EX-ANTE IMPLEMENTATION OF THE IMPACT ANALYSIS FRAMEWORK FOR THE LIVING LABS

Project deliverable D8.3

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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 MOVE21 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

Key words

#1 Impact Analysis, #2 Key Performance Indicators, #3 Ex-ante assessment framework #4 Innovative mobility solutions #5 Zero-emissions

Executive Summary

The current deliverable demonstrates the ex-ante results of the implementation of the impact analysis framework for the Living Labs (Oslo, Gothenburg, and Hamburg) as described in the Deliverable D8.1. More detailed, the monitoring tools used for data collection are presented, along with the process for supporting their launch and usage. The result indicators of the ex-ante period are demonstrated per MOVE21 impact area and Living Lab city, leading to conclusions drawn. The current ex-ante evaluation report provides an overall picture of the innovations that will be implemented during the project lifecycle and the impact of the innovations upscale to the society, traffic, and environment, based on the results of the digital twins and other simulation tools.

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1 List of abbreviations and acronyms

Acronym	Meaning
API	Application Programming Interface
B2B	Business to Business
B2C	Business to Consumer
DTs	Digital Twins
EC	European Commission
GDPR	General Data Protection Regulation
KPI	Key Performance Indicator
LLs	Living Labs
NOK	Norwegian krone
QS	Questionnaire Survey
UMMS	Urban Mobility Monitoring System
WP	Work Package

2 Purpose of the deliverable

The current deliverable describes the application of the Task 8.3 *"Implementation and Validation of the Impact Analysis Framework".* It explains the implementation of the ex-ante impact assessment framework for the Living Labs (LLs) of Oslo, Gothenburg, and Hamburg in terms of data collection and analysis and result indicators' calculation. In order to estimate the impacts of the measures, solutions, and innovations that LLs will implement, MOVE21 monitors the progress against specific target values.

This deliverable is a planned resubmission of D8.3, originally submitted on time within the project's time schedule on 31 October 2022. It contains information on those result indicators that could not be calculated within the deadline of the original deliverable (October 2022) due to ongoing finalisation of the measure descriptions. In addition to the initial content, the resubmission process was discussed and agreed within the project's consortium and the Project Officer.

2.1 Attainment of the objectives and explanation of deviations

The attainment of the objectives was a challenging task. Due to the complexity of the innovations that the LLs are planning to implement and the required cooperation of many different private and public stakeholders, the measures and solutions finalization followed an iterative process in which participants in the project simulated and tested different scenarios in order to conclude on the ones that will be adopted, implemented, and upscaled. As a result, deviations in the duration of the ex-ante evaluation were recorded. For this reason, ***the implementation of the ex-ante impact assessment methodology*** was executed ***in two phases***. During the ***first phase*** a quantification of the different innovations that are implemented and the assessment of the base case capacity of the LLs' members took place and is described within the first version of D8.3. This work took place in 2022, in particular Q2 and Q3. Within the ***second phase***, the finalization of the measures and the simulation of them took place, leading to the ex-ante impact analysis result indicators as regards the environment, traffic, and society. This work took place in 2023. The results of both phases are presented in this deliverable.

2.2 Intended audience

The main internal audience of this deliverable is the Project Coordinator, the WP Leaders, the MOVE21 Executive Board and the Living Lab representatives, as well as the European Commission Services.

Moreover, D8.3 is a public document aiming to become a guide for any interested body, as it describes a framework and methodology implementation which could be easily transferable to any relevant EU initiative or relevant research activity. Therefore, it is open to a wider audience.

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

The deliverable consists of six sections overall. Initially all the relative administrative information (authors, Deliverable number, document history, etc) and project information (project summary, project partners, is provided abbreviations and acronyms to guide through the deliverable) is given. Following, the purpose and the objectives of the project are described ending up to its construction and its links with other work packages. In the ***3rd section,*** the methodological framework of the ex-ante impact analysis is presented, enriched with a detailed presentation of the MOVE21 monitoring tools used for data collection procedures, necessary for the monitoring and calculation of the result indicators. The ***4th section*** provides the definition of several concepts/notions enclosed by the results indicators of the impact analysis framework and express the way the MOVE21 project understands them. Moving forward, within the ***5th section*** the result indicators are demonstrated per Level and Living Lab city while the ***6th and section*** includes the conclusions the next steps of the impact analysis. The deliverable is completed with the section References and ***Annexes*** (A and B) presenting the structure and images of the monitoring tools.

The current deliverable feeds on the Integrated City Assessments of Oslo, Gothenburg, and Hamburg D6.2, D6.3 and D6.4), and the Deliverable D3.1 of WP3 as well as the deliverables 4.1 and 5.1 of WP4 and WP5 respectively. The results of the ex-ante evaluation will be discussed in the LLs, in order to update their solutions and decide on their upscale approach using, as well, the Digital Twins (DTs) feedback.

3 Methodological Framework for the ex-ante MOVE21 Impact Assessment

3.1 Ex-ante impact assessment methodology overview

MOVE21 integrates smarter and cleaner mobility measures and solutions by applying a holistic and integrated approach to mobility planning, policies, and implementation in the three Living Lab cities Oslo, Gothenburg, and Hamburg. This integrated approach forms the basis for positive impact delivery as regards long-term decarbonization, sustainability, inclusiveness, security, economic development, social cohesion, and accessibility improvements. To assess the impact of MOVE21 mobility solutions, a three-level impact assessment methodology integrating three fundamental conceptual levels has been planned. ***Level one*** refers to the three innovation-enabling topics which are society, governance, and technology. ***Level two*** refers to the Living Labs co-creation procedures. ***Level three*** refers to the impact-oriented MOVE21 result indicators. More detailed:

3.1.1 Level 1: Innovation-enabling topics

Within this level, a performance assessment is taking place for assessing the number of innovations intended to be implemented, in the view of the ***three thematic areas***: urban social layer, governance, and technical integration. The ***urban social layer*** considers the implemented innovations that provide close link between social and spatial components of the cities, enhance social acceptance, and maximize the impacts on social cohesion. The ***governance level*** is related to the needed innovative actions that should be done by the LLs to solve specific problems and barriers as regards governance structures/mechanisms, and specific parameters such as regulatory knowledge, stakeholders, resource mobilization, direction of search, market and customers, legitimacy, and entrepreneurial experimentation. The ***technical integration*** is related to the technological innovations of the final implemented solutions as regards the achievement of the connectivity and interoperability among them analysing separately each of the cases in Oslo, Gothenburg, and Hamburg to be successful.

The KPIs included in this Level per thematic area are listed below:

Thematic Area 1: Urban Social Level
- Number of MOVE21 social innovations implemented in the Living Labs

Thematic Area 2: Governance Level
- Number of MOVE21 innovative business models implemented in the Living Labs
- Number of MOVE21 governance innovations implemented in the Living Labs

Thematic Area 3: Technical Integration
- Number of MOVE21 technological innovations implemented in the Living Labs
- Number of MOVE21 service innovations implemented in the Living Labs
- Number of interoperable systems of innovative solutions adopted in the Living Lab cities

In addition, the overall KPI
- Number of implemented MOVE21 innovations in the Living Labs

calculates the total number of innovations per Living Lab

3.1.2 Level 2: Living Lab procedures

The LL procedures refer to the co-creation, implementation, and upscaling of innovative mobility solutions, the efforts to increase innovation capacity in the cities and the local ecosystems, and the self-sustaining partnership models. Under this concept, there are three main targets that this Level serves:

- ✓ To evaluate the uptake of new knowledge and skills within the Living Lab cities, during the co-design and implementation procedures of the measures.
- ✓ To quantify any modifications occurred within the Living Lab cities' administrative and legal framework for strengthening the local innovation ecosystems
- ✓ To quantify the collaborations created and the business models developed within the Living Lab cities for achieving a successful implementation and operation of innovative measures.

A total of thirteen KPIs are included in this Level, addressing three targets:

Target Area 1: Uptake of new knowledge and skills

- Increased capacity to incorporate data-driven approaches in mobility planning
- Perceived improved understanding of governance drivers and barriers to implementation of measures
- Living Labs' Increased innovation capacity regarding organizational issues for implementing innovative mobility solutions
- Living Labs' Increased innovation capacity regarding knowledge management needed for implementing innovative mobility solutions
- Perceived improved understanding of the potential for the upscaling of MOVE21 solutions per Living Lab

Target Area 2: Modifications occurred within the Living Lab cities' administrative and legal framework as well as technological upgrade

- Number of policy solutions proposed for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab
- Number of Commercial decisions proposed or implemented for ensuring the successful establishment of MOVE21 mobility innovations per Living Lab
- Number of Administrative decisions proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab
- Number of Governance decisions proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab
- Number of new Technological Equipment developed/installed/purchased for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab

Target Area 3: Quantify the collaborations created and the business models developed

- Number of MOVE21 business models developed
- Number of strategic plans that will be reformulated based on the results of MOVE21 in the 3 Living Labs
- Number of New Collaboration Schemes proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab

3.1.3 Level 3: Impact-oriented result indicators

Under this level, the ***result indicators*** reveal the performance of the LLs' measures, solutions and innovations, administrative, commercial or policy decisions implemented or upscaled as regards the listed MOVE21 impact areas:

Impact Area 1: Long-term decarbonization

This area is related to the ambitious 2030 and 2050 climate goals. Integration of new scalable technologies and measures into city transport operations and existing transport infrastructures at real-life scale is the key, in order to achieve long-term decarbonisation impacts, contributing to long term economic, environmental, and policy impacts. Seven KPIs relevant to this Impact area are included:

- CO2 reductions from passenger transport in Living Lab cities
- CO2 reductions from freight transport in Living Lab cities
- No. of MOVE21 innovations upscaled in the three Living Labs
- Reduction in passenger transport related NOx air pollution as a result of deployed MOVE21 innovations
- Reduction in freight transport related NOx air pollution as a result of deployed MOVE21 innovations
- Reduction in passenger transport related PM2.5 air pollution as a result of deployed MOVE21 innovations
- Reduction in freight transport related PM2.5 air pollution as a result of deployed MOVE21 innovations

Impact Area 2: Sustainable, inclusive, safe, and secure mobility system.

This area, is related to safety, inclusiveness and security from a perceived point of view and by analysing perceived problems. This point of view is important to be shaped by individuals (i.e., the Innovation Co-creation Partnerships, the quadruple helix partners and, in particular, citizens and civil society). Furthermore, the new sustainable mobility solutions are expected to influence local air quality, safety, and quality of life positively. The expected reductions in noise and pollution, as well as improvement of health, can contribute to long-term health, wellbeing, environmental, social, and economic impacts and will be important considerations for public perception. At the same time, the new mobility solutions can lead to a more efficient handling of the flow of visitors to large (sports) events. Five in total are the KPIs included in this Impact Area:

- Increase of self-perceived inclusiveness from the implementation of transport solutions
- Increase of perceived security (crime, COVID-19 etc.) in the city-transport system
- Reduction in passenger transport related noise pollution
- Reduction in freight transport related noise pollution
- Decrease of average travel time loss per visitor of large (sports) events

Impact Area 3: Improvements of the efficiency and accessibility of the transport networks/systems covering the TEN-T urban nodes.

Due to the fact that the test sites are directly linked to the TEN-T access points, the MOVE21 innovations are expected to contribute to an access improvement as regards the TEN-T corridor and the provided sustainable transport options, while also increase efficiency and capacity utilization within the urban nodes. Thus, under this Impact Area, a contribution to short-term and long-term economic and environmental impacts is expected to be reached. Also, the collaboration through the Scan-Med Cities Observatory is expected to improve the identification and solving solutions to transport challenges at the interfaces between different spatial and governance levels, thus delivering long-term cultural, political, and capacity building impacts. Eight in total KPIs are included in this area as listed below:

- No. of daily usages of new hubs
- Load factors in urban freight as a result of MOVE21
- No. of new (micro) hubs as a result of the Project
- No. of improvements in existing hubs as a result of the Project

- Reduced number of heavy (freight) vehicles in circulation as a result of the implementations
- Increase in zero emission light duty electric vehicles
- Increase in public transport use
- Modal shift due to decrease of travel time (associated with MOVE21 hubs)

Impact area 4: Social cohesion, economic development, and public perception, resulting in behavioural and policy change.

Improved alignment of planning mechanisms in different policy domains triggers 'win-win' effects between policy goals and creates space for enhanced innovation capacity through different levels: policy, governance, urban planning, financing, business models, infrastructure, and technological solutions. MOVE21 facilitates policy change through policy-learning processes, supported by tools and methods, and through sectoral integration, ensuring greater policy coherence. The ambitious policy goals in the participating cities and in Europe (as expressed in EU's Green Deal) on reduced emissions and increased liveability in urban areas create business opportunities for innovative solutions, contributing to short- and long-term economic and policy impacts. Co-creation with industrial partners, citizens, and policy-makers ensures that real investment opportunities meet well-defined goals for sustainable mobility and bring tangible outcomes and economic development opportunities and short- and long-term economic impact, ultimately resulting in new, green jobs in Europe. Four KPIs are listed in this Impact area:

- Increase of gender mix in pedestrian space usage per Living Lab city
- Direct economic sectorial contribution to the welfare to the metropolitan area from city transport
- Increase of pedestrian density/people walking by the areas surrounding the hubs
- Increase of younger population as visitors

The Figure below depicts the result indicators of the Ex-ante MOVE21 Impact Assessment process. per Level.

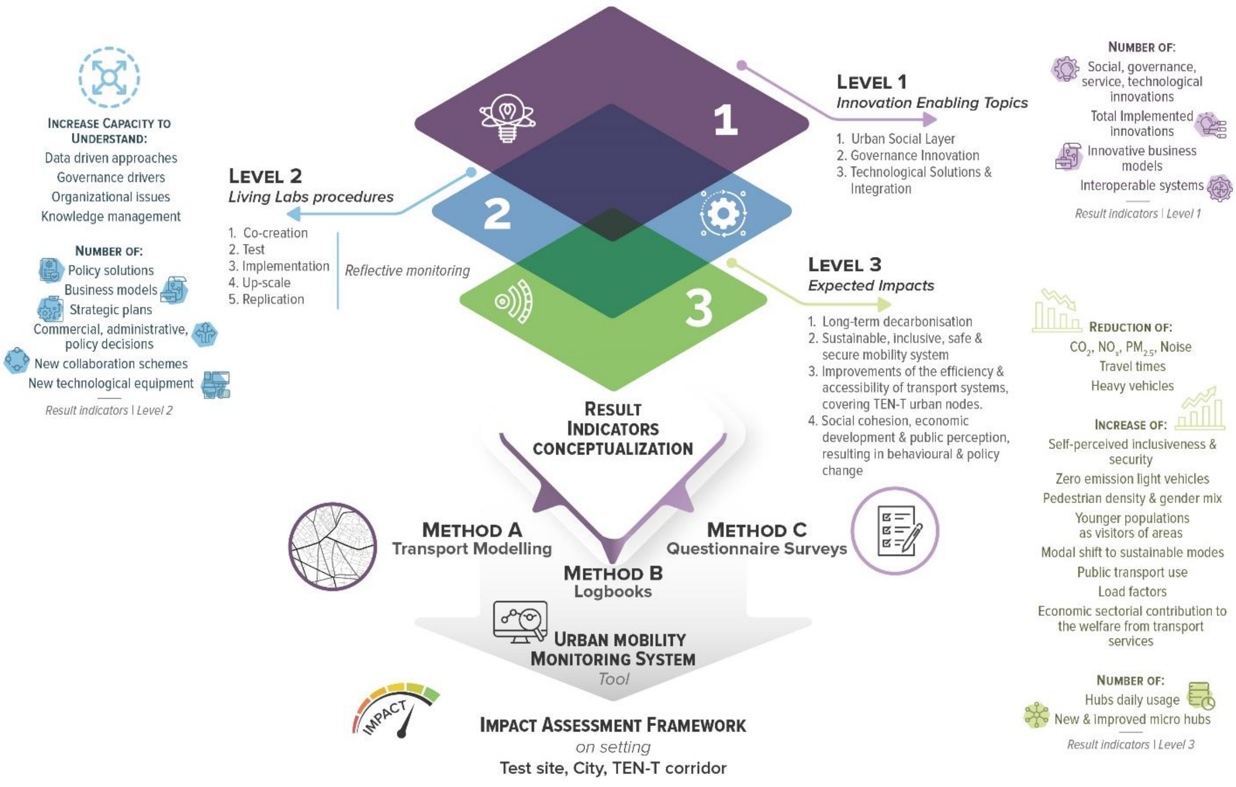

Figure 1: Results indicators of the for the first part of the ex-ante MOVE21 Impact Assessment

It is worthwhile to highlight that some of the above mentioned KPIs have been excluded and simultaneously have not been calculated in the ex-ante phase, as it seems that the estimation or the calculation of them will not be accurate before the real implementation of the innovative measures. A before and after survey will be organized in order to calculate these KPIs during the real operation of the innovative measures. The list below includes the eleven KPIs not calculated in the ex-ante phase:

- Decrease of average travel time loss per visitor of large (sports) events
- Increase of perceived security (crime, COVID-19 etc.) in the city-transport system
- Increase of self-perceived inclusiveness from the implementation of transport solutions
- Increase of gender mix in pedestrian space usage per Living Lab city
- No. of daily usages of new hubs
- Load factors increase in urban freight as a result of MOVE21
- Modal shift Load factors increase in urban freight as a result of MOVE21
- Increase of pedestrian density / people walking by the areas surrounding the hubs.
- Increase of younger population as visitors
- Reduced number of heavy (freight) vehicles in circulation as a result of the implementations
- Increase in zero emission light duty electric vehicles

3.2 Ex-ante impact assessment methodology implementation

The ex-ante impact assessment implementation is based on four monitoring tools, a ***Questionnaire Survey***, the ***Measures/Solutions/Innovations Logbook***, the ***Digital Twins***, and the ***Agent-based model***.

Complimentarily to the monitoring tools, a ***communication process*** among WP8, LLs, and project partners has been implemented in order to present the monitoring tools, set their timelines, assure their accuracy and reliability, and propose ideas for improving them.

