Data-driven and Dynamic Space and Assets for Physical Internet-led Urban Logistics and Planning

D6.2 Business and Operating Models

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Abstract

This deliverable presents the results of Task 6.2 of the DISCO project, focused on assessing the market readiness and positioning of selected digital solutions for urban logistics. The analysis targets a subset of high-maturity solutions (TRL 7–8) tested within the project's Living Labs and horizontal solutions developed within the project with a lower TRL (6-7). The process is conducted in two waves: first focusing on the solutions involved in the Starring Living Labs, then on the one involved in the Twinning Labs and on the horizontal solutions.

The methodology combines three dimensions: (1) a market readiness assessment using the "Business Opportunity Support System Tool (BOSAT)"; (2) market segmentation based on Steve Blank's four market types; and (3) market maturity analysis applying the Product Life Cycle Theory. Results provide a structured overview of each solution's market applicability and serve as a foundation for the exploitation and sustainability strategies developed in Task 6.3.

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Summary sheet

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0.7	18/08/2026	ALICE, CITYLOGIN	Comments Received
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List of acronyms

AI	Artificial Intelligence
API	Application Programming Interface
BOSAT	Business Opportunity Support Assessment Tool
CEP	Courrier Express Parcel
DANA	Depresión Aislada en Niveles Altos
DUM	Distribución Urbana de Mercaderias
EU	European Union
GIS	Geographic Information System
IPR	Intellectual Property Rights
KER	Key Exploitable Result
LEZ	Low Emission Zone
LSP	Logistic Service Provider
MMS	Meta Model Suite
PI	Physical Internet
PLC	Product Life Cycle
SDP	Smart Data Platform
SULP	Sustainable Urban Logistics Plan
TRL	Technology Readiness Level
UAC	Urban Access Control
UF	Urban Freight

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UFDS	Urban Freight Data Space
UVAR	Urban Vehicle Access Regulation
VIIP	Visualisation of Innovation and Impact Pathways
WMS	Warehouse Management System
WP	Work Package

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1. Introduction

The DISCO project aims to transform urban logistics through the development of innovative, data-driven solutions designed to enhance efficiency, sustainability, and integration within freight transport systems. Central to the project is the creation of a federated European Urban Freight Data Space: an open, collaborative digital ecosystem that facilitates secure and incentivised data sharing among the project's European Living Labs. This digital ecosystem provides local authorities, urban planners, and logistics stakeholders with advanced tools and intelligence for predictive, dynamic, and integrated urban freight planning. This supports smarter strategies for mobility and logistics across Europe. By enabling long-term access to operational, actionable data, DISCO promotes sustainable management of urban freight transport, fostering innovation in last-mile deliveries and multimodal solutions.

D6.2 is produced within Task 6.2 "Business and Operating Models," part of work package (WP) 6 dedicated to Market, Business, Exploitation, and Commercial Plans. This deliverable plays a key role in analysing the market readiness of the innovative solutions developed by DISCO and in providing the strategic and analytical basis for the identification of appropriate business and operating models. These models—aimed at ensuring the sustainable and scalable adoption of the solutions—are further developed in Task 6.3 and presented in D6.3. The analysis presented in D6.2 directly builds on the results from Task 6.1 "Market Mapper," which provided comprehensive stakeholder mapping, an ecosystem overview, and detailed monitoring of relevant market and technology trends in urban freight logistics. Specifically, Task 6.1 supported Task 6.2 in the following ways:

- stakeholder segmentation from Task 6.1 (including early adopters, procurers, and private-sector actors) enabled targeted interviews and positioning analysis for market readiness assessments at Living Labs.
- technology and market trend analysis provided a dynamic baseline against which Task 6.2 could assess the maturity of DISCO solutions across multiple application domains (e.g., digital twins, last-mile orchestration, curbside management).
- ecosystem and competitor mapping from Task 6.1 allowed Task 6.2 to place DISCO within relevant market typologies—such as new market creation, niche strategies, or cost-based re-segmentation of existing markets—based on real competition and identified gaps.

Task 6.2 employs a mixed-method evaluation framework, which includes:

- a market readiness assessment based on the Business Opportunity Support System Tool (BOSAT), used to assess the innovation maturity, business opportunity potential and to understand the strengths and weaknesses related to exploiting project results;
- data collection through surveys and one-to-one meetings with stakeholders in the project's Living Labs (both Starring and Twinning Living Labs);

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- market positioning analysis across four types: existing markets, new markets, re-segmentation of existing markets as low-cost players, and niche strategies;
- classification of innovations according to product life cycle stages (development, growth, maturity, decline).

Therefore, Task 6.2 provides an ex-ante assessment of where each DISCO solution currently stands in terms of market readiness and positioning. It maps the solutions across different market types and life cycle stages, offering a knowledge base to inform strategic decisions regarding future business and operational model development.

As a consequence, Task 6.3 will build directly on these insights to develop concrete business and operational models. This includes the creation of value proposition canvases, Lean Business Model Canvases, and the definition of Intellectual Property Rights (IPR) strategies. Furthermore, Task 6.3 will address how each solution should be governed, managed, and sustained—laying the groundwork for the exploitation plan and long-term deployment strategies. In this sense, D6.2 represents a strategic analytical foundation upon which Task 6.3 will construct the full exploitation framework of the DISCO results.

1.1. Connection with other Tasks and Work Packages

The development of D6.2 "Business and Operating Models" is linked to several tasks and work packages within the DISCO project: WP4 and WP5 for the solutions implemented within the Starring and the Twinning Living Labs; WP2 and WP3 for the horizontal solutions developed within the project and thus at a lower TRL. This integration allows the business and operational strategies for urban freight solutions developed within Task 6.3 to be based on market analysis, stakeholder engagement, technological development, and real-life demonstrations. This approach ensures consistency and alignment across project activities, supporting the definition of scalable and applicable market solutions.

1.1.1. Relationship with Task 6.1 – Market Mapper and D6.1

As anticipated, a direct connection exists between D6.2 and Task 6.1, which produced D6.1 *DISCO's Stakeholder and Market Analysis Report*. D6.1 offers comprehensive stakeholder mapping and innovation landscape analysis, identifying key actors within the digital urban logistics ecosystem, including public authorities, research organisations, private sector companies, investors, and technology developers. This detailed mapping clarifies roles, interests, and influence of relevant stakeholders, enabling the design of business and operating models aligned with market realities while fostering collaboration across a diverse ecosystem. Additionally, the assessment of ongoing R&D projects, patent activity, and private investment trends highlights areas of concentrated innovation and potential saturation. This information is important for strategically positioning DISCO's solutions and identifying competitive advantages or potential challenges.

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The report also provides a focused market positioning analysis for each of the project's Key Exploitable Results (KERs). By leveraging the broader stakeholder and trend analysis developed in D6.1, D6.2 evaluates the market potential, readiness level, and context-specific conditions of each solution. This will enable the formulation of tailored business and operating model considerations, aligned with the maturity and segmentation of each innovation, developed within Task 6.3 "Business opportunities and exploitation". Furthermore, the analysis of demand and competitive environment enriches the understanding by profiling potential users and early adopters and benchmarking DISCO's solutions against existing market offerings. These insights will guide the development of customer segmentation, value proposition differentiation, and competitive positioning. In addition, identifying adoption barriers and partnership opportunities within the competitive landscape allows D6.2 to anticipate market challenges and refine operating models accordingly.

Finally, the strategic synthesis of findings using the VIIP (*Visualisation of Innovation and Impact Pathways*) methodology provides a visual and analytical framework to understand key innovation actors, emerging trends, and their interrelations. This approach supports the prioritisation of business opportunities and informs the definition of potential governance and operating models by highlighting stakeholder roles, dependencies, and influece networks. While D6.2 does not formally define governance structures, it lays the analytical groundwork for the development of federated, collaborative operating models aligned with DISCO's vision of an open, incentivised data-sharing ecosystem for urban freight — an activity to be further developed in Task 6.3.

1.1.2. Linkages with Task 6.3 – Business Opportunities and Exploitation

D6.2 is directly linked to Task 6.3, which focuses on defining exploitation strategies and sustainability plans. While D6.2 does not develop full business and operating models, it provides the strategic and analytical groundwork through market readiness assessments, segmentation, and contextual positioning of DISCO solutions. These insights are essential for Task 6.3, which will build upon them to define value propositions, lean business model canvas, and intellectual property rights assessments . In this sense, D6.2 supports the feasibility and relevance of the exploitation pathways to be designed in Task 6.3, facilitating the long-term adoption and scalability of DISCO innovations. It is also important to specify that Task 6.2 and Task 6.3 worked in close collaboration benefitting by the support of the BOOSTER programme which is an initiative from the European Commission providing a set of services to EU-funded projects, free-of-charge, to help navigate the complexities of dissemination and exploitation.

1.1.3. Connections with other Work Packages

The development of business and operating models in D6.2 is closely linked to several other work packages within the DISCO project. These connections ensure that the models are technically feasible, market-informed, and aligned with the overall strategic vision of the project.

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WP4 – *The Starring Living Labs* provides the initial real-world environments where DISCO's innovative solutions are tested, demonstrated, and refined. WP4 is responsible for setting up the local ecosystems, managing data access, and creating a trusted environment for data exchange among stakeholders in cities such as Helsinki, Ghent, Thessaloniki, and Copenhagen. The outcomes of these demonstrations offer invaluable insights into operational challenges and user needs, which D6.2 uses to tailor its business models for market readiness and scalability.

WP5 – *The Twinning Living Labs* builds on the experience gained from WP4, aiming to replicate and expand the adoption of DISCO's solutions in a second set of cities. WP5 focuses on knowledge transfer, ensuring lessons learned from the Step 1 Living Labs inform the implementation strategies in Step 2 sites. This continuity enables D6.2 to validate and adapt the selected solutions for wider market applicability and supports the scaling potential of the project's innovations. By facilitating cross-WP integration, WP5 ensures that operational models consider diverse regional contexts and user profiles, enhancing the robustness of exploitation strategies.

WP7 – *New Generation of Sustainable Logistics and Planning* is central to DISCO's dissemination, communication, and stakeholder management activities. WP7 develops targeted strategies to maximise the impact and visibility of project results, manages key European stakeholder networks, and supports the sustainability of DISCO's innovations beyond the project duration. The Knowledge Hub and eLearning platforms created by WP7 serve as critical tools for knowledge sharing and capacity building, reinforcing the business ecosystem envisioned by D6.2. Moreover, WP7's work supporting Follower Cities and EU Mission Cities aligns with D6.2's objective of ensuring the long-term scalability and adoption of DISCO solutions.

2. Methodology

The methodology adopted in the DISCO project for the assessment of business models aims to analyse the commercial potential of the developed solutions, considering factors such as market readiness, competitive positioning, and the maturity of the target market. The approach is divided into several phases, supported by analytical tools and based on theoretical and practical references from academic literature and innovation management. They have also been contrasted with the practical knowledge of the existing logistics company.

The methodological process is implemented in two distinct cycles, corresponding to the two tiers of the DISCO Living Labs: the first involves the Starring Living Labs, and the second involves the Twinning Living Labs. The steps are consistent across both cycles but carried out at different times to allow for progressive and comparative analysis. The same methodology is employed at the Starring Living Labs and replicated in the Twinning Living Labs with potential adjustments to the tools based on data collected during the previous phase to improve their effectiveness and suitability. This sequential approach enables the collection of comparable data across both groups of Living Labs.

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In parallel to these two cycles, the same approach is also used for horizontal solutions developed within the project that have a lower market maturity.

The methodology consists of three main components:

- market readiness assessment[1]: the "Business Opportunity Support System Tool (BOSAT)" is used to assess the innovation maturity, business opportunity potential, and to understand the strengths and weaknesses related to exploiting project results. BOSAT evaluates the project across six dimensions: technology, team, market, unique value proposition, and intellectual property;
- market segmentation: positioning each solution within the appropriate competitive environment using a classification based on Steve Blank's model[2], distinguishing between existing markets, new markets, low-cost re-segmented markets, and niche re-segmented markets;
- market maturity analysis: applying the Product Life Cycle Theory (Levitt, 1965[3]; Kotler & Keller, 2016[4]) to identify the lifecycle phase of the target market (introduction, growth, maturity, decline) and derive strategic implications for each stage.

The combined application of these components allows for a coherent analysis of how each solution aligns with the characteristics of its target market, providing operational insights for business model development. The approach ensures alignment between technological maturity, market dynamics, and competitive positioning.

2.1. Market Readiness Assessment Methodology

The Market Readiness Assessment of each DISCO KER was assessed through a structured methodology building upon the Business Opportunity Support Assessment Tool (BOSAT). BOSAT provides a multidimensional evaluation of business opportunities by analysing several aspects that influence the commercial potential of an innovation, including technology, market, business, team and financial perspectives. As the BOSAT methodology does not directly classify innovations according to their commercialization stage, its results were complemented with a market readiness assessment framework specifically developed for DISCO. This framework translates the BOSAT outcomes into three market readiness stages, namely Validation, Early Market and Full Commercialization, reflecting the maturity of each solution from a market perspective. The

[1] BOSS project https://ipbooster.meta-group.com/
[2] Blank, S., & Dorf, B. (2020). *The startup owner's manual: The step-by-step guide for building a great company*. John Wiley & Sons.
[3] Levitt, T. (1965). *Exploit the Product Life Cycle*. Harvard Business Review.
[4] Kotler, P., & Keller, K. L. (2016). *Marketing Management* (15th ed.). Pearson.

