FORTHCOMING

D1.3 Innovation Quality, Risk Mitigation, and Data Management Plan

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Introduction

The FORTHCOMING project focuses on developing and testing data-driven, user-centric models of the 15-minute city concept, tailored specifically to suburban areas. By focusing on these peripheral zones, the project aims to address the unique challenges of suburban contexts, including lower densities, limited connectivity, and reduced accessibility to essential services. It aims to bridge the gap between suburban settings and urban best practices by fostering livable, inclusive, and climate-neutral communities through innovative approaches to mobility, digitalization, and land use.

The Innovation Quality, Risk Mitigation, and Data Management Plan is critical to achieving the project's goals. This report outlines the processes and standards guiding quality assurance, risk management, and data governance throughout the project lifecycle. By integrating these strategies, the project aims to maintain standards across all work packages, ensure proactive management of potential project risks, and establish data practices that support transparent, interoperable, and reusable data for current and future urban development.

The content of this report is presented below:

1. Innovation Quality Framework: The first chapter ensures that each deliverable upholds high standards of quality and consistency across the project, facilitating a cohesive approach to innovative solutions tailored to suburban settings.
2. Risk Mitigation Strategy: The second chapter identifies potential project risks, outlines mitigation measures, and establishes a proactive risk assessment process designed to support adaptive and resilient project development.
3. Data Management Plan (DMP): The final chapter of the report establishes clear guidelines for data handling, adhering to FAIR principles (Findable, Accessible, Interoperable, and Reusable), while ensuring compliance with regulatory standards and enabling meaningful data exchange among partners.

1. Innovation Quality Framework

The *Innovation Quality Framework* underpins the FORTHCOMING project's commitment to delivering high-impact, sustainable solutions for the 15-minute city model in suburban areas. This chapter outlines a structured approach to ensure excellence across all project outputs.

Section 1.1 defines Innovation Quality Benchmarks, setting measurable criteria for completeness, accuracy, usability, relevance, scalability, and timeliness. These benchmarks guide the evaluation and alignment of work packages with project goals. Section 1.2 details the Innovation Quality Control Process, a systematic workflow involving collaborative reviews, iterative revisions, and final quality assurance to ensure deliverables meet the highest standards of accuracy, relevance, and consistency. Section 1.3 highlights Continuous Improvement, focusing on lessons learned, process enhancements, and proactive problem-solving to refine quality and efficiency throughout the project. Together, these strategies ensure that all outputs contribute meaningfully to advancing suburban 15-minute city solutions while fostering innovation and sustainability.

1.1. Innovation Quality Benchmarks

Each work package and deliverable of the project will be developed to meet defined quality benchmarks, ensuring high consistency, relevance, and impact. These benchmarks provide clear, measurable criteria that align with FORTHCOMING's objectives, focusing on the effectiveness, replicability, and usability of 15-minute city solutions for suburban settings. The benchmarks are tailored to each work package's goals, providing a structured framework to assess deliverables across several critical dimensions. Benchmarks are given:

- Completeness
  Benchmark: All WPs and their associated deliverables must be fully executed, addressing all defined objectives, tasks, and outputs. Each deliverable should be fully developed, containing all required sections, data, and analyses specific to its scope. Completeness is verified by cross-referencing the deliverable with its defined scope and the project's original objectives.
  - Measure:
    - 100% task completion for each WP, ensuring that each activity aligns with the project's original scope.
    - Achieve 100% coverage of required content of the deliverable as outlined in the work package documentation.
  - Validation: UPM and other partners review deliverables against a checklist to confirm all aspects are fully addressed. A checklist to be developed according to the project output is presented in Table 1.

Table 1. Indicative Checklist for Completeness Validation

1. Scope Alignment	
✓	Ensure the deliverable aligns with the **project's objectives** and the defined **scope of work**.
✓	Check whether the WP adequately address its defined scope and responsibilities.
✓	Verify that the content covers all **requirements stated in the work package documentation**.
✓	Check whether the methodologies used in the WP consistent with project standards.
2. Structural Review	
✓	Check whether inputs from other WPs integrated into the WP's tasks and outputs.
✓	Confirm the deliverable contains all **required sections** (e.g., Introduction, Methodology, Data, Analysis, Conclusions, Recommendations, Appendices).
✓	Cross-check against the **template or structure guidelines** provided for the deliverable.
3. Content Coverage	
✓	Check whether the WP's contribution to the overall project is clear and measurable?
✓	Validate the deliverable includes all specified **data**, **analyses**, and **supporting evidence as mentioned in the project proposal**.
✓	Ensure no **missing sections or incomplete sections** remain.
4. Cross-Referencing	
✓	Cross-reference the content with the any other applicable **checklist or standards**.

- Accuracy
  Benchmark: All data, analysis, and findings presented in each WPs must be accurate, validated by

relevant data sources, and methodologically sound. This ensures that deliverables provide reliable and credible results.

   - **Measure**: Accuracy of all quantitative data, with cross-referenced data sources.
   - **Validation**: Peer review by partners and data or resource validation checks using original datasets and references.

