IMPACT ANALYSIS FRAMEWORK FOR THE LIVING LABS

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

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Project Executive Summary

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

The integrated approach in MOVE21 ensures that potential negative impacts from applying zero emission solutions in one domain are not transferred to other domains but are handled holistically. It also ensures that European transport systems will become more resilient. Real testing environments of this MOVE21 integrated approach are the three Living Labs (LLs); Oslo, Gothenburg, and Hamburg while three replicator cities; Munich, Bologna and Rome are following solutions tested in the LLs. 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 LLs 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 LLs 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**: Centre for Research and Technology Hellas (CERTH)

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Deliverable executive summary

Key words

#1 Impact Analysis, #2 Key Performance Indicators, #3 Assessment framework #4 innovative mobility solutions #5 zero-emissions

The deliverable entitled ‘Impact analysis framework for the LLs’, describes and presents the methodological approach to be followed in the impact assessment framework. That is, the conceptual approach regarding the result indicators creation, the systematic approach to collect, manage, and analyze data linked to impact assessment for the LLs, the impact assessment framework presentation and its alignment / contribution to several strategic documents and EU projects.

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1 List of abbreviations and acronyms

Acronym	Meaning
BCCMP	Box Clouc Content Management Platform
EU	European Union
GDP	Gross Domestic Product
KPI	Key Performance Indicator
LL	Living Lab
MS	Mission Board
QS	Questionnaire Survey
SCAN – MED	Scandinavian–Mediterranean Corridor
SDGs	Sustainable Development Goals
SSMS	Sustainable and Smart Mobility Strategy
SUMI	Sustainable Urban Mobility Indicators
SUMP	Sustainable Urban Mobility Plan
TEN-T	Trans-European Transport Network
UMMS	Urban Mobility Monitoring System
WP	Work Package

2 Introduction

2.1 Purpose of deliverable and attainment of objectives

The current deliverable describes the first outcomes of Task 8.1 entitled "Develop an Impact Analysis Framework". More precisely, it describes analytically the design and development of the methodological framework to be implemented for the monitoring and assessment of the impact that the project will bring to the Living Labs in Oslo, Gothenburg and Hamburg. Therefore, an in-depth analysis of the conceptual approach that will be used for calculating the result indicators as well as the approach to collect, manage, and analyse data is presented in the following chapters. The impact assessment approach harmonization vis-a-vis several strategic documents and EU projects is also analysed.

The impact assessment framework, through specific result indicators, aims to highlight the impact that the project can bring to:

- The innovation enabling topics of society, governance and technology upgrade (thematic areas of WPs 3, 4 and 5)
- The sustainable urban transport, the environment and the economy
- The efficiency of transport systems
- The accessibility to the Scan-Med TEN-T corridor
- The adequacy and effectiveness of policy and business frameworks
- The resilience of the transport network, during particular challenges (such as the organisation of large events) or unforeseen events (such as the COVID-19 pandemic)

The way that the above-mentioned impacts are going to be calculated and monitored is presented in the following sections under a structured methodology, consisting of the impact analysis framework of the MOVE21 project.

The deliverable's objective has been achieved to the fullest, while also the deliverable was finalized according to the project's time schedule.

2.2 Intended audience

The main internal audience of this deliverable is the Project Coordinator, the WP Leaders, MOVE21 Executive Board and the Living Lab Project Managers. However, Deliverable 8.1 is a public document, and it aims to become a guide for any interested body, as it describes a methodology 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

Apart from section 1, including the list of abbreviations and acronyms, used in the current deliverable and the Introductory section 2, the rest document is structured as follows: Section 3 presents the impact assessment methodology adopted by the project, structured under three fundamental levels, the methods of data collection and analysis, as well as the tools used for the monitoring of the Living Labs procedures. In parallel, the impact assessment approach harmonization is presented, highlighting the impact assessment alignments and contributions to EU strategies, and based on existing evaluation sets of proposed indicators in urban mobility (CIVITAS Impact and Process Evaluation Framework, SUMI indicators). In Section 4, an analysis of the result indicators used for the monitoring of the Living Labs evaluation process is presented and in total 30 result indicators are described in reference to the thematic areas addressed, their contribution to additional impacts, the measurement unit and the target values, the methodology approach and the monitoring tools used as well as the responsibility allocation

on partners' level. Also, the timeline of the mobility solutions' assessment is presented, consisting of three stages (ex-ante, ex-durante and ex-post evaluation of solutions). Section 5 presents the Deliverable's conclusions and next steps, while Section 6 presents the references used.

The 'Impact analysis framework for the Living Labs' is directly related to Task 8.2 under which the Urban Mobility Monitoring System (UMMS) will be established. The UMMS will collect all data needed for the impact analysis (which will take place under Task 8.3) as well for the calculation of the identified indicators. Also, Deliverable 8.1 is related to WP3 'Urban Social Layer', WP4 'Governance Innovation' and WP5 'Technological Solutions and Integration', as it includes several strategic result indicators included in the final list of indicators regarding this deliverable, after the following specific process:

1. Each WP Leader proposed a number of indicators related to the relevant to the WP context,
2. Bilateral online meetings between WP8 Leader and the other WPs took place in order the most representative indicators to be selected and included in the Impact Analysis framework,
3. The indicators selected were then added in the final list of indicators and further analyzed in the framework of this deliverable.

Also, this deliverable is strongly linked to WP6 as the impact assessment methodology approach proposed refers to the three cities of Oslo, Gothenburg and Hamburg which will be monitored under WP6. Furthermore, Deliverable 8.1 in collaboration with WPs 3, 4, 5 and 6 provides a data collection framework and evaluation benchmark in the Integrated City Assessments, therefore it is directly linked to D6.2, D6.3 and D6.4. Finally, and regarding WP2 'Data Management' the Deliverable 8.1 is directly linked with the Data Management Plan as it describes all data that will be needed for the indicators as these are presented in the current deliverable.

3 Impact assessment – the MOVE21 Concept

MOVE21 integrates smarter and cleaner mobility solutions by applying a holistic and integrated approach to transport planning, policies and implementation in several European cities (the current deliverable concerns the three Living Lab cities). 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. This is also enchanced from the high quality inter- and transdisciplinary MOVE21 consortium members and their close synergy with extensive European and global networks.

Additionally, a high impact of MOVE21 project will be secured through strong stakeholder and citizen engagement as well as through the integrated approach that will be followed in order to create win-win solutions (based on the deployment of multimodal hubs) that will be innovative, sustainable and will also serve the needs of the final users, the passenger and goods transport operators, policy authorities, and business sector.

In order to assess if the actual impacts that the project will bring match the expected impacts, an impact assessment concept, tailored in the specific notion and context of MOVE21 has been structured. The MOVE21 impact assessment consept, consists of the following three fundamental components;

- ✓ **Impact Assessment Methodological Approach**

The methodological approach refers to the overarching strategy that was developed for the impact assessment framework formulation. The approach includes the description of the relevant metrics and indicators that will be calculated as well as the procedures and tools that will be used for relevant data collection, storing and analysis in order to estimate the final impact of the project.

- ✓ **Impact Assessment Methodological Approach Harmonization**

The harmonization of the methodology refers mainly to the adoption of specific indicators, in order to align with similar and already used frameworks that have proved their value on the same topic. These frameworks could be results of previous research projects or targeted studies of EU.

- ✓ **Impact Assessment Framework**

The finalization of the above two components, will lead to the impact assessment framework formulation. The framework will consist of the result indicators on an impact-oriented approach, which will be used for estimating the impact that the project and the mobility solutions will bring. In this chapter the assessment methodology adopted in the project is analysed, trying also to highlight and explain the multi-faceted nature of the assessment activities and the harmonization to the EU previous studies.

3.1 Impact Assessment Methodological Approach

The MOVE21 three-level impact assessment methodology integrates three fundamental conceptual levels:

- The innovation enabling topics of society, governance, and technology (WPs 3, 4 and 5) (level 1) complemented with,
- The Living Labs co-creation procedures (level 2) and finally,
- The impact oriented MOVE21 result indicators (level 3).

Level 1 / Innovation enabling topics

The first level of the assessment includes the parallel performance evaluation of the measures at three thematic areas the urban social layer, the governance, and the technical integration.

Level 2 / Living Lab procedures

Under this level the Living Lab processes for achieving policy coherence, increase of innovation capacity and development of the innovation co-creation partnerships will be monitored.

Level 3 / Impact-oriented result indicators

The current level is addressing the development of the result indicators that will measure the performance of the project to the specific impact areas of the Grant Agreement.

For the implementation of the impact assessment methodology approach specific methods (transport models and questionnaire surveys) and the tool (UMMS) will be used and will be configured within the project. A detailed schematic representation of the approach is presented in Figure 1 below. Noting that, in the context of each individual level, tailored methods will be applied, and the collected data will feed the UMMS.

