Inception Report

Deliverable Number	D1.4
Deliverable Type	R – Document, Report
Dissemination Level	PU (Public)
Deliverable Responsible	LAET
Document Version & Status	v1.0 | Final version

Project Acronym	NEXTLOGIC
Project Title	Next-Gen urban freight logistics for net zero emissions through innovative solutions
Grant Agreement Number	101238585
Project Coordinator	University of Luxembourg
Project Website	www.nextlogic-project.eu

Co-funded by the European Union

NEXTLOGIC has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101238585

NEXTLOGIC is a project under the CIVITAS Initiative. Read more – civitas.eu

Funded by the European Union. Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them

Author(s)

Name	Organisation
Laura Palacios-Argüello	Universite du Luxembourg (UniLU)

Reviewers

Name	Organisation	Date
Simone Bosetti	LuxM	2026-06-16
Guido Gentile	UniR1	2026-06-18
Rafael Afonso	UniLU	2026-06-23

Change History

Version	Date	Name/Organisation	Description
0.1	2026-04-01	Laura Palacios-Argüello (UniLU)	Table of content
0.2	2026-04-15	Laura Palacios-Argüello (UniLU)	First draft
0.3	2026-05-22	Laura Palacios-Argüello (UniLU)	Integration of partners' inputs
0.4	2026-06-02	Laura Palacios-Argüello (UniLU)	Second draft for review
0.5	2026-06-19	Laura Palacios-Argüello (UniLU)	Integration of reviewers' comments
1.0	2026-06-29	Laura Palacios-Argüello (UniLU)	Final version

Table of Contents

List of Figures

List of Tables

1. Executive summary

This deliverable presents the inception report of the NEXTLOGIC project, outlining the overall framework, objectives, and initial implementation approach for pilot activities across eight Mission Cities in seven European Union countries. All participating cities have formally committed to achieving climate neutrality by 2030, positioning NEXTLOGIC within the broader European ambition for sustainable, resilient, and inclusive urban development.

The primary objective of this deliverable is to establish a coherent and structured baseline for the co-development, testing, and replication of NEXTLOGIC's "digital-by-default" solutions and tools. These solutions, reaching Technology Readiness Level 7 (TRL7), will be deployed and validated in real-life urban environments, addressing diverse challenges across city centres and suburban contexts.

NEXTLOGIC advances beyond the current state of the art by integrating multiple digital and operational solutions into a unified and scalable framework that emphasises interoperability, transferability, and cross-city learning. Rather than implementing isolated interventions, the project adopts a systemic approach that combines technological innovations, such as Digital Twins, eXtended Reality tools, and data-driven decision-support systems, with city pilot implementations. This enables cities of different sizes and characteristics to jointly develop, test, and refine tools and solutions, strengthening their replicability across European regions.

The pilots include the development of 15-minute multimodal hubs (Aarhus), smart bike parking systems supported by Digital Twins and eXtended Reality (Dublin), and Smart Loading Zones (The Hague, Bergamo, Differdange and Heidelberg). Other cities focus on mobile Microhub solutions for last-mile delivery (Wrocław, Frankfurt, and Heidelberg), zero emission zones and electrification (The Hague, Bergamo and Differdange), Incentives and Rewards mechanisms (Aarhus, Dublin and Heidelberg), Advanced Data Analytics and Visualisation - ADAV (Differdange and Aarhus), and Digital Twin-enabled optimisation of mobility and logistics flows (all cities). Across all pilots, particular emphasis is placed on integrating sustainable urban logistics, improving curbside efficiency.

The methodological approach of this deliverable is based on a collaborative and iterative process involving all pilot cities representatives. Each city has identified a tailored set of tools and solutions, supported by a clear rationale, expected outputs, and evaluation processes following the CIVITAS Evaluation Framework. A harmonised implementation timeline has been drafted, structured around pre-pilot, pilot, and post-pilot phases, with clearly defined activities and monitoring moments.

As a main result, this deliverable provides an overview of the planned pilot implementations, ensuring coherence, comparability, and effective knowledge exchange across cities. The detailed description of each pilot is presented in the following sections of the report. Further operational details, monitoring and evaluation plan will be developed and consolidated in deliverable D4.1 – Operational Guidelines for Pilot Implementation and Monitoring, which will provide the practical guidance required for the execution and assessment of the pilot activities in project Month 12 (December 2026).

Keywords: Urban freight pilots, Digital Twins, eXtended Reality, Virtual Reality, Advanced Data Analytics and Visualisation - ADAV, Microhubs, Smart Loading Zones, 15-minutes city, Incentives and Rewards, electrification.

2. Introduction

This section outlines the specific objectives of Deliverable 1.4 (D1.4) within the NEXTLOGIC project. It presents the scope of the deliverable, the methodological approach adopted, and the overall structure of this document.

The **primary objective of this deliverable** is to establish a coherent and structured baseline for the co-development, testing, and replication of NEXTLOGIC's "digital-by-default" solutions and tools. D1.4 aims to achieve the following specific objectives for each pilot city (demonstration site) participating in the project:

1. Describe the activities, tools and solutions to be piloted, implemented, or demonstrated together with their expected outputs and outcomes.
2. Define the implementation schedule for each activity, tool and solution, including start and end dates, implementation duration, and planned monitoring milestones (pre-pilot, pilot, post-pilot).
3. Present the monitoring and evaluation framework, including the methods, indicators, and data collection approaches that will be used to track progress and measure the success of each activity, tool and solution.

The **scope of the deliverable encompasses planning, progress evaluation, and an initial implementation approach for pilot activities** across eight Mission Cities in seven European Union countries, to validate NEXTLOGIC tools and solutions at Technology Readiness Level 7 (TRL7) in real-life urban environments. The tools and solutions address challenges related to freight transport, mobility integration, behavioural change, and urban freight electrification, while the digital tools provide advanced capabilities for data analysis, simulation, visualisation, and stakeholder engagement. To provide a clearer understanding of the **NEXTLOGIC tools and solutions**, the following table offers an overview of those designed to support sustainable urban logistics.

Table 1. NEXTLOGIC tools and solutions

Category	Name	Description
Tools	Digital Twin (DT)	A real-time virtual representation of the city that integrates mobility and logistics data to analyse flows, simulate scenarios, and assess the impacts of policies and interventions.
	eXtended Reality (XR)	Virtual and augmented reality tools used to visualise urban interventions, explore alternative scenarios, and support stakeholder engagement and collaborative planning.
	Advanced Data Analytics and Visualisation (ADAV)	Data processing, analytics, dashboards, and visualisation tools that transform mobility and logistics data into actionable insights for planning and decision-making.
Solutions	15-minutes Multimodal Hubs	Local hubs that integrate public transport, shared mobility, and logistics services to improve accessibility, connectivity, and sustainable urban mobility.
	Mobile Microhubs (MH)	Mobile logistics Microhubs located near urban areas where goods are consolidated and transferred to cargo bikes for zero-emission last-mile deliveries.

Category	Name	Description
	Smart Loading Zones (SLZ)	Digitally managed curbside spaces that use data, sensors, Bluetooth systems, or dynamic signage to optimise loading and unloading activities based on real-time demand.
	Electrification for urban freight (EL)	Measures that support the adoption of electric freight vehicles through policy recommendations, technical analysis of charging infrastructure deployment and the adaptation of logistics operations for zero-emission transport.
	Incentives and Rewards mechanisms (I&R)	Incentive-based approaches, such as rewards, pricing schemes, or gamification, designed to encourage sustainable mobility and logistics behaviours.

The **methodological approach** adopted for this deliverable is based on a collaborative, iterative, and city-centred process involving representatives from all participating pilot cities and project partners. This approach is guided by the **CIVITAS Evaluation Framework**, providing a common methodology for assessing pilot progress, operational performance and impacts [1], [2]. The approach aims to ensure that pilot activities are tailored to local needs while maintaining a common framework that enables comparability, knowledge exchange, and replication across different urban contexts.

The development of the inception report followed **a co-creation process among all partners involved in each pilot**, where they defined the pilot activities, expected outputs, target stakeholders, and preliminary monitoring requirements. This process ensured alignment between local priorities and the overall project objectives related to climate neutrality, sustainable urban logistics, and digital transformation.

To facilitate coordinated implementation, a **harmonised framework** was established for all cities. This framework structures activities into three main phases: (i) Pre-pilot, including baseline assessments, stakeholder engagement activities, technical preparation, and deployment planning; (ii) Pilot, comprising the implementation and operational testing of the selected tools and solutions; and (iii) Post-pilot, focusing on performance assessment, lessons learned, validation of results, scalability and transferability of the implemented solutions and tools to support policy recommendations.

The methodology further promotes continuous learning through regular exchanges between leading and following cities, enabling the sharing of experiences, challenges, and best practices throughout implementation. This collaborative process supports the refinement of tools and solutions and contributes to the development of transferable knowledge applicable across European urban environments.

The present deliverable, therefore, establishes the **strategic and operational foundations for pilot implementation and will be refined and further detailed in deliverable D4.1** – Operational Guidelines for Pilot Implementation and Monitoring in project Month 12 (December 2026).

This report is organised as follows: **Section 3** provides an overview of the NEXTLOGIC cities and pilots; **Section 4** presents a detailed description of each pilot in the leading cities; **Section 5** covers the following cities. Finally, **Section 6** provides the conclusion of the report.

3. Overview of the NEXTLOGIC cities and pilots

This section provides an overview of the eight NEXTLOGIC pilot cities and concerned pilot activities. The NEXTLOGIC pilots aim to design, test, and validate innovative, data-driven solutions for sustainable urban mobility and logistics, supporting cities in their transition towards climate neutrality. By deploying "digital-by-default" tools in real-life environments, the pilots seek to improve efficiency, reduce environmental impacts, and optimise the use of urban space, while ensuring scalability and transferability across different urban contexts.

The eight pilot cities represent a diverse set of urban environments, enabling the project to address a wide range of challenges, including congestion, inefficient last-mile delivery, and competing demands for curbside space. The pilots implement complementary solutions such as Multimodal Hubs, Electrification in urban freight, Mobile Microhubs, Incentive and Reward mechanisms and dynamic curbside management approaches, including Smart Loading Zones and flexible use of public space. Figure 1 shows the NEXTLOGIC cities and provides an overview of the NEXTLOGIC pilots.

DT=Digital Twin, XR= eXtended Reality; ADAV = Advanced Data Analytics and Visualisation; MH = Mobile Microhubs; SLZ=Smart Loading and Unloading Zones; 15Min-hub = 15-minutes Multimodal Hubs; I&R = Incentives and Reward mechanisms; EL.= Electrification of urban freight

Figure 1. The NEXTLOGIC cities and overview of the NEXTLOGIC pilots

A common feature across all pilots is the use of data-driven approaches, including Digital Twins (DT) to support planning, simulation, and operational optimisation. These are complemented by technologies such as data analytics, and visualisation tools, enhancing both system performance and decision-making processes.

In addition, the pilots promote the integration of urban logistics into broader mobility and spatial planning strategies, including extending the 15-minute city concept to freight. Strong emphasis is also placed on stakeholder engagement through co-creation processes and incentive mechanisms, ensuring user acceptance and long-term sustainability of the solutions. Table 2 provides an overview of the expected results in the eight pilot cities.