- **Usability**
  Benchmark: WPs must actively engage stakeholders (e.g., living labs, municipal authorities, EU partners) and produce actionable, user-friendly outputs. This includes ensuring clarity, ease of interpretation, and practical recommendations that stakeholders can readily apply.
   - **Measure**: Obtain positive feedback (≥80% satisfaction rate) from stakeholders engaged in WPs such as WP4 (Urban Living Labs) and WP7 (Dissemination)
   - **Validation**: Conduct iterative feedback process to assess deliverable readability, accessibility, and applicability with the participation of living labs.
- **Relevance**
  Benchmark: Ensure all WPs and deliverables directly support the project's aim of advancing the 15-minute city (15minC) concept, with a focus on suburban applications. This includes ensuring alignment with project themes, addressing the specific needs of suburban contexts, and contributing to scalable, real-world solutions.
   - **Measure**: 100% alignment of WPs with the project's objectives as verified by objective-specific checklists.
   - **Validation**: Relevance is validated through UPM and Parabol reviews and cross-referencing deliverables against the project goals and expected impacts.
- **Transferability and Scalability**
  Benchmark: Deliverables should include insights, strategies, and guidelines that can be transferred and scaled to other suburban contexts beyond the initial case studies. Transferability is critical to the success of FORTHCOMING's innovations across diverse settings.
   - **Measure**: Inclusion of transferable frameworks or methodologies relevant WPs, with documented adaptation guidelines for different suburban contexts.
   - **Validation**: Partner reviews to confirm transferability and scalability potential. The following questions can be used in the control:
      - ✓ Are WP outputs designed to be adaptable to other suburban areas or contexts?
      - ✓ Do outputs include guidelines or frameworks for scaling and transferability?
      - ✓ Have insights from Urban Living Labs or case studies been generalized for broader use?
- **Timeliness**
  Benchmark: Each deliverable must be completed within the timeframe specified by the project's work plan, ensuring the project's progress remains on schedule and aligned with overarching timelines.
   - **Measure**: 95% on-time delivery rate across all work packages.
   - **Validation**: UPM will track the submission of deliverables to identify and mitigate any risks of delay.
- **Multi-Stakeholder Impact Assessment**
  Benchmark: WPs-especially WP6- must ensure a robust evaluation of the project's impact through multi-stakeholder perspectives.

- Measure: Achieve 100% completion of stakeholder impact assessments for all participating cities and living labs.
- Validation: Use feedback mechanisms such as workshops, surveys, and interviews, ensuring diverse stakeholder representation.

- Dissemination and Knowledge Sharing
  Benchmark: WP7 should ensure broad dissemination of results, with outputs like the “15minC Implementation Guidebook” reaching key audiences.
    - Measure: Disseminate project outcomes to stakeholder groups given in the D7.1. Dissemination and Communication Plan.
    - Validation: Track engagement metrics (e.g., downloads, event participation) and feedback on knowledge-sharing initiatives.

Each benchmark is tracked and documented to foster transparency and accountability, making quality assurance a central pillar of the project’s approach to innovation.

1.2. Innovation Quality Control Process

Continuous monitoring and control mechanisms are established to track the progress and impact of implemented innovations. The progress of the work packages will be handled by the consortium leader UPM. The quality of the outputs and deliverables generated as a result of the work packages will be performed in the following order:

Step 1: Submission to Repository by Responsible Partner

The **Responsible Partner** completes the initial draft of the output or deliverable and submits it to the designated FORTHCOMING repository. This version is considered the first draft and must meet initial quality standards before proceeding to the next steps. The submission includes documentation of methodologies, data sources, and any assumptions made, providing a clear baseline for other partners to review.

Step 2: Review by Other Partners

Other Partners in the consortium will be notified of the output or deliverable submission and access it through the repository. Each partner is responsible for reviewing the content to ensure it aligns with project objectives, complies with applicable standards, and meets quality expectations. Partners examine the deliverable for any inconsistencies, errors, or areas that require improvement. This review includes:

- ✓ **Technical Accuracy**: Verification of data and methodologies.
- ✓ **Relevance**: Ensuring the deliverable aligns with project goals and outputs.
- ✓ **Clarity**: Checking for clear explanations and completeness of content.

After the review, partners document their feedback and suggested changes in a structured format (e.g., comments in the document or a separate feedback form) and submit it back to the Responsible Partner for revisions.

Step 3: Revisions by Responsible Partner

The **Responsible Partner** reviews all feedback from other partners and implements necessary changes to address any concerns or suggested improvements. This stage is critical to ensuring that the output or deliverable evolves to meet the quality standards and expectations of the consortium. The Responsible Partner carefully tracks each piece of feedback, noting whether it was addressed or, if not, providing a rationale for any suggestions that were not implemented. Once revisions are completed, the Responsible Partner submits the revised deliverable (now referred to as **Version 2**) back to the repository for further review.

Step 4: UPM Review of Version 2

The **UPM** is responsible for an additional layer of review of Version 2.

This review focuses on compliance with project specifications and overall quality control:

i. **Alignment with Project Standards**: Ensuring the WP meets the technical standards and guidelines outlined in the proposal under Chapter **4. Quality of Work, Project Objectives and Targets.**

ii. **Consistency with Project Scope**: Confirming the WP remains within the defined scope and goals of the project as given below:
   - *SO1: analysis of existing and development of new data-driven strategies for multimodal mobility integration, to improve the movement of persons and goods and to promote public transport as a backbone of sustainable mobility;*
   - *SO2: set-up of six Urban Living Labs in suburban areas to empower co-creation, knowledge exchange and stakeholders´ involvement;*
   - *SO3: promotion of digitalization for reliable information and management;*
   - *SO4: development of innovative policies for reallocation of urban space and mix of uses through co-creation*

iii. **Final Quality Adjustments**: Making any last recommendations for adjustments to enhance the clarity, accuracy, or completeness of the WP.

UPM documents any additional revisions or feedback, that the Responsible Partner may need to address before the final QA stage.