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assessment primarily considers the four BOSAT dimensions that most directly influence commercialization potential:

- Technology, assessing the maturity and robustness of the proposed solution;
- Market, evaluating the attractiveness of the target market and the evidence of customer demand;
- Business, analysing the clarity and viability of the business model and value proposition;
- Team, considering the capability of the consortium or organisation to bring the solution to market.

Although the financial dimension was analysed within BOSAT, it was not considered a primary discriminator of market readiness. As DISCO is a research and innovation project, several solutions are still in the pre-commercial phase and have not yet generated significant commercial revenues. Consequently, financial performance alone would not provide a reliable indication of commercialization maturity.

The BOSAT assessment was complemented by qualitative evidence collected throughout the project, including the level of validation achieved within the Living Labs, demonstration activities, maturity of the exploitation strategy and the existence of identified market opportunities. This combined approach ensures that the market readiness classification reflects both the quantitative BOSAT assessment and the actual progress achieved by each innovation during the project.

Based on these elements, each KER was assigned to one of the following market readiness stages:

Table 1 Market Stages

Market Stage	Assessment criteria
Validation	The solution has demonstrated its technical feasibility but still requires further market validation. Market demand, business model or organisational capabilities are not yet sufficiently consolidated for commercial deployment.
Early market	The solution has achieved successful validation in operational environments and presents a sufficiently mature value proposition and business model. Initial market opportunities have been identified and the solution is ready for early commercial deployment or first adopters.
Full commercialization	The solution demonstrates a mature technology, validated business model, clear market demand and organisational capacity to support large-scale deployment. The innovation is considered ready for broad market uptake and commercial scaling.

2.2. Placing Solutions in Relevant Markets Using Market Segmentation

The second component of the business model assessment methodology focuses on positioning each DISCO Key Exploitable Result (KER) within its target market through a structured market segmentation analysis. The objective is to identify the market environment in which each solution is expected to compete, thereby providing the basis for the subsequent definition of appropriate business models and exploitation strategies. The market positioning assessment is based on the

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market typology proposed by Steve Blank, which classifies innovations according to the characteristics of the market they address rather than their technological maturity. This approach is particularly suitable for the DISCO project, where the developed solutions range from digital platforms and decision-support tools to operational logistics innovations, each addressing different user groups and deployment contexts.

Accordingly, each DISCO solution was classified into one of the following market categories:

- Existing market: solutions competing within established markets characterised by clearly defined customer needs, recognised competitors and mature purchasing behaviours. These innovations generally improve existing processes through increased efficiency, enhanced functionality or operational optimisation.
- New market: solutions addressing previously unmet or emerging customer needs by introducing novel services, business models or technological capabilities. These innovations typically require market education and progressive adoption before reaching widespread commercial deployment.
- Re-segmented market (low-cost player): solutions entering an existing market by providing comparable functionalities with improved cost efficiency or reduced implementation costs, targeting price-sensitive customers or organisations seeking more accessible alternatives.
- Re-segmented market (niche strategy): solutions focusing on a specialised segment of an existing market by addressing specific operational, regulatory or geographical requirements that are not adequately covered by mainstream solutions.

The classification of each KER was performed through a structured qualitative assessment combining evidence collected throughout the project. Rather than relying on a single indicator, the assessment integrated technical documentation, market readiness results and implementation evidence generated during the Living Lab activities. This approach ensures that the market positioning reflects the actual deployment context and intended commercial application of each solution.

For each KER, the assessment considered four complementary dimensions:

- Primary customer: identification of the main organisation or stakeholder expected to adopt the solution (e.g. municipalities, logistics operators, infrastructure managers or technology providers);
- Customer need: identification of the operational challenge or market need addressed by the solution and assessment of whether this represents an established demand or an emerging opportunity;
- Competitive environment: assessment of whether comparable solutions already exist in the market or whether the innovation addresses a largely unexplored application domain;

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- Differentiation strategy: identification of the solution's principal competitive advantage, such as improved operational efficiency, reduced implementation costs, enhanced digital capabilities or specialisation for a specific application domain.

To support this assessment, a solution profile matrix was developed for each DISCO KER, synthesising the key characteristics required for market classification.

Table 2 Market positioning

Solution	Primary Customer	Customer Need	Competitive Environment	Main Differentiation	Assigned Market Type
[Solution]	[Customer group]	[Need addressed]	[Existing/Emerging market]	[Key competitive advantage]	[Existing/New/re-segmented Low-Cost/Re-segmented Niche]

The resulting market positioning provides a structured understanding of the commercial environment in which each DISCO solution is expected to operate. Together with the market readiness assessment presented in the previous section, this analysis establishes the foundation for the definition of the business models developed in Task 6.3. It also facilitates the identification of appropriate customer segments, strategic partners and early adopters, supporting the long-term sustainability and scalability of the project's Key Exploitable Results.

2.3. Analysing Market Maturity Using the Product Life Cycle Theory

The third component of the business model assessment methodology focuses on assessing the maturity of the market environment in which each DISCO Key Exploitable Result (KER) is expected to operate. Understanding market maturity is essential for defining realistic exploitation pathways, selecting appropriate commercialisation strategies and identifying the actions required to support market uptake.

To perform this assessment, the Product Life Cycle (PLC) theory[5] was adopted as the conceptual framework. Although originally developed to describe the evolution of commercial products, the PLC model provides a useful lens for analysing the maturity of innovation markets and the dynamics affecting technology adoption.

According to the PLC theory, markets generally evolve through four stages:

- Introduction, characterised by limited adoption, few market actors and a strong need for awareness-building and demonstration activities.
- Growth, characterised by increasing adoption, expanding customer interest and the progressive entry of competitors.

[5] Cox, William E. "Product life cycles as marketing models." *The journal of business* 40.4 (1967): 375-384.

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- Maturity, characterised by widespread market acceptance, stable demand and increased competitive pressure.
- Decline, characterised by decreasing demand due to technological substitution or changing market needs.

These stages provide a common reference for interpreting the commercial context surrounding each DISCO solution.

The PLC assessment was carried out through a qualitative evaluation combining evidence generated throughout the project rather than relying on market statistics alone. The objective was to determine the maturity of the target market by considering both the characteristics of the innovation and the context in which it is expected to be deployed.

The assessment integrated three complementary sources of evidence:

- the market readiness assessment developed through the BOSAT methodology;
- the market positioning analysis described in Section 2.2;
- implementation evidence collected through the Living Labs, including deployment experience, stakeholder engagement and feedback from potential adopters.

Based on these inputs, each solution was evaluated against four assessment criteria:

- Market adoption, considering the extent to which similar solutions are already deployed and accepted by the target users.
- Competitive environment, evaluating whether the market is emerging, expanding or already characterised by numerous established solutions.
- Customer awareness, assessing the degree to which potential customers recognise both the problem addressed and the value offered by the solution.
- Innovation dynamics, considering whether the solution represents an emerging innovation, an improving technology within an established market or a technology operating in a mature environment.

The combined assessment of these criteria enabled each DISCO solution to be positioned within one of the four Product Life Cycle stages.

The identified PLC stage was subsequently used to support the development of business models and exploitation strategies. Solutions operating in the Introduction stage generally require demonstration activities, stakeholder engagement and awareness-building initiatives to stimulate market acceptance. Solutions positioned in the Growth stage benefit from strategies supporting market expansion, strategic partnerships and scaling activities. Solutions operating in Mature markets are expected to compete primarily through differentiation, operational efficiency and continuous service improvement. Although none of the DISCO solutions are expected to operate in declining markets, the Decline stage remains part of the assessment framework to ensure methodological completeness and future applicability beyond the project.

The integration of the Product Life Cycle analysis with the market readiness and market positioning assessments provides a coherent view of the commercial context surrounding each DISCO innovation, supporting the definition of realistic exploitation pathways and sustainable business models.

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2.4. Scope and Selection of Solutions for Business Model Analysis

The analysis presented in D6.2 focuses on a selected set of DISCO solutions that have reached a sufficient level of technical maturity and strategic relevance to undergo structured evaluation in terms of market applicability. Given the wide range of tools and platforms developed within the project, criteria for inclusion were established to concentrate the assessment on those innovations best suited for analysis within the scope of Task 6.2.

The primary selection criterion was the Technology Readiness Level (TRL), with emphasis placed on solutions at TRL 7 or 8. These levels indicate technologies that have been successfully demonstrated in operational environments and are therefore suitable for the kind of market readiness analysis envisioned in Task 6.2. The TRL classification adopted is consistent with the definitions provided by the European Commission, particularly as outlined in the Horizon Europe General Annexes[6], which define TRL levels from 1 (basic principles observed) to 9 (actual system proven in operational environment).In parallel, solutions were selected based on their alignment with DISCO's Key Exploitable Results, which organise the project's outputs into thematic clusters targeting specific urban freight challenges. This strategic alignment ensures that the analysis contributes to the broader project objectives while remaining within the evaluative mandate of Task 6.2.

The focus of D6.2 is not on commercialisation planning or business case definition, which are addressed in Task 6.3, but on assessing the applicability of project solutions based on the three analytical dimensions previously introduced: market readiness, market segmentation, and market maturity.
The outcome of D6.2 consists of analytical insights and structured profiles of selected solutions, supporting the understanding of their potential application in the digital urban logistics landscape. This preparatory work lays the foundation for more advanced exploitation activities to be carried out under Task 6.3, without directly addressing aspects such as IPR, value proposition mapping, or business case development.

3. Identified solutions within the Starring LLs

3.1. Identified solutions

During the first phase of the project (until M24), four solutions have been identied with high potential for commercialization:

[6] European Commission. (2014). *Guidelines on Technology Readiness Levels (TRL) and their use in Horizon 2020*. Available at: https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

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- **The Smart Data Platform (developed by IMEC):** To facilitate the integration and sharing of urban freight data, IMEC deployed a Smart Data Platform (SDP), a tool developed within DISCOLLECTION, on a Kubernetes cluster and hosted it on their servers. The SDP was specifically designed to manage and integrate urban freight data. It included a built-in Urban Freight Data Space (UFDS) connector, enabling the platform to publish all data within it to the broader UFDS, facilitating seamless data exchange between the stakeholders in the ecosystem. *(More details in D4.2)*
- **The WareM&O Platform (developed by CERTH):** it is a digital marketplace where warehouse owners can list available spaces and tenants can easily search, compare, and book the capacity they need. It integrates e-signatures and blockchain-based smart contracts for secure, transparent transactions. By offering real-time updates on space availability, the platform enables more efficient and collaborative logistics operations, as API Documentation has been developed and tested to connect the Warehouse Management Systems and Building Management Systems to update the capacities dynamically on the platform. *(More details in D4.2)*
- **The Digital Twin for Decision Making (developed by IRTX):** the objective in Copenhagen was to develop a dynamic transport data collection model involving private logistics and e-commerce companies, and to engage the local industrial community in shaping the new Sustainable Urban Logistics Plan (SULP). To this aim they adopted a Digital Twin approach for urban logistics, allowing for the simulation and analysis of logistics movements and patterns across different scales within the city. This digital representation supports the creation of forward-looking strategies that contribute to the decarbonization of the logistics sector, such as new traffic regulations, unbundling infrastructure, incentives for clean vehicles, and the adjustment of distribution periods. *(More details in D4.2)*
- **The Urban Access Control (developed by BE-MOBILE):** this system enhances logistics efficiency, safety, and sustainability. By integrating digitized Urban Vehicle Access Regulations (UVARs) into logistics planning tools, the system will enable transport companies to automatically incorporate access rules, such as emission zones and time windows, into their route optimization. The UAC will also provide real-time information on (un)loading zones, school areas, and congestion hotspots, improving navigation and operational decision-making for logistics operators. *(More details in D4.2)*

3.2. Results of the Market Readiness assessment

The market readiness assessment was conducted to evaluate the commercial maturity of the selected DISCO KERs and their potential to progress towards sustainable market deployment. As described in the methodology, the assessment combines quantitative and qualitative evidence rather than relying on a single evaluation instrument. Specifically, the analysis integrates the results of the Business Opportunity Support Assessment Tool (BOSAT), the implementation and validation activities carried out in the Starring Living Labs, the evaluation of technical and operational impacts, and dedicated interviews conducted with the leaders responsible for each KER. This triangulation of evidence provides a comprehensive understanding of the maturity of each solution, considering both its technical achievements and its commercial potential.
Unlike technology readiness, which primarily reflects the level of technical development, market readiness evaluates the extent to which a solution is capable of generating value within a real

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market environment. Consequently, the assessment considers not only the maturity of the technology itself, but also the existence of validated customer needs, the robustness of the business model, the capability of the development team to support commercial deployment, and the degree to which the solution has already been demonstrated in operational environments. The analysis further considers the barriers that still hinder large-scale deployment and the actions required to support the transition towards wider market uptake.

For the three KERs (Smart Data Platform, WareM&O Platform and Digital Twin) supported by a BOSAT assessment, the BOSAT results were combined with evidence collected during the implementation and evaluation activities documented in D4.2 and D4.3. For the Urban Access Control solution, where no BOSAT assessment was available, the same evaluation dimensions were assessed through qualitative evidence derived from the implementation activities and from the structured interviews with the KER leader, ensuring methodological consistency across all four solutions.

Table 3 summarises the overall market readiness classification of the four KERs analysed.