Table 2. NEXTLOGIC expected results of the pilots

Pilot city		Expected results
Leading cities	Aarhus (DK)	Development and validation of 15-minute Multimodal Hubs integrating mobility, and logistics; improved accessibility and reduced emissions through DT and ADAV based planning and co-created urban designs, and enhanced stakeholder acceptance of multimodal hubs.
Leading cities	Dublin (IE)	Implementation of a Smart Bike Parking Digital Twin enabling real-time parking management, improved infrastructure planning, and enhanced compliance and stakeholder acceptance.
Leading cities	The Hague (NL)	Deployment of Smart Loading Zones; improved curbside efficiency, reduced congestion and emissions, and enhanced data-driven curbside management zero-emission freight policies.
Leading cities	Wroclaw (PL)	Implementation of Mobile Microhubs with cargo bikes supported by DT and XR tools; increased delivery efficiency, reduced congestion and emissions, and strengthened stakeholder collaboration.
Replicating cities	Bergamo (IT)	Deployment of Smart Loading Zones, assessment of EV charging infrastructure for freight vehicles supported by DT; improved space allocation, reduced emissions and congestion, and enhanced stakeholder acceptance of urban logistics solutions.
Replicating cities	Differdange (LU)	Deployment of Smart Loading Zones, assessment of EV charging infrastructure for freight vehicles supported by DT and ADAV; optimisation of loading/unloading zones and improved urban space utilisation through data-driven decision-making.
Replicating cities	Frankfurt (DE)	Deployment of Mobile Microhubs supported by DT to improve last-mile logistics efficiency and scalability through knowledge transfer and replication strategies.
Replicating cities	Heidelberg (DE)	Implementation of Smart Loading Zones and Mobile Microhubs with cargo bikes supported by DT; increased curbside efficiency, reduced illegal parking, optimisation of loading/unloading zones and improved urban space utilisation through data-driven decision-making.

Overall, the pilots provide a coherent yet diverse set of use cases that enable cross-city learning and contribute to the replication and scaling-up of effective urban mobility and logistics solutions across Europe. For all pilots, the leader responsible for overall coordination, planning, and implementation will be UniLU with the support of LuxM. The following table provides a summary of the tools and solutions of NEXTLOGIC that will be piloted in each city.

Table 3. NEXTLOGIC pilots' tools and solutions by city

Pilot City		Tools				Solutions			
		DT	XR	ADAV	15Min -hub	MH	SLZ	EL	I&R
Leading cities	Aarhus (DK)	X		X	X				X
	Dublin (IE)	X	X						X
	The Hague (NL)	X					X	X	
	Wroclaw (PL)	X	X			X			
Replicating cities	Frankfurt (DE)	X				X			
	Differdange (LU)	X		X			X	X	
	Heidelberg (DE)	X				X	X		X
	Bergamo (IT)	X					X	X	

DT=Digital Twin, XR= eXtended Reality; ADAV = Advanced Data Analytics and Visualisation; MH = Mobile Microhubs; SLZ=Smart Loading and Unloading Zones; 15Min-hub = 15-minutes Multimodal Hubs; I&R = Incentives and Reward mechanisms; EL.= Electrification of urban freight

4. Description of the leading cities' pilots

4.1 Aarhus (DK)

4.1.1 Pilot activities

The overall aim of the Aarhus pilot is to design, implement, and assess scalable solutions for climate-neutral urban development by operationalising the **15-minute city concept through multimodal, digitally enabled urban hubs**. Within NEXTLOGIC, multimodal hub designs integrating transport encompass the combination of different public transport services, the use of private bicycles and cars alongside public transport for first- and last-mile connectivity, and shared mobility services when available. It also includes the co-location of logistics services (e.g. parcel lockers) and the promotion of their use through **Incentives and Rewards mechanisms (I&R)**, with the aim of supporting more sustainable mobility and logistics behaviours.

The pilot will leverage **advanced Digital Twin (DT)** capabilities and **Advanced Data Analytics and Visualisation (ADAV)** to measure the impact of urban texture and urban design on the accessibility radius. This will enable evidence-based decision-making and facilitate the evaluation of the proposed solutions under real-life conditions. The approach aligns with Aarhus' commitment as a Mission City to achieve climate neutrality by 2030. The following are the specific objectives of the pilot:

- To develop and test multimodal hub designs integrating transport, services, and urban logistics.
- To explore the role of public transport in supporting the 15-minute city.
- To enhance accessibility and connectivity through the optimisation of active and public transport systems.
- To integrate sustainable urban logistics solutions, particularly addressing last-mile delivery challenges.
- To deploy and utilise a Digital Twin for simulation and impact assessment.
- To simulate behavioural change through Incentive and Reward mechanisms (e.g. Smart Rewards).
- To implement co-creation processes, ensuring stakeholder engagement and social acceptance.

The pilot will focus on Hjortshøj Station Square as a public transport hub and its surrounding urban areas, which will be transformed into a multifunctional, multimodal centre. This location is strategically important for improving connectivity, encouraging modal shift, and integrating urban logistics, while maintaining compatibility with the existing mobility system. The choice of this station aims to influence future station squares by gaining insights into accessibility, daily services, and public life, with the goal of strengthening the public space and the station square's role as a central point within a 15-minute city network.

4.1.2 Partners involved

The Aarhus pilot is implemented through a multi-actor partnership, including:

Table 4. Partners in Aarhus pilot

Tool/solution	Partner	Role in the pilot
All	DTU AAKS	Pilot lead. Active member in the implementation of tools and solutions at the city level, actively engage local stakeholders, and provide structured feedback to inform policy development and governance frameworks
	CBS	Responsible for business modelling
	SAU	Responsible for data acquisition and management
Digital Twins	LIST	Responsible for the development and operation of Digital Twin
	FUAS	DT task leader: Responsible for the development traffic models for the Digital Twin
	Trans	Technology provider
	UniR3	Responsible for the development of freight logistics models for the Digital Twin
Advanced Data Analytics and Visualisation - ADAV	LIST	Responsible for the development and operation of Advanced Data Analytics and Visualisation - ADAV
15-minute Multimodal Hubs	DTU	15-minute Multimodal Hubs task leader and technology development
	CBS	Local academic partner with expertise on freight
	CphM	Local transportation stakeholder, responsible for providing expertise, data, and best practices in multimodal transport hub design
Incentives & Reward mechanisms	UniR1	Incentives and Rewards Task Leader and technology developer
	MUV	Technology developer for the citizen-facing Incentives and Rewards component
	MOV	Industrial partner supporting freight stakeholder engagement

Other stakeholders to be involved:

- Logistics operators: supporting the integration of transport and last-mile logistics solutions
- Citizens, business owners: engaged through travel surveys.

4.1.3 Timeline

The pilot is structured into three phases: pre-pilot, pilot, and post-pilot. The indicative schedule is presented below.

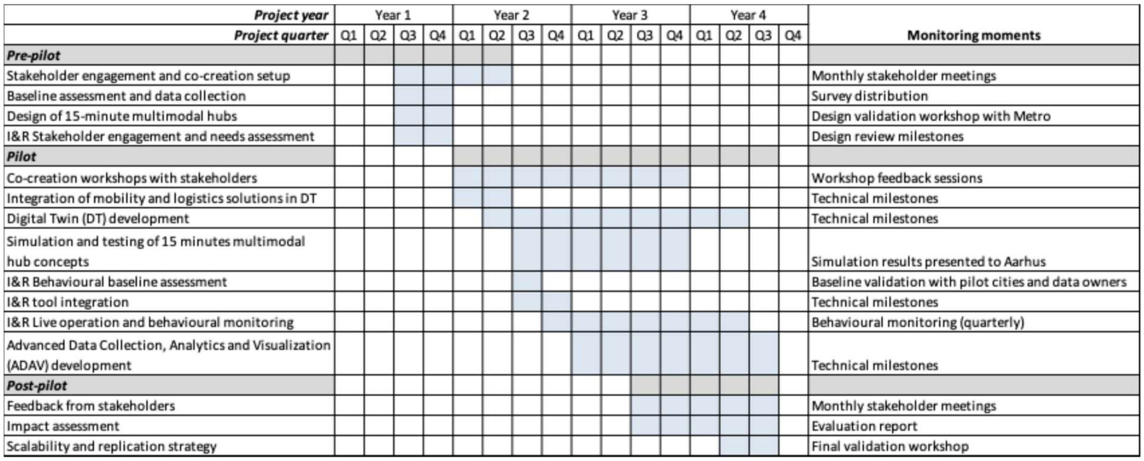

Figure 2. Timeline of Aarhus pilot

4.1.4 Assessment of progress and success

Monitoring activities will be organised across the three pilot phases:

- During the pre-pilot phase, baseline conditions will be established through mobility surveys, accessibility assessments, stakeholder consultations, and Digital Twin simulations. This includes the analysis of existing travel patterns, modal split, accessibility levels, parcel-locker operations, and urban mobility conditions.
- During the pilot phase, monitoring will combine continuous simulation-based assessments, operational data collection, and stakeholder feedback to evaluate the performance of multimodal hubs, 15-minute city interventions, and Incentives and Rewards mechanisms for the parcel locker use. Simulation models will be progressively refined as new data becomes available.
- In the post-pilot phase, monitoring results will be consolidated and compared against baseline conditions to assess the effectiveness, scalability, and transferability of the implemented solutions and to support policy recommendations.

The progress of the pilot implementation will be monitored using the implementation and operational indicators presented below.

Table 5. Pilot progress monitoring indicators for the Aarhus pilot

Monitoring area	Indicator	Measurement method	Frequency
Pilot implementation	Completion of planned pilot activities (%)	Progress reporting against implementation plan	Quarterly
Digital Twin integration with the 15-Minute City concept	Completion of baseline accessibility and mobility analysis, simulation scenarios developed and validated, and stakeholder engagement activities completed	Digital Twin simulation reports, survey implementation records, workshop reports	Quarterly
Multimodal Hub and 15-Minute	Completion of travel surveys, response rates achieved, and	Survey records and analysis reports	Quarterly

Monitoring area	Indicator	Measurement method	Frequency
City -Hjortshøj Station Intervention Assessment	analysis of behavioural and accessibility impacts		
Incentives & Rewards (I&R) Implementation	Baseline data collection completed, participation of key stakeholders, availability of operational parcel-locker data, and implementation of incentive/nudge mechanisms	Stakeholder records, operational data availability assessments, pilot progress reports	Quarterly
Data quality	Completeness and reliability of collected data (%)	Data quality assessment	Monthly
Stakeholder engagement	Number of stakeholder meetings and participants	Meeting records	Quarterly
User engagement	Number of logistics operators and citizens participating in the pilot	Registration and participation records	Quarterly
Risk management	Number of critical issues identified and resolved	Risk register	Quarterly

The **assessment framework** will rely on a set of key indicators aligned with the Aarhus pilot's expected outcomes. These include indicators such as change in modal split, increase in population and services accessible within 15 minutes, reduction in average travel times, change in travel behaviour before and after the intervention. There will also be simulation-based indicators, including accessibility levels (e.g. reachable area within 15 minutes), and network performance. Where data allow, additional indicators, such as societal indicators related to accessibility, user satisfaction, and stakeholder acceptance, may be estimated. Precise solution performance and impact indicators will be defined in the coming months, once the pilot design phase starts in M7.

The results of regular monitoring will be discussed at stakeholder meetings and quarterly reviews, enabling the pilot to adapt its operational and governance approach throughout the implementation process. The success of the Aarhus pilot will be assessed by comparing pilot results against baseline conditions and predefined targets.

4.1.5 Expected outputs

The expected contribution of the Aarhus pilot's tools and solutions is outlined below, including the main target groups, expected outputs, outcomes, and impacts.

