue and 2) will be connected to the network.

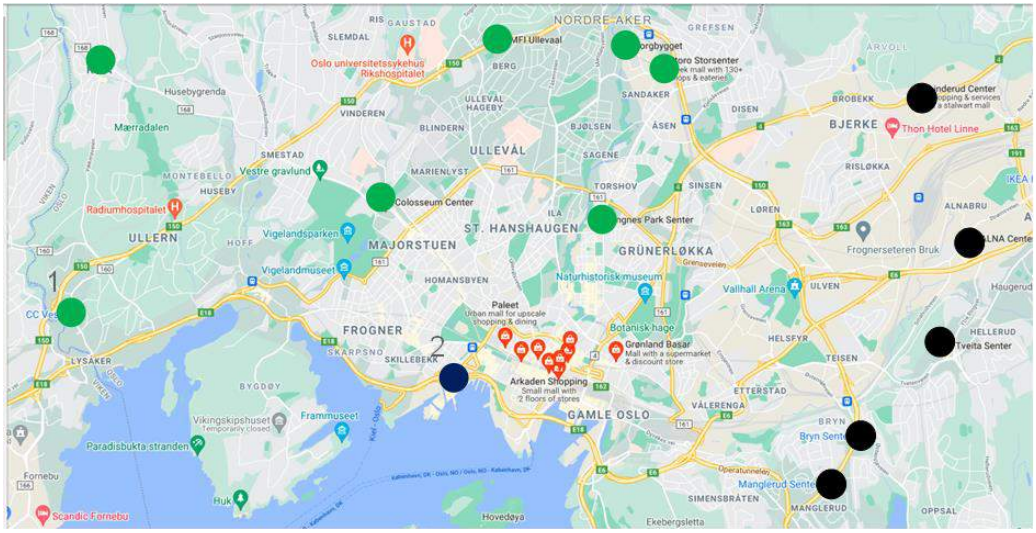

Figure 3 Shopping centres served by R-MODS

Shop customers will be allowed to buy goods in one or more stores. The stores will offer to send the goods to the shoppers' desired address. MIXMOVE Ship will be used by the employees in the stores to book transportation and to label the cargo. This will be the alternative offered in the initial proof of concept for the new services (combining people and freight). It has to be analysed if the user interface for preparing shipments may be slightly simplified, or if there may be ways of preconfiguring certain content so that data entry is kept to a minimum.

Once the "Ship" alternative is in place; it will be discussed if the stores have implemented or want to implement eCommerce platforms, e.g., with WoCommerce or PrestaShop interfaces.

3.3.1.1 The Hubs

In the shopping centres, goods will be transported from stores to a dedicated cargo hub area. Then cargo will be consolidated (shop customers may, for example, make purchases in any number of different stores) and transport will be booked (connecting to the carrier management system). The operations in these small (micro) hubs will be manual. There will be a Hub Management implementation with basic capabilities, printer, label printer and hand-held devices should be initially sufficient in each hub. If goods are being procured in stores outside shopping centres, then the cargo will be picked up there and brought to the closest hub, where consolidation will take place before transport to the final address.

3.3.1.2 Carrier Management Systems

A configuration of software components necessary for implementation is planned.

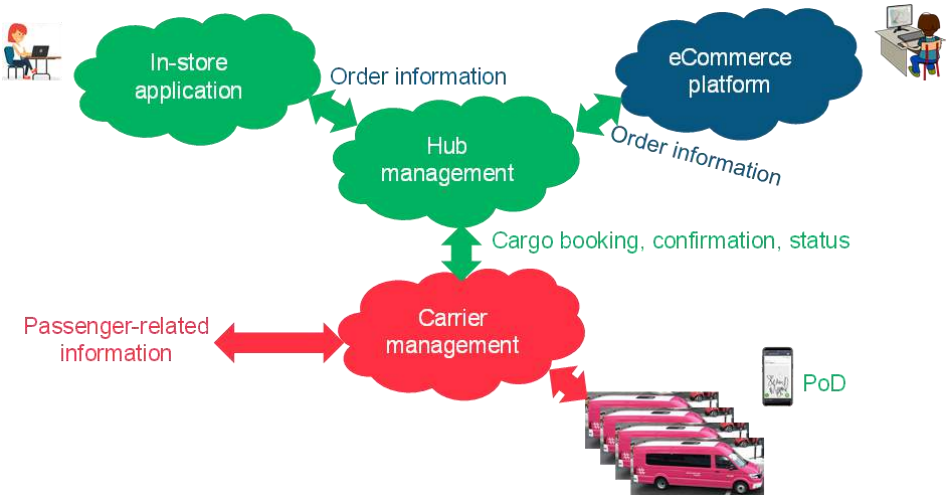

Figure 4 Management software configuration for the Oslo Living Lab implementation

3.3.1.3 Plan

This plan concentrates on establishing the operation in the first shopping centre, CC Vest. Once this is operational, new plans will be developed for expanding the activities to other shopping centres.

Figure 5 Plan of operation in the first shopping centre, CC Vest

3.3.2 Network of local mobility points for transit between transport modes

Using mobility hub “best practice” this concept aims to provide citizens with a cost efficient and flexible alternative to car ownership. Availability, predictability, and simplicity are identified as the main drivers for owning a car. Schreier et al (2018) concluded that users of station-based car sharing use public transport and other greener modalities more frequently than car owners. Through implementing a network of “neighbourhood hubs” in an area of Oslo, the Oslo LL will investigate how to increase use of public transport and reduce use of the private car.