Table 3 Market readiness assessment: Starring LLs solutions

Solution	Market Readiness Stage	Overall Assessment
SDP	Validation	Technically validated solution with successful operational demonstrations. Commercial deployment remains dependent on the maturation of the Urban Freight Data Space ecosystem and wider stakeholder adoption.
WareM&O Platform	Full Commercialization	Mature digital solution addressing an established market need with a well-defined value proposition and limited remaining barriers to commercial deployment.
Digital Twin	Early Market	Successfully demonstrated in operational conditions with clear customer value and identified early adopters, while requiring further replication and market expansion.
UAC	Early Market	Validated solution responding to increasing regulatory and operational needs, with commercial deployment depending on broader adoption of harmonised access regulation data and system integration.

3.2.1. Smart Data Platform

The Smart Data Platform (SDP), developed by IMEC, represents one of the enabling digital infrastructures within the DISCO ecosystem. Rather than functioning as a standalone commercial software product, the platform provides the technological backbone for integrating, managing and sharing urban freight data through the Urban Freight Data Space. By combining data integration capabilities with a native UFDS connector, the platform enables public authorities and logistics stakeholders to exchange information in a secure and interoperable environment, supporting evidence-based urban freight planning and collaborative decision-making. The implementation carried out within the Starring Living Labs demonstrated the technical feasibility of the platform and confirmed its capability to manage heterogeneous urban freight datasets while supporting data exchange among multiple stakeholders. The evaluation activities performed during the project

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further confirmed the operational value of the platform. Beyond its technical performance, the SDP contributed to strengthening collaboration among project partners, improving data availability and creating the conditions for more advanced planning tools such as Digital Twins and predictive logistics models. The evaluation also highlighted that the platform generated value not only through the technology itself but through its ability to facilitate trusted data sharing across organisational boundaries, a prerequisite for implementing Physical Internet principles in urban logistics. The interview with the KER leader reinforces this interpretation. While recognising the successful technical validation achieved during the project, the interview identifies several factors that currently limit broader commercial deployment. The primary challenge is not related to the maturity of the software but to the maturity of the surrounding ecosystem. The commercial success of the platform depends on the availability of high-quality datasets, the willingness of public and private stakeholders to participate in data-sharing initiatives, and the achievement of a sufficient critical mass of users capable of generating network effects. The interview also identifies municipalities with advanced digital strategies and organisations involved in digital transformation and/or data space initiatives as the most likely early adopters, indicating that market uptake is expected to occur progressively rather than through immediate large-scale commercialisation.
Given these conditions, and considering that no commercialization activities are currently envisaged by the solution owner beyond the completion of the DISCO project, a sufficiently defined commercialization pathway has not been yet established to support the development of a dedicated Business Plan. The implications of these conditions for the future exploitation of the solution are further addressed in Task 6.3.

Table 4 Market readiness assessment: SDP

Assessment criterion	Result
Market Readiness Stage	Validation
Key supporting evidence	Successful deployment within the Starring Living Labs; demonstrated capability to integrate and exchange urban freight data; positive operational evaluation; clearly identified early adopters.
Main barriers to commercialisation	Limited maturity of the Urban Freight Data Space ecosystem; dependence on stakeholder participation and data availability; need to reach a critical mass of users.
Next step towards the following stage	Expand deployments beyond the project, strengthen ecosystem participation, and demonstrate sustainable value creation through operational data-sharing services.

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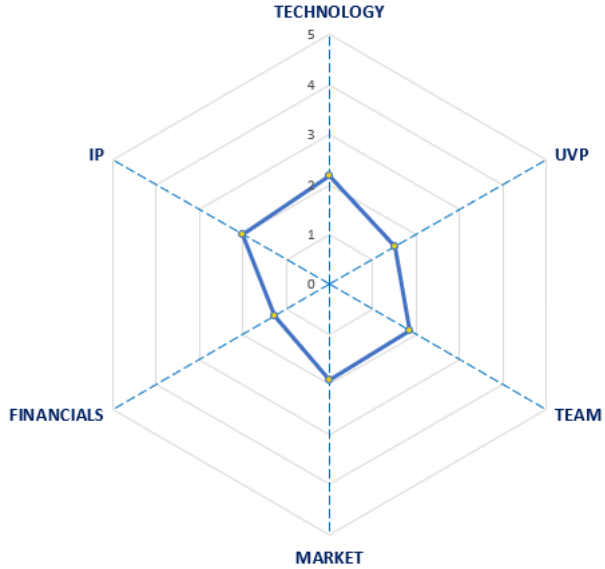

Figure 1 Radar Chart Smart Data Platform

The available evidence therefore suggests that the Smart Data Platform has successfully demonstrated its technical feasibility and operational value but has not yet reached a level of market maturity that would support broad commercial deployment. The remaining barriers are largely ecosystem-related rather than technological, requiring continued stakeholder engagement, wider adoption of Urban Freight Data Spaces and further consolidation of the governance framework for trusted data sharing.

3.2.2. WareM&O Platform

The WareM&O Platform, developed by CERTH, is the most commercially oriented solution among the analysed KERs. The platform functions as a digital marketplace connecting warehouse owners with logistics operators seeking flexible storage capacity, allowing available spaces to be searched, compared and booked through a single digital environment. The integration of electronic signatures, blockchain-based smart contracts and dynamic capacity updates through Building Management Systems and Warehouse Management Systems provides a comprehensive digital service capable of supporting collaborative warehousing and more efficient utilisation of existing logistics infrastructure. This value proposition addresses a clearly established market need, namely the optimisation of warehouse capacity and the reduction of underutilised logistics assets. The implementation activities demonstrated that the platform is capable of supporting real operational scenarios and validating the technical architecture under realistic conditions. Unlike solutions that primarily provide decision-support capabilities, WareM&O delivers a transactional service with clearly identifiable customers, operational workflows and revenue-generation potential. The evaluation performed within the Starring Living Labs further confirmed the practical applicability of the solution and highlighted its contribution to improving infrastructure utilisation and collaborative logistics operations. The interview with the KER leader confirms that the platform has moved beyond proof-of-concept and is approaching commercial deployment. The remaining challenges relate less to technological development and more to market expansion, strategic partnerships and scaling activities capable of increasing the number of participating warehouse owners and logistics operators. The interview also identifies a clearly defined customer base and recognises that the business model is already sufficiently mature to support commercial exploitation, while additional demonstrations would primarily accelerate market penetration rather than complete technical validation.

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Table 5 Market readiness assessment: WareM&O

Assessment criterion	Result
Market Readiness Stage	Full Commercialization
Key supporting evidence	Operationally validated platform; mature value proposition; clearly identified customer segments; existing market demand; scalable business model.
Main barriers to commercialisation	Expansion of the customer base, establishment of strategic partnerships and wider market penetration.
Next step towards the following stage	Scale commercial operations through customer acquisition, partnerships and deployment in additional cities and logistics networks.

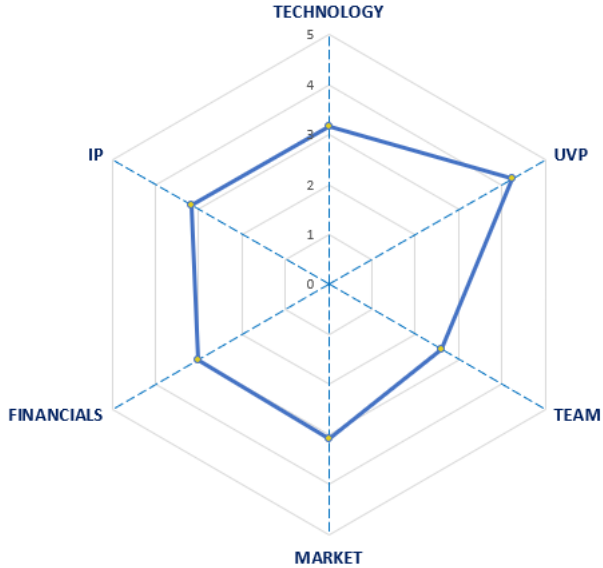

Figure 2 Radar Chart WareM&O Platform

The available evidence indicates that WareM&O has reached a substantially higher level of commercial maturity than the other analysed KERs. The technology has been successfully demonstrated, the customer value proposition is clearly established, the target market already exists, and the remaining activities primarily concern commercial scaling rather than product development. The platform can therefore be considered to have reached, or to be very close to reaching, the Full Commercialization stage.

3.2.3. Digital Twin for decision making

The Digital Twin for Decision Making, developed by IRTX and demonstrated in the Copenhagen Starring Living Lab, represents a strategic planning and decision-support tool designed to improve urban freight management through advanced simulation and predictive analysis. The solution combines multiple urban freight datasets to create a dynamic digital representation of logistics flows, enabling public authorities to evaluate the impacts of alternative policy measures before their implementation. Within DISCO, the Digital Twin was applied to support the development of Sustainable Urban Logistics Plans (SULPs) by simulating different policy scenarios, including traffic regulations, access restrictions, infrastructure allocation, distribution time windows and incentives for low-emission logistics. The implementation activities demonstrated both the technical robustness of the modelling framework and its practical applicability within urban planning processes. Unlike conventional traffic modelling tools, the Digital Twin integrates operational freight data collected through the Urban Freight Data Space, allowing the simulation environment to reflect real logistics operations more accurately. This capability significantly increases its value for

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municipalities seeking evidence-based policy design. The implementation also confirmed the feasibility of integrating multiple data sources while engaging public authorities and private logistics stakeholders throughout the modelling process. The evaluation presented in D4.3 further confirms the contribution of the Digital Twin to supporting strategic decision-making. Although the primary benefits are qualitative rather than transactional, the evaluation highlights its ability to improve planning processes, increase stakeholder awareness and facilitate collaborative policy development. The solution therefore creates value through improved decision quality rather than through direct operational optimisation alone. At the same time, the evaluation recognises that successful deployment depends heavily on the availability of reliable local datasets and the active participation of multiple stakeholders during model development and validation. The interview with the KER leader reinforces these findings. Municipalities and metropolitan authorities are identified as the primary customer groups, while urban planning consultancy firms represent additional market opportunities. As well as newly implemented companies that seek to ensure the suitability of the location where to position a distribution hub. The interview highlights that the solution has successfully demonstrated its applicability within the Living Lab but also acknowledges that each implementation requires adaptation to the local urban context, available datasets and policy objectives.

These implementation requirements also influence the solution's current commercial readiness. Although the Digital Twin demonstrates clear market potential, further replication across different urban contexts is needed to establish a sufficiently defined and repeatable commercial offering. Consequently, a dedicated Business Plan was not developed at this stage. The implications of these conditions for the future exploitation of the solution are further addressed in Task 6.3.

Table 6 Market readiness assessment: Digital Twin

Assessment criterion	Result
Market Readiness Stage	Early Market
Key supporting evidence	Successful demonstration within Copenhagen; validated support for evidence-based urban freight planning; identified customer groups; positive stakeholder engagement; recognised planning value.
Main barriers to commercialisation	Need for replication across multiple cities; dependence on local datasets; project-specific customisation; customer acquisition within the public sector.
Next step towards the following stage	Further progression would require broader deployment, stronger ecosystem participation, and evidence of sustainable value creation through operational data-sharing services.

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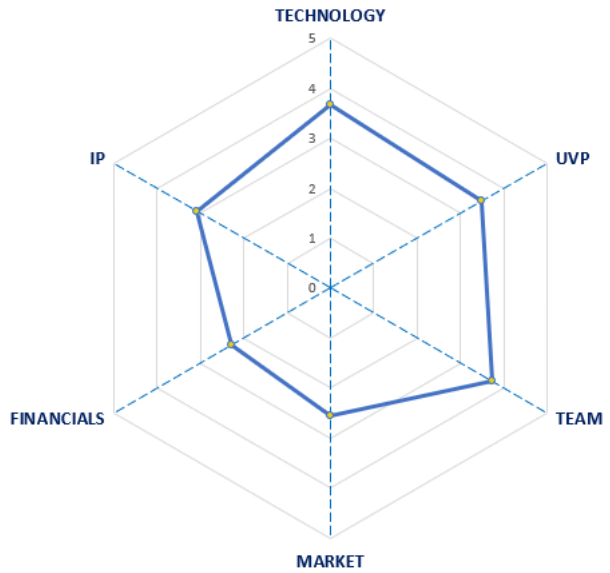

Figure 3 Radar Chart Digital Twin for decision making

Considering the combined evidence, the Digital Twin has progressed beyond the validation phase and can be considered an Early Market solution. It has demonstrated a mature technological foundation and a clearly recognised value proposition while successfully validating its application in operational environments. Nevertheless, broader commercial deployment will require additional city implementations capable of demonstrating transferability across different urban contexts and supporting the development of repeatable commercial offerings.