Table 6. Expected outcomes for the Aarhus pilot

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
Digital Twin (DT) and Advanced Data Analytics and Visualisation (ADAV)	Urban planners and local authorities; decision-makers; logistics and mobility operators	City-level Digital Twin integrating mobility, accessibility, and freight logistics data, enabling real-time monitoring and scenario simulation	Improved data-driven decision-making. Enhanced ability to simulate and evaluate alternative scenarios. Increased coordination between stakeholders and solutions	Contribution to operational and environmental improvements through scenario simulation and optimisation
15-minute Multimodal Hubs	Citizens (residents within 15 minutes of the PT hub)	One implemented urban design for a 15-minute city. Design principles for the 15-minute city in a multimodal context.	One implemented urban design for a 15-minute city. Design principles for the 15-minute city in a multimodal context. Planning tool for 15-minute city	Behavioural shift to active modes. Reduced emissions
Incentives and Rewards mechanisms (I&R)	Parcel-locker users/receivers, parcel-locker operator, local businesses or pick-up and drop-off (PUDO) services hosts where relevant, logistics operators and city authority	Incentive and Reward logic for encouraging earlier parcel collection and reducing parcel dwell time. Stakeholder validation of feasible nudges, rewards and monitoring indicators	Improved understanding of receiver-side behaviour. Increased user engagement with parcel-locker/PUDO services; potential reduction in parcel dwell time where incentives are implemented and data are available. Improved availability of locker capacity	More efficient use of parcel-locker infrastructure. Reduced risk of locker saturation. Support for out-of-home delivery and 15-minute multimodal hub concepts. Evidence for scalable receiver-side incentive mechanisms

4.2 Dublin (IE)

4.2.1 Pilot activities

The Dublin pilot focuses on developing the **Smart Bike Parking Digital Twin** (SBPDT). Building on previous experience from the Senator Project and its Urban Living Lab, the pilot advances digital and data-driven solutions for urban mobility.

The SBPDT will enable real-time monitoring, simulation, and optimisation of bike parking systems, with a particular focus on accommodating the growing use of e-bikes and e-cargo bikes. The pilot integrates sensor data and user-generated information within a Digital Twin environment. The sensor layer will include AI-powered cameras capable of detecting bike parking occupancy in real time. The **AR tool** will provide users with real-time information on parking guidance and **I&R** will offer incentives for responsible bike parking behaviour to improve parking availability and user experience. The approach supports improved infrastructure management, regulatory compliance, and behavioural change towards more sustainable mobility practices.

The overall aim of the Dublin pilot is to develop and validate a Digital Twin-based solution for smart bike parking management that enhances urban mobility, supports sustainable urban planning, and contributes to climate neutrality objectives. The following are the specific objectives of the pilot:

- To implement real-time monitoring and dynamic allocation of bike parking spaces.
- To support data-driven urban planning and infrastructure development.
- To analyse usage patterns, including differences between conventional and cargo bikes.
- To integrate AR tools for visualisation and real-time information on parking guidance.
- To promote behavioural change through smart rewards systems (I&R).
- To assess the scalability and replicability of the tools and solutions within broader urban mobility frameworks.
- To provide real-time occupancy data via Application Programming Interface (API) to external mobility applications, enabling active navigation guidance towards available parking spaces.

The pilot site location will be determined in the planning phase within the city centre, an area characterised by growing demand for cycling infrastructure, which creates challenges related to parking availability, organisation, and compliance. The Smart Bike Parking setting provides an ideal testbed for integrating digital technologies, nature-based elements, and user-centred design.

4.2.2 Partners involved

The Dublin pilot is implemented through a multi-stakeholder partnership, including:

Table 7. Partners in Dublin pilot

Tool/solution	Partner	Role in the pilot
All	DLR	Pilot lead. Active member in the implementation of tools and solutions at the city level, actively engage local stakeholders, and provide structured feedback to inform policy development and governance frameworks
	CBS	Responsible for business modelling

	SAU	Responsible for data acquisition and management
Digital Twin (DT)	LIST	Responsible for the development and operation of Digital Twin
	FUAS	DT task leader: Responsible for the development traffic models for the Digital Twin
	Exe/Trans	Technology providers
	UniR3	Responsible for the development of freight logistics models for the Digital Twin
Augmented Reality	TUD	Technology provider for AR
Incentives and Rewards mechanisms (I&R)	UniR1	Incentives and Rewards Task Leader and technology provider
	MUV	Technology developer for the citizen-facing Incentives and Rewards component, contributing expertise in mobility gamification, digital engagement, user feedback and reward mechanisms for citizens and end users
	MOV	Industrial partner supporting identification of user needs and constraints, and operational validation

Other stakeholders to be involved:

- Mobility operators: providers of bike-sharing and cargo bike services contributing with operational data.
- Citizens, businesses, visitors: engaged through user feedback and behavioural initiatives.

4.2.3 Timeline

The pilot is structured into three phases: pre-pilot, pilot, and post-pilot. The indicative schedule is presented below.

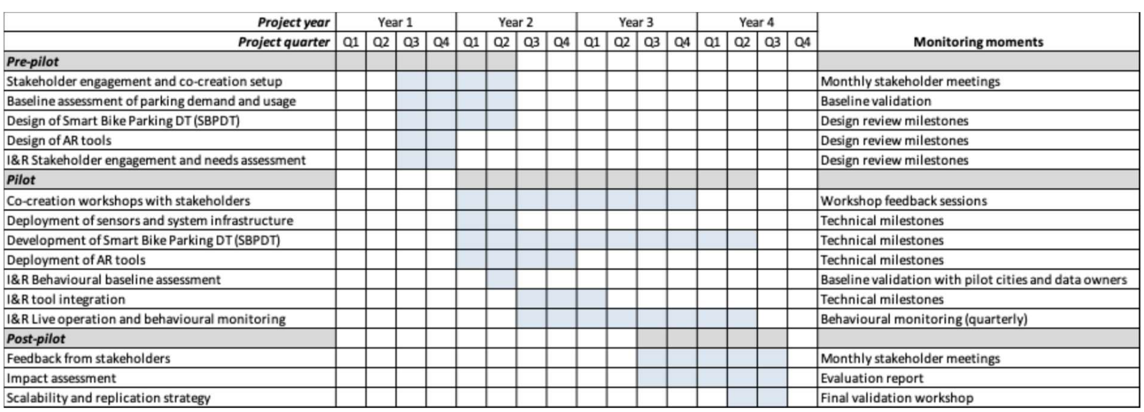

Figure 3. Timeline of Dublin pilot

4.2.4 Assessment of progress and success

Monitoring activities will be organised across the three pilot phases:

- During the pre-pilot phase, baseline conditions will be established through the assessment of bike parking demand, occupancy levels, parking behaviour, user perceptions, and parking pressure hotspots. Stakeholder consultations will support the identification of key parking-related challenges and user needs.
- During the pilot phase, monitoring will rely on continuous data collection through the Smart Bike Parking Digital Twin, sensor systems, AR application analytics, I&R, and stakeholder feedback. Regular assessments will track implementation progress, user engagement, parking behaviour, and operational performance, while supporting iterative improvements to the Digital Twin, AR application, and I&R mechanisms.
- During the post-pilot phase, pilot results will be compared against baseline conditions to evaluate the effectiveness, scalability, and transferability of the proposed solutions and to support recommendations for wider deployment.

The progress of the pilot implementation will be monitored using the implementation and operational indicators presented below.

Table 8. Pilot progress monitoring indicators for the Dublin pilot

Monitoring area	Indicator	Measurement method	Frequency
Pilot implementation	Completion of planned pilot activities (%)	Progress reporting against implementation plan	Quarterly
Smart Bike Parking Digital Twin (SBPDT)	Deployment and integration of sensors, data sources and Digital Twin functionalities, completion of monitoring and simulation capabilities, data availability, and system operational readiness	Technical reports, deployment records, system logs and validation tests	Quarterly
Augmented Reality Parking Guidance Tool	Number of stakeholder engagement activities completed, prototype development progress, user testing sessions conducted, and incorporation of user feedback into successive AR tool versions	Workshop records, development logs, prototype evaluation reports and user feedback assessments	Quarterly
Incentives & Rewards (I&R) Solution	Completion of baseline behavioural assessment, implementation of incentive and AR-integrated engagement mechanisms, participation in reward or feedback activities, and availability of data required to monitor incentivised behaviours	Baseline studies, AR application analytics, participation records, stakeholder workshops and progress reports	Quarterly
Data quality	Completeness and reliability of collected data (%)	Data quality assessment	Monthly
Stakeholder engagement	Number of stakeholder meetings and participants	Meeting records	Quarterly

Monitoring area	Indicator	Measurement method	Frequency
User engagement	Number of users participating in the pilot	Registration and participation records	Quarterly
Risk management	Number of critical issues identified and resolved	Risk register	Quarterly

The **assessment framework** will rely on a set of key indicators aligned with the Dublin pilot's expected outcomes. These include indicators for parking occupancy, AR application analytics, behavioural indicators, and system performance metrics. There will also be simulation-based indicators, including frequency of AR application use and interaction with parking guidance features, analysis of parking demand patterns by vehicle type, number of AR/I&R users, and perceived ease of use. Where data allow, additional indicators, such as societal indicators related to accessibility, user satisfaction, and stakeholder acceptance, may be estimated. Precise solution performance and impact indicators will be defined in the coming months, once the pilot design phase starts in M7.

The results of regular monitoring will be discussed at stakeholder meetings and quarterly reviews, enabling the pilot to adapt its operational and governance approach throughout the implementation process. The success of the Dublin pilot will be assessed by comparing pilot results against baseline conditions and predefined targets.

4.2.5 Expected outputs

The expected contribution of the Dublin pilot's tools and solutions is outlined below, including the main target groups, expected outputs, outcomes, and impacts.

Table 9. Expected outcomes for the Dublin pilot

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
Smart Bike Parking Digital Twin (SBPDT)	City authorities, urban planners, mobility managers, bike-sharing operators, bike and cargo-bike users	Digital Twin platform integrating sensor data, parking occupancy information, simulation capabilities and real-time monitoring tools, AI camera-based occupancy detection layer, historical analytics dashboard, API interface providing real-	Improved monitoring and management of bike parking infrastructure. Enhanced understanding of parking demand and usage patterns. Improved allocation of parking capacity, support for data-driven planning and decision-making	More efficient use of parking infrastructure, reduced parking pressure and congestion around key locations. Improved urban mobility management. Support for sustainable urban planning and climate neutrality objectives

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
		time occupancy data to external applications, optional virtual parking zone creation, and dynamic zone status publication		
Augmented Reality	Shared bike users	AR-based parking guidance application on smartphone	Guide and regulate parking behaviours of shared bike users	Reduce unauthorised parking behaviour
Incentives and Rewards mechanisms (I&R)	Cyclists, shared-bike users, e-bike and e-cargo-bike users, couriers where relevant, mobility operators, campus/city managers, visitors and local stakeholders	Incentive and Reward logic integrated with the AR app to encourage correct parking behaviour. Definition of target behaviours, reward/nudge logic, monitoring indicators and user feedback mechanisms	Improved user engagement with AR-based parking guidance, increased awareness of correct parking locations. Potential improvement in parking compliance where incentives are implemented and data are available. Improved understanding of user responses to nudges and rewards	More orderly use of bike/e-cargo-bike parking infrastructure, reduced risk of obstruction and disorderly parking. Improved user acceptance of Smart Bike Parking and AR guidance. Evidence for scalable behaviour-support mechanisms in smart parking contexts

4.3 The Hague (NL)

4.3.1 Pilot activities

The Hague pilot focuses on deploying and implementing smart, data-driven solutions for curbside management for logistics activities. Building on the introduction of a zero-emission zone in the city centre (2025) and the planned extension to coastal areas (2026), the pilot aims to enhance the efficiency and sustainability of these policies for urban freight operations and their implications for the grid network.

The pilot integrates a **Digital Twin (DT)** to support real-time monitoring and optimisation of logistics activities. A key component is the deployment of **Smart Loading Zones (SLZ)**, which enable dynamic allocation and management of curbside space. An analysis will be carried out on the deployment of

electrification strategies, with a particular emphasis on zero-emission zones and their integration into logistics operations. The approach helps reduce emissions, congestion, and conflicts over urban space, while supporting economic activity and improving urban liveability.

The overall aim of the Hague pilot is to develop, implement, and assess scalable solutions for urban logistics through smart curbside management and data-driven planning tools. The following are the pilot's specific objectives:

- To utilise Digital Twin technology for real-time monitoring and scenario analysis.
- To support the analysis on the policy impact of zero-emission zones, aiming to reduce CO_2 and NOx emissions associated with urban freight transport.
- To optimise the use of loading and unloading zones through smart and adaptive management systems.
- To improve efficiency and reduce congestion in high-demand urban areas.
- To engage stakeholders in the co-design of multifunctional public space solutions.
- To assess the scalability and transferability of Smart Loading Zones across the city.