The Oslo LL aims to measure the effects through integration with Ruter’s digital user interface. Looking at car ownership, public transport coverage and other socio-economic indicators, the area of Grorud is identified as a good place for initial place for demonstrating hubs, connecting the most densely populated areas as well as connecting to Lørenskog municiaplity in Viken county. The process of finding 10-20 locations has commenced, and the Oslo LL will use knowledge acquired through Ruter’s former

mobility hub pilots to select services and infrastructure. The neighbourhood hubs will consist of a variety of mobility and logistics services, such as public transport, parcel delivery boxes, DRT (Demand Responsive Transport) pick-up/drop-off, micro mobility, cargo bikes, car sharing (incl. cargo vans) and bike lockers. We will strive towards making populated, safe, light and clean spaces.

3.3.3 Integration of public transport with micro-mobility in a mobility as a service

Integrating public transport with on-demand micro-mobility is a concept that Oslo LL is planning to test in order to reduce private cars and make alternative transport modes attractive. As mentioned in chapter 3.2, the main drivers for owning a car are availability, predictability, and simplicity. For this particular integration, the project will focus on availability and simplicity to meet the needs of person transport within Oslo's three rings for a seamless user experience on a multi-module trip.

The Oslo LL is setting up dialogue meetings with all relevant actors (e.g., Ruter in collaboration with other actors outside the MOVE21 project consortium) in order to draft plans for involvement.

3.3.4 Freight within Zero Emission Zone (ZEZ)

This is a collaboration between the ZEZ-project initiated by the City Department for the Environment and Transport and MOVE21. The ZEZ refers to a geographically regulated area in the city centre where only zero emission vehicles have access. The aim is to reduce greenhouse gas emissions, with improved local air quality and reduce car traffic as co-benefits. The Agency for Urban Environment is at present time researching the possibility to establish a pilot project/demonstration of a ZEZ.

A part of this work is to understand how freight should move within a ZEZ, and MOVE21 will investigate how to distribute goods to the zone as well as within. This also includes how to enforce emission-free vehicles and reduce the total amount of vehicles.

The main challenges that the City of Oslo face with a ZEZ are national legal aspects and the lack of authority to regulate the zone beyond a pilot phase. A dialogue with the National Public Roads Administration (NPRA) is therefore initiated by the City of Oslo, and the Agency for Urban Environment has also started an investigation of the legal framework. In general, it is also challenging to assess which road users should be granted an exemption in this zone. Hence, there is a need for creating a viable business model to include all actors within the logistic ecosystem, regardless of size of private companies, which enables broad participation in this city transformation.

4 Summary of Context Analysis Living Lab

4.1 Urban Social Layer

In late 2021 WP3 delivered the report Urban Social Layer (D3.1) based on the areas from the proposal. It combined different data sources to analyse and extract insights about the performance of the areas - from a socio-spatial perspective. Due the supplement of Lilleakerbyen og Groruddalen in the Oslo LL as starting points for two concepts, Oslo LL will collaborate further with WP3 to analyze the urban characteristics also for these areas. For the third concept (integration of public transport with micro-mobility) the city centre characteristics from D3.1 are relevant and when further developing the Filipstad, the characteristics of Filipstad are relevant (D3.1).

More specifically, four different types of environments surrounding the hub candidate locations were identified in D3.1. For Oslo, the environment types 1 [Dense | High integration high vitality] and 4 [Segregated | High integration low vitality] were defined, suggesting recommendations on what to include in a mobility hub. For example, multi-purpose trips in synergy with activities found in them (Type 4 Filipstad) and also to attract additional functions and services. Filipstad is today known for its port-related facilities. For the city centre/ZEZ (Type 1) there are high levels of walkability and many activities. Here, hubs could serve a multi-purpose mobility scheme.

4.1.1 Case summary Oslo

There is a difference in urban types between the inner and outer part of the ring (Kirkeveien-Finnmarksgata) in Oslo. As D3.1 points out, in the inner part there are many activities and larger buildings and closed building blocks. Streets are smaller, shorter, and closer to a grid pattern. In total, these characteristics provides a highly walkable and pedestrian-friendly area with a high index of walkability.

Further, it is described that these characteristics gradually shift to “a disperse, low-density, organic model at the outer part of the ring”. This is explained as single-family housing in open block structures with an organic street pattern with multiple turns and a low number of intersections resulting in a non-pedestrian friendly atmosphere, along with the low density of amenities and services. The main activities are located in shopping malls that potentially encourage motorised traffic.

Connecting the inner and the outer parts of the ring, popular areas gather along main streets that connect the city centre to city-scale landmarks at the intersection of these axes with the ring (Storo, Colosseum, Skøyen, BI Campus, Vigeland Park) following a cartwheel structure. These streets also show a higher level of urban integration. Particularly, the E18 highway extends from the city centre towards both sides of the Oslo-Viken bay (Sandvika and Ski) being the main artery at a functional urban area scale.