Step 5: Final QA by Parabol

Parabol, as the QA lead, conducts a final quality assurance review of the deliverable to ensure it meets the highest standards before final approval. This final QA review is comprehensive, covering:

- **Compliance Verification**: Ensuring the output or deliverable adheres to all project specifications, contractual obligations, and quality benchmarks.
- **Consistency and Cohesion**: Checking that all sections are consistent, cohesive, and well-integrated, without discrepancies or gaps in information.
- **Final Formatting and Presentation**: Reviewing for professional formatting, presentation, and adherence to document standards, making sure the deliverable is ready for external stakeholders if needed.

If the QA team at Parabol identifies any remaining issues, they provide specific instructions for final adjustment. Once the deliverable passes this stage, it receives final approval and can be published or presented as part of the project's formal outputs.

Summary of Quality Control Workflow:

This structured approach ensures that WPs undergo quality checks, fostering collaboration and maintaining high standards of accuracy, reliability, and relevance to the project's goals. By implementing Quality Control Workflow as given in Figure 1, the Project aims to foster a culture of creativity and continuous improvement. Structured processes for idea generation, cross-disciplinary collaboration, evaluation, and implementation ensure that the best ideas are brought to life, driving the project's success and sustainability. Continuous monitoring and a supportive environment further enhance the project's ability to innovate and stay ahead in a competitive landscape.

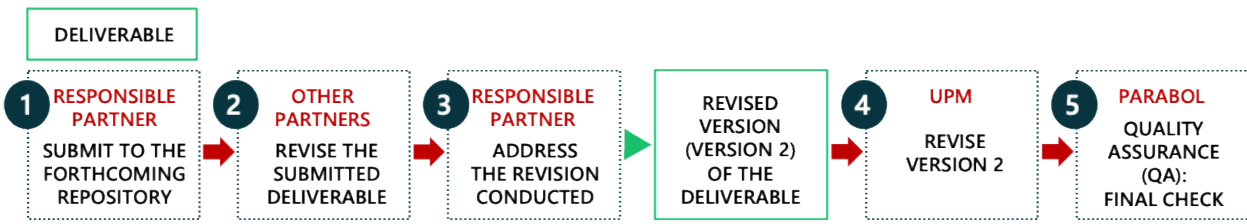

Figure 1. Quality Control Workflow

1.3. Continuous Improvement

Continuous improvement is a core principle of the QA strategy, ensuring that quality is consistently enhanced over time. A structured approach to capturing lessons learned, integrating feedback, and implementing adjustments enhances project outcomes and supports collaboration across consortium partners.

- **Lessons Learned:** Regular sharing of lessons learned during Project Coordination Meetings is a cornerstone of the project's improvement strategy.

  Activities:
    - Sharing Experiences during Project Coordination Meetings: Key successes, challenges, and areas for improvement encountered by partners will be presented during each coordination meeting.
    - Collaboration and Discussion: Consortium members discuss lessons learned to identify trends, best practices, and actionable insights.
    - Application to Future Tasks: Lessons learned are integrated into the planning and execution of subsequent activities to avoid recurring issues and capitalize on successful approaches.

  Benefits:
  - Promotes transparency and open communication among consortium partners.
  - Facilitates knowledge transfer across Work Packages.
  - Encourages proactive resolution of potential risks.

- **Process Improvement Initiatives:** Specific initiatives are undertaken to improve processes and enhance quality. These initiatives may involve adopting new technologies, refining existing procedures, or implementing best practices from other projects. Implementing small, practical changes throughout the project allows for incremental improvements that collectively enhance efficiency and quality.

  Activities:
  - Identifying Inefficiencies: Project team members highlight bottlenecks or redundancies in workflows.
  - Collaborative Problem-Solving: Partners propose and agree on straightforward changes to address identified issues.
  - Monitoring Impact: Adjustments are reviewed to ensure they lead to measurable improvements without disrupting ongoing tasks.

  Examples:
  - Streamlining reporting formats for efficiency.
  - Adjusting meeting schedules or formats to better accommodate partner availability.
  - Refining templates or tools used for documentation or data collection.

In brief, by implementing these quality assurance strategies, the project aims to ensure that all WPs meet the required standards and specifications. Structured QA processes, continuous monitoring, and a focus on continuous improvement help maintain high-quality standards throughout the project lifecycle. This comprehensive approach not only ensures stakeholder satisfaction but also sets a benchmark for quality in future initiatives. The project's commitment to quality assurance fosters a culture of excellence and continuous improvement, ensuring long-term success and sustainability.

2. Risk Management Strategy

The purpose of this section is to outline the risk management strategies and measures implemented within the project. Effective risk management is crucial for identifying, assessing, and mitigating potential risks that could impact the project's success. This section details the processes and frameworks established to manage risks throughout the project's lifecycle, ensuring that the project remains on track and achieves its objectives. To ensure that risk management is an integral part of the project, the following strategic measures will be implemented:

- **Risk Management Plan (RMP):** A risk management plan has been drafted, outlining the key processes, procedures, and responsibilities for managing risks (See Annex 1). This plan serves as a roadmap for risk management activities and provides a structured approach to identifying, assessing, and mitigating risks.

- **Risk Management Framework:** The project adopts a standardized risk management framework, which includes the identification, analysis, evaluation, treatment, monitoring, and reporting of risks. This framework ensures a consistent and systematic approach to risk management.

- **Continuous Risk Assessments:** Regular risk assessments are conducted every six months to review and report on risks encountered in project processes by each partner. This ensures that risks are continuously monitored and addressed. If a risk is identified, Parabol will be contacted and the Annex 1 will be filled.