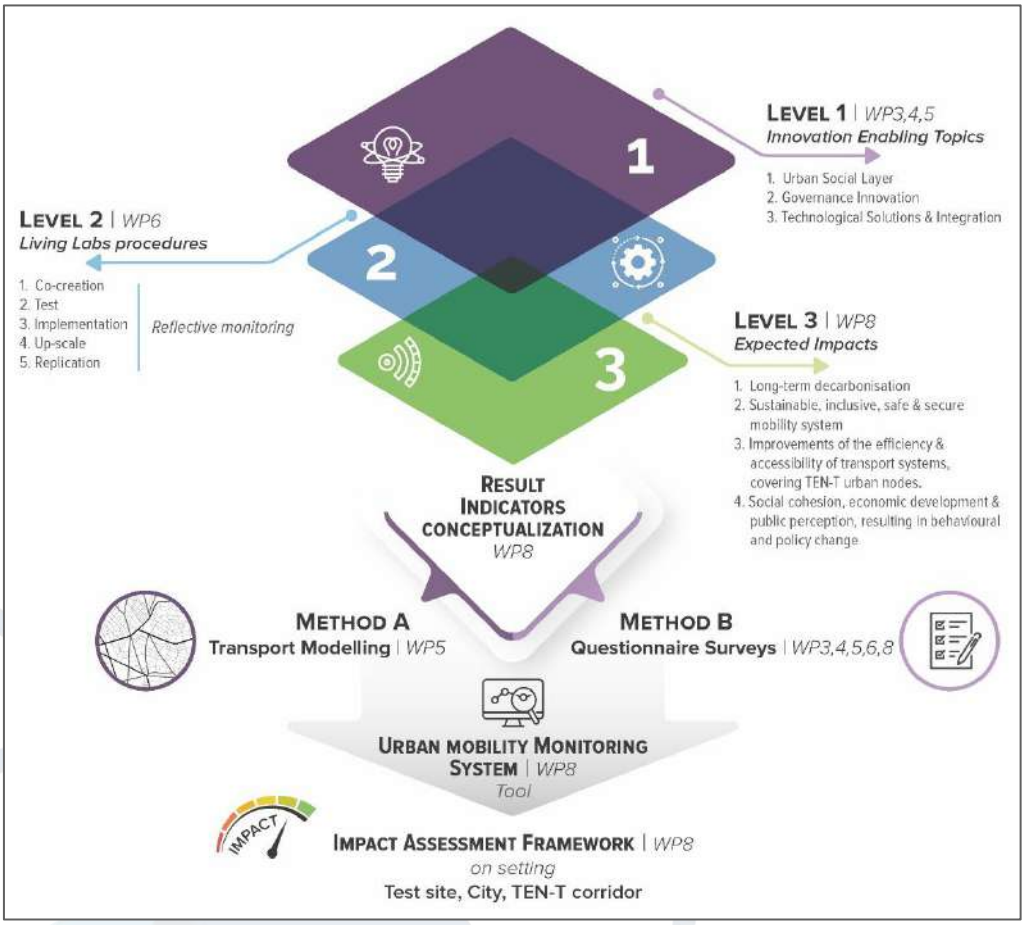

Figure 1: Impact Assessment Methodology Approach

Each component of the approach is presented in the sections above in order to give a comprehensive understanding of the step-by-step procedure that will be followed for the formulation of the MOVE21 methodological framework.

3.1.1 Level 1 Innovation enabling topics

The first innovation enabling topic of Level 1: **Urban Social Layer**

The Urban Social Layer will consider the close link between social and spatial components of cities, social acceptance of the measures deployed and whether they are well-suited to deliver impacts on social cohesion. The location assessment of the Living Labs will be carried out combining analytics at different levels: spatial characteristics of locations, spatial requirements of operators and users, and social characteristics of place and surroundings. The urban social layer will feed the impact assessment of Living Labs by calculating the impact of the innovative measures on social cohesion, livability, safety, and comfort in cities.

The second innovation enabling topic of Level 1: **Governance Innovation**

The governance innovation is related to the needed actions that should be done by each Living Lab in order 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 specific thematic area will feed the impact assessment by estimating the upgrade of the Living Labs innovation capacity to understand the governance drivers and barriers for implementing innovative solutions as well as the number of policy solutions proposed for ensuring the successful establishment of mobility hubs.

The third innovation enabling topic of Level 1: **Technological Solutions and Integration**

The integration of technical solutions is related to the evaluation of the final implemented solutions as regards the achievement of the connectivity and interoperability among them analyzing separately each one of the cases in Oslo, Gothenburg and Hamburg to be successful. The current thematic area will feed the impact assessment by calculating the upgrade of the passenger and freight urban network connectivity.

The alternative innovative solutions will be initially evaluated (ex-ante evaluation) under specific criteria in order to prove their impact and effectiveness in these three areas. The most efficient solutions will be finally selected by the cities for implementation.

Specific strategic indicators will be proposed and will be included in the impact evaluation framework of MOVE21 for monitoring in ex-durante and ex-post level the final impacts of the selected measures to the society, the governance, and the technological upgrade, as they are presented in Chapter 4.

3.1.2 Level 2 Living Lab procedures

The layer 2 of MOVE21 consists of the Living Lab procedures. The Living Labs in Oslo, Gothenburg and Hamburg are the city test cases of MOVE21 were co-creation, implementation and upscaling activities for the mobility solutions (non-technological and technological as well) will take place. The overall referred processes are efforts to increase innovation capacity in the cities and the local ecosystems. The Living Labs are designed to outlast MOVE21 by applying a self-sustaining partnership model that builds on already existing, strong partnerships for zero emission solutions with the aim to create long lasting change and impact. This will be applied by an open innovation model involving quadruple helix partners (which are the following: public authorities, researchers, businesses and citizens).

Furthermore, specific activities are developed to maximise the sustainability of the Living Labs:

- Uptake of new knowledge and skills within city governments,

- Strengthening local innovation ecosystems and networks through specific Innovation Co-Creation Partnerships, and,
- Exploring and evaluating sustainable business models for the Living Labs.

Activities in the Living Labs are monitored, in order to assess their processes, impacts and implementations, by a reflective monitoring guide designed to create a continuous loop of observations, reflections and actions to improve the operation of the Living Labs and the deployment of the innovations. The monitoring guide is the means to describe the different processes for policy coherence, for increasing innovation capacity and for monitoring the innovation co-creation partnerships. Methods applied will be (structured) observations, surveys, short questionnaires, and (in-depth) interviews. In several joint workshops results of the monitoring will be discussed, validated and translated into new actions to improve ways of working. Best practices and lessons learned are validated in joint workshops with representatives of the Living Labs.

The reflective monitoring is another level of monitoring, running in parallel and complementarily, providing input and useful insights to the impact assessment framework for the Living Labs. However, the reflective monitoring is refering only to the Living Lab procedures and its processes by using an ex-durante methodology. The monitoring of the impact assessment framework for the Living Labs is a strategic process with a wide overview of the impacts, resulting from the implementation of the innovative mobility solutions in the Living Labs. Both levels of monitoring are intersected, in the view of several strategic result indicators, as it will be more accurately understood in the methodology sheets (Chapter 4) tailored for each individual result indicator.

3.1.3 Level 3 Impact-oriented result indicators

According to the MOVE21 proposal and Grant Agreement there are 11 expected impacts' areas that MOVE21 will deliver. The 8 of these impacts areas that are addressed in the Living Labs of the project are presented below:

3.1.3.1 Impact Area 1: Long-term decarbonization

Impact area 1 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.

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

Impact area 2 is referring 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.

In the long term, it is important that the MOVE21 urban nodes are recognised as European champions of the Zero Pollution Action Plan and as European champions of Vision Zero.

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

The test sites are directly linked to the TEN-T access points. MOVE21 innovations will contribute to improving access to the TEN-T corridor, improving access to sustainable transport options and increase efficiency and capacity utilization within the urban nodes, and thereby contribute to short term and long term economic and environmental impacts. Collaboration through the Scan-Med Cities Observatory (WP10) will also improve the identification and solving of transport challenges at the interfaces between different spatial and governance levels, thus delivering long term cultural, political, and capacity**.**

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

Improved alignment of planning mechanisms in different policy domains trigger 'win-win' effects between policy goals and create 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 livability 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 ensure 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.

3.1.3.5 Additional Impacts

In addition to the impacts areas mentioned above, MOVE21 contributes to additional impacts which advance important international policy goals and are further described in section 3.2. Namely:

- **Additional Impact 1:** Contributions to the EU Sustainable and Smart Mobility Strategy (SSMS) (see section 3.2)
- **Additional Impact 2:** Contribution to the Mission board climate neutral and smart cities objectives (see section 3.2)
- **Additional Impact 3:** Achieving the UN Sustainable Development Goals (SDGs) (see section 3.2)
- **Additional Impact 4:** Active citizen engagement to support uptake of smart urban mobility solutions (see section 3.2)

The remaining impact areas that are not further discussed in this deliverable, as these are not examined in the Living Labs assessment framework, are:

- **Impact Area 5:** Development of the existing European knowledge base on the effectiveness and impacts resulting from the implementation of innovative mobility solutions.
- **Impact Area 6:** Clear commitments and contributions to Europe-wide take up during and beyond the project.