4.2 Governance Innovation

The evaluation of the governance context for Oslo in deliverable D4.1 was based on a literature review, a case study of Antwerp and results from the governance assessment of Oslo. The latter was about the parameters policy and regulations, stakeholders, legitimacy, and resources. Below is the summary with comments according to those parameters:

Policy and regulation

The City of Oslo has high ambitions for lowering emissions, e.g., by 95% within 2030 from 2009-levels and reduce the car traffic by a third within 2030 from 2015-levels. Relevant policy documents mapped in D4.1 include the Oslo climate strategy towards 2030[1], the Oslo climate budget[2], Oslo’s Street Norm[3] and Oslo Urban Development Strategy 2030[4]. Further, D4.1 points at local policies, either recently implemented or under development, that include micro-mobility restrictions, zero emission zone, and parking restrictions in the city centre. Besides D4.1, the Norwegian Public Roads Administration’s series of handbooks regarding design of physical infrastructure (incl. signs and road markings), and legislations around vehicles/bikes etc. should be mentioned.

[1] Climate Strategy for Oslo towards 2030.
[2] Oslo Climate Budget
[3] Gatenormal for Oslo
[4] Oslo Urban Development Strategy 2030

Stakeholders

For the city in general, some of the main mobility actors were found to be the Municipality's Department of Urban Development, the Department of Environment and Transport, the Norwegian Public Roads Administration (NPRA) the train operator Vy, the national transportation company Entur, the tram operator Oslo Sporveier, and Ruter. D 4.1 states that National authorities are relevant since implementations need to be followed up by large scale policy changes. Also, the transferability of the solutions to other national areas or cities will be strengthened increasing the impact of the project.

Within the Oslo LL, many more actors have been identified in stakeholder analyses, also within private sector, and as D4.1 describes, stakeholders' role depends on the current state, location and characteristics of each test site.

In the analysis of Oslo LL (D 3.1) the stakeholders were split in different groups depending on degree of involvement. As D4.1 describes these were end users (including both organisations and citizens, users and non-users), collaboration partners for creating the solutions (including private sector), and the organisations that need to be informed. It was in the deliverable proposed that the main opposition may be formed at the latter, e.g., taxi companies, delivery companies, and other private mobility companies. They may face competition from the public actors as a result of the project, e.g., Ruter's concept Mobility on-demand for people and freight (R-MODS). D 4.1 commented that there was no currently clearly defined strategy on how to deal with their opposition, but suggested to keep these stakeholders informed and to target the right individuals. This will be elaborated in D10.3 due in June 2022. Involving people within business development, innovation or sustainability departments of these companies may be beneficial as these are generally more perceptive and innovative.

However, D4.1 says that this is relevant if some of the solutions may threaten the companies' core business model. Instead of competing, attempt could be made to "share or consolidate physical assets (e.g., vehicles) and infrastructure between private and public companies, accompanied by creating shared business models". Also, the report underscored that following the city goals and ambitions for the test site design will improve accept from the politicians. Oslo LL builds concepts on existing entrepreneurial ideas and extends use of existing vehicles should be viewed as in line with that sort of acceptance from politicians and also the administrative management in the city, e.g., combining persons and goods in existing vehicles.

In addition to the groups that may form direct opposition, several potentially underrepresented stakeholder groups were identified and described as follows in D4.1. These were research organisations for close collaboration with start-ups, e.g., TØI and StartupLab Mobility, and citizens and end-user groups for user centred design. Here, Ruter has already started with interviews with focus groups that will be further developed within the Oslo LL.

In addition to groups described in D4.1 there are other existing organisations and projects that can provide platforms for, or contribute to, the dialogue. Even though they have their own agendas, the collaborations and members are relevant for the progress of the Oslo LL. These are discussed in the Task Force meetings and in the ICCP:

- *Oslo Business for Climate Partnership*. This network led by the City of Oslo may be particularly useful for increasing the end user involvement as the membership consists of the business community, citizens and NGOs.

- *STOR (Smart transport in the region of Oslo)*. The project is a collaboration between the municipality, Ruter and the Norwegian Public Roads Administration (NPRA) and focuses on testing new tech solutions and improving the existing mobility solutions.
- *Ruter*. Ruter is a partner in MOVE21 and holds regular dialogue meetings with the actors interested in transport and logistics, with broad representation of companies and start-ups.
- *ICT NORWAY*. This is an interest group for the Norwegian ICT industry. They represent the full range of the spectrum from the major players down to small entrepreneurial companies.
- *Viken county*: Viken is a partner in MOVE21 project and has several relevant projects that can contribute with useful experience, such as efficient goods delivery in west corridor.
- *FSULP*. Project for an evaluation of a sustainable urban logistic plan. This project identifies key elements for a SULP and will feed into MOVE21.

D.4.1 also suggests that proposed solutions should reflect innovative or entrepreneurial activities of the participating actors, building on existing knowledge and experiments. Entrepreneurial activity of the stakeholders is organized in several forms, with e.g., Ruter testing several ideas, and TØIs collaboration with StartupLab Mobility mentioned above where the Agency for Urban Environment and NPRA are among the partners. The topics are different, but are relevant to MOVE21 solutions to some extent, e.g., Ruter's following activities as described in D 4.1:

(1) Combining inbound logistics to the city with outbound waste collection to reduce total traffic,
(2) Demand responsive transport servicing elderly and people with special needs,
(3) Distributed delivery by citizens. The solutions being tested by Ruter are currently on different readiness levels, and face several issues to different degrees, such safety and tax issues and competition laws.