3.3 Ex-ante data collection methods

3.3.1 Questionnaire Survey

For the implementation of the MOVE21 impact assessment, a ***Questionnaire Survey (QS)*** has been organized covering several MOVE21 impact areas and result indicators. The QS of this period aimed to collect from the relevant stakeholders, all the information in relation to two specific timelines of assessment (***a) the baseline and (b) the ex-ante assessment of the future scenarios***. The baseline period refers to the reference point, the current status. The ex-ante assessment refers to the pre-identification of the result indicators: what impact the implemented solutions would achieve after their implementation. Based on the guidance of the ex-ante assessment, the alternative solutions will be modified and the decision will be more factual. This approach is more comprehensive and can lead to the achievement of the target values and the specific objectives as well as to the improvement of the quality of design of each solution. The QS form is presented in the ***Annex A*** of the current Deliverable.

The QS followed several assessment processes before and after its launch. More specifically, the first round of logical controls initiated by the authors of this document (an internal pilot phase 1, WP8). The pilot phase 2 took place with MOVE21 leaders and project partners. After that, the QS was ready to be launched and filled in by the Living Labs. The QS improvement (phase 3) took place with dedicated meetings with the Living Labs, where they expressed their opinion as regards conceptual and technical aspects of the QS.

The QS is divided into four sections. The ***first section*** includes questions concerning the city's perceived capacities in mobility planning, policy, and administrative issues. The ***second section*** includes questions about data sources available from the cities or data surveys intended to be implemented. The ***third section*** includes questions with regard to the direct economic sectorial contribution to the welfare, resulting from the innovative mobility solutions implementation. The ***final section*** is a free space to share thoughts and comments or to reflect.

The communication process was centred around ***7 online exchange meetings***, on 23/08, 06/09, 28/09, 29/09, 04/10, 21/10, 25/10 (2022). Overall, ***20 people*** involved in the project activities, participated in the communication process (Living Lab representatives and WP leaders and other project partners). Throughout the communication process the presentation of the QS took place, several issues were resolved (e.g., technicalities end time-related issues) and proposals for improving the QS were formulated).

The level of participation was an important factor in order to ensure the accuracy and reliability of the QS results. The outcome of the process was the structure of a database fulfilling the needs of several result indicators. The overall number of responses/records is 18 and the professional background of the respondents is the mobility, environment, and development sectors (e.g. climate, procurement, urban development, traffic management, transport planning).

3.3.2 Measures and Innovations Logbook

For the implementation of the MOVE21 impact assessment, a ***Measures and Innovations Logbook*** has been designed for the Living Lab cities to fill in in order to cover several MOVE21 impact areas and result indicators. The aim of the Measures and Innovations Logbook of this period was to collect all the relevant information related to the measures, solutions, and innovations intended to be implemented/upscaled in Living Labs. The Measures and Innovations Logbook form is presented in ***Annex B,*** at the end of the current Deliverable.

In the context of the Logbook, the LL representatives were invited to fill in the measures and the built-in solutions proposed and describe the innovative aspects (technical/non-technical) that are intended to be adopted. Furthermore, the LLs' representatives had to examine the administrative, commercial, and policy decisions supporting the measures, solutions, and innovations as well as the technological innovations and the governance/collaboration/business models in need for enhancement.

The communication process for supporting the Measures and Innovations Logbook followed the launch of the QS and was part of the same communication activities, as described in the previous section ***(3.3.1. Questionnaire Survey).***

3.3.3 Scenario Modelling

Two methods of scenario modelling applied from WPs (3&5) working close and overlapping with WP8 for the implementation of the impact analysis and the impact assessment. The methods are ***digital twinning*** and ***agent-based pedestrian modelling***. Both of the monitoring tools will assist the MOVE21 impact assessment by providing data-driven results for the effects of the implementation of the measures, solutions and innovations on the mobility system, the environment, the urban context, and social dimensions of the impacts. The results of these monitoring tools required a lot of data and new simulation algorithms and models in order to calculate accurate results. Additionally, the results of the simulations refer not only to the solutions to be pilot tested by the LL cities, but to the optimum number of their upscales in order to achieve the most effective impact for the city. The deliverable of the ex-ante impact analysis framework includes the impact that was calculated after the simulation of the upscaled innovations.

3.4 Urban Mobility Monitoring System for data storing

The ***UMMS*** is built within the MOVE21 project, to monitor the progress of urban innovation cases for the LLs and provide an overview of co-creation processes, data collection efforts, and result indicators from areas of impact. The UMMS is managing data needs and indicator sets for a potentially large number of innovation case studies and result indicators and keeps track of co-creation efforts and processes.

The UMMS supports rapid and easy access to the result indicators belonging to the three innovation areas, the three LLs targets as well as the four Impact areas of MOVE21. It facilitates filtering according to geographic area, time period, and value types (baselines, attainments, ex-ante, and ex-post values). The UMMS allows uploads and downloads of documents, attachment of links, and can apply procedures and tools for assessing progress, attainment percentages, and goal achievements after these have been defined and implemented.

Since there is a disparity of the individual innovations and solutions that each LL will implement and evaluate with the relative impact indicators, the UMMS will also serve as a repository for datasets and process documents used for extrapolating and harmonizing case study results. These additional intervening steps may prove necessary for ascertaining whether the set of case study achievements also implies that target values have been reached.

The information structure in the UMMS is dynamic and can be adapted to new innovation case studies, additional datasets and results, additional result indicators, as well as revisions to initially entered information. This makes it easier to revise the UMMS to reflect insights gained through the co-creation processes and work undertaken for deriving meaningful indicator values. The online version of the user manual will also benefit from user feedback and suggestions for improvement.

The UMMS is currently structured in order to automatically use the input of the three monitoring tools (Digital Twins, Questionnaire Surveys, and Logbooks) for the calculation of all the KPIs that are presented in the current report.

4 Definitions in Impact Analysis

Before presenting the impact analysis results, it is important to provide the definition of several concepts/notions enclosed by the results indicators of the impact analysis framework and express the way the MOVE21 project understands them. For the result indicator: ***Number of MOVE21 innovations intended to be implemented,*** it is important to clarify the concept of innovation as well as define the categories of innovations. As regards the innovation concept, the definition of D1.2: *Innovation Management Vision and Strategy* is adopted [1], which follows the ISO56000:2020 approach. Accordingly, innovation is defined as a new or changed entity, realizing, or redistributing value. MOVE21 has chosen LLs as its innovation model which is quintessentially an open innovation model.

MOVE21 uses the following categories of types of innovations. It is important to note that overlaps between categories often occur and that “bundled innovations” are prevalent, meaning that innovations can have characteristics from more than one category. For monitoring purposes, different innovations are only counted in one category, although they might exhibit many characteristics with other categories.

1. Social

According to the OECD, social innovation refers to the design and implementation of solutions that imply conceptual, process, product, or organizational change, which ultimately aim to improve the welfare and wellbeing of individuals and communities [2].

2. Governance

Governance innovation is defined according to D4.1: Initial Governance Innovation and Capacity Context Analysis for the Living Labs. Consequently, governance innovations concern developing better ways to organize and govern, with the goal of significantly improving the provision of public goods and services [3]. This includes various co-governance and partnership models, innovation capacity in government and policy innovation.

3. Process

According to the OECD, process innovation is referring to the implementation of a new or significantly improved production or delivery method in either public or private sector. This includes significant changes in techniques, equipment and/or software [4]. Changes in operational aspects can be a part of process innovation.

4. Business

According to the OECD and Eurostat, business innovation refers to a new or improved business process for one or more business functions that differs significantly from the firm’s previous business processes and that has been brought into use in the firm. This concerns the different functions of a firm, including production of goods or services, distribution and logistics, marketing and sales, information and communication systems, administration and management, and product and business process development [5].

In MOVE21, the category of business innovation also includes innovation related to pricing and revenue models. Pricing model refers to a way an organization maximizes profits and can pertain to pricing strategies such as flat rates, freemiums, premiums, or flexible pricing. Revenue model refers to the way an organization generates income and can pertain to for example pay-per-use, licensing, leasing, advertising, or subscriptions.

5. ***Technological***
According to the OECD, technological innovation refers the comprise of new products and processes and significant technological changes of products and processes [6].

6. ***Service***
Service innovation can pertain either to innovation of new service products, processes, or new service companies or organizations. Service innovation can pertain to both immaterial innovation but also be linked to manufacturing. Service innovation is about significantly improving user experiences [7].

For the result indicator ***Number of MOVE21 innovations intended to be implemented,*** it is, also, important to clarify ***the meaning of the test sites, measures, and solutions*** (related to passenger and freight mobility). The test sites represent the spatial (e.g., urban, peri-urban) content where the measures, solutions and innovations will be implemented. The ***measures*** refer to the urban and mobility planning decisions accompanied with the policy, administrative, and commercial decisions that will be implemented, while the ***solutions*** are closely linked to the measures and describe in detail the different components of the measures. Consequently, a measure is defined in a more strategic level (e.g., a hub network) and several solutions are enclosed by it (e.g., business models among involved stakeholders, freight and passenger mobility planning, land-use in the context of infrastructure allocation).

For the result indicator ***Number of MOVE21 business models intended to be developed,*** it is important to define the business model meaning. In the context of MOVE21, a business model is a plan for how the measure/solution in question will generate value for its users.

For the result indicator ***Number of interoperable systems of innovative solutions adopted in the Living Lab cities*** it is important to define the interoperability meaning. In general, interoperability is the ability of different systems, devices, applications, or services to communicate and exchange data effectively and efficiently. It is a key requirement for many complex and dynamic systems, such as healthcare, transportation, e-commerce. In the transport policy concept, *"interoperability"* is the ability of two, or more, transport systems to operate effectively and efficiently together to fulfil consumers' requirements of a transport system. In the context of MOVE21 concept, an interoperable system is consisted of two or more transport modes or mobility services used for the completion of a seamless trip between the origin and the destination. [8]

5 Impact Analysis Results (Ex-ante and Baseline)

The current section presents a monitoring card for each Level, Living Lab city, and result indicator. The monitoring card follows a structure that continues the corresponding card in the D8.1 evaluation framework and refers to the baseline and ex-ante time periods, both before the implementation of the measures, innovations, and solutions in the context of the LL cities.

5.1 Level 1: Innovation Enabling Topics

5.1.1 Oslo

Result Indicator 3.1: No of implemented MOVE21 innovations in the Oslo Living Lab

Result indicator 3.1	Number of MOVE21 innovations intended to be implemented
Level of evaluation	1
Contribution to additional impacts	Mission board climate neutral and smart cities objectives Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	2025: 15 (innovations)
Method/ Monitoring tools used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	39 innovations 5 innovation categories

Table 1: Result indicator 3.1 (OSL)

In the ***four test sites*** of Oslo (CCVEST, Oslo (Økern senter), Groruddalen, Oslo (within ring 3)), several measures, solutions (measures' components) and innovations are planned to be implemented, as described in the Measures/Innovations/Solutions Logbook. Figure 2 demonstrates the intention for planning and implementing ***four measures summing up to 16 solutions and 39 innovations of five different types.***

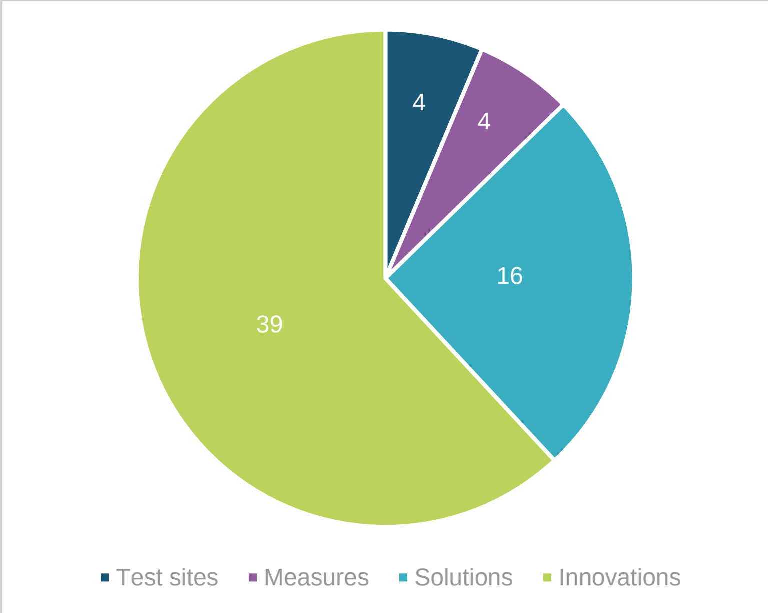

Figure 2: Test sites/Measures/Solutions//Innovations distribution in Oslo

The categories of the above-mentioned indicators intended to be integrated are social, business model, technological, service and governance innovations and their distribution is presented in Figure 3.

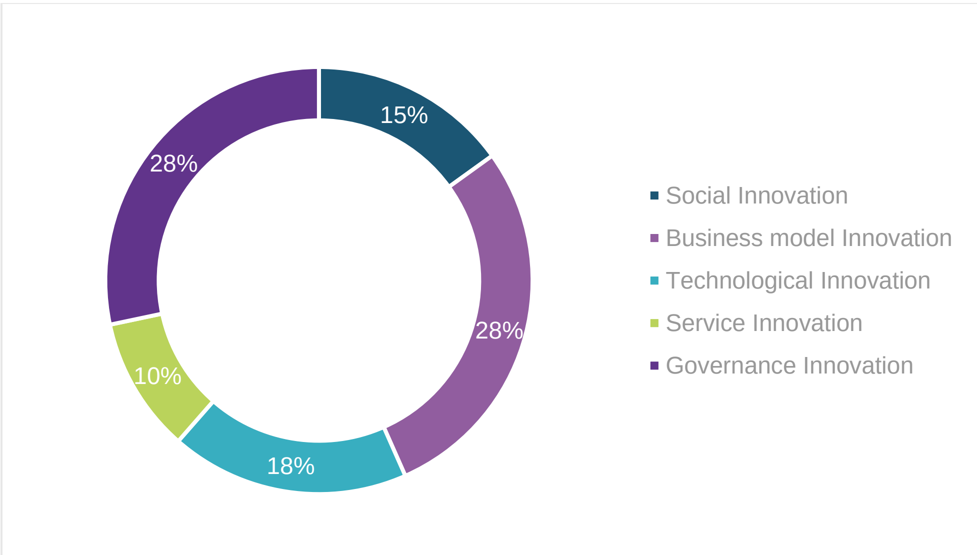

Figure 3: Innovation types in Oslo

In the case of Oslo, the ***social innovations*** refer mainly to the new service of CCVEST that enables visits to shops and restaurants without the use of private vehicle and the promotion of car sharing systems in Groruddalen.

The ***business model innovations*** are related to the pricing models of CCVEST for the transportation of goods to consumers' residents, the combination of different mobility services for specific locations in Groruddalen and the pricing structure for integrating micro mobility services in the city's public transport system.

The ***technological innovations*** refer mainly to the combination of existing mobility services as for example the integration of mobility services to the public transport system, or the integration of different technologies as for example integrating freight management systems (cargo consolidation software) to carriers that primarily provides mobility on demand services for people (CCVEST case).

The ***service innovations*** refer mainly to the combination of passenger and freight transport in the same vehicles (CCVEST) and the services for vulnerable users under which the most suited locations for parcel lockers will be identified in Groruddalen case.

The ***governance innovations*** are related to i) the urban planning process under which private space and building mass should be combined for the creation of consolidation terminals (Økern senter case), ii) the increase of governing bodies' awareness on how the introduction of new freight technology may lead to a need for change in governance procedures and the optimization of existing electrical infrastructure through procedures that support the sharing of charging points for car-sharing companies.

Result Indicator 3.14: No of interoperable systems of innovative solutions adopted in Oslo Living Lab

Result indicator 3.14	No of interoperable systems of innovative solutions adopted in Oslo Living Lab
Level of evaluation	1
Contribution to additional impacts	Mission board climate neutral and smart cities objectives Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tools used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	2 (1 in Groruddalen site and 1 in Oslo within Ring 3 site)

Table 2: Result indicator 3.14 (OSL)

Regarding Oslo Living Lab, two interoperable systems aim to be adopted (one in Groruddalen site and one in Oslo within Ring 3 site). Regarding Groruddalen, different modes will be combined for limiting the use of private vehicle for covering Grorud residents' transportation requirements. Under the Oslo –

within Ring 3 concept the increase of Public Transport system aims to be achieved, by integrating micro-mobility and shared-mobility services in the city's public transport services (facilitated by the Ruter app, which allows ticket purchase before boarding and is valid on Metro, buses, trams, ferries and trains in Oslo and Akershus). Under the system, a seamless travel experience is provided to citizens by integrating the bikes services within Ruter app.

5.1.2 Gothenburg

Result Indicator 3.1: No of implemented MOVE21 innovations in the Gothenburg Living Lab

Result indicator 3.1	No. of MOVE21 innovations intended to be implemented
Level of evaluation	1
Contribution to additional impacts	Mission board climate neutral and smart cities objectives Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	2025: 15 (innovations)
Method/ Monitoring tools used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	22 innovations 5 innovation categories

Table 3: Result indicator 3.1 (GOT)

In the ***three test sites*** of Gothenburg (Nordstan, Klippan, Lindholmen) several measures and innovations are planned to be implemented. The current situation, as described in the Measures/Innovations/Solutions Logbook and presented in Figure 4 demonstrates the intention for planning and implementing ***three measures*** including ***10 solutions*** and ***22 innovations*** of ***five different types.*** The categories of innovations and their distribution is presented in Figure 5.