The pilot site location will be determined in the planning phase and will be in a central urban area with high logistics demand, mixed land use, and limited public space. The pilot area should present challenges such as congestion, competing uses of space, and environmental impacts, making it a suitable testbed for innovative logistics and curbside management solutions.

4.3.2 Partners involved

The Hague pilot is implemented through a multi-stakeholder partnership, including:

Table 10. Partners in The Hague pilot

Tool/solution	Partner	Role in the pilot
All	GDH	Pilot lead. Active member in the implementation of tools and solutions at the city level, actively engage local stakeholders, and provide structured feedback to inform policy development and governance frameworks.
	BUAS	Local academic partner with expertise on urban freight
	CBS	Responsible for business modelling
	SAU	Responsible for data acquisition and management
Digital Twin (DT)	LIST	Responsible for the development and operation of Digital Twin
	FUAS	DT task leader: Responsible for the development of traffic models for the Digital Twin
	Trans	Technology provider
	UniR3	Responsible for the development of freight logistics models for the Digital Twin
Smart Loading Zones (SLZ)	PKUN	Technology provider: development of smart curbside management systems and monitoring tools

Electrification for urban freight (EL)	UniLU	Academic expert on electromobility

Other stakeholders to be involved:

- Logistics operators and transport companies: providing operational data and participating in pilot testing.
- Businesses, residents, visitors: engaged in co-design and evaluation processes.

4.3.3 Timeline

The pilot is structured into three phases: pre-pilot, pilot, and post-pilot. The indicative schedule is presented below.

Project year	Year 1				Year 2				Year 3				Year 4				
Project quarter	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	**Monitoring moments**
Pre-pilot																	
Stakeholder engagement and needs assessment																	Monthly stakeholder meetings
Assessment of regulatory framework and feasibility																	Regulatory report
Baseline analysis of LUZ usage and demand																	Baseline validation
Design of dynamic curbside management system																	Design validation
Identification of pilot area and system configuration																	Site validation
Co-creation workshops with stakeholders																	Workshop feedback sessions
Pilot																	
Co-creation workshops with stakeholders																	Joint workshops
Deployment of smart loading zones																	Operational monitoring (monthly)
Digital Twin development																	Technical milestones
Implementation of PKUN solution																	Operational monitoring (monthly)
Assessment of Zero emission zone																	Infrastructure performance review
Real-time monitoring and data collection																	Continuous monitoring
Post-pilot																	
Feedback from stakeholders																	Monthly stakeholder meetings
Impact assessment																	Evaluation report
Scalability and replication strategy																	Final validation workshop

Figure 4. Timeline of The Hague pilot

4.3.4 Assessment of progress and success

Monitoring activities will be organised across the three pilot phases:

- During the pre-pilot phase, the focus will be on baseline assessment, including analysis of loading/unloading zone usage, demand patterns, and regulatory constraints, to provide a reference for subsequent evaluation. For the Digital Twin, baseline traffic conditions are established using available data and simulation models.
- During the pilot phase, scenario-based simulations are used to test alternative policy configurations and compare their impacts. Where real pilot data becomes available, models are refined to improve accuracy and represent real-world dynamics. Monitoring during this phase will rely on continuous data collection through the Digital Twin and SLZ technology and the deployed Smart Loading Zones, capturing real-time information on curbside utilisation, parking turnover, and user behaviour. This will enable the assessment of operational performance and the identification of deviations or critical issues.
- The post-pilot phase will focus on evaluating the outcomes and impacts of the implemented solutions. The collected data will be used to evaluate impacts and support scalability, policy recommendations, and replication strategies.

The progress of the pilot implementation will be monitored using the implementation and operational indicators presented below.

Table 11. Pilot progress monitoring indicators for the Hague pilot

Monitoring area	Indicator	Measurement method	Frequency
Pilot implementation	Completion of planned pilot activities (%)	Progress reporting against implementation plan	Quarterly
Digital Twin integration	Availability of real-time data connections (%)	System monitoring reports	Monthly
SLZ technical deployment	Number of Smart Loading zones deployed and operational	Deployment records and system logs	Monthly
Data quality	Completeness and reliability of collected data (%)	Data quality assessment	Monthly
Stakeholder engagement	Number of stakeholder meetings and participants	Meeting records	Quarterly
User engagement	Number of logistics operators and users participating in the pilot	Registration and participation records	Quarterly
Risk management	Number of critical issues identified and resolved	Risk register	Quarterly

The **assessment framework** will rely on a set of key indicators aligned with The Hague pilot's expected outcomes. These include indicators such as utilisation rates of loading zones, parking rotation, and reduction of illegal parking. There will also be simulation-based indicators, including traffic flow efficiency, travel times, congestion levels, and network performance. Where data allow, additional indicators, such as environmental indicators (e.g. reduction in congestion and emissions), and societal indicators related to accessibility, user satisfaction, and stakeholder acceptance, may be estimated. Precise solution performance and impact indicators will be defined in the coming months, once the pilot design phase starts in M7.

The results of regular monitoring will be discussed at stakeholder meetings and quarterly reviews, enabling the pilot to adapt its operational and governance approach throughout the implementation process. The success of the Hague pilot will be assessed by comparing pilot results against baseline conditions and predefined targets.

4.3.5 Expected outputs

The expected contribution of The Hague pilot's tools and solutions is outlined below, including the main target groups, expected outputs, outcomes, and impacts.

Table 12. Expected outcomes for The Hague pilot

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
Digital Twin (DT)	Urban planners and local authorities, decision-makers, logistics and mobility operators	City-level Digital Twin integrating mobility, logistics and curbside data. Enabling real-time monitoring and scenario simulation	Improved data-driven decision-making. Enhanced ability to simulate and evaluate alternative scenarios. Increased coordination between stakeholders and solutions	Contribution to operational and environmental improvements through scenario simulation and optimisation
Smart Loading Zones (SLZ)	Urban planners and local authorities. logistics operators, retailers and service providers	Deployment of dynamic Smart Loading Zones supported by Digital Twin. Real-time monitoring systems	Improved curbside utilisation and allocation efficiency. Reduction of search time for parking/loading. Increased compliance with designated loading zones	Contribution to congestion reduction and improved delivery performance. More efficient use of urban space Reduced emissions
Electrification for urban freight (EL)	Logistics operators, fleet managers, energy providers, local authorities	EV usage for logistics activities	Increase in EV deliveries	Reduction of GHG emissions and energy consumption. Contribution to climate neutrality targets. Improved environmental performance of urban logistics systems

4.4 Wroclaw (PL)

4.4.1 Pilot activities

The Wrocław pilot focuses on improving the efficiency and sustainability of last-mile urban logistics through the deployment of **Mobile Microhubs** combined with cargo bike operations, supported by advanced digital technologies. The pilot integrates the **NEXTLOGIC Digital Twin (DT) and eXtended Reality (XR)** tools to optimise planning, design, and operational performance of last-mile deliveries.

Building on existing strategic frameworks, including the Sustainable Urban Mobility Plan (SUMP) and freight transport master planning, the pilot addresses identified inefficiencies in urban deliveries, such as high levels of non-compliant delivery times and locations. Through a technology-driven and stakeholder-oriented approach, the pilot aims to demonstrate scalable solutions for sustainable urban logistics.

The overall aim of the Wrocław pilot is to design, implement, and evaluate Mobile Microhub solutions supported by digital tools to enhance last-mile delivery efficiency, reduce environmental impacts, and improve urban logistics governance. The following are the specific objectives of the pilot:

- To design and deploy Mobile Microhubs integrated with cargo bike delivery systems.
- To harmonise the exterior design of Microhub with the wider urban context, spatial planning and the needs of the Municipality.
- To optimise hub location and operations using Decision-Support Tools (e.g. AHP, PROMETHEE).
- To integrate Digital Twin and XR technologies for planning, simulation, and stakeholder training and engagement.
- To deploy a cargo bike simulator (VehicleSim platform) enabling training of Microhub operators in realistic urban traffic scenarios, including access restrictions specific to the pilot area.
- To strengthen collaboration with the Freight Quality Partnership.
- To assess scalability and long-term financial and operational sustainability of Microhub solutions.

The pilot will be implemented in the wider Wrocław historic city in an area characterised by high delivery demand, spatial constraints, complex logistics operations, and challenges related to access restrictions. Potential Microhub locations will be identified on city-owned land, including parking areas, enabling flexible deployment of mobile infrastructure. The pilot area presents significant challenges related to delivery inefficiencies and congestion, making it an appropriate testbed for innovative logistics solutions.

4.4.2 Partners involved

The Wrocław pilot is implemented through a multi-actor partnership, including:

Table 13. Partners in Wroclaw pilot

Tool/solution	Partner	Role in the pilot
All	CoW	Pilot lead. Active member in the implementation of tools and solutions at the city level, actively engage local stakeholders, and provide structured feedback to inform policy development and governance frameworks.
	CBS	Responsible for business modelling

	SAU	Responsible for data acquisition and management
Digital Twin (DT)	LIST	Responsible for the development and operation of Digital Twin
	FUAS	DT task leader: Responsible for the development traffic models for the Digital Twin
	Exe/Trans	Technology provider
	UniR3	Responsible for the development of freight logistics models for the Digital Twin
eXtended Reality (XR)	TUD	Technology provider for XR
Mobile Microhub (MH)	WUEB	Local academic partner: analytical support, decision-support tools, and impact assessment
	WCG	Task leader and Microhub provider: infrastructure and cargo bikes for Microhub deployment.

Other stakeholders to be involved are:

- Logistics operators and SMEs: participation in pilot testing and operational validation.
- Business, residents and representatives of local authority: engagement through workshops and co-creation processes.

4.4.3 Timeline

The pilot is structured into three phases: pre-pilot, pilot, and post-pilot. The indicative schedule is presented below.

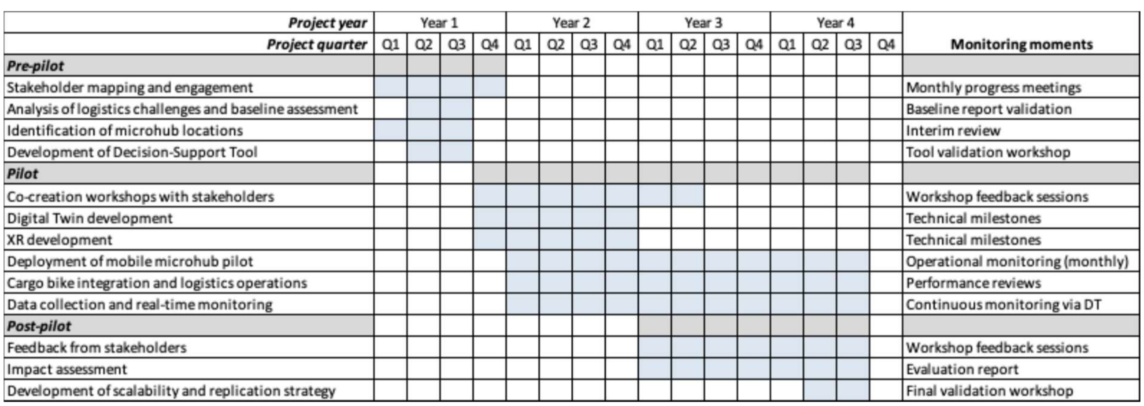

Figure 5. Timeline of Wroclaw pilot

4.4.4 Assessment of progress and success

Monitoring activities will be organised across the three pilot phases:

- During the pre-pilot phase, activities will focus on establishing baseline conditions, defining key performance indicators and target values, conducting stakeholder and governance assessments, and validating the pilot design through dedicated review and validation workshops.