Legitimacy

Another parameter from D4.1 is the legitimacy aspect when concepts involve competition between public actors or publicly owned companies and private actors. This is suggested to lead to opposition due to the already subsidized situation for the public actors. Also, the strong efforts among Norwegian Road Authorities in general (municipalities, counties and at national level) within road safety means that safety is expected to be integrated from early concept planning until testing. Only then, both politicians and the authorities can front the concepts. Finally, mobility trends were also considered to challenge legitimacy if Oslo LL concepts are not adjusted or in line with these. Oslo LL therefore considers this transport mode to be highly relevant to include in the concepts and will also follow up results from the MikroReg project (owned by the Agency of Urban Environment) which is about knowledge needs and the role of the regulator regarding micro mobility. This project runs from 2021 to 2023.

Other constraints influencing political priorities in the city is the increase in electrification, car sharing and zero emission zone ambitions, the development of automated vehicles within public transport, as well as new guidelines for working from home.

Being able to demonstrate the difference between existing mobility offers and the solutions within the concepts underscore the market value, according to D4.1. The technological solutions in concepts at Oslo LL attempts to address the need for common systems for consolidation of goods. Being able to prove this is important.

Resources

Other barriers for progress in the Oslo LL concern long term financing and lack of proper business models that address private companies. To develop such models and private investments there is a

need of collaboration and involving the private actors as stakeholders, e.g., by industry meetings. This will be done in collaboration with WP9 and commencing work on business models and exploitation.

Another big challenge regarding resources is the competition for space/area. There is a lack of available areas. As mentioned earlier one concept will start testing in areas that Ruter already is operating in. Another is about integration of public transport with micro-mobility (no specific area) whereas the third is the network of mobility points in Groruddalen. The two first do not have the same challenges for competition whereas the latter face urban space constraints.

Also, as D4.1 points out, there may be a shortage of future electricity. The costs related to operations of different mobility solutions will increase, as well as the costs for the citizens and private actors using the transport modes. On the other side, this may also underscore the need for consolidation and optimising use of existing vehicles, infrastructure etc.

4.3 Technical Solutions and Integration

The technology in MOVE21 and the Oslo LL is about information systems or software platforms for managing public transport and logistic solutions, preferably in combination. Deliverable D5.1 establishes an overview of the technical needs for the solutions to be implemented by the concepts/actions planned in the Living Labs, and on the potential for integration among these technological solutions.

Since the concepts of the Oslo LL are not yet finalized, the general issues from the deliverable are described here. These are pointed out as a prerequisite when selecting and integrating technologies. One of these is to make the use of public transportation more attractive than private cars and another is that should be moved by making the best possible use of resources. MIXMOVE and Urban Sharing (partners in the MOVE21 project consortium) both have solutions for this.

More specifically, the deliverable states that Urban Sharing can contribute to the integration between the ticketing/booking systems used in public transportation with systems being used to book the on-demand transportation services (use of bicycles, e-scooters, taxis, etc. in the mobility hubs). MIXMOVE can contribute to the establishment of a coherent infrastructure for urban distribution of freight. Key is to establish capabilities for cargo consolidation/reconstruction, including information systems to manage such operations.

For implementation in the Oslo LL, the solutions for managing cargo consolidation need to be integrated with the information systems of the companies performing hub-to-hub transport and those performing first and last-mile operations. In general, as well as for the Oslo LL, companies offering passenger transport, either regular or on-demand, should extend their ticketing/booking systems to cater for the movement of cargo in addition to moving people. They should also extend their “in-vehicle” solutions so that the status of movements and proof of delivery of goods may be recorded and reported electronically to the appropriate stakeholders.

5 Priority topics and Crossovers

To implement solutions in the Oslo LL, key contextual factors, or priority topics have been identified. They follow from the previous chapter and from progress and meetings in the Oslo LL. An overall priority

is to start demonstrations according to timeline (figures 6 and 8), to upscale concepts, and add new ideas emerging through iterative co-creation processes within the Oslo LL, WPs as well as with other national private and public stakeholders and networks within mobility.

5.1 Priority topics

The priority topics are presented below, with a suggested timeline, process and involved WPs and other actors. This is a draft of April 2022. In chapter 6 an innovation action plan at another level of the Oslo LL work is described.

Topics	Timeline	Outcome	Process / Method	Involved
Social layers				
Spatial context	Starting Q3 2022	Perform an updated analysis of spatio-social characteristics for concepts in City Centre (hubs in and around ZEZ), Lilleakerbyen and Groruddalen.	Analysis, simulations	WP3, WP5, Oslo LL
Support services	Starting Q3 2022	Establish a public space for travelling within Groruddalen. In WP3 and D3.1 a good public space is described to have a public transit, accessibility comfort as well as being safe, and show a high level of social relevance and liveliness.	Simulation of pedestrian, biking etc.	WP3, WP5, Oslo LL
Further data exploration	Starting Q2 2022	Explore data and apply tools in WP3 to work on the idea or concept of strategic placement/parking of e-scooters in the city centre/ZEZ. Public car parking is reduced and those spots can be ulitised for e-scooters.	Data analysis, simulations	Oslo LL, WP3, WP5
Involvement of stakeholder on social layers	Starting Q2 2022	Apply results, tools and methods from WP3 to strengthen arguments and involvement of stakeholders for strategic deployment of mobility services in the city centre and in Groruddalen.	Meetings Workshops	NPRA, Private actors, WP3