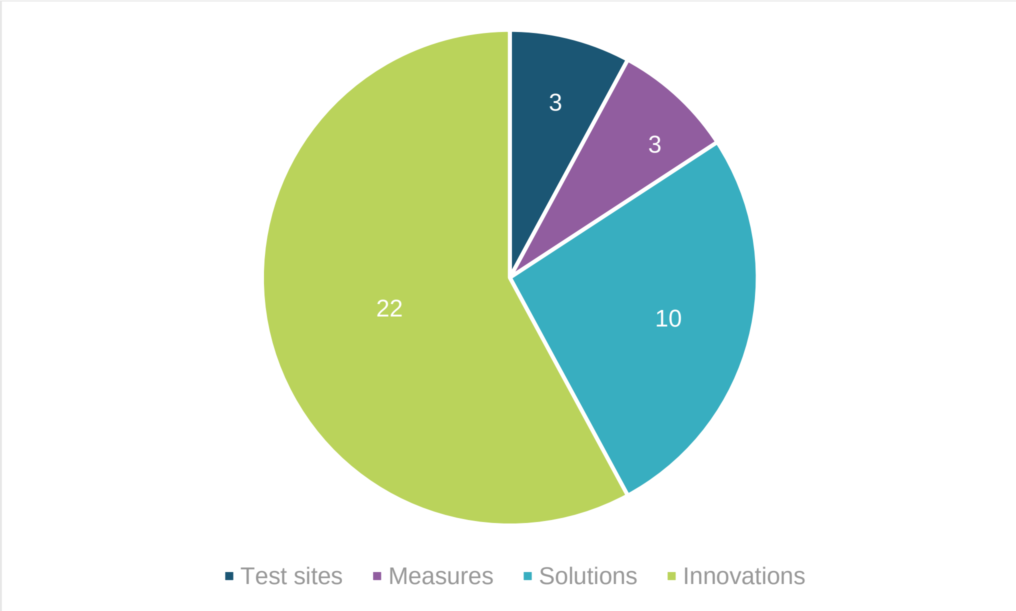

Figure 4: Test sites/Measures/Innovations in Gothenburg

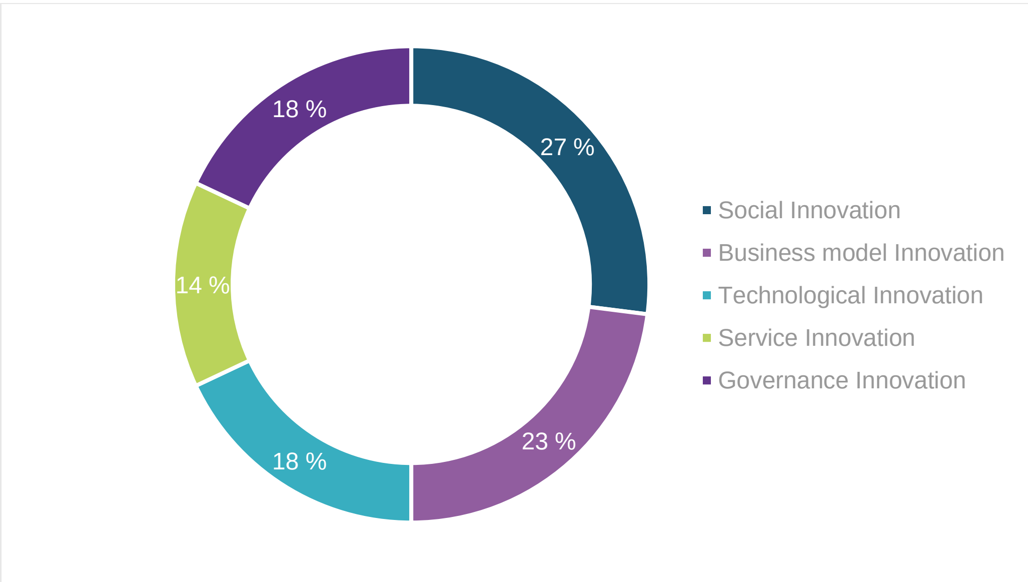

Figure 5: Innovation types in Gothenburg

Social innovations refer to services i) aim to transform the area in a more liveable one by reducing the use of private vehicles (Nordstan and Lindholmen cases) and improving working environment through active mobility for local service providers (Nordstan case), ii) improve perceived safety for bikers (Klippan)

Business model innovations are identified for clarifying issues as regards shared space and new uses of central real estate (Nordstan Case), for public-private collaboration as well as overcoming barriers of private-public partnership (which can be considered also as a ***governance innovations***).

The ***technological innovations*** refer to technological integration, in the view of i) the creation of a common API for shared mobility companies and one stop e-shop for park and bike and combined multimodal fee for parking and bike ride (Klippan case), ii) the development of a data platform including logistics data (Lindholmen).

The ***service innovations*** are related to urban logistics planning and organization referring to the picking up and delivery of goods from local companies through parcel boxes (Lindholmen case) and the one stop e-shop for park-and-bike in Klippan, for improving user experience and provide an easier orientation between different transport modes.

Result Indicator 3.14: No of interoperable systems of innovative solutions adopted in Gothenburg Living Lab

Result indicator 3.14	No of interoperable systems of innovative solutions adopted in Gothenburg Living Lab
Level of evaluation	1
Contribution to additional impacts	Mission board climate neutral and smart cities objectives Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tools used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	1 (in Klippan)

Table 4: Result indicator 3.14 (GOT)

Regarding Gothenburg Living Lab, in Klippan an interoperable system is adopted, as the concept motivates people to combine the use of private vehicle with other sustainable transport modes (half of the trip can be completed by private car and the other half by public transport, shared bike or a shared e-scooter, provided in the site). To make the transition to multimodal transportation easier, Göteborgs Stads Parkering (city parking agency) and the city of Gothenburg are investigating if Göteborgs Stads Parkerings AB's app (Parkering Göteborg mobile app) could be used to gather mobility services. The benefit for the users is using the same app when parking and for continuing the trip. The integration of different mobility services from different operators in the same app is not only a MaaS-integration, as by integrating this in the parking app can nudge traditional motorists travel by other modes of transport for the first time.

5.1.3 Hamburg

Result Indicator 3.1: No of implemented MOVE21 innovations in Hamburg Living Lab

Result indicator 3.1	No. of MOVE21 innovations intended to be implemented
Level of evaluation	1
Contribution to additional impacts	Mission board climate neutral and smart cities objectives Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	2025: 15 (innovations)
Method/ Monitoring tools used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	43 innovations 5 innovation categories

Table 5: Result indicator 3.1 (HAM)

In the ***four test sites*** of Hamburg (Holstenstraße, Kaltenkircher Platz, Harkortraße, Rissen) several measures and innovations are planned to be implemented, as described in the Measures/Innovations/Solutions Logbook and presented in Figure 6, which demonstrates the intention for planning, and implementing ***four measures***, summing up to ***15 solutions*** and ***43 innovations*** of ***five different types.***

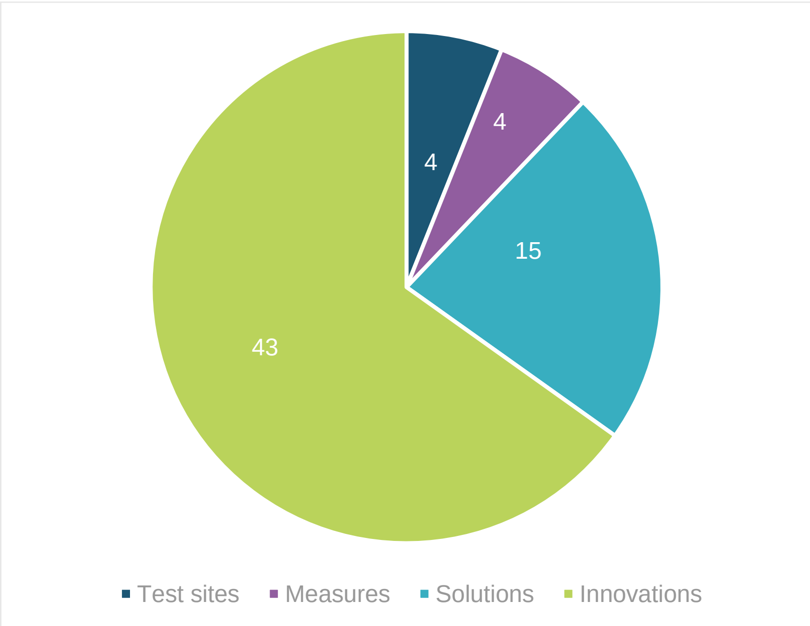

Figure 6: Test sites/Measures/Innovations in Hamburg

The distribution of innovations categories is presented in Figure 7.

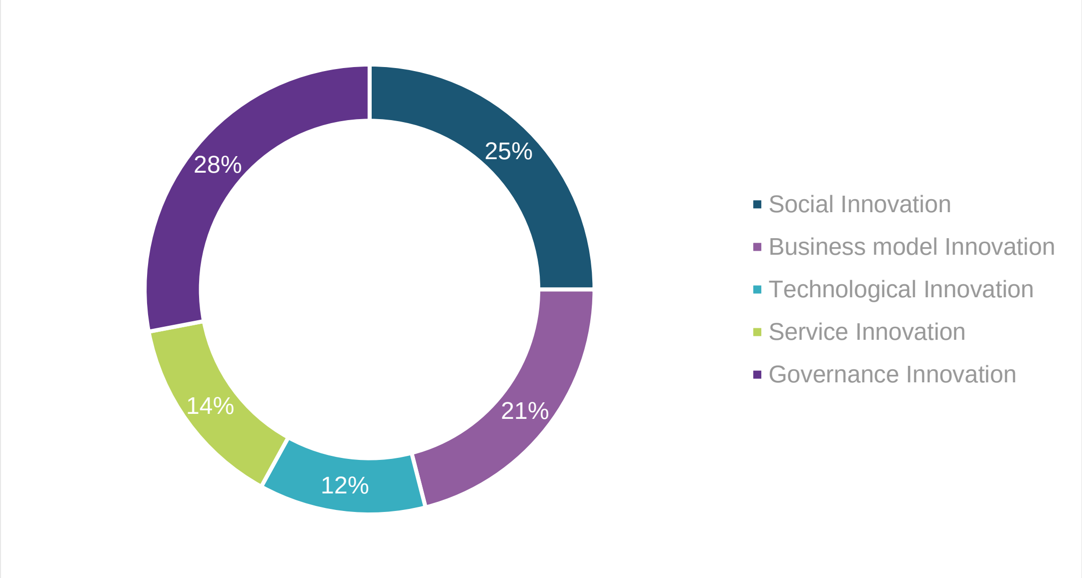

Figure 7: Types of innovations in Hamburg

The ***social innovations*** refer to the co-existence of various logistics users in the same space with citizens, in the context of a mixed user group, logistics and socio/cultural, multi-functional hub.

The ***business model innovations*** refer to a new business model in the context of the multifunctional hubs of Holstenstraße. The specific business model consists of three main aspects related to logistic users, passenger mobility aspects and the social use of the hub. For achieving this business model, issues related to contracts and the ownership status quo should be clarified.

The ***technological innovations*** refer to the implementation of the passenger and freight mobility solutions. For example, the prioritization of on-demand, commercial and logistics trucks for the reservation of e-charging points in the public parking space and the installation of bookable charging infrastructure in a public parking space.

The ***service innovations*** refer to the augmentation of the user experience and the logistic services through the multifunctional hubs that have a clear social and cultural function not usually seen in traditional mobility hubs.

The ***governance innovations*** refer to the urban and mobility planning in the context of the LL and more detailed in the spatial planning of mobility solutions, the sharing of resources, the spatial connection between existing multi-modal/mobility solutions and new services as well as overcoming and solving all the issues resulting from the permission/administrative processes. In particular, establishing a clear process by which the city or other organisations quickly and with low cost can take temporary dark spaces in the city in use (empty buildings or parts of buildings) can represent an interesting governance innovation. Noting that the concept of combined mobility (freight and passenger) is considered also an innovative mobility planning approach a service innovation as well.

Result Indicator 3.14: No of interoperable systems of innovative solutions adopted in Hamburg

Result indicator 3.1	**No of interoperable systems of innovative solutions adopted in Hamburg Living Lab**
Level of evaluation	1
Contribution to additional impacts	Mission board climate neutral and smart cities objectives Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tools used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	0

Table 6: Result indicator 3.14 (HAM)

Regarding Hamburg Living Lab, no interoperable system seems to have been adopted so far, however this might change after the final measures' implementation.

5.2 Level 2: Living Lab procedures

5.2.1 Oslo

Result indicator 1.6: Increased capacity to incorporate data-driven approaches

Result indicator 1.6	**Current capacity to incorporate data-driven approaches in mobility planning**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1: decreased, 5 : increased)
Target value according to GA	2025: 5
Method/ Monitoring tools used	Questionnaire Survey to city's administrations
Current status evaluation result	3.4

Table 7: Result indicator 1.6 (OSL)

The current capacity to incorporate data-driven approaches of ***Oslo*** was appraised by the LLs representatives coming from the mobility, environment, and development sectors. They assessed ***the capacity to incorporate data-driven approaches*** in mobility planning on a qualitative scale from 1 (decreased) to 5 (increased), resulting ***in a mean score of 3.4.*** The diagram in Figure 8 presents the distribution of the assessments around the mean value.

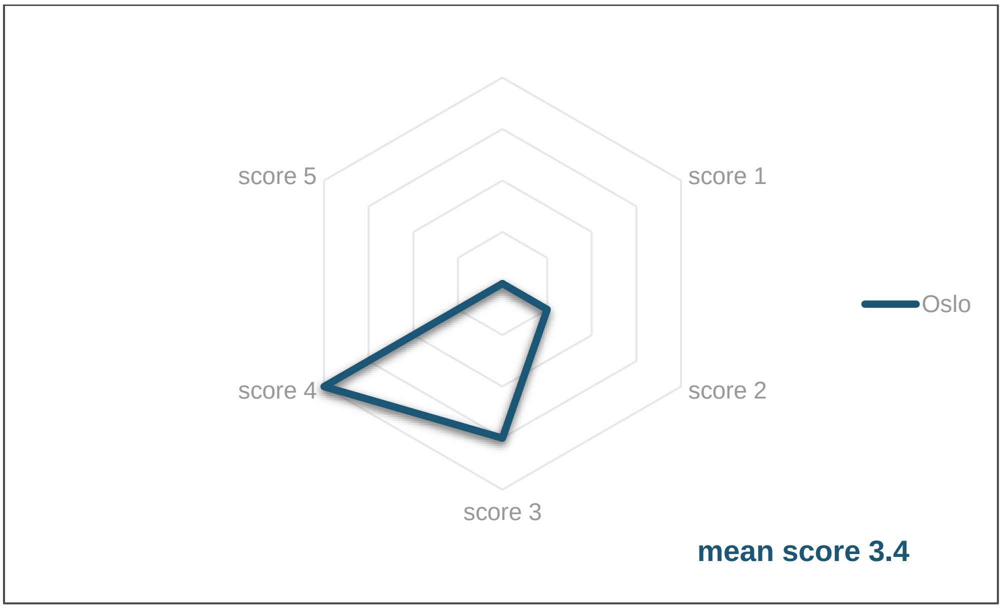

Figure 8: Current capacity to incorporate data driven approaches in mobility planning (OSL)

The capacity to incorporate data-driven approaches in mobility planning of Oslo is expected ***to be increased*** after the experience in that field, that will be gained during the implementation of the measures and solutions that the LL of Oslo is planning, reaching the highest level of capacity (5).

Result indicator 4.1: Perceived improved understanding of governance drivers and barriers to implementation of measures

Result indicator 4.1	Current improved understanding of governance drivers and barriers to implementation of measures
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1: decreased, 5: increased)
Target value according to GA	2025: 5
Method/ Monitoring tools used	Questionnaire Survey to city’s administrations
Current status evaluation result	4.0

Table 8: Result indicator 4.1 (OSL)

The perceived understanding of governance drivers and barriers are related to governance structures and specific parameters such as, regulatory knowledge, stakeholders' collaboration, resource mobilization, legitimacy and entrepreneurial experimentation. Based on these, the current perceived understanding was assessed on a qualitative scale from 1 (decreased) to 5 (increased), resulting ***in a mean score of 4 for Oslo case.*** The understanding of governance drivers and barriers is expected to increase after the measures implementations when several actions will take place for solving specific problems that might arise from the existing governance structures.

Result indicator 4.8: Number of strategic plans that will be reformulated based on the results of MOVE21 in the three Living Labs

Result indicator 4.8	**Number of strategic plans that will be reformulated based on the results of MOVE21 in the three Living Labs**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tools used	Questionnaire Survey to city's administrations
Ex-ante evaluation result	2.0

Table 9: Result indicator 4.8 (OSL)

In Oslo case, two Strategic Plans have been found so far with the possibility of being reformulated based on MOVE21 results; the development of Oslo SUMP /Revision of the Regional plan for land use and transport for Oslo and Akershus; the development of Oslo SULP / Development of land use and freight plan for Oslo FUA. The final influence will be highlighted though in the ex-post evaluation phase.

Result indicator 4.9: Increased innovation capacity regarding organizational issues for implementing innovative mobility per Living Lab

Result indicator 4.9	**Innovation capacity regarding organizational issues for implementing innovative mobility solutions**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1 : decreased, 5 : increased)
Target value according to GA	Not included in GA
Method/Monitoring tools used	Questionnaire Survey to city's administrations
Current status evaluation result	3.0

Table 10: Result indicator 4.9 (OSL)

The Oslo LL representatives, based on their experience and perception, rated the municipality from 1 (very low) to 5 (very high) as regards the ***innovation capacity concerning organizational issues*** for implementing innovative mobility solutions. The ***mean score is 3*** and it is presented in Figure 9. In the process of implementing the measures and solutions with numerous innovative aspects in different innovative fields, the mean score is expected to increase. At this moment, the result indicator is calculated as per its baseline value.