3.1.3.6 Result indicators conceptualization

During the third level of the impact assessment methodological approach, the result indicator's conceptualization is taking place. Result indicators are measuring the accomplishments, in terms of impact and demonstrating the progress made towards achieving the targeted impact values. The result

indicators of MOVE21 are interdisciplinary, since they integrate several scientific aspects, as demonstrated in the previous section 3.1, and represent the strategic outcome of the overall processes for mobility and freight solutions integration.

The result indicator conceptualization is the outcome of WP8 activities and the collaborative process among WPs 3,4,5,6,8 of MOVE21. Following the MOVE21 result indicators per impact are presented.

MOVE21 will act as “lighthouse" example for integrating new scalable technologies and measures into city transport operations and existing transport infrastructures at real-life scale in order to achieve long-term decarbonisation impacts.

Result indicators referring to the expected impact long-term decarbonisation

- CO2 reductions from local road transport in Living Lab cities: private cars, vans, heavy vehicles (incl. buses)
- Number of MOVE21 innovations upscaled in the three LLs
- Increased capacity to incorporate data-driven approaches in mobility planning

Reliable solutions for a more sustainable, inclusive, safe, and secure mobility system, including for the secure mobility of people and freight during major sport events.

Result indicators referring to a sustainable, inclusive, safe & secure mobility system

- Increased self-perceived inclusiveness from the implementation of transport solutions
- Increase of perceived security (crime, COVID-19 etc.) in the city-transport system
- Increase in active modes of transport thanks to incentive models/reward scheme
- Reduction in transport related noise pollution
- Reduction in transport related Nox air pollution as a result of deployed MOVE21 innovations
- Reduction in transport related PM2.5 air pollution as a result of deployed MOVE21 innovations
- Decrease of average travel time loss per visitor of large (sports) events
- Increase of gender mix in pedestrian space usage per Living Lab city

Clear improvements of the efficiency and accessibility of the transport networks/systems covering the TEN-T urban nodes or equivalent, and their access to the relevant TEN-T corridor(s) or equivalent transport corridors for transport of freight and/or passengers.

Result indicators referring to improvements of the efficiency & accessibility of the transport systems covering the TEN-T urban nodes

- Number of implemented MOVE21 innovations in the Living Labs
- Number of new (micro) hubs as a result of the Project
- Number of improvements in existing hubs as a result of the Project
- Number of daily usages of new hubs
- Load factors in urban freight as a result of MOVE21
- 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
- Exchange points’ decrease of delays and modal shift associated with MOVE21 hubs
- Number of interoperable systems of innovative solutions adopted in the Living Lab cities

Positive long-term impacts on social cohesion, economic development, and public perception, resulting in behavioural change and policy change.

Result indicators referring to social cohesion, economic development & public perception, resulting in behavioral and policy change

- Perceived improved understanding of governance drivers and barriers to implementation of measures
- Number of MOVE21 business models developed
- 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
- Number of policy solutions proposed for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab
- Number of strategic plans that will be reformulated based on the results of MOVE21 in the three Living Labs
- 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

The methodology for calculating the above-mentioned result indicators per impact area, enriched with the proposed level 1 and level 2 strategic indicators and taking into consideration the different EU guidelines and the CIVITAS framework, will formulate the MOVE21 evaluation framework which is analytically presented in Chapter 4 of this deliverable.

3.1.4 Methods of Data Collection and Analysis

For the calculation of the result indicators data acquirement from several data sources and regarding various thematic areas is necessary. There are two fundamental data sources that will feed the impact assessment framework presented below:

- Transport modelling and simulation outcomes
- Outcomes of the Living Lab procedures

Transport modelling and simulation methods will feed the impact assessment with datasets. The calculation of the values of several indicators per study period and per city and the ensurance that the mobility solutions are sound in upscaled formats is based on the referred methods. Also, quality assurance is in line with the guiding concept of SUMP as indicated by the Principle 8.

Principle 8: Quality assurance

In this direction, Digital Twins will be implemented for the Living Labs in the context of WP5 (TNO). The Digital Twins is the environment to test and simulate innovative mobility solutions selected by the Living Labs and a basic means of data collection for the calculation of several result indicators.

As regards the second data source, the Living Labs procedures, the data collection is based on the overall processes that will take place in the three Living Labs for the implementation of mobility solutions (e.g. co-creation, capacity building, workshops). For the data collection, through Living Labs procedures, the impact assessment framework, and the reflective monitoring (WP6), will be aligned and co-operate. The referred processes will be addressed to citizens, stakeholders, experts, transport companies, and freight companies from the Living Labs that will be the key data providers or

respondents (including agencies proving datasets). The methods that will be used for data provision are the following:

- Questionnaire surveys (short questionnaires or in-depth interviews)
- On-line data search and collection
- Structured observation
- Data agencies

As it is understood, in overall the data categories to be used for the monitoring of the Living Labs assessment processes are:

- Open-data sources
- Collected data
- Historic databases
- Digital twins
- Simulation models
- Stakeholders adding data in the cities

3.1.5 Tools to be used for the development of the assessment methodology

Monitoring is the systematic process of collecting, analysing and using information to track a programme's progress towards reaching its objectives and to guide management decisions. An important dimension for the efficient implementation of the assessment framework is the monitoring tool to be developed containing all the MOVE21 result indicators, the datasets that will be used for their measurement and the appraisal of their value per Living Lab and according to the timeline for the different phases of measurement. It is important to underline that the monitoring is in line with the SUMP Principle 7: Arrange for monitoring and evaluation, which is one of the overall eight SUMP principals that MOVE21 builds on and adopts. Therefore, in line with this principal, MOVE21 will establish an Urban Mobility Monitoring System (UMMS) as well as a monitoring data repository. This is important to ensure that the cities as anticipated enable changes to be made. At the same time, such monitoring is able to demonstrate how a city is contributing towards the delivery of the expected impacts and outcomes.

The UMMS will act as a communication channel between the WPs and will assist the collaborative process among the WPs contributing on the impact assessment framework. Furthermore, the UMMS is the location, concentrating the necessary data (quantitative and qualitative, as well) that will be used for the final calculation of the result indicators and afterwards for the overall impact assessment. In order to achieve this data collection routines will be established as well as technical mechanisms for data upoading, organization (foldering and classification) and calculation loops. An indicative organization of the UMMS is presented for each result indicator (in the result indicators methodology sheets) in Chapter 4 (Sections 4.4 – 4.7).

The data sources to be used, approximately include the outcomes of local/regional transport models and simulations, planning and climate documents, travel and citizen questionnaire surveys, statistics of planning agencies, infrastructure managers and transport operators, traffic management data, open data, crowdsourcing, and interviews. The datasets in the UMMS will be categorized per result indicator, LL and will contain the values at the specific timeline that will be presented in Chapter 4 (baseline, ex-ante, ex-durante, ex-post).

In addition to the UMMS, and in order to monitor the data collection, a dedicated Evaluation Advocate assigned in each Living Lab will guide the work and ensure the coordination of the data exchange on each thematic area.

3.2 The MOVE21 impact assessment approach harmonization

Taking into account the four in total additional MOVE21 impacts' areas, the impact assessment approach will be based on contributions to the EU Sustainable and Smart Mobility Strategy [1], Mission board climate neutral and smart cities objectives [2] the UN Sustainable Development Goals [3], the Sustainable Urban Mobility Indicators [4] and it is aligned with the Civitas Evaluation Framework [5] and the SUMP principles [6].

3.2.1 Contributions to the EU Sustainable and Smart Mobility Strategy (SSMS)

The European Green Deal has set a target to reduce transport-related greenhouse gas emissions by 90% by 2050, further elaborated in the strategy for sustainable and smart mobility (SSMS). MOVE21 will contribute in a substantial way to the SSMS objectives, in particular:

- Encouraging the shift towards sustainable alternatives for passengers and freight transport
- Increasing efficiency and multimodality across the whole transport system
- Incentivise low-carbon practices and sustainable mobility across functional urban areas
- Boosting the uptake of lower and zero emissions vehicles. MOVE21's hubs and associated measures for their uptake in their functional urban area and integration in the larger mobility system will support last-mile distribution using walking, cycling or use of light duty zero emission vehicles.

3.2.2 Contribution to the Mission board climate neutral and smart cities objectives

The Mission board for climate neutral and smart cities has identified the objective of reaching 100 climate neutral cities by 2030. MOVE21 will contribute to this goal by:

- Turning the involved cities into innovative and sustainable hubs for passenger and freight mobility and thus supporting them and other cities in a cascade effect, in their path towards climate neutrality
- Fostering a strong co-creation approach in the Living Labs and a multi-level cooperation both at functional urban area level and Scan-Med corridor level that sets the ground for the preparation of Climate City Contracts proposed by the mission.