Table 1 Priority topics within Social layers

Topics	Timeline	Outcome	Process / Method	Involved
Governance				
Legal aspects - Regulation of area	Starting Q3 2022	Legal challenges regarding regulation of ZEZ and UVAR's, road users with exemption from ZEZ regulation, viable business model to include all actors within the logistic ecosystem, regardless of size of private companies.	Dialogue meetings workshop	Task Force, The City of Oslo LL, WP4 WP9
Legal aspects- Vehicle legislation	Started Q2 2022	Vehicle legislation regarding combination of goods and persons in the same vehicle to be used in Ruter's R-MODS. Is it for example necessary to apply for vehicle approval?	Expert meeting Application of vehicle approval	Oslo LL, WP4, NPRA
Legal aspects- Strategy for handling regulations	Starting Q3 2022	E-scooter regulations can lead to challenges related to mobility hubs in Oslo. A strategy should be established that can ensure the handling of future regulations relevant for the Oslo LL. Ensure participation of the Oslo LL in the preparation of new regulations for electric scooters and perhaps also car sharing.	Meetings	Oslo LL, NPRA, WP4, MikroReg
Stakeholders involvement- Private and public actors	Started Q2 2022	Stakeholder involvement of regulatory authorities. Demonstrations may lead to issues relevant for regulatory road authorities (national and municipality), like affecting physical and digital infrastructure, area use and road safety etc. Stakeholder involvement of private companies, such as recent stakeholder meeting between NPRA, Task Force members and private actors (last mile deliveries companies etc.), hosted by NPRA. The meeting was about micro mobility and freight.	Industry meeting, workshops	Task Force The Oslo Port Authority WP4, WP6 WP10 Private Actors

Topics	Timeline	Outcome	Process / Method	Involved
		Establish a strategy for involving stakeholders that have access to areas, e.g., in Filipstad.		
Procurement	Started Q2 2022	Establish partnerships between private and public sector (See also related topic above). D4.1 states that both private and public sector are involved for public transport, whereas for freight transport, private companies are most common. Cooperation and establishing partnerships between them are important for the concepts and solutions within Oslo LL and procurement models as well as business models and organisational aspects must be defined. Procurement is also addressed in D5.1 where it is suggested that the cities investigate possibilities of collaborating with providers of goods to rethink procurement terms and conditions, thereby taking more control over cargo movement.	Industry meeting	Oslo LL, WP4, NPRA, Private actors/Industry WP9
	Starting Q3 2022	Arrange workshops to explore the potential for using public procurement (e.g., City of Oslo) to create demand for the delivery service in the concept of Mobility on-demand for people and freight, and possibly for the Network of mobility points. This will be done with the Task Force and the relevant agencies or departments in the City of Oslo.	Workshop	Task Force, WP4, The City of Oslo Department of Finance
Private investments	Starting Q3 2022	Continue the newly established collaboration with private companies (goods deliveries/first and last mile), i.e., meeting	Industry meeting	Oslo LL, WP9, WP4

Topics	Timeline	Outcome	Process / Method	Involved
		arranged by NPRA in April 2022 with Oslo LL and industry. Initiate plans for market analysis, and collaborate with WP9 in order to work on upscaling and investment needs.	Market assessment	Oslo LL, WP9
Legitimacy	Starting Q3 2022	Establish a strategy for dealing with the opposition, e.g., taxi companies, delivery companies, and other private mobility companies. They may face competition from the public actors, e.g., Ruter's concept Mobility on-demand for people and freight (R-MODS). This should also be elaborated in D10.3 due in June 2022.	Workshops	Oslo LL, ICCP, WP4, WP10
User aspects and customer value	Starting Q3 2022	Mapping user needs, preferences and user's willingness to pay are important for designing the optimal solution. It is essential for the concepts and technologies involved not only to contribute to the emission-free goal as well as being safe (road safety and security), but also make sure the concepts provide a benefit for the user. Ruter has already done some user-involvement in focus groups (customers), and the Task Force is involved in the stragegy for all concepts.	Focus-groups, Interviews (road side) and questionnaires	Oslo LL, WP3, WP10, WP4, WP6
Longterm development	Starting Q3 2022	Continue the concept of R-MODS for the upscaling to Filipstad, Ski and other places in Oslo, as well as in Viken. The reference project in Viken at Fornebu is relevant for Oslo Living Lab in Filipstad.	Business models Value creation Expert knowledge Collecting preliminary evaluations	Oslo LL, WP3, WP10, WP4, WP5, WP6, WP9, City of Oslo

Table 2 Priority topics within governance

Topics	Timeline	Outcome	Process / Method	Involved
Technology				
Digital twins	Start Q2 2022	Establish digital twins for simulations of the concepts	Digtal twin, simulations	WP5, WP3, Oslo LL
Data and GDPR	Start Q2 2022	Bring up and work on challenges concerning data storage, income sharing/calculation and GDPR (technologies involved)	Expert knowledge within privacy legislation	WP5, WP4, Oslo LL
Integration	Starting Q2 2022	Identify the need for integration of the information systems that need to interact and the methodologies/technologies that should be used for such tasks. The approach should be such that the same interfaces should be applicable in other, similar implementations.	Workshops and targeted meetings	Oslo LL, WP5

Table 3 Priority topics within technology

5.2 Cross-overs

The Oslo LL considers knowledge from the different WPs to have continuous impact on the existing concepts and for concepts that may emerge in the future. Table 1 describes which topics are considered cross-overs so far by listing involved actors and different WPs for the follow-up. There are also cross-overs that, currently, are not necessarily listed as priority topics. These may, however, be included in table when concepts are further developed.