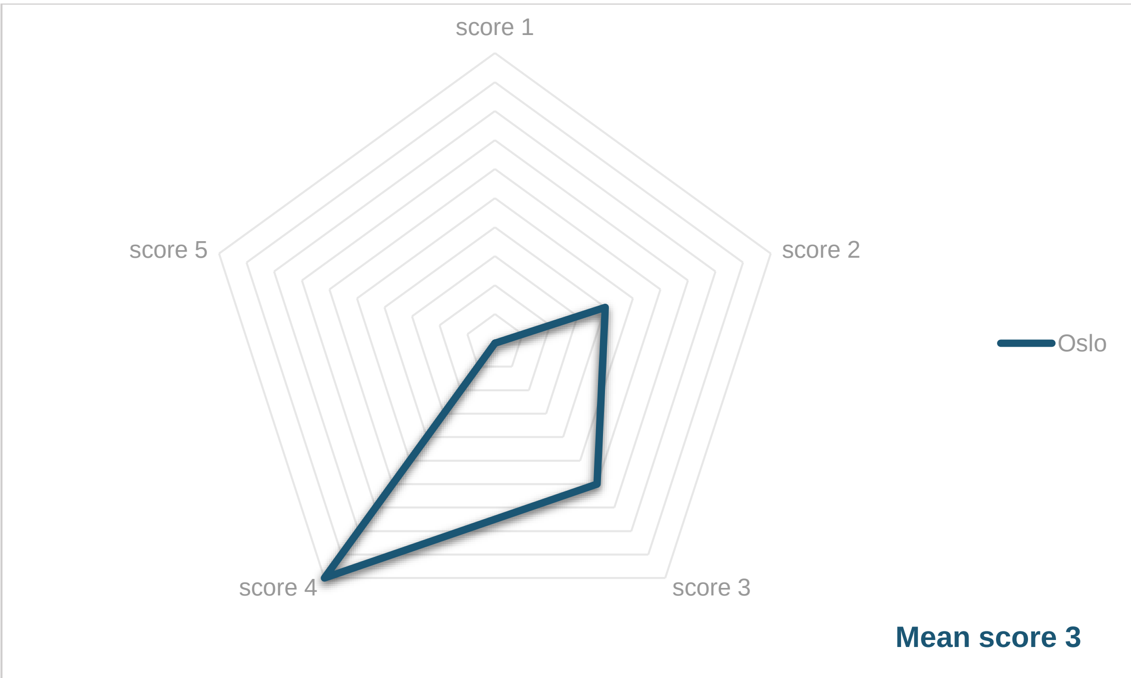

Figure 9: Innovation capacity regarding organizational issues (OSL)

Result indicator 4.10: Increased innovation capacity regarding knowledge management needed for implementing innovative mobility solutions per Living Lab

Result indicator 4.10	Innovation capacity regarding knowledge management needed for implementing innovative mobility solutions
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tools used	Questionnaire Survey to city's administrations
Current status evaluation result	3.1

Table 11:Result indicator 4.10 (OSL)

The LLs representatives, based on their experience and perception, rated the municipality from 1 (very low) to 5 (very high) as regards the ***capacity in knowledge management*** needed for implementing innovative mobility solutions. The ***mean score is 3.1*** and it is presented in Figure 10. In the process of implementing the measures and solutions with numerous innovative aspects in different innovative fields, the mean score is expected to increase. At this moment, the result indicator is calculated as per its baseline value.

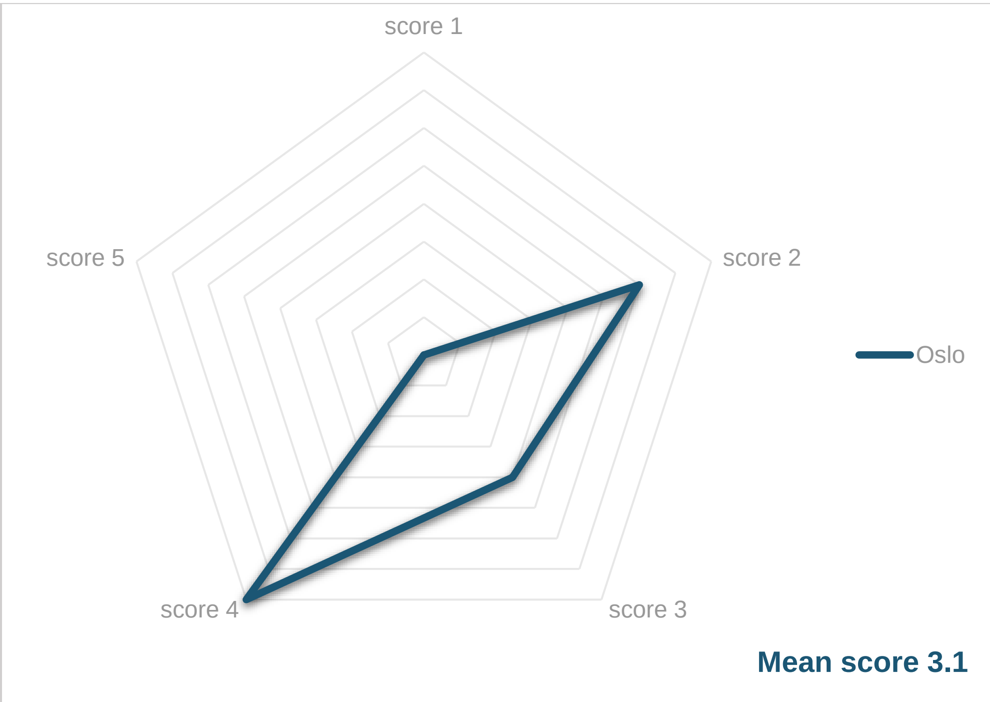

Figure 10: Innovation capacity regarding knowledge management (OSL)

Result indicator 4.11: Perceived improved understanding of the potential for the upscaling of MOVE21 solutions per Living lab

Result indicator 4.11	**Perceived improved understanding of the potential for the upscaling of MOVE21 solutions**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1: decreased, 5: increased)
Target value according to GA	Not included in GA
Method/ Monitoring tools used	Questionnaire Survey to city's administrations
Current status evaluation result	3.7

Table 12: Result indicator 4.11 (OSL)

The Oslo LL representatives, based on their experience and perception, rated the municipality from 1 (very low) to 5 (very high) as regards the ***potential for upscaling MOVE21 solutions***. The ***mean score is* 3.7** and it is presented in Figure 11. In the process of implementing the measures and solutions with numerous innovative aspects in different innovative fields, the mean score is expected to increase. At this moment the result indicator is calculated as per its baseline value.

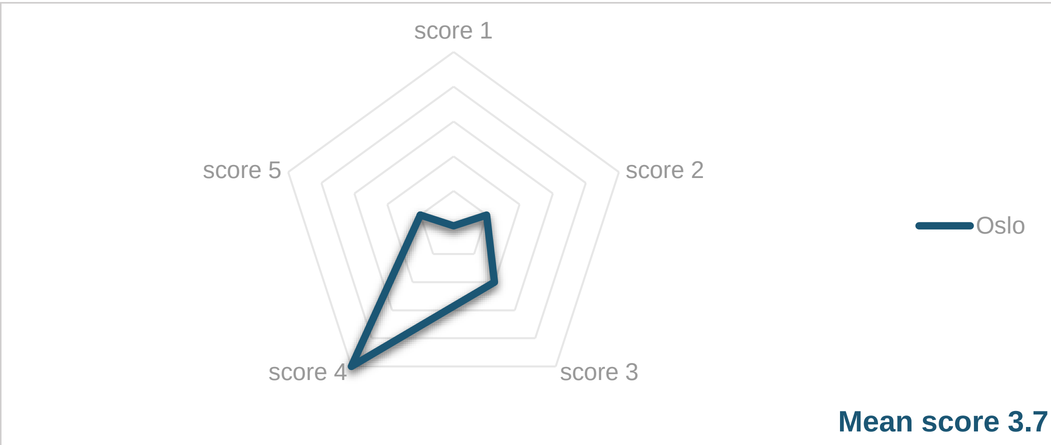

Figure 11: Potential for the upscaling of MOVE21 solutions (OSL)

For the innovations (part of the measures) to be successfully established, commercial, governance and administrative decisions need to be taken, new collaboration schemes should be created, policy solutions should be proposed, new business models should be developed and new technological equipment should be developed/installed/purchased. The Oslo LL representatives, based on their experience and perception, organized several meetings which were supported by WP Leaders 4, 5 and 9, in order the relevant sheets of the Innovation Logbooks to be filled in. In the ***four test sites*** of Oslo several commercial, administrative, and governance decisions are planned to be taken, collaboration schemes will be created, policy solutions are proposed, new business models will be developed and technical equipment will be purchased/installed for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab. All the above are described in the Measures/Innovations/Solutions Logbook and presented in Figures 12,13,14,15

Result indicator 4.12	**Number of Commercial decisions proposed or implemented for ensuring the successful establishment of MOVE21 mobility innovations per Living Lab**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	7

Table 13: Result indicator 4.12 (OSL)

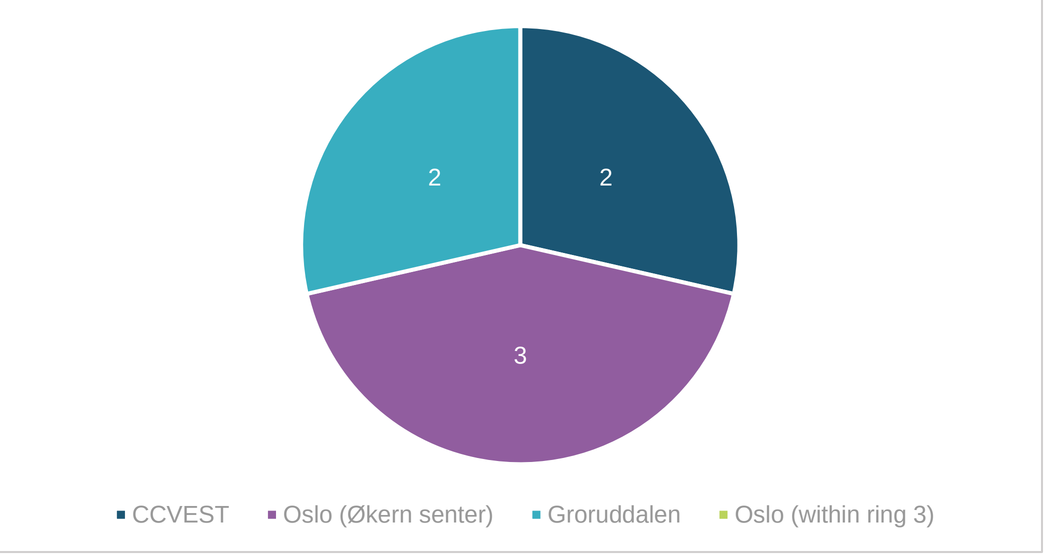

Figure 12: Number of commercial decisions (OSL)

Result indicator 4.13	**Number of Administrative decisions proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	6

Table 14: Result indicator 4.13 (OSL)

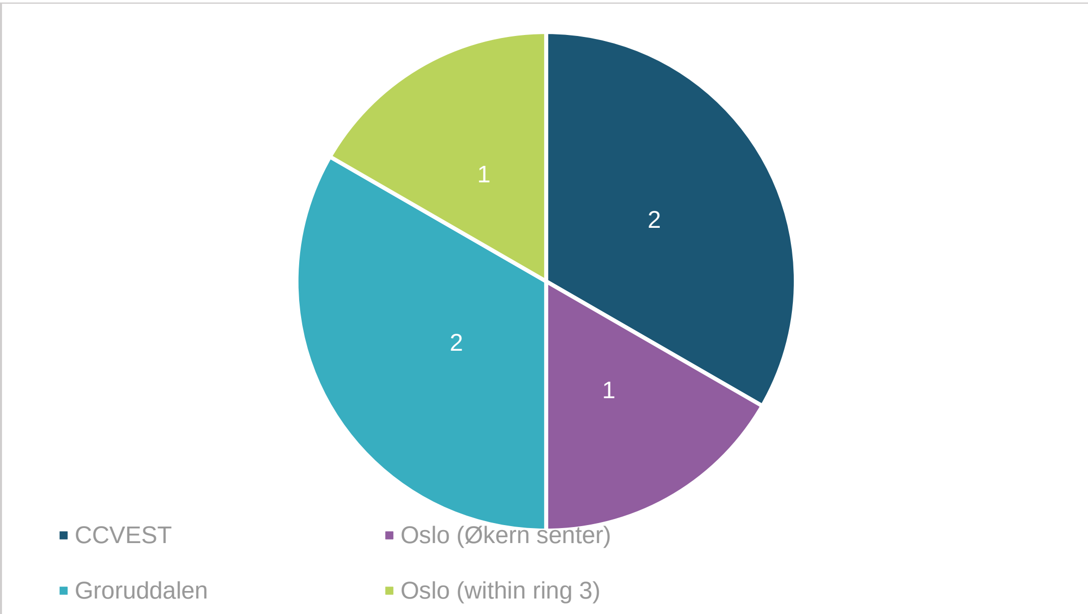

Figure 13: Number of administrative decisions (OSL)

Result indicator 4.14	Number of New Collaboration Schemes proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	4

Table 15: Result indicator 4.14 (OSL)

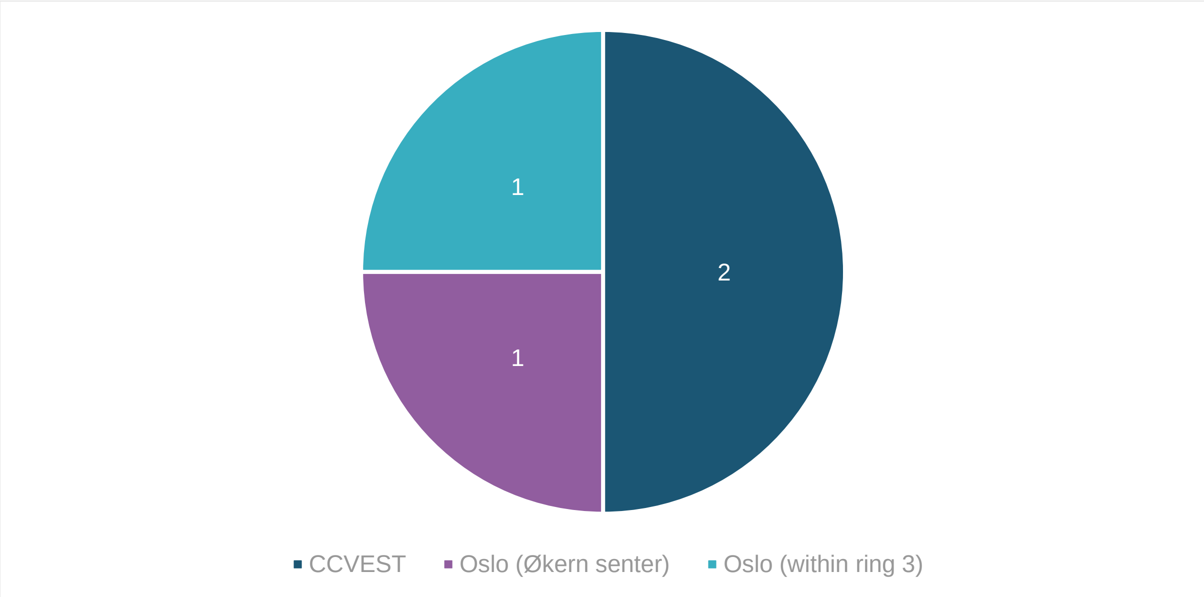

Figure 14: Number of collaboration schemes (OSL)

Result indicator 4.15	Number of governance decisions proposed or implemented for ensuring the successful establishment of MOVE21 Mobility hubs per Living Lab
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	4

Table 16: Result indicator 4.15 (OSL)

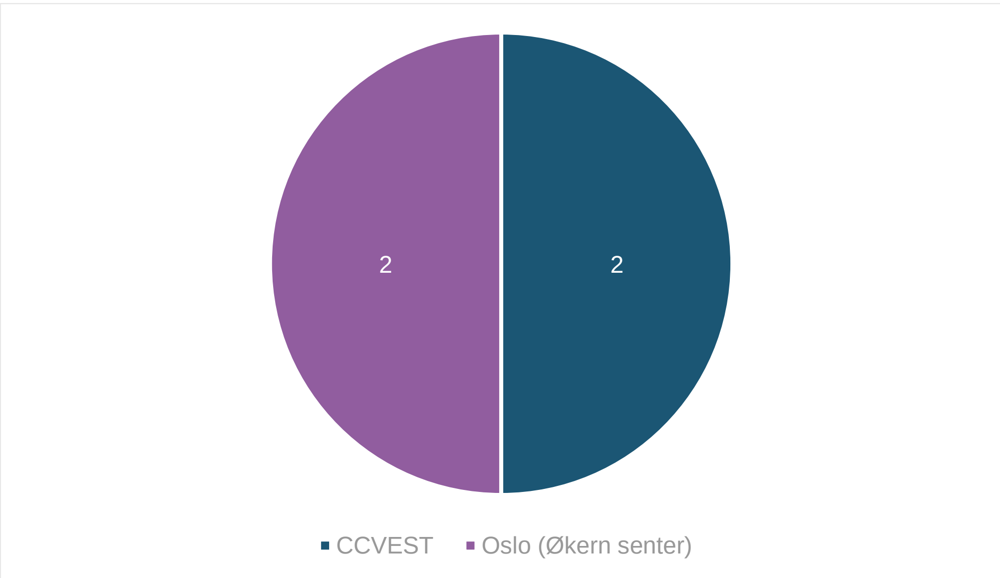

Figure 15: Number of governance decisions (OSL)

Result indicator 4.16	Number of new Technological equipment developed / installed / purchased for ensuring the successful establishment of MOVE21 Mobility hubs per Living Lab
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	1 (refers to CCVEST measure)

Table 17: Result indicator 4.16 (OSL)

Result indicator 4.2	Number of policy solutions proposed for ensuring the successful establishment of MOVE21 Mobility hubs in Oslo
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	6 (2024)
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	2 (1 in CCVEST and 1 in Økern senter)

Table 18: Result indicator 4.2 (OSL)

Result indicator 4.3	Number of MOVE21 business models developed
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	6 (2025)
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	1 (Grorudallen site)

Table 19: Result indicator 4.3 (OSL)

The total number of commercial, administrative and governance decisions to be taken, policy solutions proposed collaboration schemes to be created, business models developed and equipment developed/installed/purchased in Oslo Living lab is depicted in Figure 16.