3.2.3 Achieving the UN Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) are a collection of 17 interlinked global goals to achieve a better and sustainable future for all. The SDGs were set up in 2015 by the United Nations General Assembly (UN-GA) and are intended to be achieved by the year 2030. The 17 SDGs are: (1) No Poverty, (2) Zero Hunger, (3) Good Health and Well-being, (4) Quality Education, (5) Gender Equality, (6) Clean Water and Sanitation, (7) Affordable and Clean Energy, (8) Decent Work and Economic Growth, (9) Industry, Innovation and Infrastructure, (10) Reducing Inequality, (11) Sustainable Cities and Communities, (12) Responsible Consumption and Production, (13) Climate Action, (14) Life Below Water, (15) Life On Land, (16) Peace, Justice, and Strong Institutions, (17) Partnerships for the Goals. MOVE21 will assist the cities' efforts to reach the SDGs and in particular the following goals:

Goal 3: On good health and wellbeing and in particular:

- Target 3.6: Halve deaths and injuries from road traffic accidents
- Target 3.9: Reduce air pollution

Goal 9: On industry, innovation, and infrastructure and in particular:

- Target 9.1: Quality, reliable, sustainable, and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

Goal 11: Inclusive, safe, resilient, and sustainable cities and in particular:

- Target 11.2: Access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons).
- Target 11.3: Enhance inclusive and sustainable urbanization and capacity for participatory, integrated, and sustainable human settlement planning and management in all countries.

Goal 17: Partnerships for sustainable development, in particular:

- Target 17.14: Policy coherence for sustainable development through the work on policy coherence and sectoral integration that will be done in MOVE21

- Target 17.17: Effective public, public-private, civil society partnerships and building on the experience and resourcing strategies of partnerships.

3.2.4 Sustainable Urban Mobility Indicators (SUMI)

Sustainable urban mobility indicators are a useful tool for cities and urban areas to identify the strengths and weaknesses of their mobility system and to focus on areas for improvement. The European Commission has therefore developed a comprehensive set of practical and reliable indicators that support cities to perform a standardised evaluation of their mobility system and to measure improvements that result from new mobility practices or policies.

MOVE21 is in line several of these sustainable urban mobility indicators and more specifically with the following indicators:

- Indicator 3: Air pollutant emissions
- Indicator 4: Noise hindrance
- Indicator 7: Greenhouse gas emissions

MOVE21 will try to harmonize the methodology for the above-mentioned indicators' calculation considering data availability.

3.2.5 Harmonization with the Civitas Evaluation Framework

The CIVITAS Initiative brings together cities that are introducing sustainable urban transport policy measures or solutions. For creating a common understanding and consistency, as regards the impacts of these solutions, the CIVITAS Evaluation Framework has been presented an evaluation approach. MOVE21 has been aligned with the CIVITAS community and more precisely with the CIVITAS ELEVATE initiative which expands the CIVITAS support activities of the HORIZON initiatives, increasing their Europe-wide impact. ELEVATE is advancing the CIVITAS community to a higher level of knowledge, exchange, impact and sustainability, while guaranteeing essential high-quality support. MOVE21, as part of the ELEVATE network, is actively participating at meetings and conferences organised in the context of ELEVATE and is exchanging feedback as regards the impact assessment approach with the community. Furthermore, the extensive documentation of the CIVITAS Evaluation Framework is a key tool of the MOVE21 Evaluation Framework.

The focus of the CIVITAS and MOVE21 evaluation framework are the measures implemented in a city. Evaluation aims to describe the impact of the implemented measures in impact categories with quantitative measurements in relation to quantifiable targets set in advance and qualitative

observations. As within CIVITAS projects measures are being implemented in a real, complex, functioning environment the CIVITAS evaluation needs an optimal balance between scientific, precise analyses and synthetic interpretation of observations of the evolution of urban mobility. This is an important challenge to address in order to make the evaluation work feasible, efficient, and useful for policy conclusions. Thus, the key elements of CIVITAS 2020 evaluation framework that are adopted by Move 21 are:

- Efficient combination of impact and process evaluation
- Clear understanding of measures and their context
- Structuring measures for evaluation
- Further development of the assessment plans
- Key measures with an in-depth evaluation
- Consistency of approaches in all cities

3.2.6 The SUMP principles

The impact assessment framework is aligned with the eight SUMP principles following:

Principle 1
Plan for sustainable mobility in the functional urban area. The impact assessment framework is covering whole functional urban areas, and test cases are linked to the TEN-T. Accessibility to TEN-T and network performance is intended to be assessed, and the Scan-Med Cities Observatory is intended to increase ecosystem collaboration across functional urban areas.

Principle 2
Cooperate across institutional boundaries. The impact assessment framework is focusing on the aspect of policy coherence and sectoral integration, through horizontal and vertical collaboration across policy and transport domains, geographical areas and administrative levels.

Principle 3
Involve citizens and stakeholders. MOVE21 is emphasising citizen engagement. The quadruple helix innovation model is used to engage researchers, businesses, governments and citizens and this engagement is exploited by the impact assessment framework.

Principle 4
Assess current and future performance. The impact assessment framework is building on ex-ante, ex-durante and ex-post assessments where needs, challenges and pressure points will be evaluated against current and future performance.

Principle 5
Define a long-term vision and implementation plan. MOVE21, as well as the impact assessment framework, take as timeline of assessment the 2030 policy goals of participating cities and functional urban areas. Strategies are developed to deliver long term impacts.

Principle 6
Develop all transport modes in an integrated way. MOVE21 integrates different transport modes, systems, infrastructures, needs and planning domains in order to innovate holistics win-win solutions and this will be reflected by the impact assessment framework and, more specifically, by the result indicators (sections 4.4 – 4.7).

Principle 7
Arrange for monitoring and evaluation. The impact assessment framework is building on the establishment of an Urban Mobility Monitoring System.

Principle 8
Quality assurance. Transport modelling approaches and simulations (e.g. digital twins and agent – based modelling) will make sure the innovative mobility solutions are sound. Iterative, agile development with well defined review processes and a reflective monitoring guide (WP6) will ensure quality, as well.

4 Impact Assessment Framework

The 3 level impact assessment approach, taking also into account the EU guides and the CIVITAS evaluation framework, ended up with a list of result indicators and a specific methodology for their calculation and update. The procedure of calculating and monitoring these indicators consists the impact assessment framework of MOVE21 and is described in the current chapter. The result indicators are presented in the form of indicator group sheets that are impact-oriented. Each indicator group will determine the final decision as regards the expected impacts e.g., if it is positive, negative. The following sections present the timeline of assessment, the reference area and the categorization and detailed presentation of the result indicators.

4.1 Timeline of assessment

The assessment of the mobility solutions that will be implemented in the three Living Lab cities, will take place on the basis of a pre-defined timeline, referring to key moments of mobility solution implementation, in order to capture their impact and be comparatively useful. The technique that will be used is the traditional three-stage timeline of assessment, consisting of the following phases:

- **Ex-ante**

The ex-ante assessment can be useful in order to pre-identify what impacts certain possible solutions are going to have and as it is obvious encounters the difficulties surrounding predicting the future. 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.

- **Ex-durante**

Other than ex-ante or ex-post assessments, ex-durante assessment takes place during the implementation process and uncovers the changes that have occurred during the lead time of the implementation of solutions. Based on the outcomes of an ex-durante assessment, there can be anticipated on the current situation of the solution, which might prevent failure that would otherwise have reoccurred. Ex-durante analysis makes it possible to uncover changes and make according adjustments during the implementation process, leading to a better fitted process during the rest of the lead time of these projects.

- **Ex-post**

The ex-post evaluation takes place after the implementation of mobility solutions in the Living Lab cities. It is used to assess the introduction of the solutions whether the solutions, if they have been effectively implemented, and comparatively with the ex-ante and ex-durante assessments to come the final conclusion regarding achieving positive impacts.

4.2 Area of reference

The area of reference is important in order to delimit the zone of influence of the impacts, the simulation, modelling and monitoring processes. Also, it is crucial for defining the reference point of the framework. Consequently, the geographical area of reference is categorized in the following levels:

- Test site level or Area of interest: refering to a defined spatial area (e.g. block, site or neighborhood) where the mobility and/or freight solutions will take place in Oslo, Gothenburg and Hamburg.

- City/Functional Urban Area level: Functional urban areas are spatial units consisting from a city (or core) and a commuting zone that is functionally interconnected to the city [7].

- EU-wide/TEN-T corridor level: reffering to the most extensive setting of the framework, the European setting and TEN-T corridor.

4.3 Result indicators

The result indicators are clustered in the form of indicator groups according to their impact and specific methodological sheets have been structured in order to describe their components. Each methodology sheet is consisting of the following elements:

- **Result indicator name and encoding:** a unique code number representing the indicator along with the full name of the indicator

- **Thematic Areas:** the result indicators correspondence with the core thematic areas of the impact assessment framework. The referred thematic areas are following:

✓ The thematic areas of WPs 3, 4 and 5
✓ Sustainability for society, the environment and the economy
✓ Efficiency of transport systems
✓ Accessibility to the Scan-Med TEN-T corridor
✓ Adequacy and effectiveness of policy and business frameworks
✓ Resilience of the transport network during particular challenges(such as the organisation of large events) or unforeseen events (such as the COVID-19 pandemic)

- **Contribution to additional impacts:** correlation to one or more additional impacts, in relation to the way they are reported at sub-Chapter 3.2.