2.1. Risk Management Framework

The following steps will be adopted to identify, mitigate, or eliminate risks:"

Step 1: Risk Identification Process

Identifying potential risks early in the project is critical for proactive risk management. The collaboration between Parabol as the Risk Manager and other partners plays a central role in this process:

- Risk Register:

  A risk register will be maintained within the Risk Management Platform to document all identified risks. It includes key details such as risk description, potential impact, likelihood, risk owner, and mitigation strategies (See Annex 1).

  - When any partner identifies a potential risk, they notify Parabol. Parabol should process the detected risk in the RMP and initiate discussions with the relevant partners.
  - Conversely, if Parabol identifies a risk within a work package, Risk Manager includes the risk directly in the RMP and engages with the relevant partner to address it collaboratively.This iterative process ensures a dynamic and inclusive approach to risk identification, enabling all parties to contribute effectively.

- Continuous Monitoring and Reporting:
  Mechanisms are established to track risks and evaluate mitigation actions:

  - Risk Monitoring: Regular reviews will be conducted by Parabol to assess the status of risks and the effectiveness of mitigation strategies. Updates to the risk register, periodic risk reviews, and new risk assessments will ensure ongoing alignment. Key activities in regular reviews will include:

    i. **Tracking Timeline and Progress:**
       - Review the implementation status of each risk mitigation action.
       - Compare planned timelines against actual progress to identify delays or gaps.

    ii. **Communication with Partners:**
       - Actively engage with project partners to discuss risks they foresee or challenges they are experiencing.
       - Incorporate partner insights into risk assessments to ensure a comprehensive understanding of the risk landscape.

    iii. **Updating the Risk Register:**
       - Add new risks identified during the review period.
       - Reassess existing risks for changes in likelihood, impact, or priority.
       - Archive or de-escalate risks that are no longer relevant.

  - Risk Reporting: Risk reports shall be prepared when necessary, providing updates on identified risks, mitigation progress, and changes in the risk profile. These reports will be shared with all partners to maintain transparency.

Step 2 - Risk Management Workshop

Once risks are identified, a collaborative approach can be employed if necessary to analyze, evaluate, and respond to them through an online **Risk Management Workshop** planned and led by Parabol and involving all relevant partners. If workshop is not deemed necessary, Parabol and the relevant partners will collaborate and take the necessary measures.

- Risk Analysis:
  - **Qualitative Risk Analysis:** Risks will be prioritized based on their potential impact and likelihood. This will be conducted collaboratively, with all relevant partners contributing to categorizing risks as high, medium, or low priority.
  - **Quantitative Risk Analysis:** For critical risks, numerical techniques (e.g., decision tree analysis) will be applied to assess potential impacts, with input from all stakeholders to ensure comprehensive analysis.
- Developing Mitigation Strategies:
  Effective mitigation strategies will be planned and executed in close coordination with partners:
  - **Risk Response Planning:** For each risk, Parabol facilitates discussions to determine suitable response strategies such as avoidance, reduction, transfer, or acceptance. The chosen approach will be agreed upon collaboratively and tailored to the risk's characteristics.
  - **Mitigation Actions:** Specific actions will be defined and documented in the risk register. These actions will be monitored and regularly updated by Parabol in consultation with partners to ensure their relevance and effectiveness.
  - **Strategy Development:** After each workshop, Parabol will consolidate input from partners to develop robust mitigation strategies. These strategies will be designed to address specific risks while considering the collective insights of all involved parties.

To conclude, the risk management process will begin with **risk detection**, where partners or Parabol will identify potential risks and document them in the Risk Management Platform (RMP). These risks will be recorded in the risk register, detailing descriptions, impacts, likelihoods, owners, and mitigation strategies. Parabol will validate and process the risks while collaborating with partners to ensure accuracy. Through continuous **monitoring**, Parabol will track risk status and the effectiveness of mitigation actions, while partners will provide updates as required. Parabol will facilitate **Risk Management Workshops** with partners to analyze and prioritize risks and to develop mitigation strategies as needed. Partners will implement agreed actions, while Parabol will oversee progress and update the RMP as part of an ongoing, collaborative process. By fostering active collaboration between Risk Manager (Parabol) and other project partners, the risk management process becomes a shared responsibility, ensuring comprehensive risk mitigation and project resilience.

2.2. Risks and Associated Contingency Plans

As mentioned in Section 2.1, to ensure smooth project progress and minimize potential disruptions, the consortium partners will implement structured actions to monitor the progress of work packages (WPs) and overall project development. The main management, research, and technical risks and corresponding contingency plans are summarized in the Risks and Contingency Plan table below. Table 2 identifies potential risks, categorizes them according to their probability and impact, and describes emergency measures to effectively address each scenario. In addition, a risk management matrix has been created to keep the risks up to date (Annex 1).

Table 2. Risks and Contingency Plan

Risk No.	Description	WP No.	P1	I2	Contingency Plan
1	Failure of a WP leader to fulfill WP leadership	All	L	M	If a co-applicant initially assigned to WP leadership fails, another co-applicant will take care of the WP activities. If all co-applicants involved in one specific WP fail, then a co-applicant with a higher number of PM will take the responsibility.
2	Failure of one partner: leaving consortium, underperforming.	All	L	L	If one partner leaves the consortium, its assigned tasks will be allocated to other partners with enough expertise to assume the responsibility.
3	Breach of objectives		M	M	The Project Coordinator (UPM) will control and monitor the tasks of each WP so that the results obtained meet the objectives proposed. It will be assisted by Parabol, responsible for QA.
4	Delays on delivery of the results.	All	M	M	Project Coordinator (UPM) will take actions if a milestone is not fulfilled on time. In case of a delay, the research agenda will be rescheduled, ensuring the minimum level of impact on the project.
5	Budget (time/cost) overrun.	All	M	L	Budget and Timing of budget execution will be constantly monitored in relation with the project outputs. Delays and overcosts will be corrected by reducing other task costs with the help of the WP responsible.
6	WP not achieving expected results or Deliverables.	All	L	L	All WP leaders are responsible for ensuring that a draft version of the deliverable is ready one month before the deadline, taking actions to avoid delays and poor-quality Deliverables. QA and project coordinator will supervise the process.
7	Difficulties to set-up the ULLs in any of the CS.	4	L	H	The Consortium incorporates a variety of committed stakeholders in each CS, that will facilitate the set-up of ULL. In the unlikely scenario that ULL setup is not