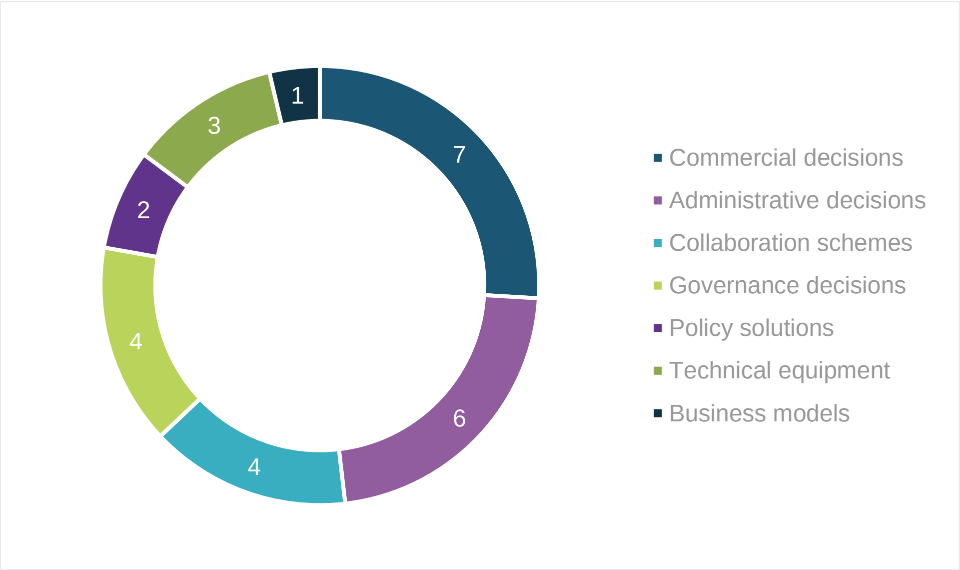

Figure 16: Number of commercial, governance and administrative decisions, policy solutions, collaboration schemes, business models and technical equipment (OSL)

5.2.2 Gothenburg

Result indicator 1.6: Increased capacity to incorporate data-driven approaches in mobility planning

Result indicator 1.6	**Current capacity to incorporate data-driven approaches in mobility planning**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1: decreased, 5: increased)
Target value according to GA	2025: 5
Method/ Monitoring tool used	Questionnaire Survey to city's administrations
Current status evaluation result	3.2

Table 20: Result indicator 1.6 (GOT)

The current capacity to incorporate data-driven approaches of ***Gothenburg*** was appraised by the LLs representatives coming from the mobility, environment, and development sectors. They assessed ***the capacity to incorporate data-driven approaches*** in mobility planning on a qualitative scale from 1 (decreased) to 5 (increased), resulting ***in a mean score of 3.2.*** The diagram in Figure 17 presents the distribution of the assessments around the mean value.

The capacity to incorporate data-driven approaches in mobility planning of Gothenburg is expected ***to be increased*** after the experience in that field, that will be gained during the implementation of the measures and solutions that the LL of Gothenburg is planning, reaching the highest level of capacity (5).

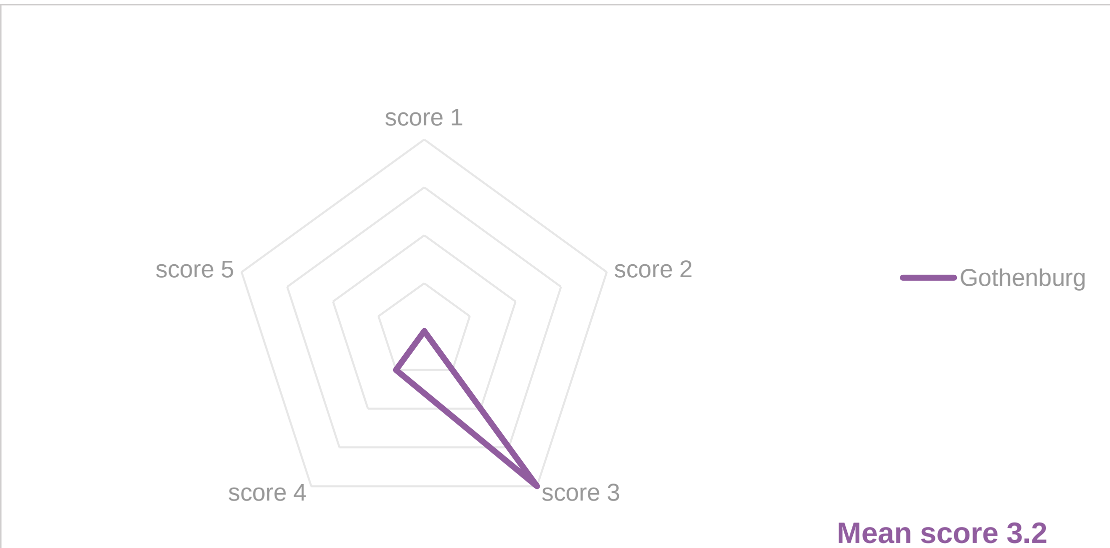

Figure 17: Current capacity to incorporate data driven approaches in mobility planning (GOT)

Result indicator 4.1: Perceived improved understanding of governance drivers and barriers to implementation of measures

Result indicator 4.1	Current improved understanding of governance drivers and barriers to implementation of measures
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1 : decreased, 5: increased)
Target value according to GA	2025: 5
Method/ Monitoring tools used	Questionnaire Survey to city's administrations
Current status evaluation result	3.1

Table 21: Result indicator 4.1 (OSL)

The perceived understanding of governance drivers and barriers are related to governance structures and specific parameters such as, regulatory knowledge, stakeholders' collaboration, resource mobilization, legitimacy and entrepreneurial experimentation. Based on these the current perceived understanding was assessed on a qualitative scale from 1 (decreased) to 5 (increased), resulting ***in a mean score of 3.1 for Gothenburg case.***

Result indicator 4.8: Number of strategic plans that will be reformulated based on the results of MOVE21 in the three Living Labs

Result indicator 4.8	Number of strategic plans that will be reformulated based on the results of MOVE21 in the three Living Labs
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tool used	Questionnaire Survey to city's administrations
Ex-ante evaluation result	2

Table 22: Result indicator 4.9 (GOT)

In Gothenburg's case two Strategic Plans have been found so far with the possibility of being reformulated based on MOVE21 results; the SUMP which is under revision and the SULP which is under development. The final influence will be highlighted though in the ex-post evaluation phase.

Result indicator 4.9: Increased innovation capacity regarding organizational issues for implementing innovative mobility solutions in Gothenburg

Result indicator 4.9	**Innovation capacity regarding organizational issues for implementing innovative mobility solutions**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Questionnaire Survey to city's administrations
Current status evaluation result	3.7

Table 23: Result indicator 4.9 (GOT)

The Gothenburg LL representatives, based on their experience and perception, rated the municipality from 1 (very low) to 5 (very high) as regards the ***innovation capacity concerning organizational issues*** for implementing innovative mobility solutions. The ***mean score is 3.7*** and is presented in Figure 18. In the process of implementing the measures and solutions with numerous innovative aspects in different innovative fields, the mean score is expected to increase. At this moment the result indicator is calculated as per its baseline value.

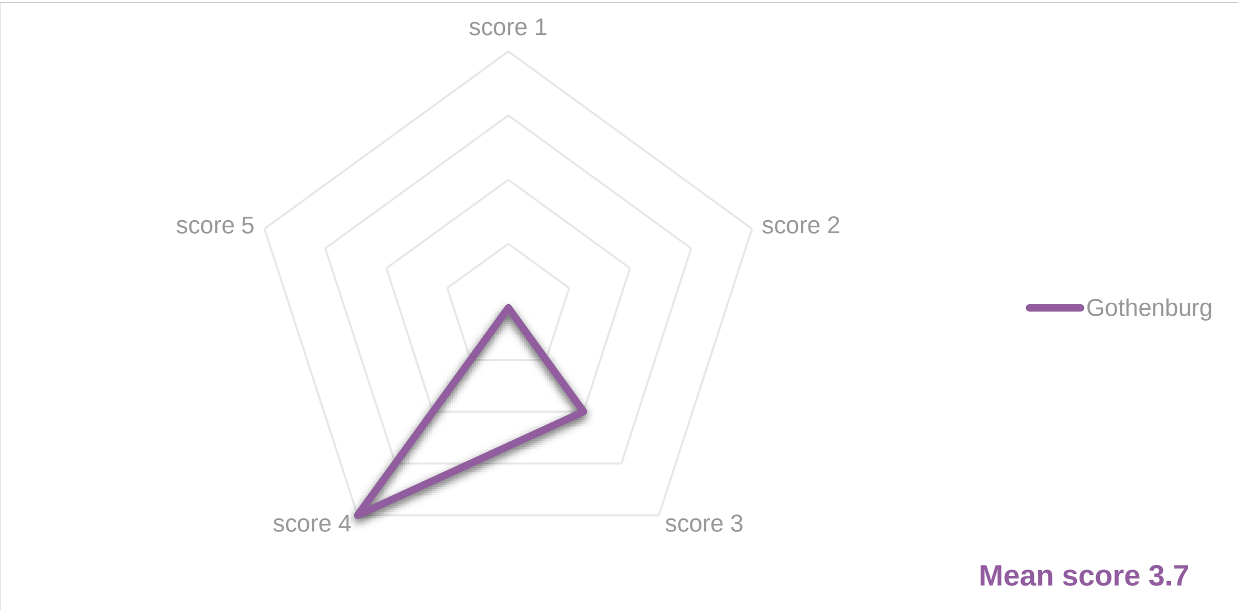

Figure 18: Innovation capacity regarding organizational issues (GOT)

Result indicator 4.10: Increased innovation capacity regarding knowledge management needed for implementing innovative mobility solutions per Living Lab

Result indicator 4.10	Increased innovation capacity regarding knowledge management needed for implementing innovative mobility solutions
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Questionnaire Survey to city's administrations
Current status evaluation result	3

Table 24: Result indicator 4.10 (GOT)

The Gothenburg LLs representatives, based on their experience and perception, rated the municipality from 1 (very low) to 5 (very high) as regards ***the capacity in knowledge management*** needed for implementing innovative mobility solutions. The ***mean score is 3*** and is presented in Figure 19. In the process of implementing the measures and solutions with numerous innovative aspects in different innovative fields, the mean score is expected to increase. This moment the result indicator is calculated as per its baseline value.

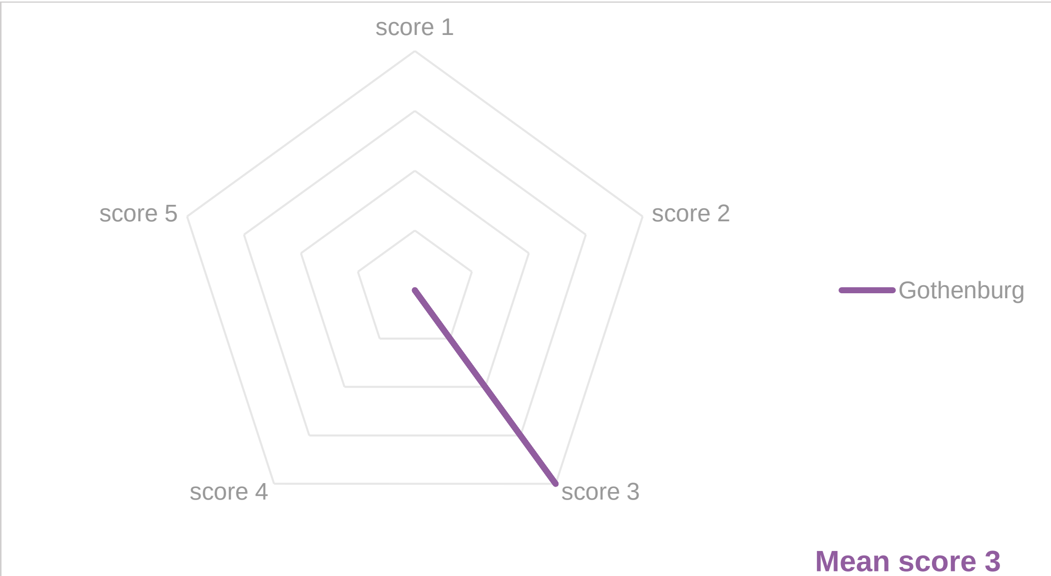

Figure 19: Innovation capacity regarding knowledge management (GOT)

Result indicator 4.11: Perceived improved understanding of the potential for the upscaling of MOVE21 solutions per Living Lab

Result indicator 4.11	**Potential for the upscaling of MOVE21 solutions**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1: decreased, 5: increased)
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Questionnaire Survey to city's administrations
Current status evaluation result	3.4

Table 25: Result indicator 4.11 (GOT)

The Gothenburg LL representatives, based on their experience and perception, rated the municipality from 1 (very low) to 5 (very high) as regards ***the potential for upscaling MOVE21 solutions***. The ***mean score is 3.4*** and is presented in Figure 20. In the process of implementing the measures and solutions with numerous innovative aspects in different fields the mean score is expected to increase. This moment the result indicator is calculated as per its baseline value.

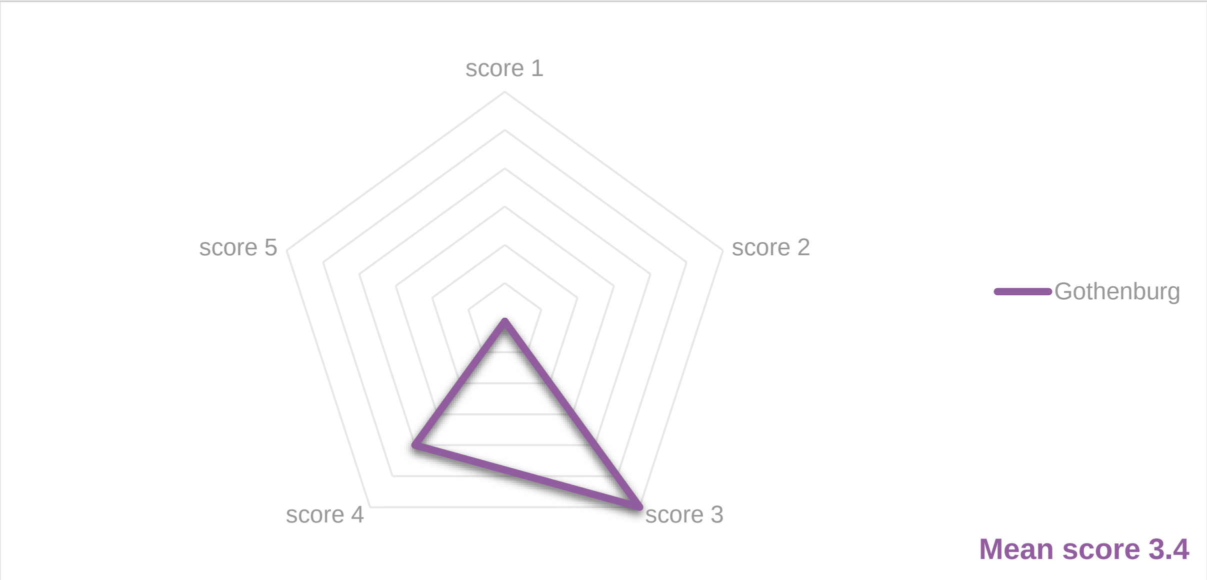

Figure 20: Potential for the upscaling of MOVE21 solutions (GOT)

For the innovations (part of the measures) to be successfully established, commercial, governance and administrative decisions need to be taken, new collaboration schemes should be created, policy solutions should be proposed, new business models should be developed and new technological equipment should be developed/installed/purchased. The Oslo LL representatives, based on their experience and perception, organized several meetings which were supported by WP Leaders 4, 5 and 9, in order to fill out the relevant sheets of the Innovation Logbooks. In the ***three test sites*** of

Gothenburg several commercial, administrative, and governance decisions are planned to be taken, collaboration schemes will be created, policy solutions are proposed, new business models will be developed and technical equipment will be purchased/installed for ensuring the successful establishment of MOVE21 mobility hubs pew Living Lab. All the above are described in the Measures/Innovations/Solutions Logbook and presented in Figures 21, 22,23, 24

Result indicator 4.12	Number of Commercial decisions proposed or implemented for ensuring the successful establishment of MOVE21 mobility innovations per Living Lab
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation results	17

Table 26: Result indicator 4.12 (GOT)

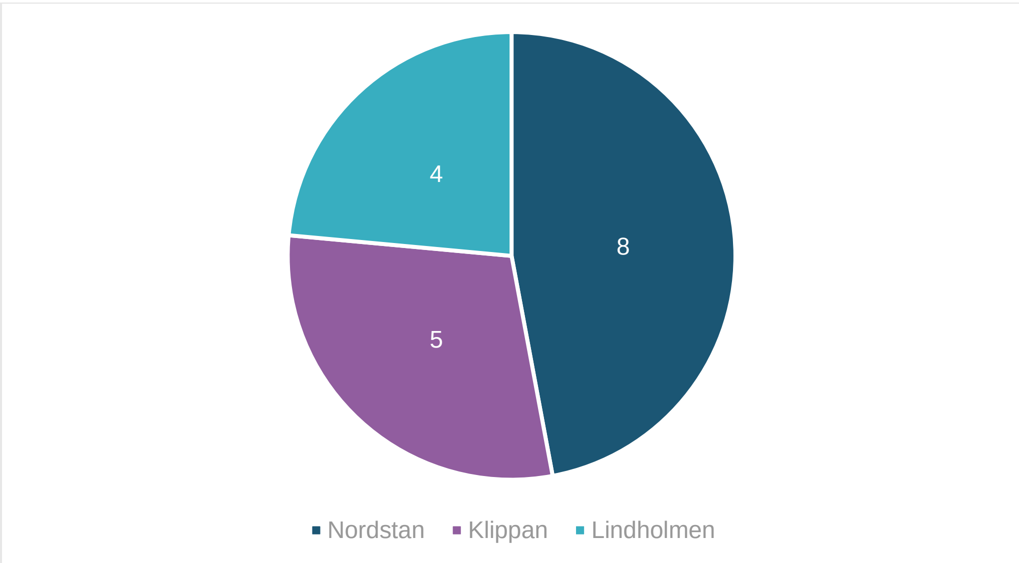

Figure 21: Number of commercial decisions (GOT)

Result indicator 4.13	Number of Administrative decisions proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living LB
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation results	10

Table 27: Result indicator 4.13 (GOT)