3.2.4. Urban Access Control

Urban Access Control (UAC), developed by BE-MOBILE, addresses one of the most rapidly evolving challenges in urban logistics, namely the increasing complexity of urban vehicle access regulations (UVARs). The solution enables logistics operators to automatically integrate dynamic access restrictions, including low-emission zones, delivery time windows, school streets and other regulatory constraints, directly into route planning and operational decision-making. By combining regulatory information with real-time operational data, the system supports more efficient route optimisation while improving regulatory compliance, reducing unnecessary vehicle movements and contributing to more sustainable urban freight operations. Although no BOSAT assessment was available for this KER, sufficient evidence was collected through the implementation activities, evaluation results and structured interview with the KER leader to apply the same market readiness framework adopted for the other solutions. The implementation documented in D4.2 demonstrates that the technical concept was successfully validated within the project and that the integration of digitalised UVAR information into logistics planning tools is technically feasible. The solution directly responds to increasing regulatory requirements introduced by European cities and therefore addresses a clearly identifiable operational need for logistics operators and transport management system providers. The evaluation activities further confirm the relevance of the solution by highlighting its contribution to improving logistics efficiency, supporting safer urban operations and facilitating compliance with evolving urban mobility policies. Beyond the direct operational benefits, the solution contributes to broader policy objectives by enabling more efficient implementation of access regulations without increasing the administrative burden on logistics operators. The evaluation also recognises that the growing number of cities introducing dynamic access restrictions substantially strengthens the long-term market potential of this type of digital service. The interview with the KER leader provides additional commercial evidence. The primary customer groups were identified as logistics operators and providers of Transport Management Systems, while early

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adopters are expected to be organisations already operating in cities with advanced access regulation schemes. At the same time, the interview identifies two important barriers to large-scale commercial deployment. First, the commercial success of the solution depends on the wider availability and harmonisation of digital UVAR information across European cities. Second, successful deployment requires integration with existing fleet management and route optimisation platforms, making interoperability a critical factor for market expansion. Despite these challenges, the interview confirms that the value proposition is well understood by potential customers and that regulatory developments are expected to further increase demand for such services over the coming years.

Despite this market potential, no commercialisation activities are currently envisaged by the solution owner beyond the completion of the DISCO project. Wider deployment also remains dependent on external conditions, particularly the availability and harmonisation of digital UVAR information and interoperability with existing transport management and route optimisation systems. Consequently, a dedicated Business Plan was not developed at this stage. The implications of these conditions for the future exploitation of the solution are further addressed in Task 6.3.

Based on the available evidence, Urban Access Control can therefore be classified as an **Early Market** solution. The technology has successfully moved beyond technical validation, addresses an increasingly recognised market need and demonstrates clear commercial potential. Nevertheless, broader commercial deployment remains dependent on ecosystem development, regulatory harmonisation and the establishment of partnerships capable of integrating the solution into existing commercial logistics platforms.

Table 7 Market readiness assessment: UAC

Assessment criterion	Result
Market Readiness Stage	Early Market
Key supporting evidence	Successful technical validation; strong alignment with evolving regulatory needs; clearly identified customer groups; increasing market demand driven by UVAR implementation across European cities.
Main barriers to commercialisation	Availability and harmonisation of digital UVAR data; interoperability with existing Transport Management Systems; market expansion across different regulatory environments.
Next step towards the following stage	Further progression would require broader geographical coverage of digital access regulations, stronger partnerships with routing and fleet management providers, and evidence of successful commercial deployments beyond the project.

3.2.5. Comparative discussion

The assessment demonstrates that the four analysed KERs occupy different positions along the commercialisation pathway despite all having reached advanced levels of technological maturity. This finding confirms the distinction introduced in the methodology between technology readiness and market readiness, showing that successful technical validation does not necessarily translate into immediate commercial deployment.

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Among the analysed solutions, the **WareM&O Platform** exhibits the highest level of market readiness. Its value proposition addresses an established market need, its customer groups are clearly identifiable, and the remaining challenges relate primarily to commercial scaling rather than technological development. The solution therefore represents the KER closest to broad market deployment.

The **Digital Twin for Decision Making** and **Urban Access Control** occupy an intermediate position. Both solutions have successfully demonstrated their operational value and present clearly identifiable customer groups and market opportunities. Nevertheless, their commercial expansion depends on wider replication, stronger market penetration and continued integration within existing urban logistics ecosystems. Their transition towards full commercialisation will therefore be driven primarily by scaling activities rather than further research and development.

The **Smart Data Platform** remains at the Validation stage despite its advanced technological maturity. Unlike the other KERs, its commercial success depends not only on the performance of the technology itself but also on the development of a broader Urban Freight Data Space ecosystem capable of generating sufficient data availability, stakeholder participation and network effects. Consequently, the remaining barriers are predominantly organisational and ecosystem-related rather than technical.

Overall, the assessment indicates that the DISCO portfolio has successfully progressed beyond pure research outputs. All four KERs have been validated in operational environments and demonstrate identifiable market opportunities. At the same time, the analysis highlights that the transition towards sustainable commercial deployment requires different strategic priorities for each solution, ranging from ecosystem development and stakeholder engagement to commercial scaling and market expansion. These findings provide the foundation for the subsequent market segmentation and market maturity analyses and will directly inform the development of business models and exploitation pathways in Task 6.3.

Table 8 Market readiness assessment: comparative overview Starring LLs

Solution	Technology	Market	Business	Team	Living Lab Validation	Final Market Readiness
SDP	High	Medium	Medium	High	High	Validation
WareM&O Platform	High	High	High	High	High	Full Commercialization
Digital Twin	High	Medium	Medium	High	High	Early Market
UAC	High	Medium	Medium	High	High	Early Market

3.3. Results of the Market Segmentation

The market segmentation analysis aims to identify the commercial environment in which each KER is expected to compete and generate value. Following the methodology presented in Section 2, the assessment adopts Steve Blank's market typology, distinguishing between Existing Markets, New

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Markets and Re-segmented Markets. Unlike the market readiness assessment, which evaluates the maturity of the solution itself, market segmentation focuses on the characteristics of the target market, the nature of customer demand, the competitive environment and the differentiation strategy adopted by each solution.

The analysis combines evidence from the implementation and evaluation activities performed within the Starring Living Labs with the commercial information collected through the interviews with the KER leaders and, where available, the BOSAT assessments. This integrated approach allows each solution to be positioned within the market that best reflects its commercial opportunity and competitive dynamics.

Table 9 summarises the results of the market segmentation analysis.

Table 9 Market segmentation: Starring LLs solutions

Solution	Market Type	Primary Customers	Primary Customer Need	Differentiation Strategy
SDP	New Market	Municipalities (with advanced digital strategies), Organisations involved in digital transformation and/or data space initiatives	Trusted and interoperable urban freight data sharing	Creation of a collaborative Urban Freight Data Space ecosystem
WareM&O Platform	Existing Market / New market	Warehouse owners, Logistics Service Providers (LSPs) manufacturers	Dynamic warehouse capacity management Warehousing as a service	Digital marketplace integrating real-time capacity updates, blockchain and smart contracts cost reduction
Digital Twin	Re-segmented (Niche) Market	Municipalities, Metropolitan Authorities, Urban Planning Consultancy Firms Owners of new warehouses to implement	Data-driven urban freight planning and policy evaluation Secure the investment	Specialised Digital Twin for urban freight decision support Good decision making
UAC	Existing Market	Logistics Operators, Transport Management Systems (TMS) Providers	Digital management and enforcement of Urban Vehicle Access Regulations (UVARs) and access control policies	Data-driven access control integrating real-time data, policy management and interoperability with urban mobility systems

3.3.1. Smart Data Platform

The Smart Data Platform addresses a market that is still emerging rather than competing within a well-established software sector. Although numerous data management platforms currently exist, the SDP differentiates itself by enabling trusted data sharing through the Urban Freight Data Space, allowing public authorities and logistics stakeholders to exchange freight-related information

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according to common interoperability and governance principles. Consequently, the commercial value of the solution lies less in the software platform itself than in enabling a new collaborative ecosystem for urban freight data exchange. The interviews confirm that the primary customers are municipalities with advanced digital strategies and organisations involved in digital transformation and/or data space initiatives. These organisations seek secure mechanisms for integrating heterogeneous freight datasets and supporting evidence-based urban logistics planning. Since comparable collaborative ecosystems remain relatively limited across Europe, the solution creates a new market opportunity centred on trusted data sharing rather than replacing existing commercial products. Accordingly, the Smart Data Platform is classified as operating within a **New Market**, where success depends on stimulating the adoption of Urban Freight Data Spaces and establishing a sufficiently large ecosystem of participating stakeholders.

Table 10 Market segmentation: SDP

Solution Profile	Assessment
Market type	New Market
Primary customer	Municipalities (with advanced digital strategies), organizations involved in digital transformation and/or data space initiatives
Customer need	Secure and interoperable urban freight data sharing
Competitive environment	Limited direct competition; emerging ecosystem
Differentiation strategy	Trusted Urban Freight Data Space integration and collaborative data governance

3.3.2. WareM&O Platform

The WareM&O Platform operates within a well-established market for warehouse management and logistics marketplaces. Warehouse owners and logistics operators have long relied on digital platforms to identify storage opportunities and optimise warehouse utilisation. Product manufacturers, during production peaks, could opt to use the WareM&O platform beyond the traditional and cumbersome logistics chain. The innovation introduced by WareM&O therefore does not create a new market but significantly improves existing commercial practices by enabling dynamic capacity sharing through an integrated digital marketplace.

The implementation demonstrated that the platform combines several advanced functionalities, including real-time warehouse capacity updates, blockchain-enabled smart contracts, electronic signatures and interoperability with Warehouse Management Systems and Building Management Systems. These capabilities allow the solution to differentiate itself from conventional warehouse marketplaces by facilitating secure, transparent and highly automated collaborative logistics operations. The interviews further identify warehouse owners and logistics service providers as the principal customer groups, confirming the existence of a clearly established customer base and market demand. Rather than creating a fundamentally new business model, the solution increases efficiency, transparency and automation within an existing commercial environment.

For these reasons, WareM&O is classified as operating within an **Existing Market**.

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Table 11 Market segmentation: WareM&O

Solution Profile	Assessment
Market type	Existing Market
Primary customer	Warehouse Owners and Logistics Service Providers
Customer need	Flexible warehouse capacity management
Competitive environment	Established logistics marketplace sector
Differentiation strategy	Dynamic capacity sharing supported by blockchain, APIs and automated transactions

3.3.3. Digital Twin for decision making

The Digital Twin for Decision Making addresses a specialised segment within the rapidly growing Digital Twin market. While Digital Twins are increasingly adopted across multiple industrial sectors, the DISCO solution specifically targets urban freight planning and logistics policy development, providing municipalities with advanced simulation capabilities tailored to freight transport rather than general urban management.

The implementation activities demonstrated that the solution supports the evaluation of alternative logistics scenarios, infrastructure planning and Sustainable Urban Logistics Plans through the integration of multiple urban freight datasets. The interviews identified municipalities, metropolitan authorities, and urban planning consultancy firms as the principal customer groups, confirming that the solution addresses organisations requiring advanced analytical capabilities rather than generic Digital Twin applications. The commercial differentiation therefore derives from sector-specific expertise rather than from competing directly with generic Digital Twin platforms. The solution serves a relatively narrow but highly specialised customer segment whose requirements differ substantially from those addressed by broader Digital Twin technologies.

Consequently, the Digital Twin for Decision Making is classified as operating within a **Re-segmented (Niche) Market**.

Table 12 Market segmentation: Digital Twin

Solution Profile	Assessment
Market type	Re-segmented (Niche) Market
Primary customer	Municipalities/ Metropolitan Authorities, Urban Planning Consultancy Firms
Customer need	Evidence-based urban freight planning and policy assessment
Competitive environment	Existing Digital Twin market with specialised urban freight niche
Differentiation strategy	Advanced simulation capabilities specifically designed for urban logistics planning

3.3.4. Urban Access Control

Urban Access Control addresses a market characterised by the increasing digitalisation of urban traffic regulation and fleet management. Navigation systems, routing software and Transport

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Management Systems already constitute an established commercial market. The innovation introduced by the DISCO solution lies in integrating digitalised Urban Vehicle Access Regulations directly into these existing operational systems, enabling logistics operators to automatically consider regulatory constraints during route planning.
The implementation activities demonstrated the capability of the solution to integrate information regarding low-emission zones, delivery time windows, school streets and loading restrictions into operational logistics planning. Rather than creating a new market, the solution enhances existing logistics software by providing regulatory intelligence that is becoming increasingly important as European cities adopt more sophisticated access management policies. The interviews identified logistics operators and Transport Management System providers as the principal customer groups. The commercial opportunity therefore lies in complementing existing logistics software with additional functionality rather than replacing current market offerings. The increasing number of cities implementing Urban Vehicle Access Regulations further strengthens the long-term demand for this type of service.
Accordingly, Urban Access Control is classified as operating within an **Existing Market**, where competitive advantage is achieved through the integration of dynamic regulatory information into established logistics planning solutions.

Table 13 Market segmentation: UAC

Solution Profile	Assessment
Market type	Existing Market
Primary customer	Logistics operators, Transport Management System providers
Customer need	Efficient compliance with urban access regulations
Competitive environment	Established routing and fleet management software market
Differentiation strategy	Integration of real-time regulatory intelligence into logistics planning tools

3.3.5. Comparative discussion

The market segmentation analysis demonstrates that the DISCO portfolio addresses complementary commercial opportunities rather than competing within the same market space. This diversity represents one of the portfolio's principal strengths, as each KER targets a distinct customer need and follows a different commercial positioning strategy.
The **WareM&O Platform** and **Urban Access Control** both operate within established markets where customer needs, competitors and commercial models are already well defined. Their competitive advantage therefore depends on delivering superior functionality and operational efficiency compared with existing market solutions. In contrast, the **Smart Data Platform** creates value by enabling a new collaborative market centred on Urban Freight Data Spaces, where the primary challenge is stimulating ecosystem development rather than competing against established commercial products.

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The **Digital Twin for Decision Making** occupies an intermediate position by targeting a specialised niche within the broader Digital Twin market. Rather than creating a new market or competing directly with generic Digital Twin platforms, it differentiates itself through domain-specific expertise and advanced decision-support capabilities specifically designed for urban freight planning.
Overall, the analysis confirms that the four KERs exhibit a high degree of commercial complementarity. Together they address different customer segments, respond to distinct operational challenges and follow differentiated market entry strategies. This diversity reduces internal competition among the project results while strengthening the overall exploitation potential of the DISCO portfolio. Moreover, the identified market positioning provides an important foundation for the subsequent market maturity analysis, which examines how the development stage of each target market may influence future commercial deployment and growth opportunities.