- **Measurement Unit:** a quantity used as a standard of measurement. The measurement unit is defined for the qualitative and quantitative indicators of the current research.

- **Target values:** values intended to be achieved *(if necessary)*

- **Methodology approach & monitoring tools:** the overarching strategy and methodological rationale behind each indicator, providing, at the same time the tools/ methods used for the measurement of the indicator. The following key tools for the monitoring/measurement of several result indicators are being introduced, with some of them being part of the working structure of other WPs (3,4,5,6) as described in detail in Chapter 3.

  In parallel, there is information related to the time horizon and the calculation stage of the result indicators. It is noted that for the result indicators arising from transport modelling (more specifically Digital Twins), in case there is no opportunity for ex-ante, ex-durante and ex-post measurements, the data provided by the Living Lab cities will shed light on the assessment of

the mobility solutions at the specific time horizons and calculation stages. The same claim applies, also, for the base year. The calculation stages corresponding to these cases are highlighted with an asterisk (*) at the Impact Assessent Framework (sections 4.4 – 4.7 of the current document).

- **References of Harmonization:** result indicators' references alignment

The following figure (Figure 1) presents the result indicators' clustering while in the next sections the indicators per impact area are presented. It should be mentioned that the numbering of the KPIs is following the numbering as it was included in the Grand Agreement and for this reason some discontinuities appear as some of the indicators will be used only for the transferability monitoring framework that will be formulated in a later stage of the project.

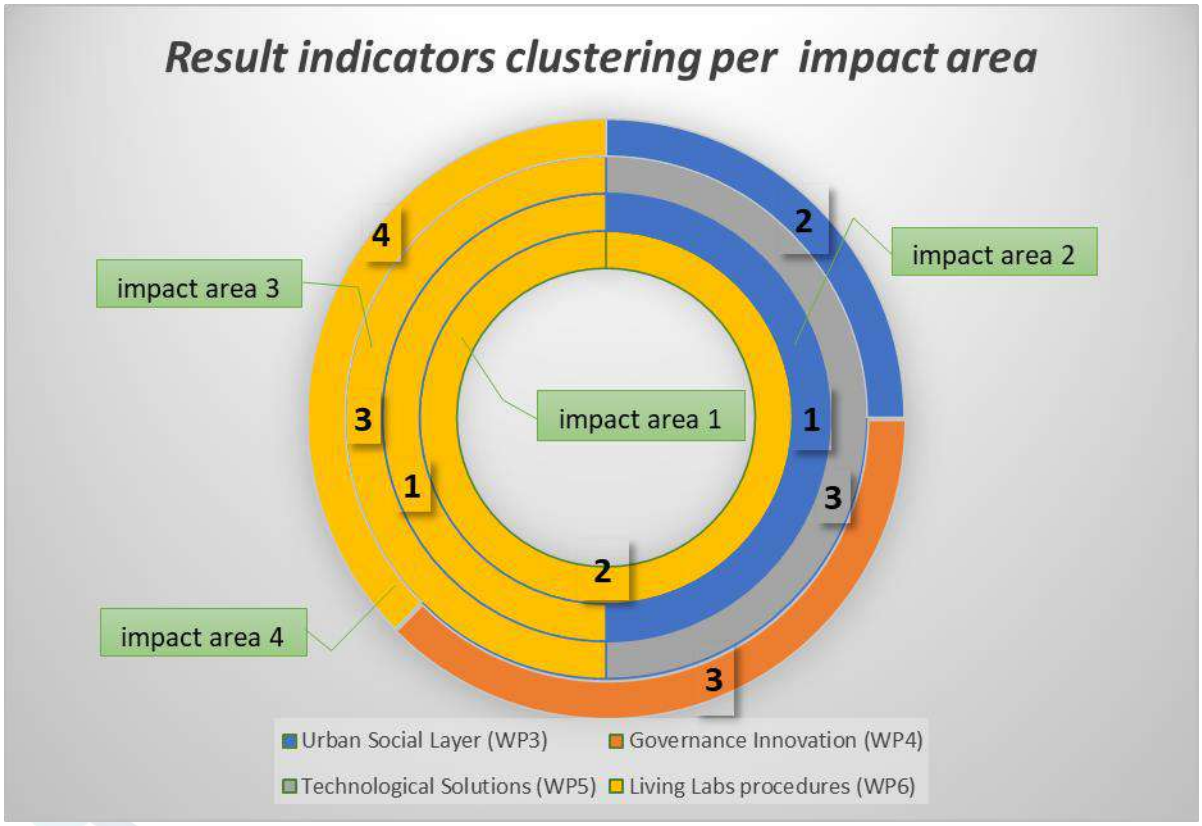

Figure 2: Result indicators clustering

4.4 Impact Area 1: Long-term decarbonisation

The first group of indicators (consisting of three result indicators) of the Living Labs Framework is addressing the impact area 1 of the MOVE21 Impact Assessment Framework:

Impact 1: Integrating new scalable technologies and measures into city transport operations and existing transport infrastructures at real-life scale in order to achieve long-term decarbonisation impacts.

Table 1: Result indicator 1.1

<table>
<tr><td>Result indicator 1.1</td><td colspan="3">CO2 reductions from local road transport in Living Lab cities : private cars, vans, heavy vehicles (incl. buses)</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable & Smart Mobility Strategy
✓ Sustainable Development Goals / Goal 3 / Target 3.9</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">CO2 –eqv</td></tr>
<tr><td>Target values</td><td colspan="3">2025: -15%, 2030 : -30%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Transport Modelling
Modelling Approach: Digital Twins, Simulations
Input Data: Data collection from Living Lab cities, national statistics agencies
<table><tr><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr><tr><td>Base year</td><td>2017</td><td>Current situation*</td></tr><tr><td>Future projections</td><td>2025, 2030</td><td>Ex-ante</td></tr><tr><td>After real implementation</td><td>2025</td><td>Ex-post*</td></tr><tr><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr></table></td></tr>
<tr><td>References of Harmonization</td><td colspan="3">Sustainable Urban Mobility Indicator
Refined CIVITAS process and impact evaluation framework</td></tr>
</table>

Table 2: Result indicator 1.3

<table>
<tr><th>Result indicator 1.3</th><th>No. of MOVE21 innovations upscaled in the three Living Labs</th></tr>
<tr><td>Thematic area(s)</td><td>✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems
✓ Increase Innovation Capacity</td></tr>
<tr><td>Contribution to additional impacts</td><td>✓ Mission board climate neutral and smart cities objectives
✓ Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td>Number</td></tr>
<tr><td>Target values</td><td>2025: 12 (innovations)</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td>Method: Living Lab procedures
Approach: Questionnaire Survey (policy, administrative or commercial decisions)
<table>
<tr><td>Time Horizon</td><td>Year</td><td>Calculation Stage</td></tr>
<tr><td>Future projection</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
</table>
Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

Table 3: Result indicator 1.6

<table>
<tr><th>Result indicator 1.6</th><th colspan="3">Increased capacity to incorporate data-driven approaches in mobility planning</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems
✓ Increase Innovation Capacity</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable Development Goals / Goal 11 / Target 11.3</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Qualitative scale: (1: decreased, 5: increased)</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 5 (from scale)</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Living Lab procedures
Approach: Questionnaire Survey (answered by city administrations)</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>2021</td><td>Current situation</td></tr>
<tr><td></td><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

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

The second group of indicators (consisting of seven result indicators) of the Living Labs addresses the impact area 2 of the MOVE 21 Impact Assessment Approach:

> *Impact 2: Reliable solutions for a more sustainable, inclusive, safe, and secure mobility system, including for the secure mobility of people and freight during major/sport events*

Table 4: Result indicator 2.1

<table>
<tr><td>Result indicator 2.1</td><td colspan="3">Increased self-perceived inclusiveness from the implementation of transport solutions</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems
✓ Social characteristics of place and surroundings</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable Development Goals / Goal 11 / Target 11.3
✓ Active citizen engagement to support uptake of smart urban mobility solutions</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Qualitative scale: (1: decreased, 5: increased)</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 4 (from scale)</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Living Lab procedures
Approach: Qualitative Survey answered by citizens</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>2021</td><td>Current situation</td></tr>
<tr><td></td><td>Future projection</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

Table 5: Result indicator 2.2

Result indicator 2.2	**Increase of perceived security (crime, COVID-19 etc.) in the city-transport system**
Thematic area(s)	✓ Efficiency of transport systems ✓ Resilience of the transport network during particular challenges (such as the organisation of large events) or unforeseen events (such as the COVID-19 pandemic)
Contribution to additional impacts	✓ Sustainable Development Goals (SDGs) / Goal 3 / Target 3.6
Measurement Unit	Qualitative scale: (1: decreased, 5: increased)
Target values	2025: 4 (from scale)
Methodology approach & monitoring tools	Method: Living Lab procedures Approach: Qualitative Survey answered by citizens