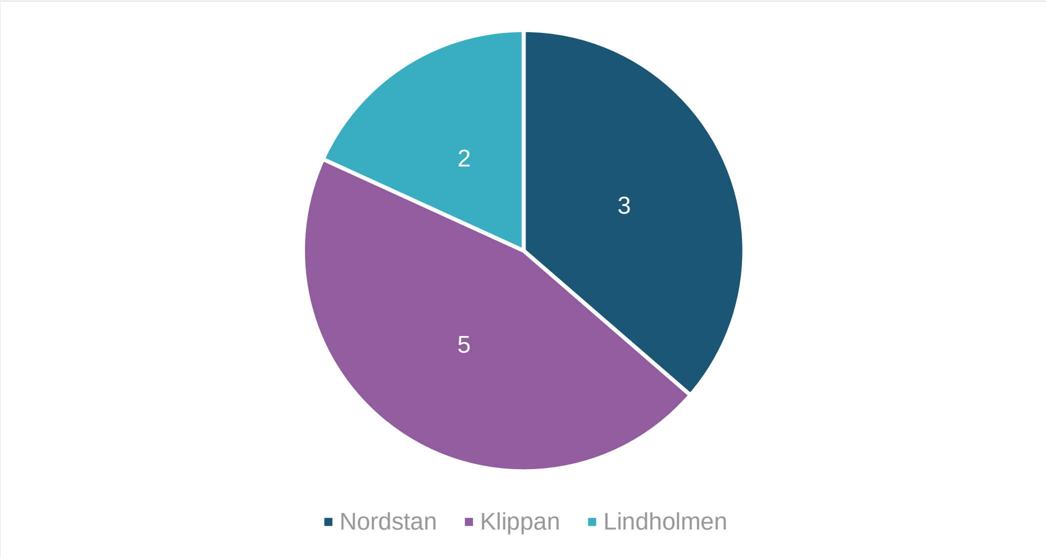

Figure 22: Number of administrative decisions (GOT)

Result indicator 4.14	Number of New Collaboration Schemes proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number

Target value according to GA	Not included in GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation results	10

Table 28: Result indicator 4.14 (GOT)

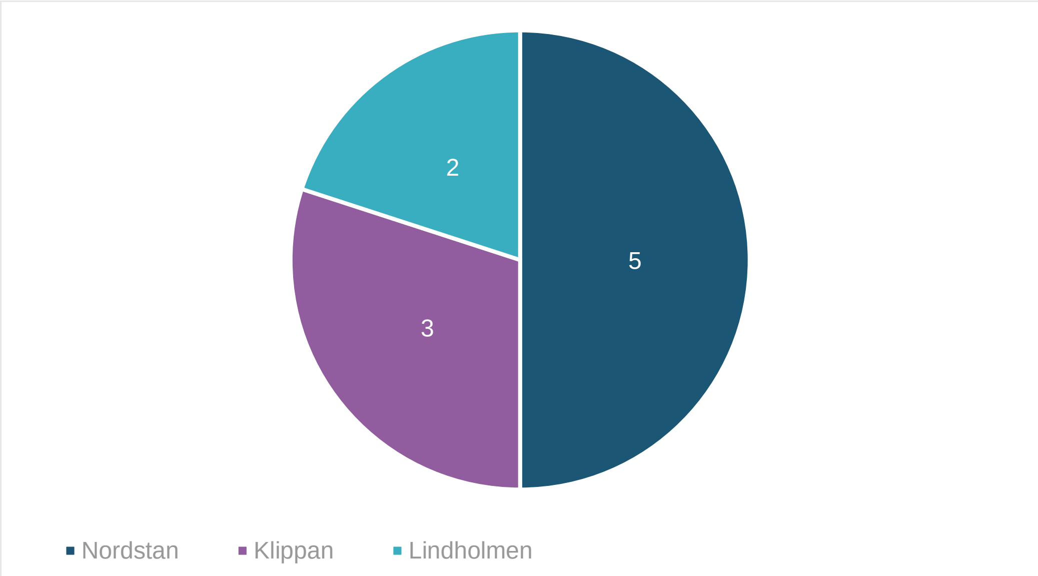

Figure 23: Number of collaboration schemes (GOT)

Result indicator 4.15	**Number of governance decisions proposed or implemented for ensuring the successful establishment of MOVE21 Mobility hubs per Living Lab**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation results	1 (in Klippan site)

Table 29: Result indicator 4.15 (GOT)

Result indicator 4.2	Number of policy solutions proposed for ensuring the successful establishment of MOVE21 Mobility hubs
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	6 (2024)
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation results	3 (all of them in Klippan site)

Table 30: Result indicator 4.2 (GOT)

Result indicator 4.3	Number of MOVE21 business models developed
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	6 (2025)
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation results	6

Table 31: Result indicator 4.3 (GOT)

The total number of commercial, administrative and governance decisions to be taken, policy solutions proposed collaboration schemes to be created, business models developed and equipment developed/installed/purchased in Gothenburg Living lab is depicted in Figure 24.

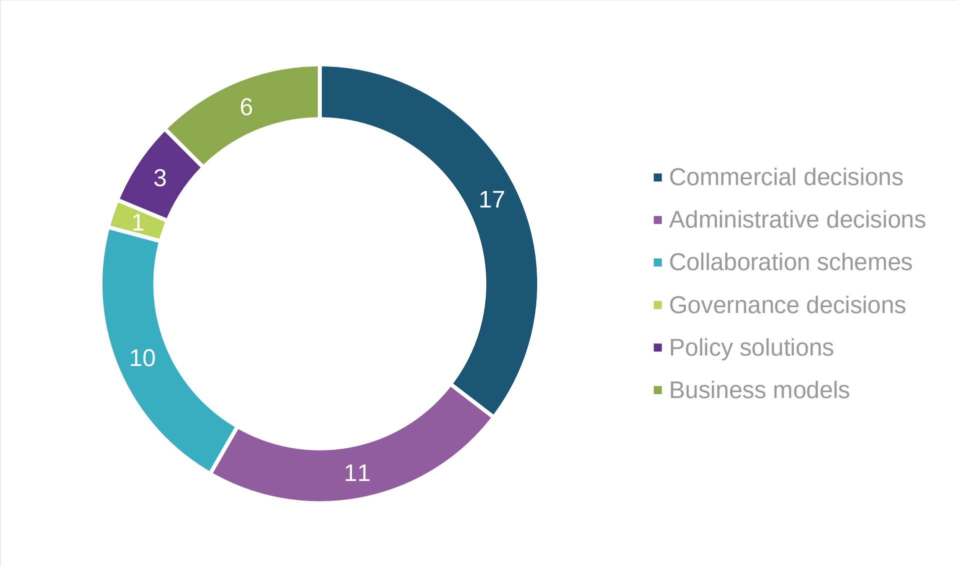

Figure 24: Number of commercial, governance and administrative decisions, policy solutions and collaboration schemes (GOT)

5.2.3 Hamburg

Result indicator 1.6: Increased capacity to incorporate data-driven approaches in mobility planning

Result indicator 1.6	Current capacity to incorporate data-driven approaches in mobility planning
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1: decreased, 5: increased)
Target value according to GA	2025: 5
Method/ Monitoring tool used	Questionnaire Survey to city's administrations
Current status evaluation result	4

Table 32: Result indicator 1.6 (HAM)

The current capacity to incorporate data-driven approaches of ***Hamburg*** was appraised by the LLs representatives coming from the mobility, environment, and development sectors. They assessed ***the capacity to incorporate data-driven approaches in mobility planning*** on a qualitative scale from 1 (decreased) to 5 (increased), resulting in a ***mean score 4***. The diagram in Figure 25 presents the distribution of the assessments around the mean value.

The capacity to incorporate data-driven approaches in mobility planning of Hamburg is expected ***to increase*** after experience gained during the implementation of the measures and solutions that the LL of Hamburg is planning, reaching the highest level of capacity (5).

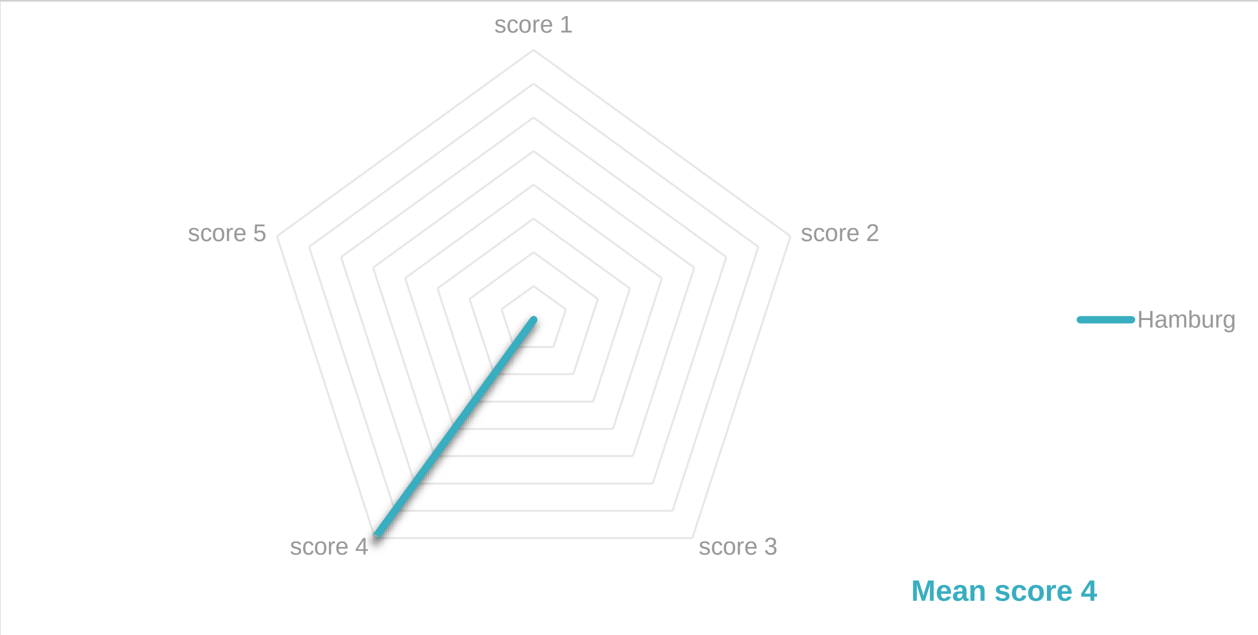

Figure 25: Current capacity to incorporate data-driven approaches in mobility planning (HAM)

Result indicator 4.1: Perceived improved understanding of governance drivers and barriers to implementation of measures

Result indicator 4.1	**Current improved understanding of governance drivers and barriers to implementation of measures**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1: decreased, 5: increased)
Target value according to GA	2025: 5
Method/ Monitoring tools used	Questionnaire Survey to city's administrations
Current status evaluation result	4.0

Table 33: Result indicator 4.1 (HAM)

The perceived understanding of governance drivers and barriers are related to governance structures and specific parameters such as, regulatory knowledge, stakeholders' collaboration, resource mobilization, legitimacy and entrepreneurial experimentation. Based on these, the current perceived understanding was assessed on a qualitative scale from 1 (decreased) to 5 (increased), resulting ***in a mean score of 4,0 for Hamburg case.*** The understanding of governance drivers and barriers is expected to increase further after the measures implementations when several actions will take place, solving specific problems that will arise from the existing governance structures.

Result indicator 4.8: Number of strategic plans that will be reformulated based on the results of MOVE21 in the three Living Labs

Result indicator 4.8	Number of strategic plans that will be reformulated based on the results of MOVE21 in the three Living Labs
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tool used	Questionnaire Survey to city’s administrations
Ex-ante evaluation result	3

Table 34: Result indicator 4.8 (HAM)

In the Hamburg case, three Strategic Plans have been found so far with the possibility of being reformulated based on MOVE21 results; the Traffic Development Plan (SUMP - development ongoing) the City’s Climate Plan (update); the Climate Action & mobility plan for district of Altona (development ongoing). The final influence will be highlighted though in the ex-post evaluation phase.

Result indicator 4.9: Increased innovation capacity regarding organizational issues for implementing innovative mobility solutions in Hamburg

Result indicator 4.9	Innovation capacity regarding organizational issues for implementing innovative mobility solutions in Hamburg
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in GA
Current status evaluation result	4

Table 35: Result indicator 4.9 (HAM)

The Hamburg LL representatives, based on their experience and perception, rated the municipality from 1 (very low) to 5 (very high) as regards the ***innovation capacity concerning organizational issues*** for implementing innovative mobility solutions. The ***mean score is 4*** and is presented in Figure 26. In the process of implementing the measures and solutions with numerous innovative aspects in different innovative fields the mean score is expected to increase. At this moment the result indicator is calculated as per its baseline value.

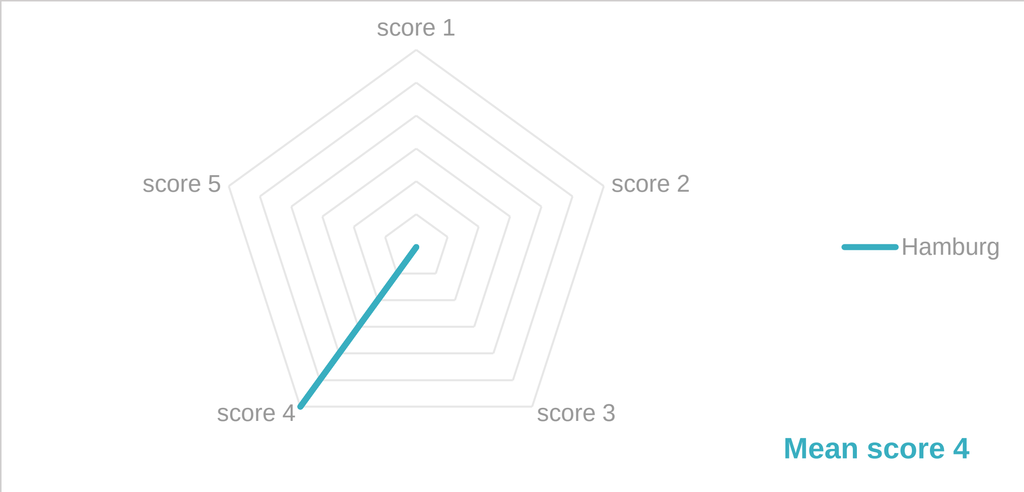

Figure 26: Innovation capacity regarding organizational issues (HAM)

Result indicator 4.10: Increased innovation capacity regarding knowledge management needed for implementing innovative mobility solutions in Hamburg

Result indicator 4.10	Innovation capacity regarding knowledge management needed for implementing innovative mobility solutions
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	2 Questionnaire Survey to city's administrations
Current status evaluation result	4.0

Table 36: Result indicator 4.10 (HAM)

The Hamburg LLs representatives, based on their experience and perception, rated the municipality from 1 (very low) to 5 (very high) as regards ***the capacity in knowledge management*** needed for implementing innovative mobility solutions. The ***mean score is 4*** and is presented in Figure 27. In the process of implementing the measures and solutions with numerous innovative aspects in different innovative fields the mean score is expected to increase. At this moment the result indicator is calculated as per its baseline value.

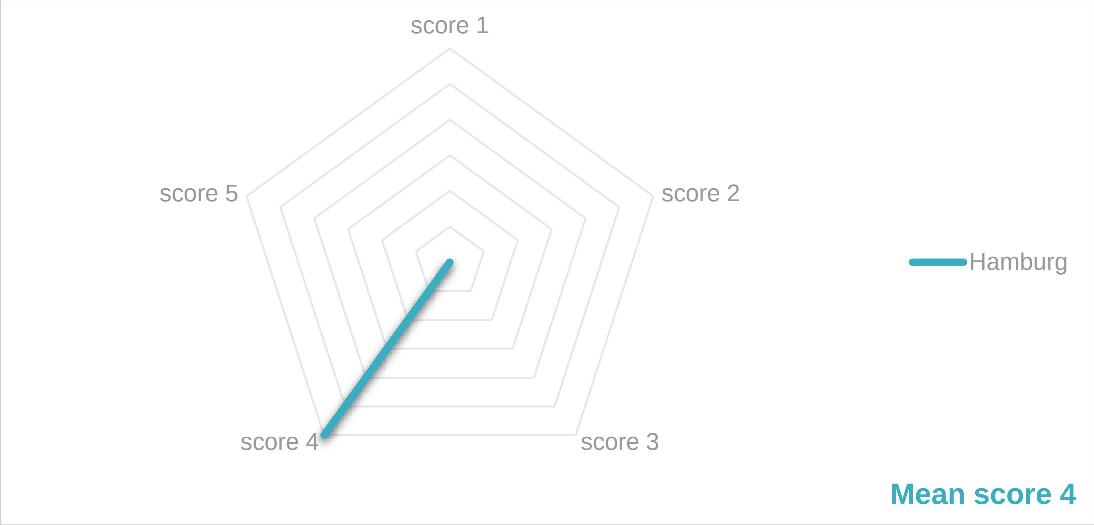

Figure 27: Innovation capacity regarding knowledge management (HAM)

Result indicator 4.11: Perceived improved understanding of the potential for the upscaling of MOVE21 solutions in Hamburg

Result indicator 4.11	Potential for the upscaling of MOVE21 solutions
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1
Measurement unit	Qualitative scale: (1: decreased, 5: increased)
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Questionnaire Survey to city's administrations
Current status evaluation result	3.4

Table 37: Result indicator 4.11 (HAM)

The Hamburg LL representatives, based on their experience and perception, rated the municipality from 1 (very low) to 5 (very high) as regards ***the potential for upscaling MOVE21 solutions***. The ***mean score is 3.4*** and is presented in Figure 28. In the process of implementing the measures and solutions with numerous innovative aspects in different innovative fields the mean score is expected to increase. At this moment the result indicator is calculated as per its baseline value.