3.4. Results of the Market Maturity

Following the market readiness and market segmentation analyses, the maturity of the target markets addressed by each KER was assessed using the Product Life Cycle (PLC) framework presented in Section 2.3. Unlike the previous analyses, which evaluated the commercial readiness of the solutions and the characteristics of their target markets, the PLC analysis examines the evolutionary stage of the markets in which these solutions compete. The assessment therefore reflects the maturity of customer demand, the intensity of competition, market awareness, regulatory drivers and innovation dynamics, rather than the technological maturity of the individual solutions.
The analysis combines evidence gathered from the Living Lab demonstrations, the market readiness assessment, the market segmentation analysis and the commercial perspectives provided by the KER leaders. This integrated approach allows each solution to be positioned within the Product Life Cycle according to the maturity of its target market and the expected evolution of future demand.
The overall assessment is summarised in Table 14.

Table 14 Market maturity: Starring LLs solutions

Solution	Product Life Cycle Stage	Market Characteristics
SDP	Introduction	Emerging Urban Freight Data Space ecosystem characterised by limited market adoption, growing policy support and high future potential.
WareM&O Platform	Maturity	Well-established warehouse marketplace characterised by stable customer demand and competition focused on service differentiation and digital innovation.
Digital Twin	Growth	Rapidly expanding market driven by increasing adoption of Digital Twins in transport planning and smart city initiatives.

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UAC	Growth	Expanding market supported by the increasing implementation of Urban Vehicle Access Regulations and the digitalisation of urban mobility management.

3.4.1. Smart Data Platform

The Smart Data Platform addresses a market that is still in its early stages of development. Although data management platforms have existed for many years, the concept of Urban Freight Data Spaces remains an emerging domain supported primarily by European digitalisation initiatives and the increasing adoption of trusted data-sharing ecosystems. Consequently, customer awareness is still developing, operational deployments remain relatively limited, and market standards continue to evolve.

The implementation activities performed within DISCO demonstrate that the technological foundations of the platform are robust and capable of supporting real operational environments. Nevertheless, the interviews and the market readiness assessment indicate that widespread adoption remains dependent on the development of a broader ecosystem involving municipalities, logistics operators and data providers willing to exchange information under common governance frameworks. This dependence on ecosystem development is a defining characteristic of markets in the Introduction stage, where customer education and ecosystem building remain more important than competitive differentiation. For these reasons, the Smart Data Platform is positioned in the **Introduction** stage of the Product Life Cycle.

Table 15 Market maturity: SDP

Market Maturity Assessment	Result
PLC Stage	Introduction
Supporting evidence	Emerging Urban Freight Data Space ecosystem; limited commercial deployments; increasing policy support; strong future growth potential.
Current market dynamics	Market awareness and ecosystem development remain the principal drivers of adoption.
Strategic implication	Commercial efforts should prioritise ecosystem expansion, demonstration activities and stakeholder engagement.

3.4.2. WareM&O Platform

The WareM&O Platform operates within one of the most established markets among the analysed KERs. Digital platforms supporting warehouse management, storage optimisation and logistics marketplaces have become increasingly common over the last decade, reflecting the widespread digital transformation of supply chain operations. Customers are already familiar with the underlying business need, while competition increasingly focuses on improving operational efficiency, automation and service quality.

Within this mature market, the DISCO solution differentiates itself through real-time warehouse capacity management, blockchain-enabled transactions and interoperability with Warehouse

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Management Systems and Building Management Systems. These innovations strengthen its competitive position but do not fundamentally alter the characteristics of the underlying market, which already exhibits stable customer demand, numerous commercial providers and well-established purchasing behaviours.
The analysis therefore indicates that the WareM&O Platform competes within a Maturity market. Future commercial success will depend primarily on competitive differentiation, customer acquisition and service innovation rather than on market creation or awareness raising.

Table 16 Market maturity: WareM&O Platform

Market Maturity Assessment	Result
PLC Stage	Maturity
Supporting evidence	Established customer demand; numerous market competitors; mature commercial practices; differentiation through advanced digital functionalities.
Current market dynamics	Competition increasingly based on operational efficiency, interoperability and value-added services.
Strategic implication	Commercial strategy should focus on differentiation, partnerships and market share expansion.

3.4.3. Digital Twin for Decision Making

The Digital Twin for Decision Making addresses a market currently experiencing rapid expansion. Although Digital Twin technologies have been adopted across several industrial sectors for many years, their application to urban mobility and freight planning has accelerated significantly in recent years due to increasing investments in smart cities, digital governance and evidence-based planning. The implementation within DISCO demonstrates that municipalities increasingly recognise the value of simulation tools capable of evaluating alternative logistics policies before implementation. The interviews further identify growing interest among public authorities, metropolitan agencies and specialised consultancies seeking advanced analytical capabilities to support Sustainable Urban Logistics Plans (SULPs) and wider urban mobility strategies. The market therefore exhibits the typical characteristics of the **Growth** stage: increasing customer awareness, expanding investment, rising numbers of solution providers and continuous technological innovation. While competition is becoming stronger, significant opportunities remain for further market expansion as Digital Twin technologies become progressively integrated into urban planning processes.

Table 17 Market maturity: Digital Twin

Market Maturity Assessment	Result
PLC Stage	Growth
Supporting evidence	Rapid expansion of Digital Twin applications; increasing municipal demand; growing investment in smart city technologies.
Current market dynamics	Expanding customer base combined with continuous technological innovation and increasing competition.

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Strategic implication	Commercial efforts should prioritise rapid market penetration, replication and strategic partnerships.

3.4.4. Urban Access Control

The Urban Access Control solution also operates within a market characterised by strong growth dynamics. Across Europe, municipalities are progressively introducing Urban Vehicle Access Regulations (UVARs), low-emission zones (LEZs), delivery restrictions and other dynamic traffic management measures aimed at improving environmental sustainability and urban liveability. These regulatory developments are generating increasing demand for digital services capable of translating complex access regulations into operational guidance for logistics operators.

Unlike traditional navigation or routing systems, the DISCO solution integrates dynamic regulatory intelligence directly into operational planning, allowing logistics operators to optimise routes while ensuring regulatory compliance. The interviews indicate that demand is expected to increase further as more European cities adopt digital access management systems and harmonised regulatory data become available. The market therefore demonstrates the characteristics of the **Growth** stage. Customer demand is increasing rapidly, new providers are entering the market, and regulatory developments continue to create additional commercial opportunities. The principal challenge is no longer market creation but achieving rapid commercial deployment before the market reaches maturity.

Table 18 Market maturity: UAC

Market Maturity Assessment	Result
PLC Stage	Growth
Supporting evidence	Increasing implementation of Urban Vehicle Access Regulations; expanding demand for regulatory intelligence; growing digitalisation of urban mobility management.
Current market dynamics	Strong market expansion driven by regulation and digital transformation.
Strategic implication	Commercial strategy should prioritise rapid scaling, interoperability and expansion across European cities.

3.4.5. Comparative discussion

The Product Life Cycle analysis highlights the diversity of the commercial environments addressed by the DISCO portfolio and confirms that the four KERs operate in markets characterised by different levels of maturity. This diversity represents a strategic advantage, as it enables the project to address both emerging and well-established commercial opportunities while reducing dependence on a single market segment.

The **Smart Data Platform** targets an emerging market where ecosystem development, stakeholder engagement and market awareness remain the primary drivers of future growth. Consequently, commercialisation efforts should focus on expanding participation within Urban Freight Data Spaces and demonstrating the long-term value of collaborative data-sharing ecosystems.

Conversely, the **WareM&O Platform** operates within a mature market where customer demand is already well established and competitive advantage depends primarily on service differentiation,

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interoperability and operational efficiency. Its commercial success will therefore be determined by its ability to outperform existing market solutions rather than by creating new demand.
The **Digital Twin for Decision Making** and **Urban Access Control** occupy rapidly expanding markets driven by digital transformation, increasing public investment and evolving regulatory frameworks. Both markets exhibit strong growth potential, creating favourable conditions for commercial expansion provided that the solutions achieve sufficient market penetration during this phase of market development.
Overall, the Product Life Cycle analysis complements the previous assessments by demonstrating that commercialisation strategies should not be defined solely according to the maturity of the individual solutions but also according to the characteristics of the markets they address. While emerging markets require ecosystem building and awareness raising, growth markets demand rapid expansion and partnership development, whereas mature markets require differentiation and continuous innovation.

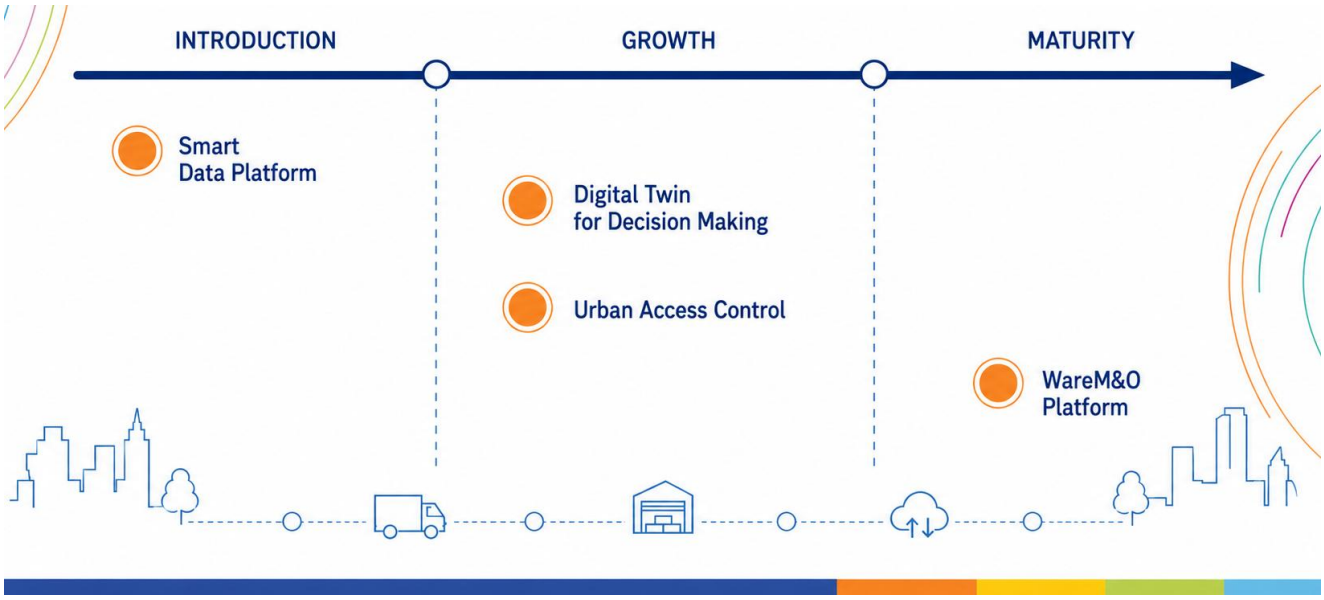

Figure 4 Product Life Cycle of the DISCO KERs

4. Identified solutions within the Twinning LLs

The assessment of the Twinning Living Labs follows the same methodological framework applied to the Starring Living Labs. While the BOSAT assessment was available for all solutions, the complementary Market Readiness Assessment questionnaire was not conducted. Consequently, the final readiness classification was established by combining the BOSAT results with evidence gathered from the implementation and evaluation activities documented within the project.

4.1. Identified solutions

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During the second phase of the project (until M38), additional solutions coming from the Twinning Living Labs have been identied with high potential for commercialization:

- **Curbside Management Tool (developed by UPC):** it involves the installation of cameras in loading/unloading (DUM) zones to monitor vehicle operations using computer vision and artificial intelligence. Using cameras looking at the parking zones, this system automatically tracks parking activities, collecting data on the duration of stays, the frequency of operations at different times of the day, and the types of vehicles using the space. License plate recognition helps distinguish between commercial and non commercial vehicles, assess the environmental impact based on vehicle types (e.g., CO_2 emissions), and cross check SPRO records to evaluate their accuracy. The system leverages this data to generate policy recommendations for improving DUM regulations. Using advanced data analysis techniques, it will be identified patterns and inefficiencies in the current system and propose tailored adjustments to enhance efficiency, compliance, and sustainability. *(More details in D5.2)*
- **E-pods with internal lockers (developed by NEXT):** ePods are "mobile parcel lockers on wheels" designed to alter last-mile delivery. They serve as modular, temporary consolidation points that seamlessly complement existing depots and cargo bike fleets. By positioning these units close to final delivery areas, logistics operators can optimize routes and operate effectively under strict urban access, time, and emission constraints. It is a small electric vehicle equipped with secure internal parcel lockers that can be used for parcel storage and last-mile deliveries. It enables contactless pick-up and drop-off and reduces the need for vans to circulate in dense urban areas. The solution offers a flexible alternative for moving and storing goods in the city. *(More details in D5.2)*
- **Urban Logistics Disaster Plan (developed by T-BOX):** a structured five-phase framework covering preparedness, planning, response, evaluation, and continuous improvement. This methodology is supported by a digital platform that enables real-time demand aggregation, inventory management, resource allocation, and operational monitoring. In parallel, a governance model establishes clear roles, responsibilities, and coordination protocols among different stakeholders involved in emergency response, including municipalities, humanitarian organizations, civil protection agencies, emergency services, military actors, and private-sector partners. The proposed solution has already demonstrated a high level of maturity and operational readiness. The methodology reached Technology Readiness Level (TRL) 8 following its validation during the DANA floods in Valencia in 2024, where the approach was tested in a real emergency environment. *(More details in D5.2)*
- **Parcel Location Tool (developed by ALIA):** it is a data-driven digital solution designed to support urban logistics planning and optimize parcel infrastructure placement in cities. The tool aims to improve the efficiency of last-mile delivery operations by identifying optimal parcel locations and supporting decision-making processes for municipalities, logistics operators, parcel carriers, and other urban logistics stakeholders. The solution addresses urban logistics challenges, including inefficient parcel placement, limited visibility of urban logistics flows, high rates of failed deliveries, excessive delivery distances, and the environmental impacts associated with last-mile operations. *(More details in D5.2)*

4.2. Results of the Market Readiness Assessment

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The market readiness assessment of the Twinning Living Labs followed the same methodological framework applied to the Starring Living Labs. The assessment combines the Business Opportunity Support Assessment Tool (BOSAT) with qualitative evidence gathered during the implementation and evaluation of the demonstrations. While the complementary Market Readiness Assessment questionnaire adopted for the Starring Living Labs was not conducted for the Twinning Living Labs, the availability of the BOSAT assessments for all four solutions, together with the comprehensive implementation (D5.2) and evaluation (D5.3) reports, provides sufficient evidence to establish a robust market readiness classification.
Table 19 summarises the overall market readiness classification of the four KERs analysed.