- During the pilot phase, monitoring will track implementation progress, operational performance, and stakeholder engagement through operational records, performance monitoring systems, stakeholder feedback, and regular project reviews. Continuous data collection will be done through the Digital Twin, the deployed VR, and Microhubs with cargo bikes. Where data-sharing agreements and Data Protection Impact Assessment (DPIA) clearance allow, this will also include GPS-derived cargo bike movement analytics, AI-based package count monitoring at the Microhub (before and after courier loading), and retrospective analysis of operator data for hub usage patterns. Quarterly assessments will measure pilot progress and identify any implementation barriers.
- In the post-pilot phase, results will be compared with baseline conditions and expected outcomes to evaluate the effectiveness and transferability of the Microhub concept and XR/VR solution, with particular attention to validating governance arrangements, access rules, operational responsibilities, data-sharing procedures, conflict-resolution mechanisms, and replication potential.

The progress of the pilot implementation will be monitored using the implementation and operational indicators presented below.

Table 14. Pilot progress monitoring indicators for Wroclaw pilot

Monitoring area	Indicator	Measurement method	Frequency
Pilot implementation	Completion of planned pilot activities (%)	Progress reporting against implementation plan	Quarterly
Microhubs technical deployment	Completion of Microhub setup and operational readiness	Deployment records and validation reviews	Quarterly
DT: Cargo bike movement and Microhub operations monitoring	GPS data coverage rate (% of active cargo bikes transmitting), package count estimation accuracy at Microhub entry/exit (%); Microhub access reader integration status and DPIA clearance milestone achieved	System logs, DT data quality reports, DPIA documentation	Quarterly
XR Solution – Co-design Tool Development and Stakeholder Engagement	Number of stakeholders participating in the XR co-design process, number of XR co-design workshops and prototype testing sessions completed, and percentage of stakeholder requirements incorporated into successive prototype versions	Participation records, workshop reports, prototype development logs, user feedback and evaluation reports	Quarterly
Stakeholder engagement	Number of stakeholder meetings and workshops organised	Meeting records	Quarterly

Monitoring area	Indicator	Measurement method	Frequency
Risk management	Number of identified issues resolved	Issue logs and corrective action records	Quarterly

The **assessment framework** will rely on a set of key indicators aligned with the Wroclaw pilot's expected outcomes. These include indicators such as the integration of the Microhub, DT and, XR/VR with decision-making processes, environmental indicators such as reductions in congestion and emissions, and societal indicators related to accessibility, user satisfaction, and stakeholder acceptance. For the DT, these include simulation-based indicators, such as cargo bike travel times, traffic flow efficiency, queue formation, and overall network performance across different Microhub network design scenarios. Precise solution performance and impact indicators will be defined in the coming months, once the pilot design phase starts in M7.

The results of regular monitoring will be discussed at stakeholder meetings and quarterly reviews, enabling the pilot to adapt its operational and governance approach throughout the implementation process. The success of the Wroclaw pilot will be assessed by comparing pilot results against baseline conditions and predefined targets.

4.4.5 Expected outputs

The expected contribution of the Wroclaw pilot's tools and solutions is outlined below, including the main target groups, expected outputs, outcomes, and impacts.

Table 15. Expected outcomes for the Wroclaw pilot

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
Digital Twin	Local authorities, courier companies, university	Digital representation of pilot sites, logistics flows, baseline conditions, operational data, and scenario options for Microhub deployment and scaling. Real-time and historical analytics of cargo bike GPS movement (occupancy, routes, dwell time) and Microhub usage	Improved evidence-based planning of Microhub locations and operations (better understanding of freight flows, delivery patterns, site constraints, and stakeholder needs)	More efficient and data-driven urban logistics planning. Improved coordination between public and private stakeholders (basis for scaling and replication)

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
		(packages, orders). VehicleSim cargo bike simulator with operator training scenario library		
Mobile Microhubs	Local authority, courier companies and other users of the hub	Two-modules Microhub	Improved operational efficiency for logistics operations. Increase of e-bike and e-cargo bike deliveries. Improved traffic flows	Reduced delivery inefficiencies in the pilot zone (reduced fossil-kilometers, congestion, local emissions). Improved awareness of Microhubs. More sustainable City logistics . Raising awareness and knowledge within scientific papers
eXtended Reality (XR)	Local authorities, courier companies, universities, and users of the Microhubs	Virtual Reality co-design tool for the Microhubs with different stakeholders	Supporting tools for Microhubs development	Improved awareness and understanding of Microhub concepts by providing stakeholders with immersive, hands-on experiences that demonstrate Microhub operations, benefits, challenges, and their role in sustainable urban logistics

5. Description of the replicating cities' pilots

5.1 Bergamo (IT)

5.1.1 Pilot activities

The Bergamo pilot focuses on deploying smart, data-driven solutions for the **dynamic management of loading and unloading zones (LUZ)** to enhance the efficiency, inclusivity, and sustainability of urban mobility and logistics. The pilot integrates smart curbside management with broader urban strategies, including **analysis of electric freight vehicles charging stations**.

Building on existing measures, the pilot will leverage advanced **Digital Twin (DT)** capabilities and digitally enabled, flexible curbside solutions. These solutions aim to optimise the allocation of public space by accommodating multiple uses, such as freight delivery, parking, and electric freight vehicle (EFV) charging, based on real-time demand. The approach supports Bergamo's Sustainable Urban Mobility Plan (SUMP) and contributes to climate neutrality objectives.

The overall aim of the Bergamo pilot is to develop and validate dynamic curbside management solutions that optimise the use of urban space, improve logistics efficiency, and promote sustainable mobility. The following are the specific objectives of the pilot:

- To analyse and optimise the use of loading and unloading zones in high-demand urban zones.
- To implement dynamic curbside management systems based on real-time data.
- To assess EV charging infrastructure feasibility within loading and unloading zones.
- To enhance stakeholder collaboration and acceptance of innovative solutions.
- To assess regulatory feasibility and scalability within the Italian context.

The pilot site will be defined in the planning phase, but two urban contexts are being considered: the Lower Town and the Upper Town. The Lower Town represents a central, mixed-use area characterised by high commercial activity and significant competition for curbside space among retail, logistics, and parking functions. Implementing the pilot in this area is well aligned with the city's Sustainable Urban Mobility Plan (SUMP) objectives, offering strong potential for visibility, scalability, and replication in other medium-sized European cities. It has been selected due to its high delivery density, frequent curbside conflicts, feasibility for integrating EV charging infrastructure, and the opportunity to demonstrate measurable before-and-after impacts, supported by strong engagement from local retailers and associations.

In contrast, the Upper Town is a historic and highly tourist-oriented district with narrow streets, restricted vehicle access, and a high concentration of small HORECA businesses that require frequent light deliveries. Here, spatial constraints, noise, and emissions are critical challenges. The area has been selected to explore early-stage solutions, including time-restricted access and potential booking or permit-based systems for electric freight vehicles, despite the current absence of clearly defined loading/unloading zones. Its high stakeholder engagement potential, particularly with local businesses and tourism operators, makes it a valuable testbed for innovative and adaptable logistics solutions.

5.1.2 Partners involved

The Bergamo pilot is implemented through a multi-stakeholder partnership, including:

Table 16. Partners in Bergamo pilot

Tool/solution	Partner	Role in the pilot
All	CoBG	Participation in the implementation of tools and solutions at the city level, actively engage local stakeholders, and provide structured feedback to inform policy development and governance frameworks.
	UniBG	Pilot lead. Local academic partner: Active participation and coordination in the implementation of tools and solutions at the city level and actively engage local stakeholders.
	LuxM	Local technical support to pilot activities (data, planning, monitoring and impact assessment).
	CBS	Responsible for business modelling
	SAU	Responsible for data acquisition and management
Digital Twin (DT)	LIST	Responsible for the development and operation of Digital Twin
	FUAS	DT task leader: Responsible for the development traffic models for the Digital Twin
	Trans	Technology provider
	UniR3	Responsible for the development of freight logistics models for the Digital Twin
Smart Loading Zones (SLZ)	PKUN	Technology provider: development of smart curbside management systems and monitoring tools
	BUAS	As leader of the Pilot in The Hague, will offer guidelines for implementing the pilot, transferring learning from the leading city.
Electrification for urban freight (EL)	UniLU	Academic expert on electromobility

Other stakeholders to be involved:

- Logistics operators: participation in pilot testing and data provision.
- Retailers and shop owners category's association: participation in pilot testing and data provision.
- Energy providers: deployment of EV charging infrastructure.
- Businesses, residents, users: engagement through consultation and feedback processes.

5.1.3 Timeline

The pilot is structured into three phases: pre-pilot, pilot, and post-pilot. The indicative schedule is presented below.

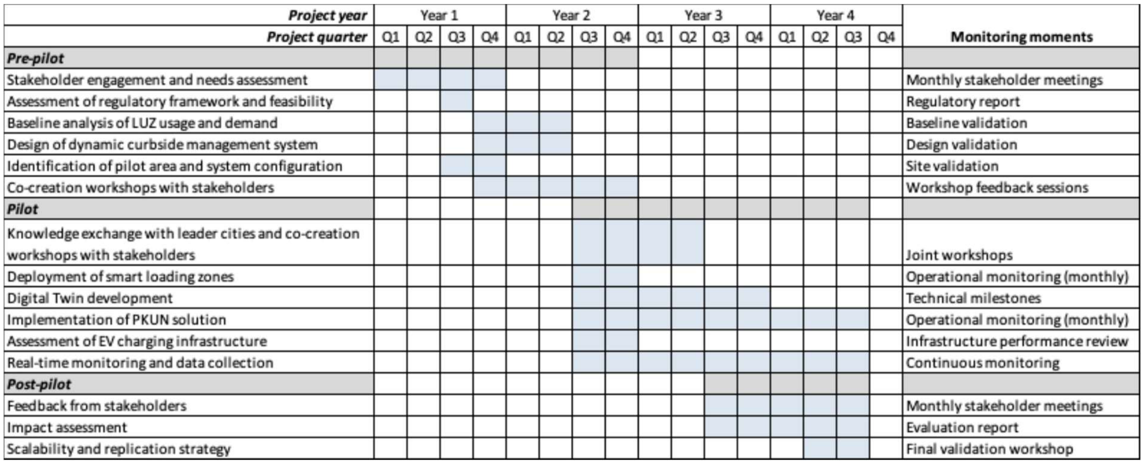

Figure 6. Timeline of Bergamo pilot

5.1.4 Assessment of progress and success

Monitoring activities will be organised across the three pilot phases:

- During the pre-pilot phase, the focus will be on baseline assessment, including analysis of loading/unloading zone usage, demand patterns, and regulatory constraints, to provide a reference for subsequent evaluation. For the DT, baseline traffic conditions are established using available data and simulation models.
- During the pilot phase, baseline traffic conditions are established using available data and simulation models. Where additional data becomes available, the models can be refined to better reflect real-world conditions. Monitoring during this phase will rely on continuous data collection through the Digital Twin and the deployed Smart Loading Zones, capturing real-time information on curbside utilisation, parking turnover, and user behaviour. This will enable the assessment of operational performance and the identification of deviations or critical issues.
- The post-pilot phase will focus on evaluating the outcomes and impacts of the implemented solutions. The collected data will be used to evaluate impacts and support scalability and replication strategies.

The progress of the pilot implementation will be monitored using the implementation and operational indicators presented below.

Table 17. Pilot progress monitoring indicators for the Bergamo pilot

Monitoring area	Indicator	Measurement method	Frequency
Pilot implementation	Completion of planned pilot activities (%)	Progress reporting against implementation plan	Quarterly
Digital Twin integration	Availability of real-time data connections (%)	System monitoring reports	Monthly

Monitoring area	Indicator	Measurement method	Frequency
SLZ Technical deployment	Number of Smart Loading Zones deployed and operational	Deployment records and system logs	Monthly
Electrification solution implementation	Completion of the assessment of EV charging infrastructure integration within loading/unloading zones and the urban logistics system (%)	Progress reporting against assessment workplan	Quarterly
Data quality	Completeness and reliability of collected data (%)	Data quality assessment	Monthly
Stakeholder engagement	Number of stakeholder meetings and participants	Meeting records	Quarterly
User engagement	Number of logistics operators and users participating in the pilot	Registration and participation records	Quarterly
Risk management	Number of critical issues identified and resolved	Risk register	Quarterly

The **assessment framework** will rely on a set of key indicators aligned with the Bergamo pilot's expected outcomes. These include indicators such as utilisation rates of loading zones, parking rotation, and reduction of illegal parking; environmental indicators such as reductions in congestion and emissions; and societal indicators related to accessibility, user satisfaction, and stakeholder acceptance. Precise solution performance and impact indicators will be defined in the coming months, once the pilot design phase starts in M7.