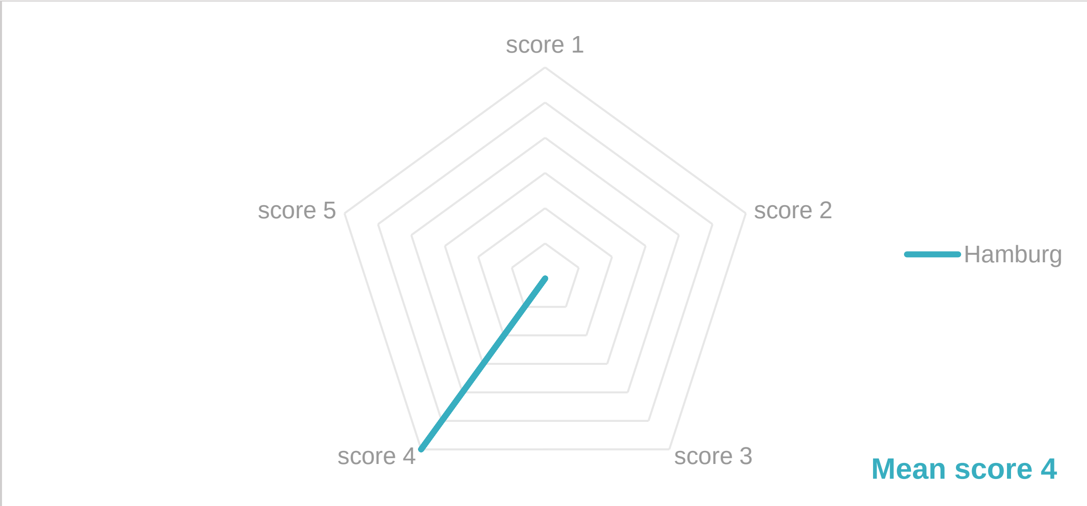

Figure 28: Potential for the upscaling of MOVE21 solutions (HAM)

For the innovations (part of the measures) to be successfully established, commercial, governance and administrative decisions need to be taken, new collaboration schemes should be created, policy solutions should be proposed, new business models should be developed and new technological equipment should be developed/installed/purchased. The Hamburg LL representatives, based on their experience and perception, organized several meetings which were supported by WP Leaders 4, 5 and 9, in order the relevant sheets of the Innovation Logbooks to be filled in. In the ***four test sites*** of Hamburg several commercial, administrative, and governance decisions are planned to be taken, collaboration schemes will be created, policy solutions are proposed, new business models will be developed and technical equipment will be purchased/installed for ensuring the successful establishment of MOVE21 mobility hubs pew Living Lab. All the above are described in the Measures/Innovations/Solutions Logbook and presented in Figures 29, 30, 31,32,33,34,35

Result indicator 4.12	**Number of Commercial decisions proposed or implemented for ensuring the successful establishment of MOVE21 mobility innovations per Living Lab**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	9

Table 38: Result indicator 4.12 (HAM)

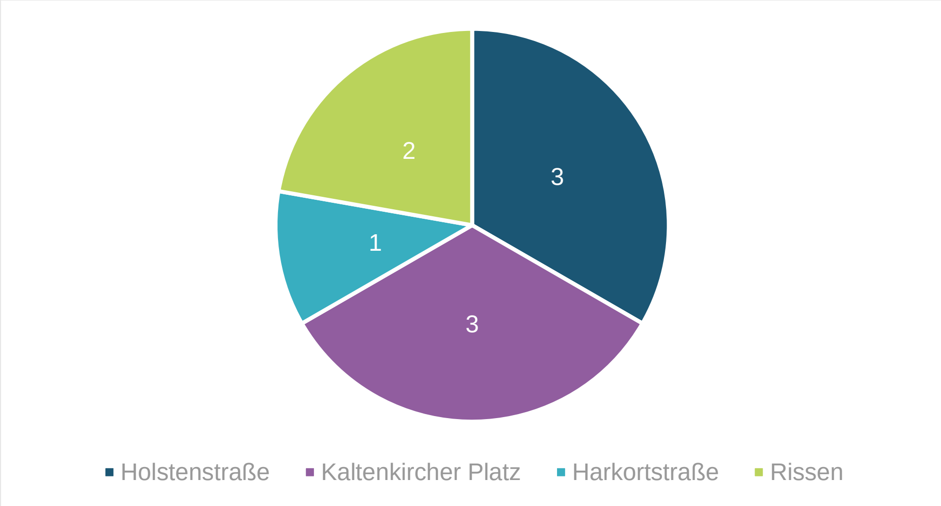

Figure 29: Number of commercial decisions (HAM)

Result indicator 4.13	Number of Administrative decisions proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	28

Table 39: Result indicator 4.13 (HAM)

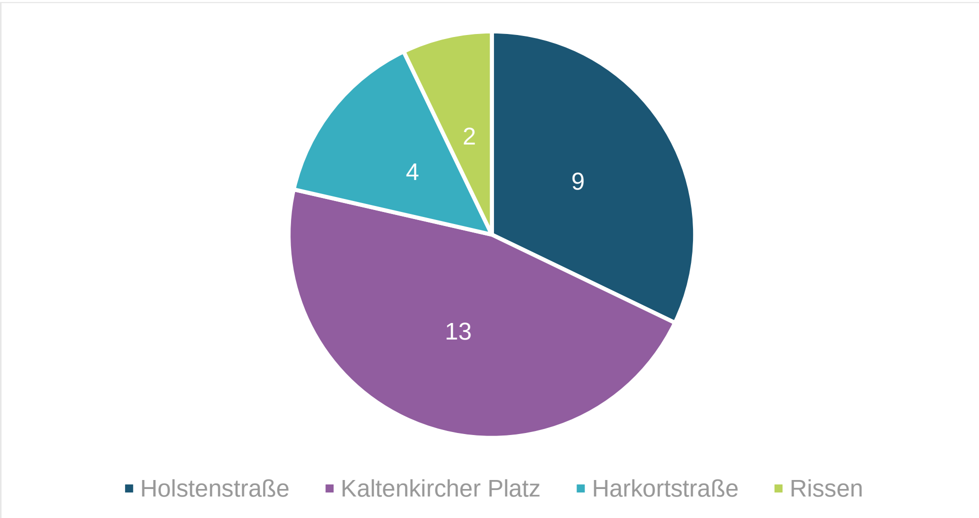

Figure 30: Number of administrative decisions (HAM)

Result indicator 4.14	Number of New Collaboration Schemes proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	6

Table 40: Result indicator 4.14 (HAM)

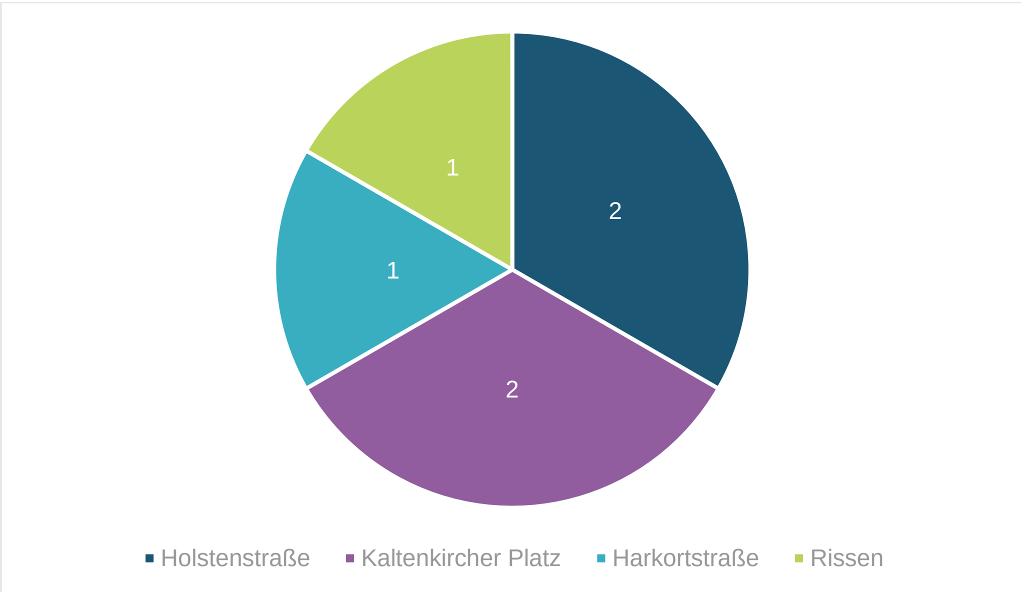

Figure 31: Number of collaboration schemes (HAM)

Result indicator 4.15	**Number of governance decisions proposed or implemented for ensuring the successful establishment of MOVE21 Mobility hubs per Living Lab**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	3 (Holstenstraße, Kaltenkircher, Rissen)

Table 41: Result indicator 4.15 (HAM)

Result indicator 4.16	**Number of new Technological equipment developed/installed/purchased for ensuring the successful establishment of MOVE21 Mobility hubs per Living Lab**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	Not included in the GA
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	5

Table 42: Result indicator 4.16 (HAM)

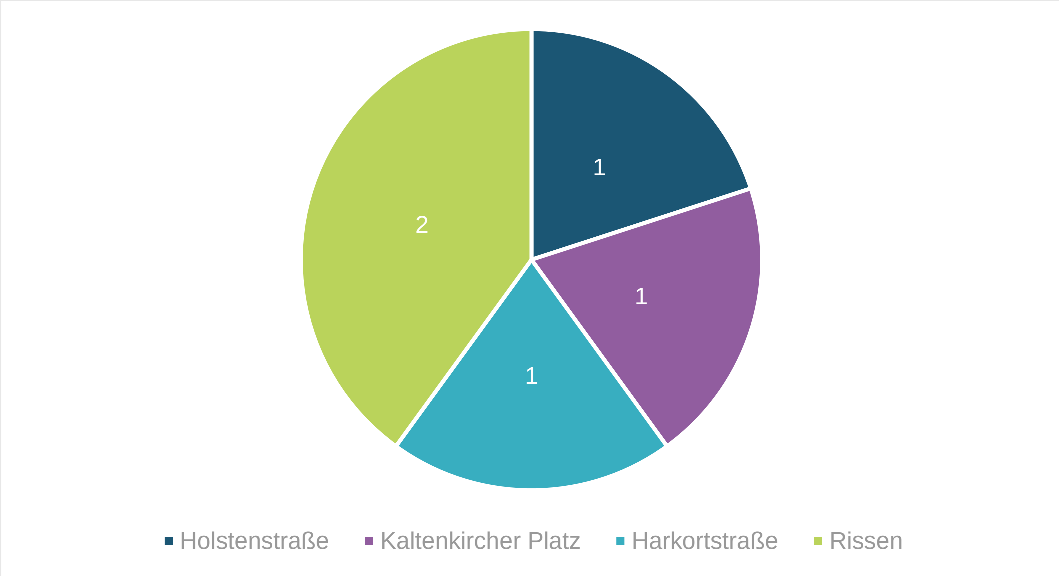

Figure 32: Number of technological equipment (HAM)

Result indicator 4.2	**Number of policy solutions proposed for ensuring the successful establishment of MOVE21 Mobility hubs in Hamburg**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	6
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	3

Table 43: Result indicator 4.2 (HAM)

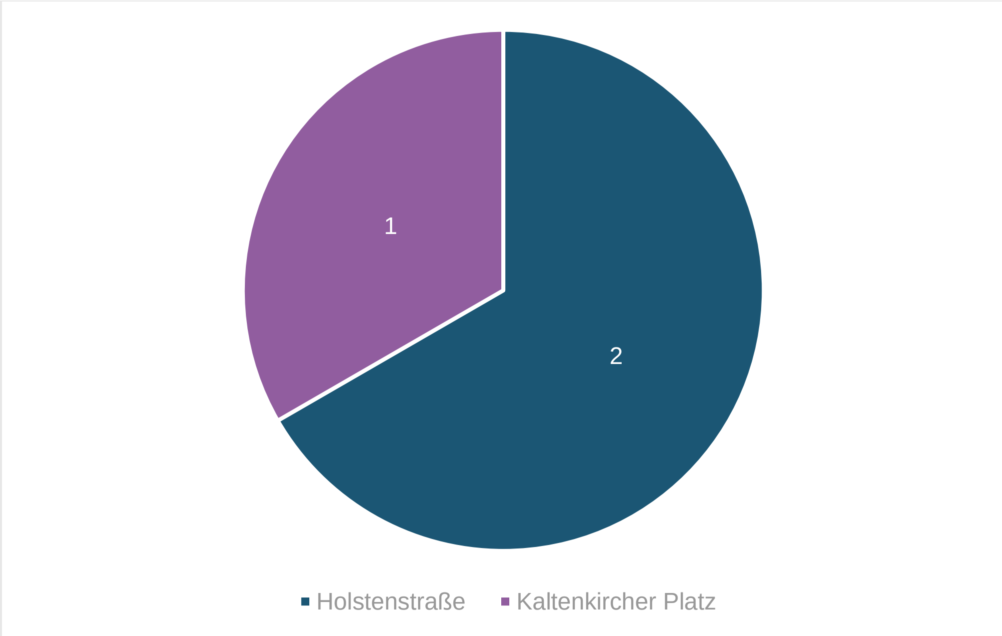

Figure 33: Number of policy solutions (HAM)

Result indicator 4.3	**Number of MOVE21 business models developed**
Level of evaluation	2
Contribution to additional impacts	Sustainable Development Goals / Goals 9 / Target 9.1 Mission board climate neutral and smart cities objectives
Measurement unit	Number
Target value according to GA	6 (2025)
Method/ Monitoring tool used	Measures/Solutions/Innovations Logbook
Ex-ante evaluation result	5

Table 44: Result indicator 4.3 (HAM)

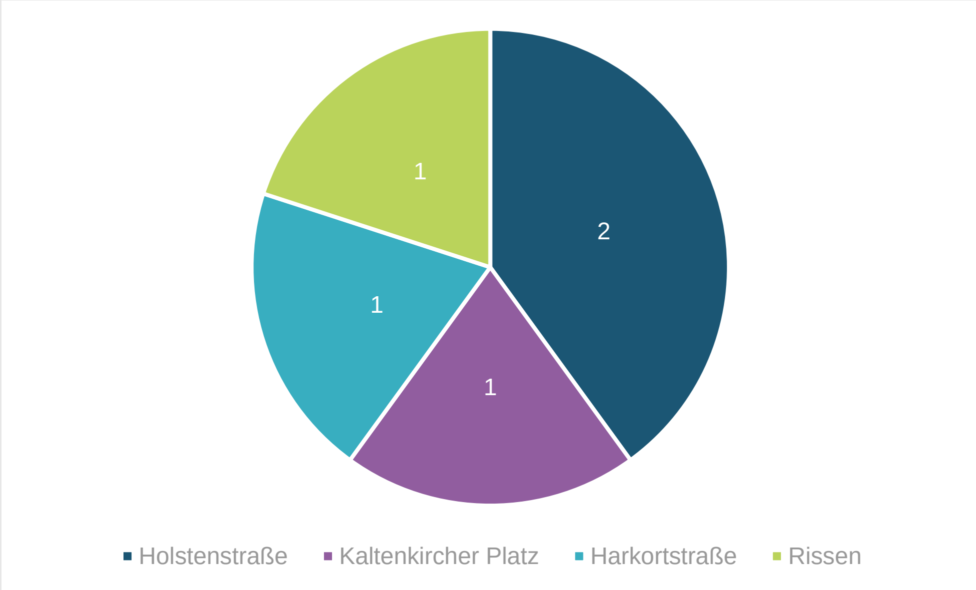

Figure 34: Number of business models (HAM)

The total number of commercial, administrative and governance decisions to be taken, policy solutions proposed collaboration schemes to be created, business models developed and equipment developed/installed/purchased in Humburg Living lab is depicted in Figure 35.

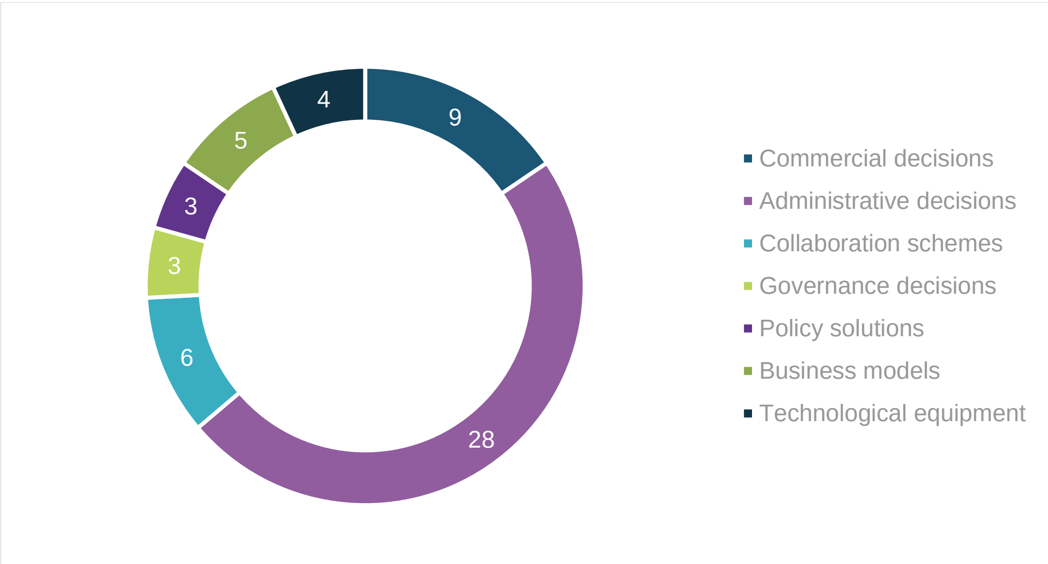

Figure 35: Number of commercial, governance and administrative decisions, policy solutions, Collaboration schemes, business models and technological equipment (HAM)

5.3 Level 3: Impact-oriented result indicators

The main results of the current evaluation level were calculated using the digital twins of each Living Lab city. After a three-round procedure of simulations and discussions with the Living Lab representatives, the final scenarios of the innovative measures implementation and upscale were decided. The results of the following tables are taking into account some specific assumptions for each city.

In Oslo the upscaled scenario assumes that besides the MOVE21 hub locations the entire study area is populated with micro mobility hubs in such a way that all shared mobility demand is covered. The study area includes all city districts in Oslo (Alna, Bjerke, Frogner, Gamle Oslo, Grorud, Grünerløkka, Marka, Nordre Aker, Nordstrand, Østensjø, Sagene, Sentrum, Søndre Nordstrand, St. Hanshaugen, Stovner, Ullern and Vestre Aker), effectively covering the whole geographical scope and reach of the municipality. Meaning that these districts have shared scooters and shared bikes available for first/last mile trips. In addition, three consolidation hubs will operate close to the city center, consolidating trips from all destinations and replacing the last mile with zero emission freight vehicles.