Table 19 Market readiness assessment: Twinning LLs solutions

Solution	Market Readiness Stage	Overall Assessment
Curbside Management Tool	Early Market	Successfully validated in a real urban environment with strong commercial potential for municipalities. Future commercialisation depends primarily on public procurement, integration with existing mobility management systems and market expansion rather than further technological development.
E-pods with internal lockers	Validation	Demonstrated the technical and operational feasibility of a novel mobile parcel locker concept. Further commercial validation is required to establish sustainable business models, operational partnerships and wider market adoption.
Urban Logistics Disaster Plan	Close to full commercialization	Demonstrated the highest commercial maturity within the Twinning Living Labs through real-world validation during the 2024 DANA floods. Future activities should focus on institutional adoption, replication and large-scale deployment rather than additional technological development.
Parcel Location Tool	Early Market	Successfully demonstrated as a data-driven planning tool supporting parcel infrastructure optimisation. Commercial deployment will depend on wider adoption by municipalities and logistics operators together with integration into existing planning processes.

4.2.1. Curbside Management Tool

The Curbside Management Tool, developed by UPC, is an artificial intelligence-based solution designed to support municipalities in the management and optimisation of urban loading and unloading zones. The system combines computer vision, automatic licence plate recognition and advanced data analytics to continuously monitor parking activities within designated delivery bays. By collecting information on occupancy, parking duration, vehicle categories and temporal usage patterns, the tool generates evidence-based recommendations for improving curbside regulations, optimising the allocation of loading spaces and reducing the environmental impacts associated with urban freight operations. Through the integration of operational data with municipal parking records, the solution also enables the verification of existing datasets and supports more informed urban logistics planning.
The implementation carried out in the Barcelona Twinning Living Lab successfully demonstrated the operational feasibility of the solution under real urban conditions. The deployment confirmed the

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capability of the system to automatically monitor loading and unloading activities using artificial intelligence and computer vision while generating high-quality datasets for policy evaluation. The evaluation activities performed during the project further demonstrated the value of the tool as a decision-support instrument for public authorities. Beyond improving the accuracy of curbside monitoring, the solution enables municipalities to better understand freight traffic patterns, identify inefficient use of loading zones and assess the environmental performance of different vehicle categories. These capabilities provide valuable evidence for designing more efficient and sustainable curbside management policies while supporting data-driven urban logistics planning.

The commercial assessment confirms that the solution addresses a clearly identified market need. European cities are progressively introducing urban access regulations, low-emission zones and dedicated freight management policies, creating increasing demand for digital tools capable of monitoring curbside operations and supporting evidence-based decision-making. The BOSAT assessment reflects this favourable positioning, highlighting strong technological maturity, a well-defined customer base and good scalability potential across different urban contexts. The analysis also indicates that the proposed business model benefits from the increasing digitalisation of municipal services and the growing adoption of smart city technologies.

Despite these positive characteristics, the assessment identifies several factors that currently constrain wider commercial deployment. The principal barriers are not related to the maturity of the technology itself, which has already demonstrated reliable operational performance, but rather to the characteristics of the public procurement market. Commercial adoption depends on municipal investment priorities, procurement procedures, integration with existing urban traffic management systems and the willingness of local authorities to adopt data-driven approaches for curbside regulation. Furthermore, although the cost of the devices is decreasing, the fact of having to cover large areas still makes it necessary to make them cheaper. These factors are expected to influence the speed of market penetration rather than the technical viability of the solution.

Table 20 Market readiness assessment: Curbside management tool

Assessment criterion	Result
Market Readiness Stage	Early Market
Key supporting evidence	Successful demonstration in the Barcelona Twinning Living Lab; operational validation of AI-based curbside monitoring; demonstrated capability to generate reliable evidence for urban freight planning; strong market need identified through BOSAT assessment.
Main barriers to commercialisation	Dependence on municipal procurement procedures; integration with existing city management systems; varying levels of digital maturity across public authorities; relatively long public-sector purchasing cycles
Next step towards the following stage	Expand deployments across additional cities, establish commercial agreements with municipalities, demonstrate long-term operational benefits and strengthen integration with existing smart mobility and traffic management platforms

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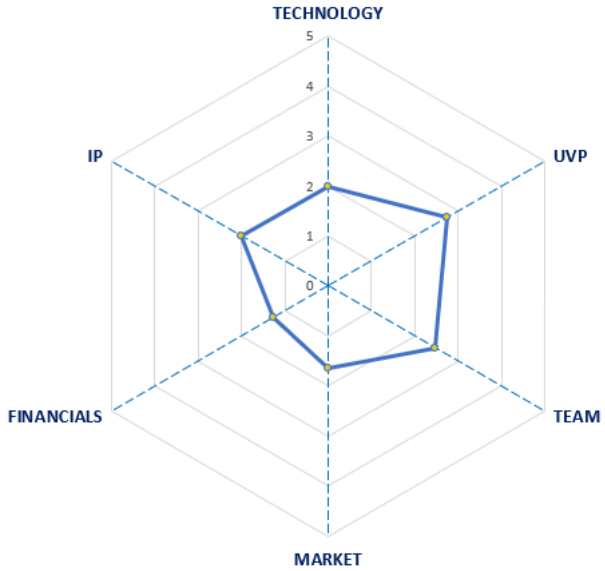

Figure 5 Radar Chart Curbside Management Tool

The available evidence therefore suggests that the Curbside Management Tool has successfully progressed beyond the validation stage and is ready for its first commercial deployments. The technology has demonstrated operational robustness in a real urban environment, addresses a clearly recognised market demand and presents a scalable value proposition for municipalities seeking to improve urban freight management. The remaining challenges are primarily associated with market adoption and institutional deployment rather than further technological development.

4.2.2. E-pods with internal lockers

The E-pods with Internal Lockers, developed by NEXT, represent an innovative approach to last-mile logistics based on the concept of mobile parcel lockers. The solution consists of a small electric vehicle equipped with secure internal lockers that can operate as a flexible and relocatable micro-consolidation hub. By combining the functions of parcel storage, temporary consolidation and low-emission urban distribution, the system enables logistics operators to position goods closer to final delivery destinations while reducing the circulation of conventional delivery vans within dense urban environments. The modular nature of the solution allows its deployment to be adapted according to demand patterns, urban events and operational requirements, providing cities and logistics providers with a flexible alternative to permanent logistics infrastructure.

The implementation carried out in the Padua Twinning Living Lab successfully demonstrated the operational feasibility of the concept under real urban conditions. The demonstration validated the capability of the E-pods to support last-mile delivery operations through secure parcel storage, contactless collection and flexible deployment within the urban environment. The evaluation activities performed during the project confirmed that the solution contributes to reducing unnecessary vehicle movements while improving delivery efficiency in areas characterised by restricted access, limited parking availability and increasing environmental constraints. Beyond its technical performance, the pilot demonstrated the potential of mobile logistics infrastructure to complement existing depot networks and cargo bike operations, increasing operational flexibility without requiring significant investments in permanent urban facilities.

The commercial assessment highlights a promising value proposition driven by the continuous growth of e-commerce, the increasing demand for sustainable last-mile delivery solutions and the progressive tightening of urban access regulations across European cities. The BOSAT assessment indicates strong innovation potential and a clearly identifiable customer base, including CEP

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(Courier, Express, Parcel) Operators, Grocery and Retail Logistics Operators, and municipalities seeking to reduce congestion and emissions associated with urban freight transport. The flexibility of the solution further enhances its market attractiveness, as the same asset can be relocated according to operational needs without requiring fixed infrastructure investments.
Despite these favourable characteristics, the assessment also identifies several barriers that currently limit broader commercial deployment. Unlike software-based solutions, the E-pods require physical assets, fleet management capabilities and operational integration within existing logistics networks. Their commercial success therefore depends on the willingness of logistics operators to adapt established delivery processes and invest in new operational models. In addition, the economic viability of the solution is closely linked to utilisation rates, requiring sufficient delivery volumes to justify fleet deployment and maintenance costs. The need to coordinate with municipalities regarding parking permissions and urban space allocation further increases the complexity of large-scale implementation. One of the unknowns that remains to be revealed is the behavior of the end customer, people, when faced with a dynamic solution like this.

Table 21 Market readiness assessment: E-pods with internal lockers

Assessment criterion	Result
Market Readiness Stage	Validation
Key supporting evidence	Successful demonstration in the Padua Twinning Living Lab; validation of the mobile parcel locker concept under real operating conditions; positive evaluation of operational flexibility and contribution to sustainable last-mile logistics; strong commercial interest linked to growing e-commerce and urban access restrictions.
Main barriers to commercialisation	Need for investment in physical assets; dependence on logistics operators' adoption; integration into existing delivery networks; requirement for sufficient operational volumes to ensure economic viability; coordination with municipalities for urban space allocation. Adoption of the solution by the end customer, the people.
Next step towards the following stage	Expand pilot deployments with commercial logistics operators, validate long-term business performance under operational conditions, optimise fleet utilisation and demonstrate economic scalability across different urban markets

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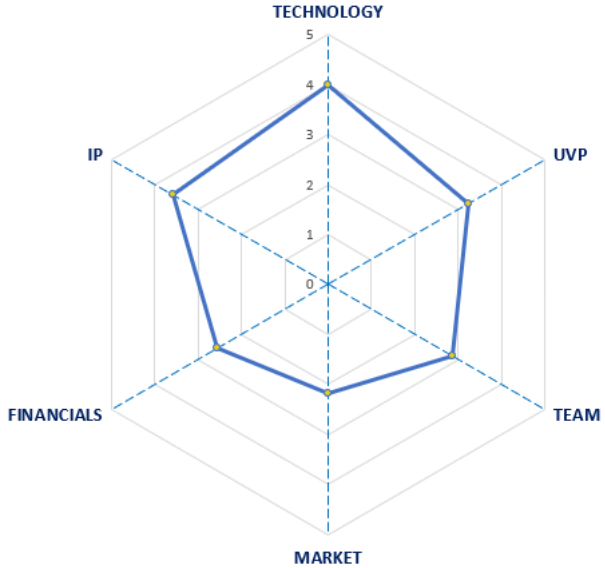

Figure 6 Radar Chart E-pods with internal lockers

The available evidence therefore suggests that the E-pods with Internal Lockers have successfully demonstrated their technical feasibility and operational value, while commercial deployment still requires further validation under larger-scale operating conditions. The technology itself has reached a satisfactory level of maturity, but the commercial model depends on broader market adoption, operational partnerships and the demonstration of long-term economic sustainability across different urban contexts.

4.2.3. Urban Logistics Disaster Plan

The Urban Logistics Disaster Plan, developed by T-BOX, is an integrated methodology designed to support the planning, coordination and management of urban logistics during emergency and disaster situations. The solution combines a structured five-phase operational framework, covering preparedness, planning, response, evaluation and continuous improvement, with a dedicated digital platform that enables real-time demand aggregation, inventory management, resource allocation and operational monitoring. Complementing the technological component, the solution establishes a governance model that clearly defines the roles and responsibilities of different stakeholders involved in emergency response, including municipalities, civil protection agencies, humanitarian organisations, emergency services, military actors and private logistics operators. Rather than representing a single software application, the Urban Logistics Disaster Plan provides an operational framework that integrates digital technologies, organisational processes and multi-stakeholder coordination to strengthen urban resilience during crisis situations.

The implementation carried out in the Valencia Twinning Living Lab provided a unique opportunity to validate the solution under real emergency conditions following the DANA floods that affected the Valencia region in October 2024. Originally conceived as a demonstration of urban logistics planning tools, the Living Lab rapidly evolved into a real-life emergency logistics operation, allowing the proposed methodology to be tested under circumstances that closely reflected its intended operational environment. The experience demonstrated the capability of the framework to support the coordination of emergency logistics activities, optimise the allocation of available resources and facilitate collaboration among public authorities, emergency organisations and private-sector stakeholders. Unlike conventional pilot demonstrations, the validation was performed during an actual emergency response, providing a level of operational evidence that is rarely achievable within research and innovation projects.