The results of regular monitoring will be discussed at stakeholder meetings and quarterly reviews, enabling the pilot to adapt its operational and governance approach throughout the implementation process. The success of the Bergamo pilot will be assessed by comparing pilot results against baseline conditions and predefined targets.

5.1.5 Expected outputs

The expected contribution of the Bergamo pilot's tools and solutions is outlined below, including the main target groups, expected outputs, outcomes, and impacts.

Table 18. Expected outcomes for the Bergamo pilot

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
Digital Twin (DT)	Urban planners and local authorities; decision-makers; logistics and mobility operators	City-level Digital Twin integrating mobility, logistics and curbside data, enabling real-time monitoring and	Improved data-driven decision-making. Enhanced ability to simulate and evaluate	Contribution to operational and environmental improvements through scenario simulation and optimisation

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
		scenario simulation	alternative scenarios Increased coordination between stakeholders and solutions	
Smart Loading Zones (SLZ)	Urban planners and local authorities; logistics operators; retailers and service providers	Deployment of dynamic Smart Loading Zones supported by Digital Twin and real-time monitoring systems	Improved curbside utilisation and allocation efficiency. Reduction of search time for parking/loading. Increased compliance with designated loading zones	Reduced congestion and improved curbside efficiency. Contribution to congestion reduction and improved delivery performance. More efficient use of urban space and reduced emissions.
Electrification for urban freight (EL)	Logistics operators; fleet managers; energy providers; local authorities	Assessment of EV charging infrastructure integration within loading/unloading zones and urban logistics system	Increased adoption of electric vehicles for last-mile delivery. Improved integration between logistics operations and energy infrastructure. Enhanced feasibility of zero-emission logistics solutions	Reduction of GHG emissions consumption. Contribution to climate neutrality targets. Improved environmental performance of urban logistics systems

5.2 Differdange (LU)

5.2.1 Pilot activities

The Differdange pilot focuses on the integration of urban mobility and logistics flows within an **enhanced Digital Twin (DT) and Advanced Data Analytics and Visualisation (ADAV) to support data-driven planning and the curbside management**. Building on existing digital capabilities, the pilot aims to expand the DT to include dynamic mobility and logistics data, enabling scenario analysis and evidence-based decision-making.

A central component of the pilot is the deployment of **Smart Loading Zones (SLZ)**, which enable dynamic allocation and management of curbside space. These spaces will be dynamically managed to accommodate various uses, such as freight delivery, parking, and **electric freight vehicle charging**, depending on real-time demand. The pilot contributes to Differdange's broader ambition to achieve climate neutrality by 2030, while addressing urban congestion, environmental impacts, and socio-economic challenges. The following are the specific objectives of the pilot:

- To expand the existing Digital Twin and ADAV to integrate mobility and urban logistics data.
- To analyse and optimise the use of loading and unloading zones in high-demand urban zones.
- To implement dynamic curbside management systems based on real-time data.
- To assess electric freight vehicle charging infrastructure feasibility within loading and unloading zones and policy development.
- To enhance stakeholder engagement through data visualisation and participatory approaches.
- To promote sustainable mobility and logistics solutions among citizens and businesses.
- To assess regulatory feasibility and scalability within the Luxembourgish context.

The pilot is implemented in Differdange's city centre, including the main street and surrounding areas. The pilot area is characterised by mixed-use urban functions, high demand for freight and passenger movement, and limited space availability. Its location within a cross-border region (Luxembourg–Belgium–France) further increases mobility and logistics complexity. The selected site provides a suitable environment to test innovative approaches for integrated curbside and public space management.

5.2.2 Partners involved

The Differdange pilot is implemented through a multi-stakeholder partnership, including:

Table 19. Partners in Differdange pilot.

Tool/solution	Partner	Role in the pilot
All	CoDif	Pilot lead. Active member in the implementation of tools and solutions at the city level, actively engage local stakeholders, and provide structured feedback to inform policy development and governance frameworks.
	LuxM	Local technical support to pilot activities (data, planning, monitoring and impact assessment)
	C4L	Logistics operators: participation in testing and validation of solutions
	CBS	Responsible for business modelling
	SAU	Responsible for data acquisition and management
Digital Twin (DT)	LIST	Responsible for the development and operation of Digital Twin
	FUAS	DT task leader: Responsible for the development traffic models for the Digital Twin
	Trans	Technology provider

	UniR3	Responsible for the development of freight logistics models for the Digital Twin
Advanced Data Analytics and Visualisation - ADAV	LIST	Responsible for the development and operation of Advanced Data Analytics and Visualisation - ADAV
Smart Loading Zones (SLZ)	PKUN	Technology provider for the design and optimisation of urban space and L/U areas
	BUAS	As leader of the Pilot in The Hague, will offer guidelines for implementing the pilot, transferring learning from the leading city
Electrification for urban freight (EL)	UniLU	Academic expert on electromobility

Other stakeholders to be involved:

- Citizens, local business and local communities: engagement through participatory processes and feedback mechanisms.
- Logistics operators and service providers: participation in pilot operations and testing.

5.2.3 Timeline

The pilot is structured into three phases: pre-pilot, pilot, and post-pilot. The indicative schedule is presented below.

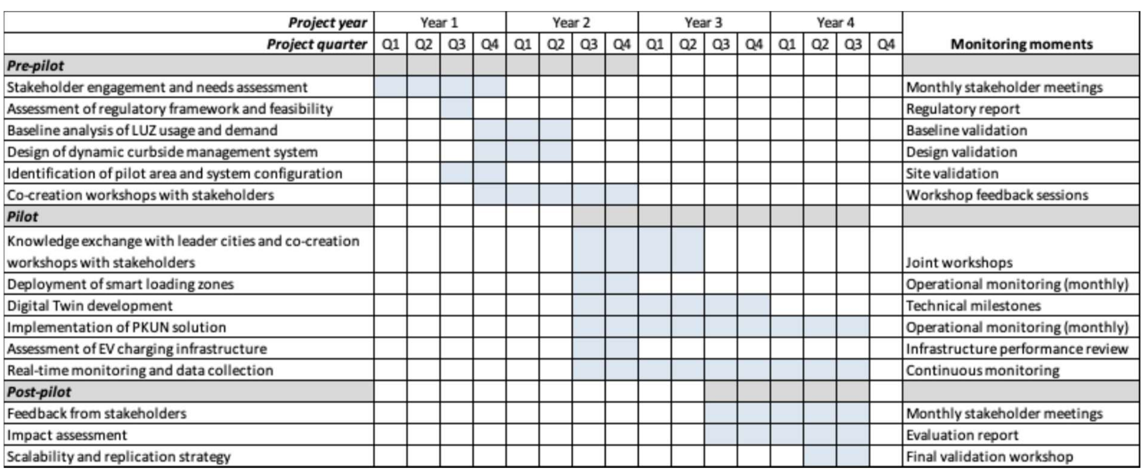

Figure 7. Timeline of Differdange pilot

5.2.4 Assessment of progress and success

Monitoring activities will be organised across the three pilot phases:

- During the pre-pilot phase, the focus will be on baseline assessment, including analysis of loading/unloading zone usage, demand patterns, and regulatory constraints, to provide a reference for subsequent evaluation. For the DT and ADAV baseline traffic conditions are established using available data and simulation models.

- During the pilot phase, baseline traffic conditions are established using available data and simulation models. Where additional data becomes available, the models can be refined to better reflect real-world conditions. Monitoring during this phase will rely on continuous data collection through the Digital Twin and the deployed Smart Loading Zones, capturing real-time information on curbside utilisation, parking turnover, and user behaviour. This will enable the assessment of operational performance and the identification of deviations or critical issues.
- The post-pilot phase will focus on evaluating the outcomes and impacts of the implemented solutions. The collected data will be used to evaluate impacts and support scalability and replication strategies.

The progress of the pilot implementation will be monitored using the implementation and operational indicators presented below.

Table 20. Pilot progress monitoring indicators for the Differdange pilot

Monitoring area	Indicator	Measurement method	Frequency
Pilot implementation	Completion of planned pilot activities (%)	Progress reporting against implementation plan	Quarterly
Digital Twin and ADAV integration	Availability of real-time data connections (%)	System monitoring reports	Monthly
SLZ Technical deployment	Number of Smart Loading Zones deployed and operational	Deployment records and system logs	Monthly
Electrification solution implementation	Completion of the assessment of EV charging infrastructure integration within loading/unloading zones and the urban logistics system (%)	Progress reporting against assessment workplan	Quarterly
Data quality	Completeness and reliability of collected data (%)	Data quality assessment	Monthly
Stakeholder engagement	Number of stakeholder meetings and participants	Meeting records	Quarterly
User engagement	Number of logistics operators and users participating in the pilot	Registration and participation records	Quarterly
Risk management	Number of critical issues identified and resolved	Risk register	Quarterly

The **assessment framework** will rely on a set of key indicators aligned with the Differdange pilot's expected outcomes. These include indicators such as utilisation rates of loading zones, parking rotation, and reduction of illegal parking; environmental indicators such as reductions in congestion and emissions; and societal indicators related to accessibility, user satisfaction, and stakeholder acceptance. For the DT and ADAV, these include simulation-based indicators, such as vehicle travel times, traffic flow efficiency, congestion levels, queue formation, and overall network performance under different curbside management scenarios. Precise solution performance and impact indicators will be defined in the coming months, once the pilot design phase starts in M7.

The results of regular monitoring will be discussed at stakeholder meetings and quarterly reviews, enabling the pilot to adapt its operational and governance approach throughout the implementation process. The success of the Differdange pilot will be assessed by comparing pilot results against baseline conditions and predefined targets.

5.2.5 Expected outputs

The expected contribution of the Differdange pilot's tools and solutions is outlined below, including the main target groups, expected outputs, outcomes, and impacts.

Table 21. Expected outcomes for the Differdange pilots

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
Digital Twin (DT) and Advanced Data Analytics and Visualisation (ADAV)	Urban planners and local authorities; decision-makers; logistics and mobility operators	City-level Digital Twin integrating mobility, logistics and curbside data, enabling real-time monitoring and scenario simulation	Improved data-driven decision-making. Enhanced ability to simulate and evaluate alternative scenarios. Increased coordination between stakeholders and solutions	Contribution to operational and environmental improvements through scenario simulation and optimisation
Smart Loading Zones (SLZ)	Urban planners and local authorities; logistics operators; retailers and service providers	Deployment of dynamic Smart Loading Zones supported by Digital Twin and real-time monitoring systems	Improved curbside utilisation and allocation efficiency. Reduction of search time for parking/loading; increased compliance with designated loading zones	Reduced congestion and improved curbside efficiency. Contribution to congestion reduction and improved delivery performance. More efficient use of urban space and reduced emissions
Electrification for urban freight (EL)	Logistics operators; fleet managers;	Assessment of EV charging infrastructure	Increased adoption of electric vehicles	Reduction of GHG emissions and energy consumption.

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
	energy providers; local authorities	integration within loading/unloading zones and urban logistics system	for last-mile delivery. Improved integration between logistics operations and energy infrastructure. Enhanced feasibility of zero-emission logistics solutions.	Contribution to climate neutrality targets. Improved environmental performance of urban logistics systems.