In Gothenburg, the three MOVE21 hub locations are scaled up in terms of available modes, meaning that besides shared bikes and shared scooters also shared cars are available as mode of transport. As regards the consolidation centers, it is assumed that freight trips with an origin in the focus area of Lindholmen and the mall Nordstan are consolidated. Meaning the last mile within these areas is made by zero emission freight vehicle.

Finally, in Hamburg, it is assumed that besides all optional MOVE21 hub locations the entire study area is populated with micro mobility hubs in such a way that all shared mobility demand is covered. This is for both the centre of Altona, consisting of the districts Bahrenfeld, Groß Flottbek, Othmarschen, Ottensen, Altona-Nord, Altona-Altstadt and Sternschanze as the outskirts of Altona consisting of Rissen, Sülldorf, Blankenese, Iserbrook, Nienstedten, Osdorf and Lurup. Meaning that these districts have shared scooters and shared bikes available for first/last mile trips. For freight, three consolidation hubs are simulated close to the center, consolidating trips from all destinations and replacing the last mile with zero emission freight vehicles.

5.3.1 Impact Area I: Long-term decarbonization

Regarding the result indicators of Impact Area I, a significant difference is noticed between the indicators related to passenger transport and the ones related to freight transport. In all cases, the reduction corresponds to CO2 emissions, Nox and PM2.5 air pollution produced by the passenger transport is larger than the one produced from freight. Regarding Oslo, the reduction noticed regarding the passenger transport is the higher one, while Hamburg follows with a lower reduction but still a significant one. Gothenburg presents the lowest reduction; however, it can be characterized as a notable one. As regards the reduction noticed from freight passenger, the perspective percentages range from 0% to 5% with Hamburg to present the higher reduction.

It is important to note that the reductions are the result of the characteristics of the scenario (level of upscaling), but also the size of the study area has an influence on the projected reduction.

#	Result indicator	Assessment mechanism	Time framework/ Expansion of measures	OSL	GOT	HAM
Result indicator 1.1a	CO2 reductions from passenger transport in Living Lab cities	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	**CO2-eqv.**		
				15%	3%	9%
Result indicator 1.1b	CO2 reductions from freight transport in Living Lab cities	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	1%	0%	5%
Result indicator 1.3	No. of MOVE21 innovations upscaled in the three Living Labs	WP8 LLs Logbooks/Digital Simulations	LongTime	**No.**		
				150	5	20
Result indicator 2.5a	Reduction in passenger transport related Nox air pollution as a result of deployed MOVE21 innovations	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	**µg/m3**		
				15%	3%	9%
Result indicator 2.5b	Reduction in freight transport related Nox air pollution as a result of deployed MOVE21 innovations	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	**µg/m3**		
				1%	0%	5%
Result indicator 2.6a	Reduction in passenger transport related PM2.5 air pollution as a result of deployed MOVE21 innovations	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	**µg/m3**		
				15%	3%	9%
Result indicator 2.6b	Reduction in freight transport related PM2.5 air pollution as a result of deployed MOVE21 innovations	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	**µg/m3**		
				1%	0%	5%

Table 45: Result indicators Impact area I (OSLO-GOT-HAM)

5.3.2 Impact Area II: Sustainable, inclusive, safe, and secure mobility system

Regarding the result indicator included in this Impact area, similar findings are noticed between the reduction of noise pollution between passenger and freight transport. For the latter, no reduction is noticed, except for Hamburg case presenting the lowest reduction (1%).

#	Result indicator	Assessment mechanism	Time framework/ Expansion of measures	OSL	GOT	HAM
Result indicator 2.4a	Reduction in passenger transport related noise pollution	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	**Noise pollution over 55 dB**		
				9%	1%	5%
Result indicator 2.4b	Reduction in freight transport related noise pollution	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	**Noise pollution over 55 dB**		
				0%	0%	1%

Table 46: Result indicators Impact area II (OSLO-GOT-HAM)

5.3.3 Impact Area III: Improvements of the efficiency and accessibility of the transport networks/systems covering the TEN-T urban nodes

As regards the Impact area III and ***result indicators 3.3***: ***Number of new (micro) hubs*** and ***3.4***. ***Number of improvements in existing hubs intended to be implemented accordingly***, it should be noted that the measures in the three cities are in different phases and may necessitate clarifications later on for calculating the final numbers.

However, until now it has been approximated that i) Oslo LL aims to establish or improve ***seven mobility hubs***. For instance, a Mobility Hub Network is planned in Groruddalen (an area between Furuset, Haugenstua and Grorud train station) where hubs of different sizes, typically small, medium, and large will serve different transport modes for freight and passenger mobility as well as parcel distribution. As for the improvements in already existing hubs in Oslo, representatives of the Oslo Living Lab estimate that specifically for Groruddalen site (measure: integration with public transport) improvements will be implemented in almost all existing hubs (approximately 50), ii) Gothenburg LL aims to establish **two *mobility hubs in Nordstan***. As for the improvements in already existing hubs in Gothenburg, representatives of the Gothenburg Living Lab estimate that approximately improvements will take place in three existing hubs (two in Lindholmen and one in Klippan), iii) Hamburg LL aims to establish **three *mobility hubs*** (one in Holstenstraße, one in Kaltenkircher Platz and one in Harkortstraße) As for the improvements in already existing hubs in Hamburg, representatives of the Hamburg Living Lab estimate for the moment no improvements in existing hubs will take place.

#	Result indicator	Assessment mechanism	Time framework/ Expansion of measures	OSL	GOT	HAM
Result indicator 3.3	No. of new (micro) hubs as a result of the Project.	LLs Logbooks	Short Time	**No.**		
				7	2	3
Result indicator 3.4	No. of improvements in existing hubs as a result of the Project	LLs Logbooks	Short Time	**No.**		
				50	2	-
Result indicator 3.9	Increase in public transport use	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	**% increase**		
				15%	2%	10%
New Result indicator 3.13	Modal shift to sustainable modes due to decrease of travel time (associated with MOVE21 hubs)	Transport modelling, Digital Twins (results are referred to the upscales)	Long Time/ Upscaled of Measures	**% of modal shift to more sustainable modes**		
				27% shared car+ 4% shared bike + 1% shared scooter	2% shared car + 3% shared bike + 0% shared scooter	17% shared car + 10% shared bike + 4% shared scooter

Table 47: Result indicators Impact area III (OSLO-GOT-HAM)

As regards the increase in public transport use - ***Result indicator 3.9***, Oslo presents the largest increase (15%) and Gothenburg follows (10%). For Hamburg case, the increase is lower (2%) and less significant (2%).

Interest is noticed regarding the percentages of modal shift to sustainable modes due to travel time decrease ***(Result Indicator 3.13.).*** For Oslo, the modal shift to shared mobility reaches 27% as regards the use of shared cars, 4% the use of shared bikes and 1% the use of shared scooter. Hamburg also presents a significant modal shift as regards the use of shared cars and shared bikes (17% and 10% respectively), while in Gothenburg the percentages are significantly lower (the use of scooter is excluded).

5.3.4 Impact Area IV: Social cohesion, economic development, and public perception, resulting in behavioural and policy change.

Regarding the ***direct economic sectorial contribution to the welfare of the metropolitan area from city transport***, Oslo stated approximately ***62804 NOK million*** **(6%)** for the year ***2020,*** based on Statistics Norway [9], the national statistical agency, and the main producer of official statistics, collecting and producing statistics related to the economy, population, and society at national, regional, and local levels. According to the value of this result indicator the mobility sector is very significant for the economy of the city. The contribution of MOVE21 measures, solutions and innovations is expected to offer additional economic contributions to society. In Gothenburg the ***direct economic sectorial contribution of the welfare to the metropolitan area*** of the city from the mobility sector is approximately ***7.1%***. In Hamburg the ***direct economic sectorial contribution of the welfare to the metropolitan area*** of the city from the mobility sector is approximately ***9.3%***.

#	Result indicator	Assessment mechanism	Time framework/ Expansion of measures	OSL	GOT	HAM
Result indicator 4.4	Direct economic sectorial contribution to the welfare to the metropolitan area from city transport	WP8 LL Questionnaire Survey	Long Time/ Upscaled of Measures	**% contribution**		
				6%	7.1%	9.3%

Table 48: Result indicators Impact area IV (OSLO-GOT-HAM)

6 Conclusions and next steps

This deliverable of the ex-ante evaluation can be considered as a first move towards quantifying the innovations, solutions, and systems that the project will leave beyond its lifetime. This evaluation proves that the project through its relevant capacity building actions, managed to create the knowledge and skills that relevant actors need in order to ensure the proper operation and upscaling of the innovations that are developed.

During the project's implementation, the cities seem to have managed to capitalize the co-creative and cooperative procedures and the knowledge gained from the different actions in order to plan in detail the next phase of the measures' implementation and operation. Numerous issues were resolved to this extent and the level of achievement is reflected in the result indicators as these were presented within the previous sections.

According to the process progress, the following has been accomplished:

- One of the main achievements of the project so far is mapped in the Innovation Logbooks that have been used for the ex-ante impact assessment. The Logbooks include a detailed description of the measures, as regards the different solutions that each measure includes, the innovative aspects and the respective administrative and governance issues that should be covered for achieving their proper implementation are described in detail. The impact of the innovations (the upscaled scenario) on society, environment and traffic provides the last input needed before the final measures' detailed planning and implementation. Following this procedure, the project ensures the implementation and upscale of reliable solutions for a more sustainable, inclusive, safe, and secure mobility system.

- In total, ***11 test sites, 11 measures, and 41 solutions*** including ***104 innovations*** are discussed to be implemented and upscaled in the Living Labs and ***12 new business models to be developed***. The measures include approximately ***12 new hubs*** which will bring quite a significant direct economic contribution of the welfare to the metropolitan area. The current numbers are ensuring that MOVE21 will create a European lighthouse ecosystem, integrating new innovative technologies and measures into city transport operations at a real-life scale, in order to achieve long-term decarbonization impacts and also meaningful improvements of the transport system efficiency and accessibility.

- More specifically, as it is presented in the Table 49, Oslo intends to implement 39 innovations, Gothenburg 22, and Hamburg 43. As the MOVE21 innovations are mainly concern the implementation or upgrade of hubs, each city will implement at least one or two hubs and they will also need some new business models for their proper operation.

Living Labs	Number of innovations intended to be implemented	Number of hubs intended to be implemented	Number of business models intended to be developed
OSL	39	7	1
GOT	22	1	6
HAM	43	3	5

Table 49: Number of innovations and hubs intended to be implemented, number of business models intented to be developed (OSLO-GOT-HAM)

- After the capacity building procedures of the project and the knowledge gained through the co-creation and cooperative meetings of the LLs, it seems that they are feeling confident to follow a data-driven approach for mobility planning, also solving several organizational issues. They are also capable to manage the knowledge gained by the project, in order to upscale the MOVE21 solutions. These results are ensuring the project's contribution to the development of the existing European knowledge base on the effectiveness and impacts resulting from the implementation of the innovative solutions.

- However, Gothenburg and Oslo seem to need more guidance from the experts and transversal project partners in order to strengthen their capacity regarding the knowledge management, . Additionally, Oslo seems not so confident about the organisational issues (Table 50).

Living Labs	Capacity to incorporate data driven approaches in mobility planning	Innovation capacity regarding organizational issues	Innovation capacity regarding knowledge management	Potential for the upscaling of MOVE21 solutions	Understanding of governance barriers for the measures implementation
OSL	3.4	3.0	3.1	3.7	4.0
GOT	3.2	3.7	3.0	3.4	3.5
HAM	4.0	4.0	4.0	4.0	4.0

Table 50: Total innovations implemented by the three LLs (OSLO-GOT-HAM)

- The result indicators calculated are aligned with the expected target values and promise to deliver a positive impact on the MOVE21 impact areas, providing a positive impression as regards their progress against the target value.

- Regarding the policy, administrative, commercial, and governance, decisions need to be taken for the implementation of the measures, the required business models and collaboration schemes needs to be developed as well as the technological equipment needs to be installed/developed/purchased, these are depicted in Table 52 according to the Logbooks completion.

Living Labs	Commercial decisions	Administrative decisions	Policy decisions	Governance decisions	Technological equipment	Business models	Collaboration schemes
OSL	7	6	2	4	3	1	4
GOT	17	11	3	1		6	10
HAM	9	28	3	3	4	5	6

Table 51:Total innovations implemented by the three LLs (OSLO-GOT-HAM)

- Regarding the impact to the environment, the simulations took place including all the relevant up-scales of the measures concluded that the most significant results are noticed in Oslo, while for all the three cities, passenger transport seems to affect the environmental results in a wider degree than the freight transport.

The ***implementation of the impact assessment framework*** identified minimum deviations between the target values and the measured values of the indicators. Nevertheless, results will be used as feedback to the three Living Labs for discussing ***possible future modifications in the operation of the innovative mobility solutions***. After the measures' implementation the final measured values will be compared to the ones of the before implementation phase (presented in the current deliverable), in order to evaluate overall whether the solutions have been effectively implemented, and come to the final conclusion regarding achieving positive impacts.

7 References

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Annex A: Questionnaire Survey for the Living Labs for the Ex-Ante Impact Assessment

Dear representatives of the Living Lab cities,
Thank you for making use of the Questionnaire survey form. The information provided here will be used for the implementation of the MOVE21 impact assessment. The Questionnaire survey covers MOVE21 impact areas and indicators. This Questionnaire survey is the first one out of three similar surveys planned within MOVE21.

The aim of the Questionnaire survey of this period is to collect all the relevant information in relation to the baseline and the ex-ante assessment part.

Should you have any questions or difficulties in filling in this form, please use contact CERTH in the following emails nconstantinidou@certh.gr and nilia@certh.gr.

Data protection declaration:
The data shared by you through this form will be used for monitoring the progress of impact assessment of MOVE21 and it may be quoted anonymously in publicly available online reports. Personal data may be shared with MOVE21 partners, all of whom are contractually bound to abide to EU data protection law. Under no circumstances will any data submitted to this form be given to third partners.

Please tick to confirm that you understand and agree with the above.

Personal information

Your email:

Your full name:

The city you are representing:

- Oslo
- Gothenburg
- Hamburg

The organization/ department you are working for:

1. City's Perceived Capacities

1.1 How do you perceive your city's capacity to incorporate data driven approaches in mobility planning?

From 1-very low to 5-very high, please estimate the current level of capacity to incorporate data-driven approaches in mobility planning.

	1	2	3	4	5	
Very low	o	o	o	o	o	*Very High*

1.2 What is the current innovation capacity regarding organization issues for implementing innovative mobility solutions of your city administration?

From 1-very low to 5-very high, please estimate the current level of capacity to incorporate data-driven approaches in mobility planning.

	1	2	3	4	5	
Very low	o	o	o	o	o	*Very High*

1.3 What is the current innovation capacity regarding knowledge management needed for implementing innovative mobility solutions of your city administration?

From 1-very low to 5-very high, please estimate the current level of capacity to incorporate data-driven approaches in mobility planning.

	1	2	3	4	5	
Very low	o	o	o	o	o	*Very High*

1.4 What is the potential for the upscaling the MOVE21 solutions in your city?

From 1-very low to 5-very high, please estimate the current level of capacity to incorporate data-driven approaches in mobility planning.

	1	2	3	4	5	
Very low	o	o	o	o	o	*Very High*

2. Data Sources

2.1 Is there any existing data source in your city relevant to the citizens' perception as regards their inclusiveness from the implementation of transport solutions?

- Yes
- No

2.2 If your answer to the previous question is Yes, please, describe the data source that already exists.

Example: Sample, type of survey, scope of survey, data owner, easiness of the city to use the data etc.

2.3 If your answer to the previous question is No, a short citizens survey or poll should be implemented until 20/9/2022 in order to capture the current citizens' perception as regards their inclusiveness from the implementation of transport solutions.

Specific instructions will be sent to you. Please, share your thoughts in case you have.

2.4 Is there any existing data source in your city relevant to the citizens' perception as regards the security issues from the implementation of transport solutions?

- Yes
- No

2.5 If your answer to the previous question is Yes, Please describe the data that already exists.

Example: Sample, type of survey, scope of survey, data owner, easiness of the city to use the data etc.

2.6 If your answer to the previous question is No, a short citizens survey or poll should be implemented until 20/9/2022 in order to capture the citizens' perception as regards the security issues from the implementation of transport solutions.

Specific instructions will be sent to you. Please, share your thoughts in case you have.

2.7 Is there any existing database in the city, which can be used in order to appraise your city's current load factors?

- Yes
- No

2.8 If your answer to the previous question is Yes, please describe the data source that already exists.

Example: Sample, type of survey, scope of survey, data owner, easiness of the city to use the data etc.

2.9 If your answer to the previous question is No, a survey to your city's freight companies should be organized until 20/9/2022 in order to appraise your city's current load factors.

Please, share your thoughts in case you have.

2.10 Is there any existing data source in your city, which can be used in order to appraise your city's current zero emission light duty electric vehicles?

- Yes
- No

2.11 If your answer to the previous question is Yes, please describe the data that already exists.

Example: Sample, type of survey, scope of survey, owner of the data, easiness of the city to use the data etc

2.12 If your answer to the previous question is No, a survey to your city's freight companies should be organized until 20/9/2022 in order to estimate your city's current zero emission light duty electric vehicles.

Please, share your thoughts in case you have.

3. Direct Economic Sectorial Contribution to the Welfare

3.1 What is the direct economic sectorial contribution to the welfare to the metropolitan area from city transport?

Please state a percentage.

4. Comments

4.1 Feel free to share any comments you may have here.

Annex B: Measures and Innovations Logbook

The Measures/Solutions/Innovations Logbook per has been filled in per test site.

Proposed measures	Innovative aspects per measure (technical/non-technical)	Solution code	Solutions description	Number of upscales	Administrative decisions for supporting solution	Commercial decisions for supporting solution	Policy decisions for supporting solution	Technological solutions	New governance decisions needed	New collaboration schemes needed	New Business models needed
1	I2.1	S1.1									
		S1.2									
2	I2.2	S2.1									
		S2.2									
3	I3.1	S3.1									

Table 52 Measures and Innovations Logbook (part 1)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 953939