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The evaluation activities further confirmed the operational value of the solution. Besides demonstrating its effectiveness in supporting emergency logistics operations, the project highlighted the flexibility of the methodology to adapt existing urban logistics infrastructures and digital tools to rapidly changing operational needs. The evaluation framework was itself expanded to include dedicated resilience indicators, disaster-management guidelines and humanitarian-focused Sustainable Development Goal targets, recognising that the Valencia experience extended beyond the original project objectives. The results illustrate how the solution contributes not only to improving emergency preparedness but also to strengthening the long-term resilience of urban logistics systems by establishing structured governance mechanisms and coordinated decision-making processes.

The commercial assessment confirms that the solution addresses a rapidly growing societal and institutional need. Climate-related disasters, extreme weather events and other emergency situations are increasing the demand for coordinated urban logistics planning capable of supporting both preparedness and response activities. The BOSAT assessment reflects this favourable positioning, highlighting the strong value proposition of the methodology, its broad applicability across different urban contexts and its high replication potential. The assessment also indicates that the solution benefits from a clearly identifiable customer base, including municipalities and emergency response organisations (e.g. civil protection agencies), while the integration of the supporting digital platform further strengthens its operational attractiveness.

Although the methodology has demonstrated a high degree of operational maturity, several factors continue to influence its wider commercial deployment. Successful implementation requires strong institutional commitment, inter-organisational cooperation and the establishment of governance arrangements among multiple public and private actors. In addition, adoption may require adaptation to national emergency management procedures and existing civil protection frameworks, limiting the possibility of immediate standardised deployment across different jurisdictions. These challenges, however, relate primarily to organisational implementation rather than to the maturity of the methodology itself.

Table 22 Market readiness assessment: Urban Logistics Disaster Plan

Assessment criterion	Result
Market Readiness Stage	Close to full commercialization
Key supporting evidence	Real-world validation during the 2024 DANA floods in Valencia; achievement of TRL 8; successful coordination of emergency logistics operations; demonstrated scalability of the governance model and supporting digital platform; strong demand from public authorities responsible for emergency management
Main barriers to commercialisation	Dependence on institutional adoption; need to integrate with existing civil protection and emergency management frameworks; adaptation to different governance structures and national regulatory contexts; coordination among multiple stakeholders
Next step towards the following stage	Support large-scale deployment through commercial agreements with public authorities, standardise implementation procedures for different governance contexts and expand adoption across European municipalities and emergency response organisations.

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	Governments need to anticipate solutions like this before emergency situations occur, which are becoming increasingly frequent due to the current climate emergency.

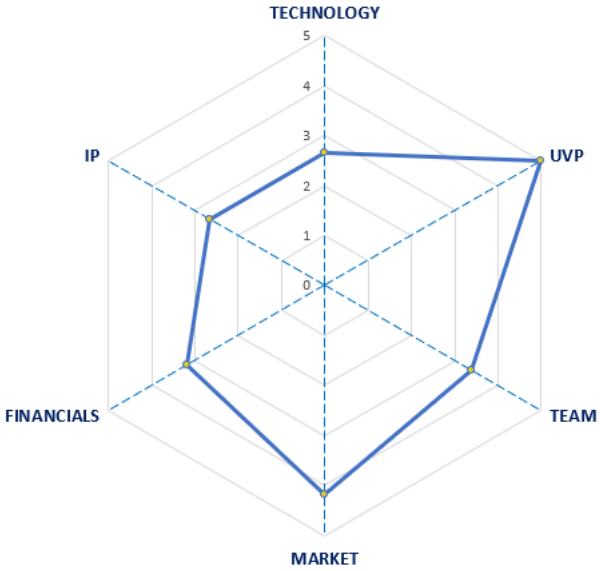

Figure 7 Radar Chart Urban Logistics Disaster Plan

The available evidence therefore suggests that the Urban Logistics Disaster Plan has reached a high level of market readiness. The methodology has been validated in a real emergency environment, achieving Technology Readiness Level 8 and demonstrating its capability to support operational decision-making under highly demanding conditions. Combined with a robust governance framework, a scalable digital platform and a clearly identified market need, the solution presents all the characteristics of an innovation approaching full commercial deployment. Future activities should therefore focus on market expansion, institutional adoption and replication across additional cities and regions rather than further technological development.

4.2.4. Parcel Location Tool

The Parcel Location Tool, developed by ALIA, is a data-driven decision-support solution designed to optimise the planning and location of parcel delivery infrastructure within urban environments. The tool assists municipalities and logistics operators managing parcel lockers networks, in identifying the most suitable locations for parcel lockers and other collection points by combining spatial analysis, urban logistics data and demand forecasting techniques. Through the systematic analysis of urban characteristics, delivery patterns and accessibility conditions, the solution supports evidence-based decisions that improve the efficiency of last-mile logistics while reducing failed deliveries, unnecessary vehicle movements and the environmental impacts associated with urban freight transport.

The implementation carried out in the Zaragoza Twinning Living Lab successfully demonstrated the operational capabilities of the solution within a real urban planning context. The demonstration confirmed the ability of the tool to integrate multiple data sources and translate complex spatial information into practical recommendations for parcel infrastructure deployment. Rather than relying on intuitive or opportunistic placement decisions, the proposed approach provides municipalities and logistics operators with an analytical framework capable of identifying locations that maximise accessibility while improving the overall efficiency of parcel distribution networks. The Living Lab demonstrated that data-driven planning can support better coordination between

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public authorities and private logistics operators, contributing to more sustainable urban freight systems.

The evaluation activities further confirmed the operational value of the solution. The project demonstrated that optimising parcel location strategies has the potential to reduce delivery distances, improve service accessibility and increase the efficiency of last-mile operations. Beyond these direct operational benefits, the tool supports more strategic urban logistics planning by providing public authorities with objective evidence to guide infrastructure investments and regulatory decisions. The evaluation also highlighted the flexibility of the solution, which can be adapted to different urban contexts and planning objectives through the integration of locally available datasets.

The commercial assessment indicates that the Parcel Location Tool addresses a growing market opportunity driven by the continuous expansion of e-commerce and the increasing deployment of parcel lockers throughout European cities. The BOSAT assessment highlights a strong value proposition supported by clear customer needs and favourable replication potential across different urban environments. Municipalities are increasingly seeking analytical tools capable of supporting strategic logistics planning, while logistics operators require objective methodologies for expanding parcel networks in a cost-effective manner. The software-based nature of the solution further facilitates scalability, as implementation primarily requires data availability rather than significant investments in physical infrastructure.

Despite these favourable conditions, several factors continue to influence commercial deployment. The effectiveness of the tool depends on the availability and quality of urban logistics datasets, as well as the willingness of municipalities and logistics operators to share information and collaborate in planning activities. Furthermore, although the analytical methodology has demonstrated strong technical performance, wider market adoption will require integration into existing planning processes and decision-making practices within both public administrations and private organisations. As with many decision-support systems, commercial success ultimately depends on demonstrating measurable operational benefits that justify organisational change and investment.

Table 23 Market readiness assessment: Parcel Location Tool

Assessment criterion	Result
Market Readiness Stage	Early Market
Key supporting evidence	Successful demonstration in the Zaragoza Twinning Living Lab; validated capability to support data-driven parcel infrastructure planning; positive evaluation of its contribution to improving last-mile logistics efficiency; strong market demand associated with the expansion of parcel locker networks and urban logistics planning
Main barriers to commercialisation	Dependence on the availability and quality of urban logistics data; need for collaboration between municipalities and logistics operators managing parcel lockers networks; integration into existing planning and decision-making processes; demonstration of long-term economic value for different user groups
Next step towards the following stage	Expand commercial deployments in additional cities, strengthen interoperability with urban planning platforms, demonstrate measurable operational and economic benefits across

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	different urban contexts, and establish long-term service agreements with municipalities and logistics operators

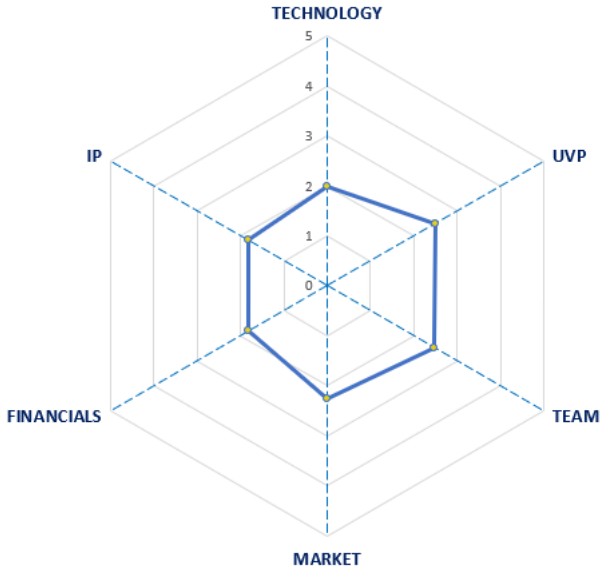

Figure 8 Radar Chart Parcel Location Tool

The available evidence therefore suggests that the Parcel Location Tool has progressed beyond the validation stage and is well positioned for early commercial deployment. The solution has demonstrated its operational value within the Zaragoza Twinning Living Lab, addresses a clearly recognised market need and offers a scalable software-based approach that can be replicated across different cities with relatively limited implementation effort. The remaining challenges are primarily associated with market adoption, data availability and organisational integration rather than with the maturity of the underlying technology.

4.2.5. Comparative discussion

The assessment demonstrates that the four Twinning Living Lab KERs occupy different positions along the commercialisation pathway while sharing a common characteristic: all have successfully moved beyond proof-of-concept and have demonstrated their operational value in real-world environments. Compared to the Starring Living Labs, the Twinning Living Labs showcase solutions that are generally closer to market deployment, reflecting both the later stage of the project and the progressive maturation of the DISCO innovation portfolio.

Among the analysed solutions, the Urban Logistics Disaster Plan exhibits the highest level of market readiness. Unlike conventional pilot demonstrations, the methodology was validated during the DANA floods in Valencia under actual emergency conditions, achieving Technology Readiness Level 8 and demonstrating its capability to coordinate complex emergency logistics operations. The solution addresses an increasingly relevant societal challenge associated with climate resilience and emergency preparedness, while its remaining barriers relate primarily to institutional adoption, governance integration and market expansion rather than further technological development. Consequently, it represents the KER closest to full commercial deployment.

The Curbside Management Tool and the Parcel Location Tool occupy an intermediate position within the commercialisation pathway. Both solutions have successfully demonstrated their operational effectiveness within the Twinning Living Labs and address clearly identifiable market needs arising from the digital transformation of urban logistics and the increasing demand for data-driven planning tools. Their software-based nature facilitates replication across different urban contexts, while their target customers, primarily municipalities and logistics operators, are well defined. Nevertheless, broader commercial deployment will depend on public procurement

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processes, integration within existing planning systems, data availability and the demonstration of sustained operational benefits. Their transition towards full commercialisation will therefore be driven primarily by market penetration and scaling activities rather than additional technological development.

The E-pods with Internal Lockers remain at the Validation stage despite demonstrating satisfactory technical maturity and operational feasibility. In contrast to the software-based solutions, commercial success depends on the deployment of physical assets, the adaptation of existing logistics operations and the establishment of sustainable business models capable of supporting fleet utilisation and long-term operational viability. The remaining uncertainties are therefore predominantly commercial and organisational, reflecting the higher investment requirements and operational complexity associated with hardware-based logistics innovations.

Overall, the assessment indicates that the Twinning Living Lab portfolio represents a significant progression in the commercial maturity of DISCO innovations. While the Starring Living Labs primarily validated enabling digital infrastructures supporting future urban logistics ecosystems, the Twinning Living Labs demonstrate market-oriented applications capable of addressing concrete operational challenges faced by municipalities, logistics operators and emergency management authorities. All four KERs have successfully completed operational validation and present clearly identifiable market opportunities. At the same time, the assessment confirms that the transition towards sustainable commercial deployment requires different strategic priorities for each solution, ranging from institutional adoption and governance development to business model validation, commercial scaling and wider market expansion. These findings provide the foundation for the subsequent market segmentation and market maturity analyses and will directly support the development of business models and exploitation pathways presented in Task 6.3.

Table 24 Market readiness assessment: comparative overview Twinning LLs

Solution	Technology	Market	Business	Team	Living Lab Validation	Final Market Readiness
Curbside Management Tool	High	High	Medium	High	High	Early Market
E-pods with Internal Lockers	High	Medium	Medium	High	High	Validation
Urban Logistics Disaster Plan	High	High	High	High	High	Close to Full Commercialization
Parcel Location Tool	High	High	Medium	High	High	Early Market

4.3. Results of the Market segmentation

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The market segmentation analysis aims to identify the commercial environment in which each KER is expected to compete and generate value. Following the methodology presented in Section 2, the assessment adopts Steve Blank's market typology, distinguishing between Existing Markets, New Markets and Re-segmented Markets. Unlike the market readiness assessment, which evaluates the maturity of the solution itself, market segmentation focuses on the characteristics of the target market, the nature of customer demand, the competitive environment and the differentiation strategy adopted by each solution.

The analysis combines evidence from the implementation and evaluation activities carried out within the Twinning Living Labs with the commercial information captured through the BOSAT assessments. This integrated approach allows each solution to be positioned within the market that best reflects its commercial opportunity, customer profile and competitive dynamics. Compared with the Starring Living Labs, the Twinning Living Labs focus on a portfolio of operational solutions addressing distinct urban logistics challenges, resulting in a broader spectrum of target markets and commercial positioning strategies.