5.3 Frankfurt (DE)

5.3.1 Pilot activities

The Frankfurt pilot focuses on the implementation and validation of zero-emission last-mile logistics solutions through **Mobile and Modular Microhubs**, supported by collaborative governance and knowledge transfer from Wroclaw as the leading city. Frankfurt builds on its existing strategic frameworks, including the Frankfurt Logistics Concept 2021 and the Mobility Masterplan 2030, which define a comprehensive approach to sustainable urban logistics. The pilot integrates the NEXTLOGIC Digital Twin (DT) to optimise planning, design, and operational performance of last-mile deliveries.

The pilot adopts a phased implementation strategy, combining real-life testing of Microhub solutions with the progressive integration of digital tools and business models. It aims to address key urban challenges such as increasing delivery demand, limited public space, and environmental constraints, while contributing to climate neutrality objectives. The following are the specific objectives of the pilot:

- To design and deploy Mobile Microhubs integrated with cargo bike delivery systems.
- To co-develop and adapt solutions in collaboration with leading cities (e.g. Wrocław).
- To explore sustainable business models for Microhub deployment and operation.
- To assess the integration of Microhubs within urban space and logistics ecosystems.
- To develop scalable and replicable strategies for wider city deployment.

Frankfurt is a major European logistics hub characterised by high delivery volumes, dense urban structure, and significant space constraints. The first Microhub will be deployed on Deutsche Bahn (DB) property, providing a strategic location with strong connectivity to transport networks. A location for a second Microhub will be identified during the project, based on insights gained from the initial deployment, using digital tools and collaboration with stakeholders. The pilot areas reflect typical urban logistics challenges, including congestion, competing land uses, and environmental pressures.

5.3.2 Partners involved

The Frankfurt pilot is implemented through a multi-stakeholder partnership, including:

Table 22. Partners in Frankfurt pilot

Tool/solution	Partner	Role in the pilot
All	STFAM	Participation in the implementation of tools and solutions at the city level, actively engage local stakeholders, and provide structured feedback to inform policy development and governance frameworks.
	HOLM	Pilot lead. Stakeholders' involvement, pilot monitoring, and innovation support
	CBS	Responsible for business modelling
	SAU	Responsible for data acquisition and management
Digital Twin (DT)	LIST	Responsible for the development and operation of Digital Twin
	FUAS	DT task leader: Responsible for the development traffic models for the Digital Twin
	Exe	Technology provider
	UniR3	Responsible for the development of freight logistics models for the Digital Twin
Mobile Microhubs (MH)	DBINF	Provision of site and infrastructure for Microhub deployment
	WUEB, CoW	As leader of the Pilot in Wroclaw, will offer guidelines for implementing the pilot, transferring learning from the leading city.
	WCG	Microhub provider: infrastructure for Microhub deployment

Other stakeholders to be involved:

- Logistics operators and service providers: participation in pilot operations and testing.
- Businesses, residents: engagement through consultations and feedback processes.

5.3.3 Timeline

The pilot is structured into three phases: pre-pilot, pilot, and post-pilot. The indicative schedule is presented below.

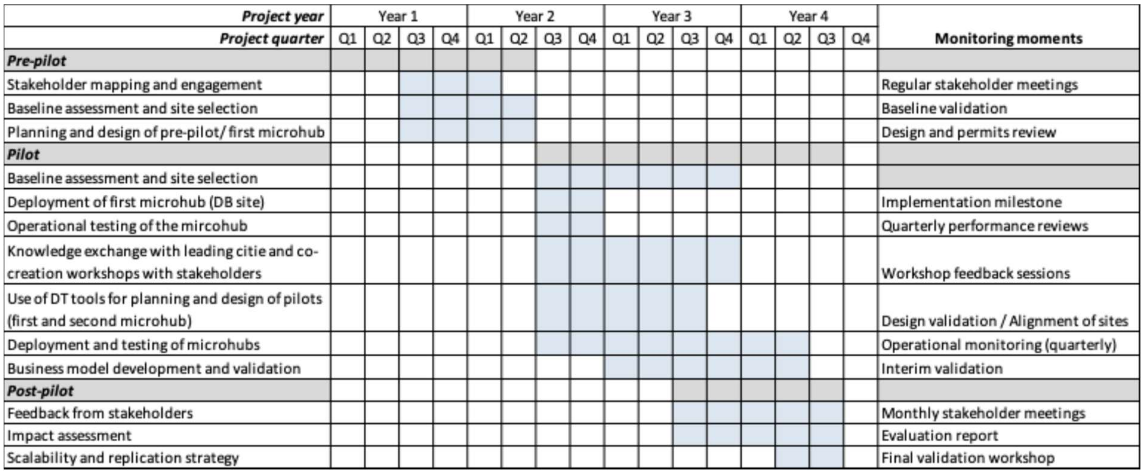

Figure 8. Timeline of Frankfurt pilot

5.3.4 Assessment of progress and success

Monitoring activities will be organised across the three pilot phases:

- During the pre-pilot phase, activities will focus on establishing baseline conditions, defining key performance indicators and target values, conducting stakeholder and governance assessments, and validating the pilot design through dedicated review and validation workshops.
- During the pilot phase, monitoring will track implementation progress, operational performance, stakeholder engagement, and business model development through operational records, performance monitoring systems, stakeholder feedback, and regular project reviews. Quarterly assessments will measure pilot progress and identify any implementation barriers.
- In the post-pilot phase, results will be compared against baseline conditions and expected outcomes to evaluate the effectiveness and transferability of the Microhub concept, with particular attention given to the validation of governance arrangements, access rules, operational responsibilities, data-sharing procedures, conflict-resolution mechanisms, and replication potential.

The progress of the pilot implementation will be monitored using the implementation and operational indicators presented below.

Table 23. Pilot progress monitoring indicators for the Frankfurt pilot

Monitoring area	Indicator	Measurement method	Frequency
Pilot implementation	Completion of planned pilot activities (%)	Progress reporting against implementation plan	Quarterly
Pilot deployment	Completion of Microhub setup and operational readiness	Deployment records and validation reviews	Quarterly

Monitoring area	Indicator	Measurement method	Frequency
Stakeholder engagement	Number of stakeholder meetings and workshops organised	Meeting records	Quarterly
Stakeholder engagement	Number of participating logistics operators and stakeholders	Participation records	Quarterly
Risk management	Number of identified issues resolved	Issue logs and corrective action records	Quarterly

The **assessment framework** will rely on a set of key indicators aligned with the Frankfurt pilot's expected outcomes. These include indicators such as integration of the DT and Microhub solution with decision-making processes; environmental indicators (e.g. reductions in congestion and emissions); and societal indicators related to stakeholder acceptance. For the DT, these include simulation-based indicators such as cargo bike travel times, traffic flow efficiency, queue formation, and overall network performance under different Microhub network design scenarios. Precise solution performance and impact indicators will be defined in the coming months, once the pilot design phase starts in M7.

The results of regular monitoring will be discussed at stakeholder meetings and quarterly reviews, enabling the pilot to adapt its operational and governance approach throughout the implementation process. The success of the Frankfurt pilot will be assessed by comparing pilot results against baseline conditions and predefined targets.

5.3.5 Expected outputs

The expected contribution of the Frankfurt pilot's tools and solutions is outlined below, including the main target groups, expected outputs, outcomes, and impacts.

Table 24. Expected outcomes for the Frankfurt pilot

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
Digital Twin	Local authorities, courier companies, DB, other users, research partners	Digital representation of pilot sites, logistics flows, baseline conditions, operational data, and scenario options for Microhub deployment and scaling	Improved evidence-based planning of Microhub locations and operations (better understanding of freight flows, delivery patterns, site constraints, and stakeholder needs)	More efficient and data-driven urban logistics planning. Improved coordination between public and private stakeholders (basis for scaling and replication)

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
First Microhub	Logistics operators, couriers, local businesses, local authorities, DB	First operational Microhub deployed and tested at the first DB site (including operational procedures, stakeholder agreements, and performance monitoring)	Practical validation of the Microhub concept. Improved last-mile delivery consolidation. Lessons learned (design, governance, operator's need), integration within existing delivery networks	Reduced delivery inefficiencies in the pilot zone (reduced fossil-kilometres, congestion, local emissions). Improved acceptance of Microhubs as part of Frankfurt's sustainable logistics system
Second Microhub	Courier companies, local stakeholders, businesses, research and replication partners	Second Microhub planned, designed, deployed, and tested, informed by lessons from the first Microhub	Validation of the transferability of the Microhub model to a second location (refinement of operational and business model assumptions based on understanding of location-specific success factors).	Reduced delivery inefficiencies in the pilot zone (reduced fossil-kilometres, congestion, local emissions). Improved acceptance of Microhubs as part of Frankfurt's sustainable logistics system

5.4 Heidelberg (DE)

5.4.1 Pilot activities

The Heidelberg pilot focuses on the development and implementation of **Smart Loading Zones (SLZ)** and **integrated Mobile Microhubs** with electric cargo bikes to improve urban logistics efficiency and reduce congestion, emissions, and safety risks.

Given Heidelberg's compact and dense urban structure, characterised by limited public space and high competition among users, the pilot adopts a combined approach integrating digital curbside management and sustainable last-mile delivery solutions. The pilot will leverage advanced Digital Twin (DT) capabilities and Smart Loading Zones (SLZ) to optimise the use of loading zones and reduce inefficiencies caused by illegal parking and delivery-related traffic.

The overall aim of the Heidelberg pilot is to enhance the efficiency, safety, and sustainability of urban logistics through smart curbside management and the deployment of low-emission delivery solutions. The following are the specific objectives of the pilot:

- To implement dynamic curbside management systems based on real-time data.
- To improve the efficiency and utilisation of loading and unloading zones.
- To deploy Mobile Microhubs supported by electric cargo bikes.
- To promote behavioural change through Incentive and Rewards mechanisms (e.g. Smart Rewards).
- To assess legal, operational, and technical requirements for large-scale implementation.
- To assess regulatory feasibility and scalability within the German context.

The pilot site will be defined in the planning phase, considering several districts with high logistics pressure, including Bergheim, Neuenheim, Weststadt, and the Old Town, particularly its 2 km-long pedestrian zone. These areas are characterised by high delivery demand, limited curbside space, and frequent conflicts between transport modes, making them suitable testbeds for innovative logistics and curbside management solutions.

5.4.2 Partners involved

The Heidelberg pilot is implemented through a multi-stakeholder partnership, including:

Table 25. Partners in Heidelberg pilot

Tool/solution	Partner	Role in the pilot
All	STH	Pilot lead. Active member in the implementation of tools and solutions at the city level, actively engage local stakeholders, and provide structured feedback to inform policy development and governance frameworks.
	CBS	Responsible for business modelling
	SAU	Responsible for data acquisition and management
Digital Twin (DT)	LIST	Responsible for the development and operation of Digital Twin
	FUAS	DT task leader: Responsible for the development traffic models for the Digital Twin
	Exe/Trans	Technology provider
	UniR3	Responsible for the development of freight logistics models for the Digital Twin
Mobile Microhub (MH)	DBINF	Provision of site and infrastructure for Microhub deployment
	WCG	Microhub provider: infrastructure for Microhub deployment
	WUEB/CoW	As leader of the Pilot in Wroclaw, will offer guidelines for implementing the pilot, transferring learning from the leading city.
	PKUN	Technology provider

Tool/solution	Partner	Role in the pilot
Smart Loading Zones (SLZ)	BUAS	As leader of the Pilot in the Hague, will offer guidelines for implementing the pilot, transferring learning from the leading city.
Incentives and Rewards mechanisms (I&R)	UniR1	Incentives and Rewards Task Leader and technology developer
	MUV	Technology developer for the citizen-facing Incentives and Rewards component, contributing expertise in mobility gamification, digital engagement, user feedback and reward mechanisms for citizens and end users.
	MOV	Industrial partner supporting freight stakeholder engagement, identification of user needs and constraints, and operational validation.