Time Horizon	Year	Calculation stage
Base year	2021	Current situation
Future projections	2025	Ex-ante
After real implementation	2025	Ex-post

Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)

Table 6: Result indicator 2.4

<table>
<tr><th>Result indicator 2.4</th><th colspan="3">Reduction in transport related noise pollution</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment and the economy
✓ Efficiency of transport systems</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable & Smart Mobility Strategy</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent (dbB)</td></tr>
<tr><td>Target values</td><td colspan="3">2030: -30%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Transport Modelling
Modelling Approach: Digital Twins
Input Data: Data collection from Living Lab cities, national statistics agencies</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>2016 (OSL)
2014 (GOT)
2012 (HAM)</td><td>Current situation*</td></tr>
<tr><td></td><td>Future projection</td><td>2030</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post*</td></tr>
<tr><td></td><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
<tr><td>References of Harmonization</td><td colspan="3">Sustainable Urban Mobility Indicators
Refined CIVITAS process and impact evaluation framework</td></tr>
</table>

Table 7: Result indicator 2.5

<table>
<tr><th>Result indicator 2.5</th><th colspan="3">Reduction in transport related Nox air pollution as a result of deployed MOVE21 innovations</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment and the economy
✓ Efficiency of transport systems</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable & Smart Mobility Strategy
✓ Sustainable Development Goals (SDGs) / Goal 3 / Target 3.9</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent (µg/m3)</td></tr>
<tr><td>Target values</td><td colspan="3">2030: -15%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Transport Modelling
Modelling Approach: Digital Twins, Simulations
Input Data: Data collection from Living Lab cities, national statistics agencies</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>2018</td><td>Current situation*</td></tr>
<tr><td></td><td>Future projection</td><td>2030</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post*</td></tr>
<tr><td></td><td colspan="3">Monitoring Tool: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
<tr><td>References of Harmonisation</td><td colspan="3">Sustainable Urban Mobility Indicators
Refined CIVITAS process and impact evaluation framework</td></tr>
</table>

Table 8: Result indicator 2.6

<table>
<tr><td>Result indicator 2.6</td><td colspan="3">Reduction in transport related PM2.5 air pollution as a result of deployed MOVE21 innovations</td></tr>
<tr><td>Thematic area(s)
Contribution to additional impacts</td><td colspan="3">✓ Sustainability for society, the environment and the economy
✓ Efficiency of transport systems
✓ Sustainable & Smart Mobility Strategy
✓ Sustainable Development Goals (SDGs) / Goal 3 / Target 3.9</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent (µg/m3)</td></tr>
<tr><td>Target values</td><td colspan="3">2030: -8%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Calculation Method: Transport Modelling
Modelling Approach: Digital Twins, Simulations
Input Data: Data collection from Living Lab cities, national statistics agencies</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation Stage</td></tr>
<tr><td></td><td>Base year</td><td>2019</td><td>Current situation*</td></tr>
<tr><td></td><td>Future projection</td><td>2030</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post*</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
<tr><td>References of Harmonization</td><td colspan="3">Sustainable Urban Mobility Indicators
Refined CIVITAS process and impact evaluation framework</td></tr>
</table>

Table 9: Result indicator 2.7

<table>
<tr><th>Result indicator 2.7</th><th colspan="3">Decrease of average travel time loss per visitor of large (sports) events</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">Sustainability for society, the environment and the economy
Efficiency of transport systems</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">Sustainable & Smart Mobility Strategy
Sustainable Development Goals (SDGs) / Goal 3 / Target 3.9</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent (mins)</td></tr>
<tr><td>Target values</td><td colspan="3">2025: -5%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Transport Modelling
Modelling Approach: Digital Twins, Simulations</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>2022</td><td>Current situation*</td></tr>
<tr><td></td><td>Future projection</td><td>2030</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post*</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
</table>

Table 10: Result indicator 2.8

<table>
<tr><td>Result indicator 2.8</td><td colspan="3">Increase of gender mix in pedestrian space usage per Living Lab city</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Social Cohesion of Urban Areas</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent</td></tr>
<tr><td>Target values</td><td colspan="3">2025: Male: Female 1: 1
2030: Male: Female 1: 1</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Transport Modelling
Modelling Approach: Agent – based modelling
Input Data: Data collection local level (Field observations, cities, national statistics agencies)</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>Measured before innovations are deployed</td><td>Current situation</td></tr>
<tr><td></td><td>Future projections</td><td>2025,
2030</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

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

The third group of indicators (consisting of 10 result indicators) of Living Labs addresses the Impact Area 3 of the MOVE21 Impact Assessment Approach:

Impact 3: Clear improvements of the efficiency and accessibility of the transport networks/systems covering the TEN-T urban nodes or equivalent, and their access to the relevant TEN-T corridor(s) or equivalent transport corridors for transport of freight and/or passengers

Table 11: Result indicator 3.1

<table>
<tr><th>Result indicator 3.1</th><th colspan="3">No. of implemented MOVE21 innovations in the Living Labs</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems
✓ Adequacy and effectiveness of policy and business frameworks
✓ Increase innovation capacity</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Mission board climate neutral and smart cities objectives
✓ Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Number</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 15 (innovations)</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Living Lab procedures
Approach: Questionnaire Survey (policy, administrative or commercial decisions)</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Future projection</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

Table 12: Result indicator 3.3

<table>
<tr><th>Result indicator 3.3</th><th>No. of new (micro) hubs as a result of the Project</th></tr>
<tr><td>Thematic area(s)</td><td>✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems
✓ Adequacy and effectiveness of policy and business frameworks
✓ Increase innovation capacity</td></tr>
<tr><td>Contribution to additional impacts</td><td>✓ Mission board climate neutral and smart cities objectives
✓ Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td>Number</td></tr>
<tr><td>Target values</td><td>2025: 15 (micro-hubs)</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td>Method: Living Lab procedures
Approach: Questionnaire survey (policy, administrative or commercial decisions)
<table>
<tr><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td>Future projection</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
</table>
Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

Table 13: Result indicator 3.4

<table>
<tr><th>Result indicator 3.4</th><th colspan="3">No. of improvements in existing hubs as a result of the Project</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems
✓ Adequacy and effectiveness of policy and business frameworks
✓ Increase innovation capacity</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Mission board climate neutral and smart cities objectives
✓ Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Number</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 33 (improvements)</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Living Lab procedures
Approach: Questionnaire survey (policy, administrative or commercial decisions)</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

Table 14: Result indicator 3.5

<table>
<tr><th>Result indicator 3.5</th><th colspan="3">No. of daily usages of new hubs</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">Sustainability for society, the environment, and the economy
Efficiency of transport systems
Adequacy and effectiveness of policy and business frameworks</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">Mission board climate neutral and smart cities objectives
Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Number</td></tr>
<tr><td>Target values</td><td colspan="3">1 million</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method Transport Modelling
Approach: Hub traffic counts /Simulation</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post*</td></tr>
<tr><td></td><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Dataset.</td></tr>
</table>

Table 15: Result indicator 3.6

<table>
<tr><th>Result indicator 3.6</th><th colspan="3">Load factors in urban freight as a result of MOVE21</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">Sustainability for society, the environment, and the economy
Efficiency of transport systems</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">Sustainable & Smart Mobility Strategy (SSMS)</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent</td></tr>
<tr><td>Target values</td><td colspan="3">2025 : 70%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Calculation Method : Living Lab procedures
Approach : Survey answered by freight companies</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>2020</td><td>Current situation</td></tr>
<tr><td></td><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
</table>

Table 16: Result indicator 3.7

<table>
<tr><td>Result indicator 3.7</td><td colspan="3">Reduced number of heavy (freight) vehicles in circulation as a result of the implementations</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable & Smart Mobility Strategy (SSMS)
✓ Mission board climate neutral and smart cities objectives
✓ Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent</td></tr>
<tr><td>Target values</td><td colspan="3">2025 : -4% (heavy vehicles)</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Living Lab procedures
Approach: Survey answered by freight companies, counts/traffic volume data</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>2021</td><td>Current situation</td></tr>
<tr><td></td><td>Future projection</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
</table>

Table 17: Result indicator 3.8

<table>
<tr><th>Result indicator 3.8</th><th>Increase in zero emission light duty electric vehicles</th></tr>
<tr><td>Thematic area(s)</td><td>✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems
✓ Passenger and freight urban network connectivity.</td></tr>
<tr><td>Contribution to additional impacts</td><td>✓ Sustainable & Smart Mobility Strategy (SSMS)
✓ Mission board climate neutral and smart cities objectives
✓ Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td>Percent (passenger cars)</td></tr>
<tr><td>Target values</td><td>2025: 50%, 2030: 100%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td>Method: Living Lab procedures
Approach: Survey answered by freight companies, counts/traffic volume data
<table>
<tr><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td>Base year</td><td>2021</td><td>Current situation</td></tr>
<tr><td>Future projection</td><td>2025
2030</td><td>Ex-ante</td></tr>
<tr><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
</table>
Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
</table>