6 Innovation Agenda

6.1 Action plan

The actions below are based on the priority topics, and on present information/status of the concepts. The action plan for each concept is described individually, however, topics in table 1 may be more descriptive.

6.1.1 Concept of Mobility on-demand for people and freight

This is the last mile delivery service added to Ruter's current Mobility on-demand service for seniors, using the same vehicles (minibuses) for transportation of passengers and goods. The demonstration will be testing delivery of shopping items bought by consumers in selected shopping malls, as well as online (e-commerce). The deliveries will be either home deliveries or deliveries to pick up points. The draft timeline for the concept is shown in figure 6. Later in Q2 2022 a more detailed implementation plan

will be finalised. As the figure shows, the dialogue about agreements is going on in April and May 2022. The plan is to have contracts signed before summer (July 2022).

Figure 6 Draft timeline for preparing and kick off for the mobility on demand service for people and freight (draft March 2022).

6.1.1.1 User aspects and customer value

The needs of the users – the shopping mall customers and e-commerce customers – will be mapped for a view on how the delivery service adds value to their way of receiving goods. This will be done during the demonstrations and in line with other WP's. Work in WP3 will guide how to involve citizens and transport users, and this work will be used as input to the planning of the user involvement (WP10 and D10.3). As mentioned earlier, it is essential to involve users at an early stage to ensure the development of the right solution. Involvement starts already in the creation of a detailed plan for the implementation of the concept

6.1.1.2 Stakeholders and legitimacy

Ruter has recently investigated and approved the legislative relations/law into this concept (including vehicle technical regulations). As described in chapter 4.2 (Government) and in Table 1, the vehicle legislation is still important to know in detail, e.g., weight of goods in open space. Another issue concerns the fact that Ruter is owned by two public entities - the City of Oslo and Viken county – and Ruter's mobility services are subsidized. The last mile goods delivery service to be demonstrated will compete with services provided by private companies, and this could as earlier mentioned distort competition. Ruter is investigating the legal issues related to this. In this process WP4 will be involved. The Task Force will arrange an information meeting to ensure dialogue about all regulations.

6.1.2 Concept of Network of local Mobility Hubs

This holistic concept aims to establish a network of 10-20 mobility hubs in a limited area for seamless transit between public transport, shared cars, micro-mobility/city bikes, cargo bikes and possibly pick-up points for parcels. Services will be integrated in Ruter's travel app, there will be clear graphic profile (physical and digital) and infrastructure for charging different types of vehicles. The concept is still in an early stage, where many necessary clarifications are needed.

The mobility hubs points will be located at existing public transport transit points, e.g., metro stations, tram stops or bus stops (D3.1).

6.1.2.1 User aspects and customer value

MOVE21 project partners have carried out insight work regarding the use of this type of mobility hubs, e.g., from dialogue with mobility providers to user interface (focus groups). The goal is to involve users

within this area in mapping their needs to ensure it adds value to their travels and how they receive goods. Analyses from WP3 (movement) and simulations in WP5 will be done.

6.1.2.2 Stakeholders and legitimacy

Identification of relevant stakeholders needs to be made as well as collaboration and agreements. The Task Force will arrange an initial information meeting to ensure dialogue about all regulations. This is in line with WP4 and D4.1 and the other two concepts, and WP10 will also be involved to ensure stakeholder buy-in and effective strategies for this.

6.1.2.3 Technological solution

An information system/software platform will be used to combine different transport modes. Innovation challenges regarding this concept as well as the concept of integrating public transport with micro-mobility is to understand how effective this measure is to reduce private cars and how to avoid cannibalizing public transport. This is also related to the topic of user aspects and customer value. Another synergy between the two concepts is about visibility, meaning digital (integration) and physical (signage and marking) visibility and whether this can increase the use of such mobility points.

6.1.3 Concept of Integration of public transport with micro-mobility

This is a concept for the integration of micro-mobility for city bikes and e-scooters, and public transportation like buses and trams, in a Mobility-as-a-Service. It will be a digital integration of existing mobility services, providing the customers with the possibility of booking e.g., a city bike through Ruter's booking and ticketing platform.The demonstration is digital and does not require interventions in physical infrastructure. The radius of the service is within the road network Ring 3 in Oslo, with the largest transport volume within the city centre (figure 7).

The Oslo LL will commence work on this in Q2 or Q3 in 2022.