Other stakeholders to be involved:

- Logistics operators and service providers: participation in pilot testing and operations.
- Businesses, residents, users: engagement through feedback and behavioural initiatives.

5.4.3 Timeline

The pilot is structured into three phases: pre-pilot, pilot, and post-pilot. The indicative schedule is presented below.

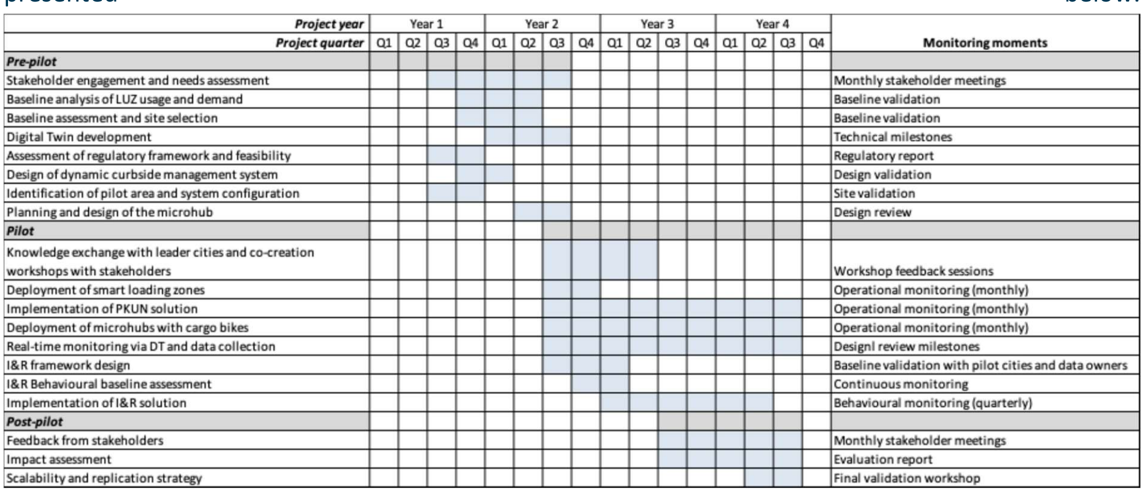

Figure 9. Timeline of Heidelberg pilot

5.4.4 Assessment of progress and success

Monitoring activities will be organized across the three pilot phases:

- During the pre-pilot phase, baseline conditions will be established through the analysis of loading/unloading zone usage, demand patterns for LUZ and Microhub use, traffic conditions, and regulatory constraints, complemented by stakeholder and governance assessments, the definition of key performance indicators and target values, and validation workshops to refine the pilot design. For the Digital Twin, baseline traffic conditions will be established using available data and simulation models, providing a reference for subsequent evaluation.

- During the pilot phase, monitoring will track implementation progress, operational performance, stakeholder engagement, and business model development through operational records, performance monitoring systems, stakeholder feedback, and regular project reviews. Continuous data collection will be performed through the Digital Twin, the deployed Smart Loading Zones, Microhubs with cargo bikes and I&R. They will capture real-time information on curbside utilisation, parking turnover, delivery patterns, Microhub participation, cargo-bike use, operational feasibility, and stakeholder acceptance, enabling the assessment of operational performance, the identification of deviations or critical issues, and the refinement of simulation models as additional data becomes available. Quarterly assessments will be conducted to evaluate progress against milestones and identify implementation barriers.
- In the post-pilot phase, monitoring results will be compared against baseline conditions and expected outcomes to assess the effectiveness, impacts, and transferability of the implemented solution. Particular attention will be given to validating governance arrangements, access rules, operational responsibilities, data-sharing procedures, conflict-resolution mechanisms, and replication potential, while the collected data will support the evaluation of pilot impacts and the development of scalability and replication strategies.

The progress of the pilot implementation will be monitored using the implementation and operational indicators presented below.

Table 26. Pilot progress monitoring indicators for the Heidelberg pilots

Monitoring area	Indicator	Measurement method	Frequency
Pilot implementation	Completion of planned pilot activities (%)	Progress reporting against implementation plan	Quarterly
Digital Twin integration	Availability of real-time data connections (%)	System monitoring reports	Monthly
Microhubs technical deployment	Completion of Microhub setup and operational readiness	Deployment records and validation reviews	Quarterly
SLZ Technical deployment	Number of Smart Loading Zones deployed and operational	Deployment records and system logs	Monthly
I&R Technical deployment	Number of participating logistics operators, couriers and professional drivers; frequency of Microhub use; operator and driver satisfaction with the Microhub and incentive mechanism	Participation records, Microhub operational data, user surveys and stakeholder interviews	Quarterly
Data quality	Completeness and reliability of collected data (%)	Data quality assessment	Monthly

Monitoring area	Indicator	Measurement method	Frequency
Stakeholder engagement	Number of stakeholder meetings and workshops organised	Meeting records	Quarterly
Stakeholder engagement	Number of participating logistics operators and stakeholders	Participation records	Quarterly
User engagement	Number of logistics operators and users participating in the pilot	Registration and participation records	Quarterly
Risk management	Number of identified issues resolved	Issue logs and corrective action records	Quarterly

The **assessment framework** will rely on a set of key indicators aligned with the Heidelberg pilot's expected outcomes. These include indicators such as integration of the Microhub, DT, SLZ and I&R solution with decision-making processes; environmental indicators (e.g. reductions in congestion and emissions); and societal indicators related to accessibility, user satisfaction, and stakeholder acceptance. For the DT, these include simulation-based indicators, such as cargo bike travel times, traffic flow efficiency, queue formation, and overall network performance under different Microhub network design scenarios. For the SLZ, these include indicators such as utilisation rates of loading zones, parking rotation, and reduction of illegal parking; environmental indicators (e.g. reductions in congestion and emissions); and societal indicators related to accessibility, user satisfaction, and stakeholder acceptance. Precise solution performance and impact indicators will be defined in the coming months, once the pilot design phase starts in M7.

The results of regular monitoring will be discussed at stakeholder meetings and quarterly reviews, enabling the pilot to adapt its operational and governance approach throughout the implementation process. The success of the Heidelberg pilot will be assessed by comparing pilot results against baseline conditions and predefined targets.

5.4.5 Expected outputs

The expected contribution of the Heidelberg pilot's tools and solutions is outlined below, including the main target groups, expected outputs, outcomes, and impacts.

Table 27. Expected outcomes for the Heidelberg pilot

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
Digital Twin (DT)	Urban planners and local authorities; decision-makers;	City-level Digital Twin integrating mobility, logistics, and curbside data to create a real-time digital	Improved data-driven decision-making. Enhanced ability to simulate and evaluate	Contribution to operational and environmental improvements through scenario simulation and optimisation.

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
	logistics and mobility operators	representation of pilot sites, logistics flows, operational conditions, Microhub deployment scenarios, enabling continuous monitoring, impact assessment, and evidence-based planning for the scaling of sustainable urban logistics solutions	alternative scenarios. Increased coordination between stakeholders and solutions	More efficient and data-driven urban logistics planning; improved coordination between public and private stakeholders (basis for scaling and replication)
Mobile Microhub (MH)	Courier companies, local stakeholders, businesses, research and replication partners	Microhub planned, designed, deployed, and tested.	Scaling blueprint for Microhub's dimensions, form and function	Reduced delivery inefficiencies in the pilot zone (reduced fossil-kilometres, congestion, local emissions). Improved acceptance of Microhubs as part of Heidelberg` sustainable logistics system.
Smart Loading Zones (SLZ)	Urban planners and local authorities; logistics operators; retailers and service providers	Deployment of dynamic Smart Loading Zones supported by Digital Twin and real-time monitoring systems	Improved curbside utilisation and allocation efficiency. Reduction of search time for parking/loading. Increased compliance with designated loading zones	Contribution to congestion reduction and improved delivery. More efficient use of urban space and reduced emissions
Incentives and Rewards mechanisms (I&R)	Logistics operators, professional drivers, couriers, Microhub providers, local	Microhub-focused Incentive and Reward logic to support operator participation, e-cargo-bike uptake	Improved understanding of freight stakeholder needs. Increased willingness to	Support for cleaner and more efficient last-mile logistics. Reduced transition barriers for Microhub and cargo-bike operations.

Solution/Tool	Target groups	Outputs	Outcomes	Impacts
	businesses, city authority and, where relevant, SLZ users	and sustainable last-mile delivery. Optional SLZ-linked incentive logic where technically and legally feasible	participate in Microhub-based logistics. Potential increase in Microhub and cargo-bike use where incentives are implemented and data are available. Improved feedback on operational barriers.	Evidence for scalable freight-focused incentive mechanisms. Potential contribution to improved curbside efficiency if SLZ-linked incentives are feasible.

6. Conclusion and next steps

This inception report provides a shared vision and baseline guidance for the NEXTLOGIC project pilot activities, defining a common framework, the deployment timeline for tools and solutions demonstrations, monitoring, and the expected outcomes for pilot activities across the eight NEXTLOGIC Mission Cities in seven European countries. It provides a shared vision for developing pilots for cities with diverse urban freight and mobility challenges, while supporting the transition toward climate-neutral, sustainable, and resilient urban environments by 2030.

The report describes how the NEXTLOGIC project will develop and validate interoperable solutions capable of addressing complex urban challenges while supporting evidence-based decision-making, through the deployment of Digital Twins, eXtended Reality tools, advanced data analytics (ADAV), 15-minutes Multimodal Hubs, Smart Loading Zones, mobile Microhubs with cargo bikes, electrification solutions, and behavioural incentive mechanisms.

A key achievement of this deliverable is the establishment of a harmonised framework for describing and monitoring activities that ensures consistency across pilots while preserving the flexibility needed to address local needs and priorities. The defined pilot description, implementation timelines, expected outcomes, and monitoring approach provide a robust basis for coordinated action, cross-city learning, and the generation of transferable knowledge. By bringing together cities with different characteristics, scales, and levels of maturity, NEXTLOGIC creates a unique environment for testing innovative solutions and assessing their replicability across Europe.

As the project progresses, the pilot scope definition, pilot activity timelines, and implementation and monitoring progress plans presented in this report will be further refined and operationalised. Additional guidance on the execution of city pilots, monitoring methodologies, data collection procedures, key performance indicators, and progress evaluation and replication will be provided in deliverable D4.1 – Operational Guidelines for Pilot Implementation and Monitoring. Together, these activities will support the successful delivery of the NEXTLOGIC pilots and contribute to the development of scalable, transferable tools and solutions that advance the European mission of climate-neutral and smart cities.

7. References

[1] Engels, D., Van Den Bergh, G., & Breemersch, T. (2017). Refined CIVITAS process and impact evaluation framework (Deliverable D2.3, CIVITAS SATELLITE Project). Transport & Mobility Leuven. https://civitas.eu/sites/default/files/satellite_d2.3_refined_evaluation_framework-final_version_2017-08-31.pdf

[2] Pechin, S., Fiorello, D., Borgato, S., & Diallo, S. (2024). Mobility for Urban Sustainability and the Environment CIVITAS 2030 Coordination and Support Action: Sustainable and Smart Mobility for All. https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e50bf7be75&appId=PPGMS

8. Abbreviations

Term	Definition
ADAV	Advanced Data Analytics and Visualisation
API	Application Programming Interface
AR	Augmented Reality
DLR	Dún Laoghaire-Rathdown
DPIA	Data Protection Impact Assessment
DT	Digital Twin
EFV	Electric Freight Vehicle
GHG	Greenhouse gas
HORECA	Hotels, Restaurants, and Cafés/Catering
I&R	Incentives and Rewards
KPI	Key Performance Indicators
LUZ	Loading and Unloading zones
PU	Public
PUDO	Pick-Up and Drop-Off
R	Document, Report
SBPDT	Smart Bike Parking Digital Twin
SLZ	Smart Loading Zones
SUMP	Sustainable Urban Mobility Plan
TLR	Technology Readiness Level
VR	Virtual Reality
WP	Work Package
XR	eXtended Reality