Table 18: Result indicator 3.9

<table>
<tr><th>Result indicator 3.9</th><th colspan="3">Increase in public transport use</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">Sustainability for society, the environment, and the economy
Efficiency of transport systems</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">Sustainable & Smart Mobility Strategy (SSMS)
Sustainable Development Goals / Goals 11 / Target 11.2</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent (trips)</td></tr>
<tr><td>Target values</td><td colspan="3">2025 : 15%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Calculation Method: Transport Modelling
Approach: Digital Twins, survey answered by public transport operators, counts/traffic volume data</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>2019</td><td>Current situation*</td></tr>
<tr><td></td><td>Future projection</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post*</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
</table>

Table 19: Result indicator 3.13

<table>
<tr><td>Result indicator 3.13</td><td colspan="3">Modal shift due to decrease of transfer time (associated with MOVE21 hubs)</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">Sustainability for society, the environment, and the economy
Efficiency of transport systems
Passenger and freight urban network connectivity.</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">Sustainable & Smart Mobility Strategy
Sustainable Development Goals / Goal 3 / Target 3.9</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">
<table>
<tr><td colspan="3">Method: Transport Modelling
Modelling Approach: Digital Twins, Simulations
Input Data: Data collection from Living Lab cities, national statistics agencies</td></tr>
<tr><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td>Base year</td><td>Measured before innovations are deployed</td><td>Current situation*</td></tr>
<tr><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td>After real implementation</td><td>2025</td><td>Ex-post*</td></tr>
<tr><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
</table>
</td></tr>
</table>

Table 20: Result indicator 3.14

<table>
<tr><th>Result indicator 3.14</th><th colspan="3">Number of interoperable systems of innovative solutions adopted in the Living Lab cities</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment, and the economy
✓ Efficiency of transport systems
✓ Passenger and freight urban network connectivity.</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Number</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Living Lab procedures
Approach: Questionnaire Survey (policy, administrative or commercial decisions)</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Future projection</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

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

The fourth and final group of indicators (consisting of 10 result indicators) of the Living Labs addresses the Impact 2 of the MOVE21 Impact Assessment Approach:

Impact 4: Positive long-term impacts on social cohesion, economic development, and public perception, resulting in behavioural change and policy change

Table 21: Result indicator 4.1

<table>
<tr><td>Result indicator 4.1</td><td colspan="3">Perceived improved understanding of governance drivers and barriers to implementation of measures</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Adequacy and effectiveness of policy and business frameworks.
✓ Governance structures/mechanisms</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable Development Goals / Goal 17 / Target 17.14,17.17
✓ Active citizen engagement to support uptake of smart urban mobility solutions</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Qualitative scale: (1: poor, 5: good)</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 4.5 (from scale)</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Calculation Method: Living Lab procedures
Approach: Questionnaire Survey answered by city administrations</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation Stage</td></tr>
<tr><td></td><td>Base year</td><td>2021</td><td>Current situation</td></tr>
<tr><td></td><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

Table 22: Result indicator 4.3

<table>
<tr><th>Result indicator 4.3</th><th colspan="3">Number of MOVE21 business models developed</th></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Adequacy and effectiveness of policy and business frameworks
✓ Sustainable business models</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Mission board climate neutral and smart cities objectives
✓ Sustainable Development Goals / Goal 17 / Target 17.14,17.17</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Number</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 6 (business models)</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Calculation Method: Living Lab procedures
Approach: Commercial decisions</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation Stage</td></tr>
<tr><td></td><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
</table>

Table 23: Result indicator 4.4

<table>
<tr><td>Result indicator 4.4</td><td colspan="3">Direct economic sectorial contribution to the welfare to the metropolitan area from city transport</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Sustainability for society, the environment and the economy
✓ Efficiency of transport systems
✓ Resilience of the transport network during particular challenges (such as the organisation of large events) or unforeseen events (such as the COVID-19 pandemic)</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable Development Goals / Goal 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Gross Value Added (GVA) by transport sector, in total GDP</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 1%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Calculation Method: Living Lab procedures/National statistics data
Approach: Share of Gross Value Added by transport sector and storage in total GDP
<table><tr><td>Time Horizon</td><td>Year</td><td>Calculation Stage</td></tr><tr><td>Base year</td><td>2018 (OSL, GOT)
2017 (HAM)</td><td>Current situation</td></tr><tr><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr><tr><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr></table>Monitoring tools: Urban Mobility Monitoring System
Outcome Type: Question (e-template)</td></tr>
<tr><td>References of Harmonisation</td><td colspan="3">Refined CIVITAS process and impact evaluation framework</td></tr>
</table>

Table 24: Result indicator 4.5

<table>
<tr><td>Result indicator 4.5</td><td colspan="3">Increase of pedestrian density/people walking by the areas surrounding the hubs</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Spatial requirements of operators and users
✓ Accessibility to the Scan-Med TEN-T corridor</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable & Smart Mobility Strategy</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 15%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Transport Modelling
Modelling Approach: Agent – based modelling
Input Data: Data collection local level (Field observations, cities, national statistics agencies)</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>Measured before innovations are deployed</td><td>Current situation</td></tr>
<tr><td></td><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
</table>

Table 25: Result indicator 4.6

<table>
<tr><td>Result indicator 4.6</td><td colspan="3">Increase of younger population in areas of interest (neigborhoods of interventions)</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Social characteristics of place and surroundings
✓ Accessibility to the Scan-Med TEN-T corridor</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable Development Goals / Goals 9 / Target 9.1</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Percent</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 15%</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Method: Transport Modelling
Modelling Approach: Agent – based modelling
Input Data: Data collection local level (Provided by city administrations, national statistics, agencies)</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>Measured before innovations are deployed</td><td>Current situation</td></tr>
<tr><td></td><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System
Outcome Type: Dataset</td></tr>
</table>

Table 26: Result indicator 4.7

<table>
<tr><td>Result indicator 4.7</td><td colspan="3">Number of policy solutions proposed or implemented for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab</td></tr>
<tr><td>Thematic area(s)</td><td colspan="3">✓ Governance drivers and barriers
✓ Adequacy and effectiveness of policy and business frameworks</td></tr>
<tr><td>Contribution to additional impacts</td><td colspan="3">✓ Sustainable Development Goals / Goal 11 / Target 11.3</td></tr>
<tr><td>Measurement Unit</td><td colspan="3">Numbers</td></tr>
<tr><td>Target values</td><td colspan="3">2025: 7</td></tr>
<tr><td>Methodology approach & monitoring tools</td><td colspan="3">Calculation Method: Living Lab procedures
Approach: Questionnaire Survey answered by city administrations</td></tr>
<tr><td></td><td>Time Horizon</td><td>Year</td><td>Calculation stage</td></tr>
<tr><td></td><td>Base year</td><td>Measured before innovations are deployed</td><td>Current situation</td></tr>
<tr><td></td><td>Future projections</td><td>2025</td><td>Ex-ante</td></tr>
<tr><td></td><td>After real implementation</td><td>2025</td><td>Ex-post</td></tr>
<tr><td></td><td colspan="3">Monitoring Tools: Urban Mobility Monitoring System, Reflective monitoring
Outcome Type: Question (e-template)</td></tr>
</table>

Table 27: Result indicator 4.8

Result indicator 4.8	**Number of strategic plans that will be reformulated based on the results of MOVE21 in the 3 Living Labs**		
Thematic area(s)	✓ Policy coherence,		
Contribution to additional impacts	✓ Sustainable Development Goals / Goal 17 / Target 17.14		
Measurement Unit	Number		
Target values	2025: >3 (one per LL)		
Methodology approach & monitoring tools	Method: Living Lab procedures Approach: WP6 internal procedures		
	Time Horizon	Year	Calculation stage
	MOVE21 duration	At the end of the capacity building activities.	Ex-post
	Monitoring tools: Urban Mobility Monitoring System Outcome Type: Question (e-template)		

Table 28: Result indicator 4.9

Result indicator 4.9	**Living Labs' Increased innovation capacity regarding organizational issues for implementing innovative mobility solutions**		
Thematic area(s)	✓ Increase innovation capacity		
Contribution to additional impacts	✓ Sustainable Development Goals / Goal 17 / Target 17.14		
Measurement Unit	Number		
Target value	2025: 3%		
Methodology approach & monitoring tools	Method: Living Lab procedures Approach: WP6 internal procedures		
	Time Horizon	Year	Calculation stage
	MOVE21 duration	At the end of the capacity building activities.	Ex-post
	Monitoring tools: Urban Mobility Monitoring System Outcome Type: Question (e-template)		

Table 29: Result indicator 4.10

Result indicator 4.10	**Living Labs' Increased innovation capacity regarding knowledge management needed for implementing innovative mobility solutions**		
Thematic area(s)	✓ Increase innovation capacity		
Contribution to additional impacts	Sustainable Development Goals / Goal 17 / Target 17.14		
Measurement Unit	Number		
Target value	2025: %3		
Methodology approach & monitoring tools	Method: Living Lab procedures Approach: WP6 internal procedures		
	Time Horizon	Year	Calculation stage
	MOVE21 duration	At the end of the capacity building activities.	Ex-post
	Monitoring tools: Urban Mobility Monitoring System Outcome Type: Question (e-template)		