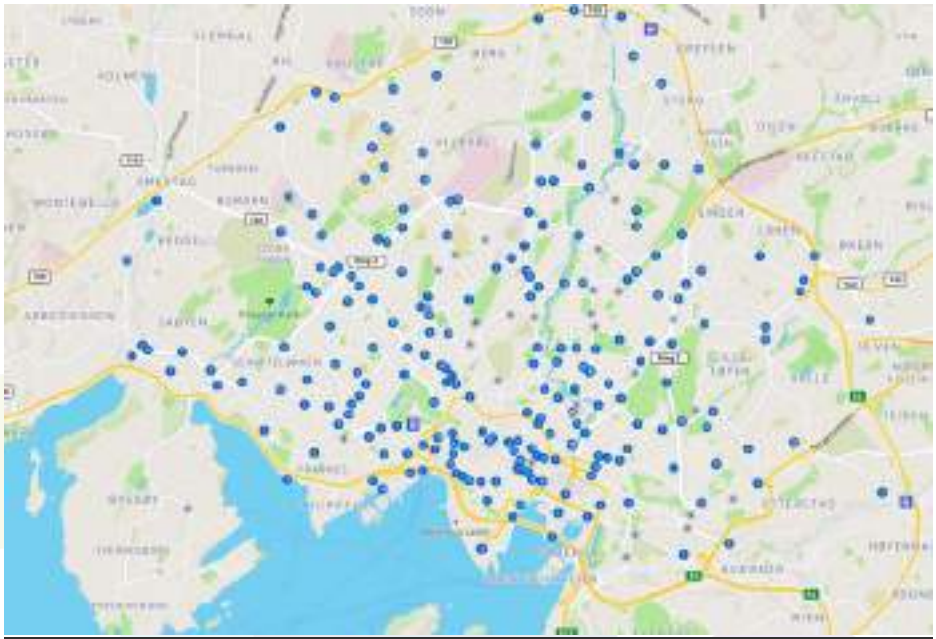

Figure 7 City bike stations (https://oslobysykkel.no/stasjoner)

6.1.3.1 User aspects and customer value

Urban Sharing and Ruter have recently carried out analyses providing insight into the users/traveller's needs. This will be aligned with WP3 to ensure enough information about travels and needs.

6.1.3.2 Stakeholders and legitimacy

The Task Force in the Oslo LL will organise an information meeting to ensure a dialogue about regulations, including participation from WP4 with supporting knowledge. Other relevant players will be the already mentioned MikroReg project (building knowledge about e-scooters in Oslo), owned by the City of Oslo and headed by TØI, as well as aligning the plan with knowledge from hospital-registered injuries with bicycles, pedestrians and e-scooters in Oslo.

6.1.3.3 Technological solutions

Develop an integration that results in a two-way communication between several mobility operators. For demonstration purposes there will be one application that provides access to two separate services from separate operators in the private and public sector. There are solutions based on different business logics and end results, where one of the solutions is scheduled and the other is on request. Innovation challenges concerns data storage, income sharing/calculation, GDPR and end-user expectations.

6.2 Knowledge brokering needs

The knowledge brokering aims to develop relationships and networks with, among and between the partners that all are producers and users of knowledge. This is done by providing linkages, knowledge sources, and technical know-how (MixMove and Urban Sharing). A key feature is the facilitation of knowledge exchange or sharing between and among various stakeholders (researchers, businesses, practitioners, and policy makers). In the Oslo LL this process comes out of the identified needs and innovation challenges so far for the different concepts (cf. 6.1). The process is a collaboration between the Oslo LL, WPs as well as within the ICCP and Task Force.
One of the topics with knowledge needs concerns urban characteristics and updated information on travel behaviour. Collaboration with WP3 is of importance regarding this by real observations of travel behaviour before (pre) the mobility solutions are applied. Also, we will search and learn for experiences from other test sites and living labs.

Another topic concerns the use of digital twins developed in WP5. The concepts in the Oslo LL depend on the possibility to simulate the conditions. We would also like to investigate the possibility to use TNO's simulation tool not only to plan and establish, but also consider the possibility to use the physical network to verify the simulation tool.

Also, to be addressed is the challenge of electricity regarding mobility hubs, e.g., for city bikes and car sharing. Finding ways to reduce the costs as much as possible will be elaborated, and during the period find a flexible way of charging that can be adjusted and optimized. Also, power transformers, batteries and solar cells will be considered, as well as the use of incentives. Here, the experience from the exisiting mobility hub at Filipstad will considered. This is relevant for WP4 when looking at agreements between private and public stakeholders. Probably, stakeholders, legitimacy and resources are key words for this as well (D4.1).

Further contribution from, or collaboration with, WP4 concerns the discussion within MOVE21 on whether private stakeholders should have responsibility for the establishment of infrastructure of goods (consolidation centre), or if a municipality should have that. The ViV project in Viken county about

logistics, has recently done some investigations regarding this, and it was concluded that the municipality should have this increased responsibility. However, it has to be explored whether this is applicable to other locations and governance contexts.

The Task Force in the Oslo LL has also discussed what kind of policy exist for ZEZ. What tools do the authorities have for the establishment and enforcement of ZEZ, and what tools exist for area use concerning people and goods? Many of these questions require involvement of legislative bodies with overview of the transport/mobility sector.

Before the demonstrations and simulations for each concept start, the evaluation plan from WP8 will be added.

6.3 Timing of the knowledge brokering process in the living lab

Several concepts are identified and being developed in the Oslo LL. Collaboration between the different members of the Task Force and the ICCP through regular meetings has led to the identification of concepts. Decisions are also heavily influenced by the Covid-19 pandemic due to the consequences of less travelling in Oslo (5). Also, knowledge about area and property access is added to the discussions. The aim is to scale and be able to apply the concepts to larger part of the city.