					possible, activities will be adjusted to fully achieve project´s objectives in the new conditions.
8	Unavailability of adequate experts for the FGs in any of the CS.	3 5	L	M	The diversity of co-applicants and committed co-operation partners facilitates the search of FG participants due to large network and contact resources available.
9	Difficulties in getting valid outputs to feed the KPIs to measure project impacts.	6	L	M	Results and KPIs will be reviewed to ensure the impact measurements; KPIs will be reformulated if necessary to be based on achievable results to deliver appropriate impact analysis.
10	Poor quality content of Guidebook and publications.	7	L	M	There are 6 universities involved in the project with a large expertise in publications that will look for other sources to complete the content of the scientific and practical dissemination materials.
1 Probability: Low (L), Medium (M), High (H). 2 Impact: Low (L), Medium (M), High (H).					

2.3. Continuous Risk Management

To ensure ongoing risk management throughout the project, the RMS will be regularly updated:

- **Updating RMS:** The RMS will be reviewed and updated as the project progresses. This involves incorporating new risks, modifying existing mitigation strategies, and adapting to changes in the project environment.
- **Implementing Corrective Actions:** After each risk assessment, corrective actions will be planned and realized against identified risks or problems. Corrective actions will be implemented quickly and effectively to ensure the healthy progress of the project and the achievement of the objectives.
- **Lessons Learnt:** The project team regularly reviews lessons learned from past activities to identify best practices and areas for improvement. These lessons will be documented and shared across the team to foster a culture of continuous improvement.
- **Process Improvement Initiatives:** Specific initiatives will be undertaken to improve risk management processes. These initiatives may involve adopting new technologies, refining existing procedures, or implementing best practices from other projects.

Implementing these risk management strategies will ensure proactive identification, assessment, and mitigation of potential risks that could impact the project's success. Structured risk management processes, continuous monitoring, and a focus on continuous improvement help maintain a high level of risk awareness and preparedness throughout the project lifecycle. This comprehensive approach not only ensures the project's resilience but also sets a benchmark for risk management in future initiatives.

3. Data Management Plan

The purpose of this section is to outline the data management plan to be implemented within the project. Effective data management ensures that all data related to the project is handled securely, efficiently, and in compliance with relevant regulations. This section details the processes, tools, and frameworks established to collect, store, process, and protect data throughout the project's lifecycle.

The outputs of the FORTHCOMING project rely heavily on the integration of various types of data to ensure a data-driven approach in achieving the project's objectives. Quantitative data such as transport usage statistics, demographic patterns and geographical mapping form the backbone of outputs such as D3.2 (KPIs) and D6.2 (Impact Assessments), enabling precise measurement and evaluation of urban and suburban dynamics. Qualitative data collected through surveys, interviews and focus groups enrich outputs such as D3.1 (SWOT Analysis) and D5.1 (Methodology for Strategy Transfer) by capturing stakeholder insights and contextual nuances as given in the tables below. Finally, the synthesis of comparative best practices and local case study findings results in high-impact outputs such as D2.1 (Portfolio of Successful Strategies) and D7.2 (15minC Implementation Guide) that provide actionable insights for policy makers and practitioners. By linking data types to specific outputs, the project achieves a comprehensive framework for advancing the 15-minute city model.

To ensure the effective integration and operation of the project outputs, robust data governance, sharing, and management framework is essential. As highlighted in the “Mobility as a Service (MaaS) and Sustainable Urban Mobility Planning” guide published by Ertico, sustainable data management must be established by adhering to principles that ensure transparency, reliability, and inter-operability. This framework is crucial for enabling seamless monitoring, evaluation, and planning processes throughout the project lifecycle.

Data management and policy;

- It should comply with open data principles,
    - A scalable mobility data sharing framework (confidentiality, transparency, ownership, reliability) should be established,
    - Multi-modal mobility should be implemented for cross-modal integration.

It should be based on the legal framework and principles. This policy is described as 4P by NACTO Policy.

The implementation of a sustainable data management system requires addressing the following critical components:

1. Data Architecture and Standards: Establishing a standardized approach to organizing, storing, and managing data.
2. Data Warehousing and Reporting: Developing centralized data repositories and reporting mechanisms for streamlined analysis.
3. Data Integration and Publication: Ensuring seamless integration of diverse datasets and their publication for public and stakeholder use.
4. Platforms and Hosting: Building scalable and secure platforms to host and manage the project's data infrastructure.