Table 30: Result indicator 4.11

Result indicator 4.11	**Perceived improved understanding of the potential for the upscaling of MOVE21 solutions per Living Lab**		
Thematic area(s)	✓ Sustainability for society, the environment, and the economy ✓ Efficiency of transport systems ✓ Increase Innovation Capacity		
Contribution to additional impacts	✓ Mission board climate neutral and smart cities objectives ✓ Sustainable Development Goals / Goals 9 / Target 9.1		
Measurement Unit	Qualitative scale: (1: poor, 5: good)		
Methodology approach & monitoring tools	Calculation Method: Living Lab procedures Approach: Questionnaire Survey answered by city administrations		
	Time Horizon	Year	Calculation Stage
	Future projections	2025	Ex-ante
	After real implementation	2025	Ex-post
	Monitoring tools: Urban Mobility Monitoring System Outcome Type: Question (e-template)		

5 Next Steps

The next steps concern the calculation and monitoring of each individual result indicator and the integration of these results in order to monitor the progress of each impact area per project time slot (ex-ante, ex-durante, ex-post). A key role throughout the monitoring process will have the UMMS, which will be structured in order to facilitate the organized and systematic calculation and analysis of the KPIs. During the continuous exchange of data, and the evaluation of the available information by the different WPs and the Living Lab cities, possible modifications of the current framework would take place in order to ensure that the KPIs proposed by the project are based on accurate data and which will result in a realistic impact assessment.

In addition to the monitoring and analysis of the values of the result indicators, the alignment of the indicators with the strategic documents, policies and thematic areas presented in sub-Chapter 3.2 will take place. The alignment will be achieved and maintained through the continuous data update, the design and implementation of the questionnaire surveys and interviews and the actual appraising of the result indicators values.

Therefore, following step by step the methodological approach presented at the impact assessment framework, the periodical calculation of the indicators will take place, as well as the integration of these values per impact area. In every stage of this procedure (ex-ante, ex-durante, ex-post), the results will be carefully studied while the comparison of the targeted and the calculated values (as stated per indicator methodology sheet) will give feedback to the three Living Labs for discussing possible modifications in the innovative mobility solutions implementation or/and operation. This is exactly the main reason that the assessment framework has been designed as a periodical procedure and will be implemented in specific time slots of the project lifetime. To avoid failures that would be showed in the ex-post evaluation when modifications are hard to realize.

What must be noted at this point, is the possible modification of some KPIs, if there will be barriers in the collection of the pre-described data that is needed for their calculation or if the data provided by the Living Labs is not accurate. In order to ensure that the impact framework results will mirror the real achievements of the project, alternative data will be gathered and specific modifications would be realized in the calculation of the relative KPIs.

Finally, the next steps include the use of the current framework as a foundation for the structure of the framework of the replicator cities, paving the way for and influencing the replicator cities to implement their selected innovative mobility solutions.

6 References

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[7] Dijkstra, L., H. Poelman and P. Veneri (2019), "The EU-OECD definition of a functional urban area", OECD Regional Development Working Papers, No. 2019/11, OECD Publishing, Paris, https://doi.org/10.1787/d58cb34d-en.

Annex

Table 31: Summary of result indicators (Impact Area 1)

Impact 1	Long-term decarbonisation			
#	Result indicator	Assessment mechanism	Target Value Year 1: 2025	Target Value Year 2: 2030
Result indicator 1.1	CO2 reductions from local road transport in Living Lab cities: private cars, vans, heavy vehicles (incl. buses)	Use of energy or km driven. Data collection local level (Living Lab cities, national statistics agencies), simulations	-15%	-30%
Result indicator 1.3	No. of MOVE21 innovations upscaled in the three Living Labs	Policy, administrative or commercial decisions	12	-
Result indicator 1.6	Increased capacity to incorporate data-driven approaches in mobility planning	Qualitative survey answered by city administrations (scale 1-5)	5	-

Table 32: Summary of result indicators (Impact Area 2)

Impact 2	Reliable solutions for a more sustainable, inclusive, safe, and secure mobility system, including for the secure mobility of people and freight during major/sport events			
#	Result indicator	Assessment mechanism	Target Value Year 1: 2025	Target Value Year 2: 2030
Result indicator 2.1	Increased self-perceived inclusiveness from the implementation of transport solutions	Qualitative survey answered by citizens (scale 1-5)	4	-
Result indicator 2.2	Increase of perceived security (crime, COVID-19 etc.) in the city-transport system	Qualitative survey answered by citizens (scale 1-5)	4	-
Result indicator 2.4	Reduction in transport related noise pollution	Data collection local level (cities, national statistics agencies), simulations	-	-20%
Result indicator 2.5	Reduction in transport related Nox air pollution as a result of deployed MOVE21 innovations	Use of energy or km driven. Data collection local level (cities, national statistics agencies), simulations	-	-15%
Result indicator 2.6	Reduction in transport related PM2.5 air pollution as a result of deployed MOVE21 innovations	Data collection local level (cities, national statistics agencies), simulations	-	-8%
	Decrease of average travel time loss per	Simulation	-20%	-

Result indicator 2.7	visitor of large (sports) events			
Result indicator 2.8	Increase of gender mix in pedestrian space usage per Living Lab city	Simulation	Male: Female 1:1	Male: Female 1:1

Table 33: Summary of result indicators (Impact Area 3)

Impact 3	Clear improvements of the efficiency and accessibility of the transport networks/systems covering the TEN-T urban nodes or equivalent, and their access to the relevant TEN-T corridor(s) or equivalent transport corridors for transport of freight and/or passengers			
#	Result indicator	Assessment mechanism	Target Value Year 1: 2025	Target Value Year 2: 2030
Result indicator 3.1	No. of implemented MOVE21 innovations in the Living Labs	Policy, administrative or commercial decisions	15	-
Result indicator 3.3	No. of new (micro)hubs as a result of the Project	Policy, administrative or commercial decisions	15	-
Result indicator 3.4	No. of improvements in existing hubs as a result of the Project	Policy, administrative or commercial decisions	33	-
Result indicator 3.5	No. of daily usages of new hubs	Hub traffic counts /Simulation	1milion	-
Result indicator 3.6	Load factors in urban freight as a result of MOVE21	Survey answered by freight companies	70%	-
Result indicator 3.7	Reduced number of heavy (freight) vehicles in circulation as a result of the implementations	Survey answered by freight companies, counts/traffic volume data	-4%	0
Result indicator 3.8	Increase in zero emission light duty electric vehicles	Data collection by cities	50%	100%
Result indicator 3.9	Increase in public transport use	Data collection by public transport companies	15%	-

Result indicator 3.13	Exchange points' decrease of delays and modal shift associated with MOVE21 hubs	Simulations	-	-
Result indicator 3.14	Number of interoperable systems of innovative solutions adopted in the Living Lab cities.	Data collection by cities		-

Table 34: Summary of result indicators (Impact Area 4)

Impact 4	Positive long-term impacts on social cohesion, economic development, and public perception, resulting in behavioural change and policy change			
#	Result indicator	Assessment mechanism	2025	2030
Result indicator 4.1	Perceived improved understanding of governance drivers and barriers to implementation of measures	Qualitative survey answered by city administrations (scale 1-5)	4.5	-
Result indicator 4.2	No. of sets of policy solutions implemented for ensuring the successful establishment of MOVE21 mobility hubs and/or solutions	Policy or administrative decisions	6 (2024)	-
Result indicator 4.3	Number of MOVE21 business models developed	Commercial decisions	6	-
Result indicator 4.4	Direct economic sectorial contribution to the welfare to the metropolitan area from city transport	Share of GVA (gross value added) by transport sector and storage in total GDP (Living Lab level)	1%	-
Result indicator 4.5	Increase of pedestrian density / people walking by the areas surrounding the hubs	Simulation	15%	-

Result indicator 4.6	Increase of younger population as visitors.	Simulation	15%	-
Result indicator 4.7	Number of policy solutions proposed for ensuring the successful establishment of MOVE21 mobility hubs per Living Lab MOVE21 mb.	Policy or administrative decisions		-
Result indicator 4.8	Number of strategic plans that will be reformulated based on the results of MOVE21 in the 3 Living Labs.	MOVE21 internal processes	-	-
Result indicator 4.9	Living Labs' Increased innovation capacity regarding organization issues for implementing innovative mobility solutions	Qualitative survey answered by city administrations (scale 1-5)	-	-
Result indicator 4.10	Living Labs' Increased innovation capacity regarding knowledge management needed for implementing innovative mobility solutions	Qualitative survey answered by city administrations (scale 1-5)	-	-
Result indicator 4.11	Perceived improved understanding of the potential for the upscaling of MOVE21 solutions per Living Lab	Qualitative survey answered by city administrations (scale 1-5)	-	-