There are several next steps ahead and timelines are being developed in Q2 2022. Figure 4 shows a preliminary draft of the Oslo LL progress. When concepts are developed, and evaluations and user involvements set, it will look different. Regarding evaluations this requires coordination and meetings with WP8 to decide KPIs and methods for the demonstration, e.g., digital simulations, digital surveys and other online data gathering tools, feeding into task 8.1 and 8.2. Part of this is deciding what should be done at a city level and what should be done per concept/demonstration. For citizen involvement both WP3, WP6 and WP10 are important to coordinate with, e.g., townhall type of meetings or similar are mentioned in the evaluating aspects of urban space area.

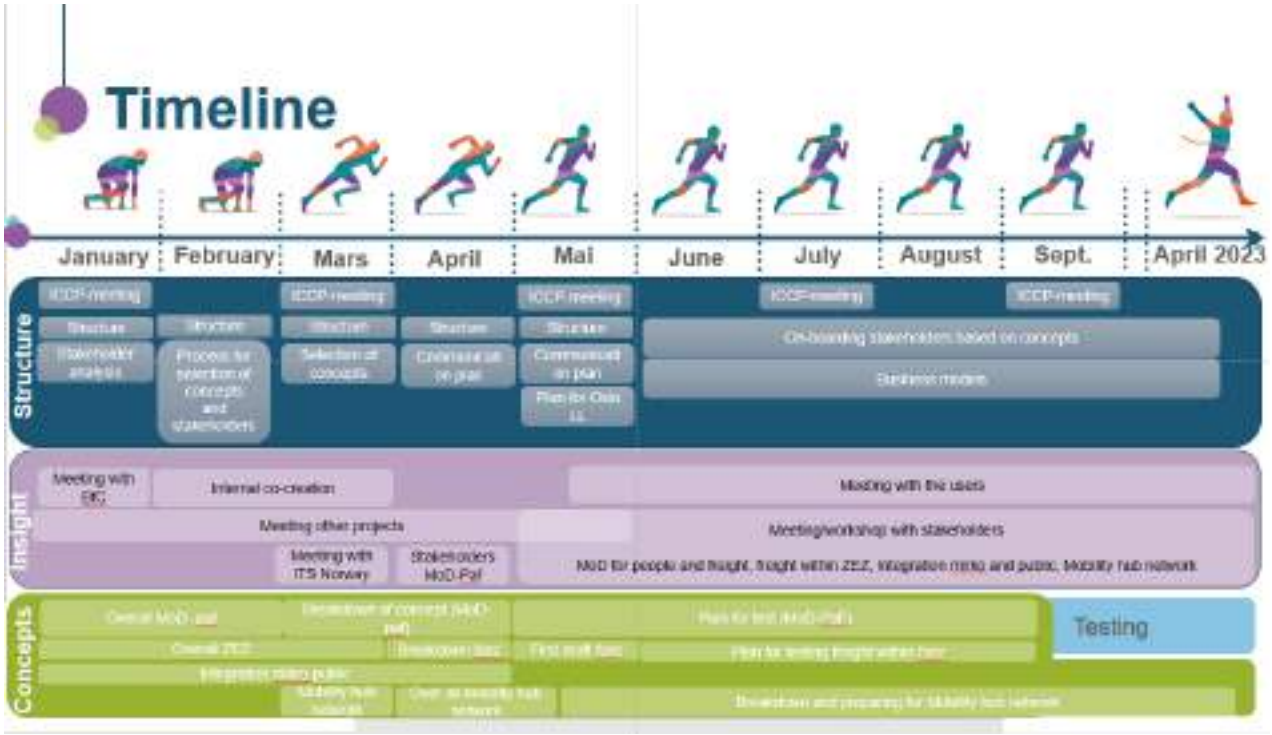

Figure 8 Draft timeline for the Oslo LL

7 Conclusions

The concepts as well as timeline for the Oslo LL are being developed at present time. The technologies/information systems are worked on to ensure integration between public transport and logistics interfaces for all three concepts. The plan is to start testing in August 2022.

The Oslo LL has a holistic view working on concepts that can be applied in several places. Building on existing activities and vehicles key private and public stakeholders are collaborating already and are quite hands-on similar ideas. It is also a strength that many of these actors are involved in the Oslo LL (ICCP and/or Task Force), as well as being involved in other national networks, collaborations and test sites within mobility. Insight work has also been done and still goes on to ensure knowledge about other ongoing projects testing and activities. Recently, NPRA has also become a collaborating stakeholder and meetings have been conducted in April 2022.

Other important actors are goods owners and suppliers, car sharing companies, micro-mobility actors and others related to the concept network of mobility hubs or points.

Further steps for progress and collaboration across WPs concern the need of simulations/digital twins of the concepts. Also, analysing data on travel behaviour/movements and goods/logistic data will be done, as well as using the assessment plan and use of indicators of the activities/pilots. Also, investments and proper business models is important to explore.

As the co-creation of solutions is an iterative process, other issues might arise that need expert input, and which should be taken up in the knowledge brokerage process, as the LL solutions are deployed and replicated

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