A Data Management Plan (DMP) is essential for the successful handling of project data. The main components of this plan are given below:

i. **Development of a Data Catalog:** At the beginning of the project, a data catalog is developed and elaborated (See Annex 2). The catalog includes columns such as **Data Source, Data Usage Area/Analysis, Data Description, Type, Partner, Public/Company, Completeness, Time Dimension, Validity** for each data. This catalog helps in efficiently tracking and managing data assets, ensuring data is well-organized and easily accessible. Parabol leads the creation and maintenance of the Data Catalogue, ensuring that all partners have the necessary templates and guidance. It is responsible for ensuring that data is accurately represented in the catalogue. WP Leaders populate the data catalogue with details on data types, sources and use cases. Other partners contribute data collected for their work packages and update the catalogue as new data is collected, ensuring completeness and alignment with project objectives. As a dynamic and enduring tool, the Data Catalog plays a critical role in monitoring the sustainable and smart growth of urban transport, supporting the overarching goal of the 15minC philosophy.

ii. **Data Collection:** Collecting accurate and reliable data is critical for the project's success. According to the data written in the Data Catalog, Parabol coordinates the data collection process among all partners, ensures consistency in methods and ensures that all partners follow the guidelines for surveys, interviews, focus groups and observations. WP leaders and other partners implement the agreed data collection methods in their work packages. Data types, sources, and collection methods are given below. What is presented below may vary based on the Data Catalog to be filled in:

- **Data Types and Usage Areas:** Below are the types of indicative data required for the production of the main outputs of the project and their applications in the production of outputs:

Data Type	Usage Area
Quantitative and Spatial Data	
Transport Data: Modal split statistics, public transport use, traffic flows and multimodal travel patterns.	D3.2. Definition of the Key Performance Indicators (KPIs): Input-KPIs, Process-KPIs, and Outputs-KPIs. D5.2. Transfer potential city-to-suburbs and scaling-up to other contexts and cities.
Demographic Data: Population density, socioeconomic status and urban/suburban characteristics.	D3.1. SWOT Analysis of 15minC Strategies. D4.1. Report on the Set-up of 6 European Living Labs. D5.2. Transfer potential city-to-suburbs and scaling-up to other contexts and cities.
Geospatial Data: Maps and GIS layers for urban structures, OpenStreetMap, land use and accessibility metrics.	D3.2. Definition of the Key Performance Indicators (KPIs): Input-KPIs, Process-KPIs, and Outputs-KPIs.
Environmental Data: Pollution levels, green space distribution and energy consumption patterns.	D3.1. SWOT Analysis of 15minC Strategies.
Qualitative and Quantitative Data	

Survey and Interview: Feedback from residents, local stakeholders and urban planners.	D4.1. Report on the Set-up of 6 European Living Labs. D4.2. Cross-sectional Analysis of 6 European Living Labs. D5.2. Transfer potential city-to-suburbs and scaling-up to other contexts and cities.
Focus Group Results: Semi-structured discussions to capture perspectives on strategies and KPIs.	D3.1. SWOT Analysis of 15minC Strategies. D3.2. Definition of the Key Performance Indicators (KPIs): Input-KPIs, Process-KPIs, and Outputs-KPIs. D5.1. Methodology for Transferring 15minC Strategies from Core Cities to Suburban Cities.

- **Data Sources:** Identifying and documenting all data sources, including primary and secondary data. This includes data from surveys, experiments, databases, and third-party sources. Each source is evaluated for reliability and relevance. Potential data sources is given Table

Data Type	Potential Data Sources
Modal split statistics, public transport use, traffic flows, and multimodal travel patterns.	- National transport databases (e.g., Eurostat, national transport agencies). - OpenStreetMap (OSM). - City-specific mobility apps (MaaS, LaaS). - Local transport operator reports.
Population density, socioeconomic status, and urban/suburban characteristics.	- National census databases. - Municipal demographic statistics. - Surveys conducted in case study cities.
Maps, GIS layers for urban structures, land use, and accessibility metrics.	- OpenStreetMap (OSM). - Local GIS departments. - Satellite imagery (e.g., Sentinel, Landsat). - National cartographic institutes.
Pollution levels, green space distribution, and energy consumption patterns.	- European Environment Agency (EEA). - National environmental agencies. - Municipal green space and energy reports. - IoT-based air quality sensors of local authorities.
Data from MaaS and LaaS applications.	- MaaS platforms (e.g., Citymapper, Moovit). - Logistics platforms (e.g., LaaS providers). - Municipal traffic management systems.
Movement and usage patterns from urban mobility sensors.	- IoT networks. - Smart city sensor deployments. - Localized mobility monitoring and management projects (e.g., pedestrian counters, cycling lane sensors, outputs of SUMP projects).

- **Data Collection Methods:** Selecting appropriate data collection methods based on the type of data and project requirements. These methods include but are not limited to:
    - **Surveys:** Surveys will be used to collect both quantitative and qualitative insights from stakeholders, residents, and experts. These surveys will help gather data on mobility preferences, travel behavior, satisfaction levels, and

the challenges associated with implementing 15-minute city strategies. The relevant work packages include WP2 (Portfolio of Successful 15minC Strategies in Urban Areas), WP3 (SWOT Analysis of 15minC Strategies), WP4 (6 EU 15minC Urban Living Labs), and WP6 (Multi-Stakeholder Impact Assessment). The data will consist of quantitative metrics, such as mobility patterns, and qualitative insights into the perceptions of 15minC measures and the barriers to their implementation. The surveys will be conducted using customized project surveys, online tools, and structured questionnaires targeting a diverse range of demographic groups. Parabol's map-based survey tool, Mapalyse, can be deployed to ease the data collection and analysis.

- **Interviews:** Interviews will be conducted to gather in-depth qualitative insights from urban planners, policymakers, and local stakeholders. These interviews will provide expert opinions on the challenges of policy implementation, the success criteria for 15minC strategies, and their potential transferability to different urban contexts. This method will be particularly relevant for WP2 (Portfolio of Successful 15minC Strategies in Urban Areas) and WP5 (Transfer Guidelines of the 15minC). The data collected will focus on expert perspectives regarding local conditions and strategic goals. Interviews will be structured or semi-structured and will be conducted with city representatives, public transport operators, and technical experts.
- **Focus Groups:** Focus groups will be used to facilitate semi-structured discussions aimed at validating strategies, KPIs, and transfer methodologies. These discussions will help identify strengths, weaknesses, and barriers related to the implementation of 15minC strategies, and they will provide insights into the feasibility of transferring strategies to suburban areas. Focus groups will be conducted for WP3 (SWOT Analysis of 15minC Strategies), WP4 (6 EU 15minC Urban Living Labs), and WP5 (Transfer Guidelines of the 15minC). The data gathered will include qualitative perspectives on the effectiveness of strategies and the challenges faced by local communities. Workshops will involve local stakeholders, community leaders, and urban mobility experts.
- **Observations:** Observations will be used to systematically monitor urban and suburban areas in order to collect context-specific data on mobility patterns, land-use diversity, and accessibility. This method will help gather real-world insights into how 15minC strategies are functioning in specific environments. Observations will be particularly relevant for WP3 (SWOT Analysis of 15minC Strategies), WP4 (6 EU 15minC Urban Living Labs), and WP6 (Multi-Stakeholder Impact Assessment). The data will include quantitative and spatial information on transport flows, land use, and accessibility metrics. Field visits, mobility counters, and physical audits of urban spaces will be used as the primary sources for these observations.
- **Static/Historic Data**: Static and historic data will be used to establish baselines and validate findings from the live data collection efforts. This data will provide historical context on urban planning and mobility strategies, which will be

essential for understanding the effectiveness of 15minC strategies over time. Relevant work packages for static and historic data include WP2 (Portfolio of Successful 15minC Strategies in Urban Areas), WP4 (6 EU 15minC Urban Living Labs), and WP5 (Transfer Guidelines of the 15minC). The data types will include historical urban planning documents, Sustainable Urban Mobility Plans (SUMPs), and policy reports. The primary sources will be public archives, national statistical databases, and municipal GIS platforms.

iii. Data Quality Assurance: Ensuring data quality is critical for assessing the reliability and usability of project data. A comprehensive data audit will be conducted to address key questions such as:

- What data is missing?
- How reliable are the existing data sources?
- What additional data is required for a robust 15minC evaluation?

Given the heterogeneous and distributed nature of the data—managed by various organizations, systems, and storage centers—it is essential to harmonize the data both semantically and syntactically. This includes aligning time scales, spatial coverage, and measurement units. Quality analysis will utilize advanced data fusion and spatio-temporal data mining techniques, supported by strong communication and data-sharing agreements with stakeholders.

For big data sources such as GPS, smart card data, and traffic sensor data, quality analysis will include visualization methods like histograms, thermal maps, and circle graphs, using R Studio and Python. During this process, issues like noise (incorrectly labeled data) and missing values will be identified. Univariate and multivariate analyses will be supported by graphical and non-graphical outputs. Additionally, the compatibility of datasets with international standards will be assessed. For instance:

- Public transport data will be checked for GTFS compliance.
- GIS data will follow international formats such as GPX, GeoJSON, Shapefile, KML, and KMZ.

The project will ensure that datasets are:

- Accurate and complete,
- Up-to-date,
- Consistent and readable by machines,
- Compliant with terminology standards,
- Published with adequate metadata to aid user understanding.

Each dataset will be analyzed based on key dimensions: **accuracy, completeness, consistency, uniqueness, timeliness, and validity.**

- **Ensuring Data is Findable, Accessible, Interoperable, and Re-Usable (FAIR Principles)**: Data to be use in the analyses will be investigated according to the FAIR principles ensures that data is managed and shared effectively. Parabol oversees the implementation of FAIR principles by ensuring that data is validated and cleaned. Parabol ensures that all partners follow appropriate data quality control measures and review data for consistency. This involves:

- **Findable:** Assigning unique identifiers to data sets and creating metadata to describe the data.
- **Accessible:** Ensuring data can be retrieved using standard protocols and maintaining appropriate access controls.
- **Interoperable:** Using standardized formats and languages to facilitate data integration and compatibility with other datasets.
- **Re-Usable:** Providing clear usage licenses and maintaining data quality to ensure data can be reused in future research.

Following measures will be implemented to ensure FAIR Principles of collected data:

- **Validation Checks:** Using predefined rules to validate data at the point of entry.
- **Data Cleaning Procedures:** Identifying and correcting errors or inconsistencies in the data.
- **Quality Control Measures:** Conducting regular controls and reviews to ensure data quality.

- **Data Storage:** Secure and efficient data storage solutions are essential for managing project data:
  - **Data Storage Solutions:** Utilizing secure and scalable data storage solutions such as cloud storage and databases. These solutions are selected based on data volume, accessibility, and security requirements. Services like Google Cloud for scalable storage solutions will be deployed.
  - **Data Organization:** Organizing data using a standardized structure and naming conventions to ensure easy access and retrieval. This includes creating metadata in data catalog.
    - **Metadata:** The partner who will own the data will create detailed metadata for each dataset to describe its content, format and origin in the data catalog.
- **Data Backup and Recovery:** Performing regular data backups to prevent data loss. A data recovery plan is in place to ensure that data can be restored in case of accidental loss or system failure.
  - **Backup Frequency:** Determining the frequency of backups based on the criticality of the data.
  - **Recovery Procedures:** Developing detailed procedures for data recovery in case of data loss.

iv. **Data Processing:** Processing data efficiently and accurately is crucial for generating meaningful insights:

- **Data summarization and data synthesis:** Data synthesis will be made by bringing together the data collected from different sources. Data synthesis will be done separately for quantitative and qualitative data. A general framework for synthesis will be used to guide the process of planning the comparisons, preparing for synthesis, undertaking the synthesis, and interpreting and describing the results.

- **Data pre-processing and cleaning:** Pre-processing and data cleaning usually involves cleaning the data that is considered to be erroneous or unreliable and, where necessary, deleting it, examining and labeling the columns in the data.
    - **Data Processing Tools:** Specialized software tools are used to manage data collection, storage, processing, and analysis. These tools help streamline data management processes and ensure accurate and timely reporting. Examples include:
        - **SQL:** For querying and managing relational databases.
        - **Python/R:** For data analysis, visualization, and statistical modeling.
        - **Data Visualization Tools:** GIS environment, different mobility solutions, and/or BI tool for creating interactive visualizations. Data visualization techniques are used to present data in a clear and accessible manner. This includes creating charts, graphs, and dashboards to help stakeholders understand data insights and make informed decisions.
- **Data Integration:** Integrating data from different sources to create a unified dataset. This involves data merging, matching, and reconciliation processes. These processes will be planned based on data type.
- **Data Analysis:** Analyzing data using appropriate statistical and analytical techniques to generate insights and support decision-making. This includes:
    - **Descriptive Statistics:** Summarizing data to understand its main characteristics.
    - **Inferential Statistics:** Making predictions or inferences about a population based on a sample.

v. **Data Security and Privacy:** Protecting data from unauthorized access and ensuring compliance with data protection regulations is a top priority:

- **Access Controls:** Implementing role-based access controls to restrict access to sensitive data.
- **Regular Updates to Data Privacy Measures:** Privacy measures will be reviewed and updated to ensure ongoing compliance with relevant regulations and best practices. This includes:
    - **Privacy Controls:** Conducting regular controls to assess compliance with data privacy policies.
    - **Policy Updates:** Revising data privacy policies based on new regulations or emerging threats.

vi. **Data Sharing:** Sharing data securely and responsibly is important for collaboration and transparency:

- **Data Sharing Policies and Agreements:** Depending on the type of data, clear policies and sharing agreements for sharing data with internal and external stakeholders will be drafted by the data owner as necessary. These policies will outline the conditions and protocols for data sharing, ensuring compliance with data protection regulations.
    - **Data Access Requests:** Developing procedures for handling data access requests from stakeholders.
    - **Data Sharing Guidelines:** Creating guidelines to ensure data is shared in a secure and ethical manner.
    - **Data Sharing Agreements:** These agreements include confidentiality clauses, data usage restrictions, and responsibilities of each party.
- **Data Access Controls:** Controlling access to data based on user roles and responsibilities. This includes implementing role-based access controls and ensuring that only authorized users can access sensitive data.

ANNEX 1 - Risk Management Plan

Risk ID	Description	WP No.	Probability	Impact	Mitigation Strategy	Contingency Plan	Relevant Partner
1	Failure of a WP leader to fulfill WP leadership	All	Low	Medium	Ensure backup leaders for each WP and regular monitoring of leadership performance.	Reassign WP leadership to another qualified co-applicant with a higher number of PM if needed.	Parabol
2	Failure of one partner: leaving consortium or underperforming	All	Low	Low	Regular performance evaluations and fostering strong communication among partners.	Reallocate tasks to other partners with expertise to cover the responsibilities of the leaving partner.	UPM
3	Breach of objectives	All	Medium	Medium	Establish clear milestones and regular progress reviews with detailed reports.	Project Coordinator to take corrective actions and re-align tasks to meet objectives.	UPM
4	Delays in delivery of the results	All	Medium	Medium	Implement a robust project timeline with buffer periods and frequent progress checks.	Reschedule the research agenda to minimize impact on the project timeline.	UPM
5	Budget (time/cost) overrun	All	Medium	Low	Constant monitoring of budget and timely adjustments to prevent overruns.	Reduce costs in other tasks if necessary and allocate resources efficiently.	UPM
6	WP not achieving expected results or Deliverables	All	Low	Low	Ensure that draft versions of deliverables are ready one month before deadlines.	QA and project coordinator to supervise and take actions to avoid delays and poor-quality deliverables.	WP Leaders

7	Difficulties in setting up the ULLs in any of the CS	4	Low	High	Engage a variety of committed stakeholders to facilitate ULL setup.	Adjust activities to achieve project objectives if ULL setup is not possible.	Consortium
8	Unavailability of adequate experts for the FGs in any of the CS	3, 5	Low	Medium	Utilize the diverse network of co-applicants and cooperation partners to find FG participants.	Leverage large network and contact resources to ensure availability of experts.	Consortium
9	Difficulties in getting valid outputs to feed the KPIs to measure project impacts	6	Low	Medium	Regular review of results and KPIs to ensure accurate impact measurements.	Reformulate KPIs based on achievable results to deliver appropriate impact analysis.	Consortium
10	Poor quality content of Guidebook and publications	7	Low	Medium	Collaborate with the 6 universities involved in the project to ensure high-quality content.	Seek additional sources to complete the scientific and practical dissemination materials.	Universities

ANNEX 2 - Data Management Catalog

Data			Data Source	Data Usage Area/ Analysis	Data Description	Type	Partner	Public/ Company	Completeness	Time Dimension	Validity
Transport Demand Data	Other Relevant Data	Vehicle Ownership Information									
		Roadside Car Park Usage Data									
	Big Data	Number Plate Recognition System Data									
		Bluetooth Data									
		GPS Data									
transport system data	road network data										
	bicycle network data										
Road Safety Data	Big Data	Accident Data									
Fare Data	Public Transport Fare Data										
	Taxi Usage Fare Data										