Table 25 summarises the results of the market segmentation analysis

Table 25 Market segmentation: Twinning LLs solutions

Solution	Market Type	Primary Customers	Primary Customer Need	Differentiation Strategy
Curbside Management Tool	Existing Market	Municipalities and/or public authorities responsible for urban logistics planning, parking management and mobility regulation	Intelligent monitoring and optimisation of loading and unloading zones	AI-based computer vision and automated analytics supporting evidence-based curbside management
E-pods with Internal Lockers	Re-segmented (niche) Market	CEP (Courier Express Parcel) Operators, Grocery and Retail Logistics Operators, Municipalities	Flexible and sustainable last-mile delivery infrastructure	Mobile parcel lockers combining secure storage, temporary consolidation and flexible deployment
Urban Logistics Disaster Plan	New Market	Public Authorities, Humanitarian & Emergency Response Organisations	Integrated planning and coordination of urban logistics during emergencies	Combination of governance framework, operational methodology and digital decision-support validated under real emergency conditions
Parcel Location Tool	Existing Market	Municipalities and/or Metropolitan Authorities, Logistics Operators managing parcel lockers networks	Data-driven optimisation of parcel infrastructure planning	Dedicated spatial decision-support tool integrating logistics-specific datasets for parcel location optimisation

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4.3.1. Curbside Management Tool

The Curbside Management Tool is positioned within an Existing Market, understood here as the broader market for municipal management and regulation of curbside space, loading and unloading activities, parking and related urban mobility functions. Municipalities already address these functions through a combination of regulatory measures, enforcement practices and, in more advanced cases, digital parking, loading/unloading and monitoring solutions. The underlying customer need is therefore established, even though the adoption of integrated and dynamic Curbside Management platforms remains at an early stage.

Current practices vary considerably across European cities. In many municipalities, loading and unloading areas continue to be managed through static signage, parking discs, permits and on-site enforcement, while more advanced cities have introduced dedicated digital solutions. Examples include Barcelona's SPRO application and Madrid DUM 360, while solutions such as ParkUnload support digital management of loading and unloading areas in several municipalities. International platforms such as Vianova, CurbIQ and Lacuna further illustrate the emergence of specialised solutions for curbside data management and analytics. These examples indicate that a commercial and technological ecosystem is developing, but adoption remains concentrated among pioneering cities and pilot initiatives rather than representing a fully standardised municipal practice.

Against this background, the Curbside Management Tool should not be interpreted primarily as replacing incumbent curbside-management software. For many municipalities, adoption represents the first transition from analog or fragmented management practices towards integrated digital curb management. Its market opportunity therefore lies in introducing a more comprehensive approach within an existing municipal management domain, interconnecting data, monitoring and regulatory functions to support the dynamic allocation and governance of public space for logistics and mobility.

The solution is consequently classified as operating in an Existing Market, but within an emerging technological segment of that market. Its competitive positioning depends less on replacing established dedicated curbside platforms and more on demonstrating the added value of integrated, dynamic and data-driven management compared with analog practices, fragmented digital tools and conventional parking or traffic-management systems.

Table 26 Market segmentation: Curbside management tool

Solution Profile	Assessment
Market type	Existing Market
Primary customer	Municipalities and/or public public authorities responsible for urban logistics planning, parking management and mobility regulation
Customer need	Digital and dynamic management of loading and unloading activities and curbside space, supporting evidence-based regulation, enforcement and urban freight planning.
Competitive environment	Emerging market of dedicated digital curbside management solutions, alongside established but often fragmented parking management systems, loading/unloading applications, traffic monitoring platforms and conventional analog management practices.
Differentiation strategy	Integration of artificial intelligence, computer vision and automated analytics to support integrated and dynamic management of curbside space, connecting monitoring evidence with urban logistics planning and mobility regulation.

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This classification reflects a market where customer demand is already established, procurement mechanisms are well defined and competing technologies are available. The commercial success of the Curbside Management Tool will therefore depend primarily on its ability to demonstrate superior operational performance, ease of integration and long-term value compared with existing solutions, rather than on the need to educate the market or create new demand.

4.3.2. E-pods with internal lockers

The E-pods with Internal Lockers target the rapidly evolving last-mile delivery market, where logistics operators are seeking innovative solutions to address increasing delivery demand, stricter environmental regulations and limited urban space. While parcel lockers, urban consolidation centres and microhubs are already established components of urban logistics systems, the solution developed by NEXT introduces a different operational concept by combining mobile parcel lockers with flexible micro-consolidation capabilities. Rather than relying on fixed infrastructure, the E-pods can be relocated according to operational needs, enabling logistics operators to dynamically adapt their delivery networks to changing demand patterns, temporary restrictions or urban events.

The implementation carried out in the Padua Twinning Living Lab demonstrated the operational feasibility of this approach within a real urban environment. The pilot confirmed that mobile parcel lockers can effectively support contactless parcel collection, temporary parcel storage and low-emission last-mile distribution while complementing existing depot networks and cargo bike operations. The evaluation activities further highlighted the operational flexibility of the solution, demonstrating its potential to reduce unnecessary vehicle movements, improve delivery efficiency and support logistics operations in areas characterised by limited accessibility or strict environmental constraints.

Unlike conventional parcel locker systems, which require permanent installations and significant infrastructure investments, the E-pods provide a flexible asset that can be repositioned according to operational requirements. This mobility represents the principal source of innovation and differentiates the solution from existing market offerings. Rather than competing directly with traditional parcel lockers, the solution creates value for logistics operators requiring temporary consolidation points, seasonal deployment, event-based logistics or dynamic adaptation to changing urban conditions.

The primary customer segment consists of Courrier Express Parcel (CEP) operators and Grocery and Retail Logistics Operators seeking greater flexibility in their last-mile operations. Municipalities may also represent an important customer group by supporting the deployment of sustainable urban logistics solutions that contribute to reducing congestion and emissions. The competitive landscape includes conventional parcel lockers, micro-consolidation centres and urban logistics hubs. Nevertheless, the E-pods occupy a distinct market position by combining the advantages of these existing solutions with the operational flexibility associated with mobile infrastructure.

The analysis therefore suggests that the E-pods with Internal Lockers address a re-segmented niche market. Rather than creating an entirely new demand, the solution responds to existing last-mile logistics challenges through a differentiated business model that targets customers whose operational needs cannot be fully satisfied by conventional fixed parcel lockers or permanent

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consolidation centres. Its commercial success will therefore depend on demonstrating the additional value generated by flexibility, mobility and operational adaptability compared with existing infrastructure-based alternatives.

Table 27 Market segmentation: E-pods with internal lockers

Solution Profile	Assessment
Market type	Re-segmented market (niche)
Primary customer	CEP Operators, Grocery and Retail Logistics Operators, Municipalities
Customer need	Flexible and sustainable last-mile delivery infrastructure capable of adapting to changing operational conditions
Competitive environment	Conventional parcel lockers, urban consolidation centres, microhubs and other last-mile delivery solutions
Differentiation strategy	Mobile parcel lockers combining secure parcel storage, temporary consolidation and flexible deployment without requiring permanent urban infrastructure

This classification reflects a solution that enters an already established market while differentiating itself through a novel operational model. Instead of competing directly on price or performance with traditional parcel lockers, the E-pods create a specialised value proposition centred on flexibility and mobility, positioning the solution within a niche segment of the broader last-mile delivery market. This strategic positioning reduces direct competition with conventional infrastructure while creating opportunities to serve logistics operators facing increasingly dynamic urban delivery environments.

4.3.3. Urban Logistics Disaster Plan

The Urban Logistics Disaster Plan addresses an emerging market driven by the growing need for resilient urban logistics systems capable of supporting emergency preparedness and disaster response. Climate change, extreme weather events and other large-scale disruptions are increasing the pressure on public authorities to strengthen the resilience of critical urban services, including logistics and supply chain operations. Although emergency management frameworks and civil protection procedures are well established in many countries, integrated methodologies specifically addressing urban logistics preparedness through the combination of governance, operational planning and digital decision-support remain relatively limited. The solution developed by T-BOX therefore addresses a rapidly evolving market in which customer demand is increasing while comprehensive commercial solutions are still scarce.

The implementation in the Valencia Twinning Living Lab provided an exceptional validation opportunity. Following the DANA floods in October 2024, the proposed methodology was applied within a real emergency context, demonstrating its capability to coordinate emergency logistics activities under highly dynamic operational conditions. The deployment confirmed that the five-phase framework, supported by the digital platform, could facilitate demand aggregation, inventory management, resource allocation and operational coordination among multiple public and private stakeholders. The evaluation activities further demonstrated that the methodology contributes not only to improving emergency response but also to strengthening long-term urban resilience through structured planning, governance and inter-organisational collaboration.

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Unlike traditional emergency planning documents, which are often static and organisation-specific, the Urban Logistics Disaster Plan integrates operational procedures, digital technologies and collaborative governance within a single framework specifically designed for urban logistics. This holistic approach significantly differentiates the solution from existing practices and reflects the increasing recognition that resilient logistics systems require continuous coordination among municipalities, humanitarian organisations, emergency services, logistics providers and civil protection authorities. The successful validation achieved during the DANA emergency substantially reduces uncertainty regarding the operational applicability of the methodology.
The primary customer segment consists of public authorities responsible for the logistics coordination during emergencies and/or crisis, and humanitarian & emergency response organisations responsible for disaster preparedness and response. Additional opportunities exist for consulting companies, infrastructure operators and logistics service providers supporting emergency planning activities. Although emergency management itself is an established policy domain, the commercial landscape for integrated urban logistics resilience solutions remains relatively immature, creating favourable conditions for first-mover advantages and early market leadership.
The analysis therefore indicates that the Urban Logistics Disaster Plan is positioned within a new market. Rather than replacing existing emergency management tools, the solution introduces a new category of integrated urban logistics resilience services that combine governance, operational methodologies and digital decision-support within a unified framework. Future market growth is expected to be driven by increasing investments in climate adaptation, urban resilience and disaster preparedness, supported by both national policies and European resilience strategies.

Table 28 Market segmentation: Urban Logistics Disaster Plan

Solution Profile	Assessment
Market type	New market
Primary customer	Public authorities, Humanitarian & Emergency Response Organizations
Customer need	Integrated methodologies and digital tools supporting urban logistics preparedness, emergency coordination and disaster response
Competitive environment	Limited number of integrated urban logistics resilience solutions; existing emergency management frameworks and consultancy services
Differentiation strategy	Integration of governance, operational planning and digital decision-support into a comprehensive urban logistics resilience framework validated under real emergency conditions

This classification reflects a solution that addresses an emerging market shaped by evolving societal needs rather than by the replacement of existing technologies. While emergency management itself is a well-established field, the Urban Logistics Disaster Plan introduces a specialised service focused on urban logistics resilience, positioning the solution within a market that is expected to expand significantly as cities increasingly prioritise climate adaptation and disaster preparedness in their strategic planning.

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4.3.4. Parcel Location Tool

The Parcel Location Tool addresses the growing market for digital decision-support solutions aimed at improving urban logistics planning and the deployment of parcel delivery infrastructure. The rapid expansion of e-commerce, combined with increasing pressure to reduce congestion, emissions and failed deliveries, has led municipalities and logistics operators to invest in more efficient parcel distribution networks. Within this context, parcel lockers and collection points have become an established component of last-mile logistics strategies, creating demand for analytical tools capable of supporting evidence-based decisions on where this infrastructure should be located to maximise accessibility and operational efficiency.

The implementation carried out in the Zaragoza Twinning Living Lab demonstrated the capability of the solution to support strategic planning through the integration of multiple datasets describing urban characteristics, logistics demand and accessibility conditions. The tool successfully generated location recommendations for parcel infrastructure by applying a data-driven methodology that replaces subjective planning decisions with objective spatial analysis. The evaluation activities further confirmed that the solution has the potential to improve last-mile logistics performance by reducing delivery distances, increasing the accessibility of parcel collection points and supporting more efficient allocation of urban logistics infrastructure. Beyond these operational benefits, the solution also provides municipalities with a transparent and replicable methodology that can support long-term urban logistics planning.

Unlike conventional Geographic Information System (GIS) applications or generic spatial planning software, the Parcel Location Tool has been specifically designed to address the operational requirements of urban freight and parcel logistics. Its analytical framework integrates logistics-specific variables and decision criteria that are rarely incorporated into standard planning tools, enabling municipalities and logistics operators to make more informed infrastructure investment decisions. This sector-specific focus represents the main source of differentiation compared with existing planning solutions.

The primary customer segment includes municipalities and/or metropolitan authorities, and logistics operators managing parcel lockers networks. These organisations already invest in planning activities and spatial analysis tools, but increasingly require specialised solutions capable of supporting the rapid expansion of parcel infrastructure within increasingly constrained urban environments. The competitive landscape therefore consists of existing GIS platforms, logistics planning software and consultancy services, while the Parcel Location Tool differentiates itself through its dedicated focus on urban parcel infrastructure optimisation and its ability to integrate logistics-specific datasets into the planning process.

The analysis therefore indicates that the Parcel Location Tool is positioned within an existing market. The underlying customer need is already well recognised, and organisations are actively investing in digital planning solutions to support urban logistics decision-making. The commercial opportunity lies in offering a more specialised and data-driven alternative to generic planning tools, enabling customers to improve infrastructure planning while supporting broader sustainability and efficiency objectives.

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Table 29 Market segmentation: Parcel Location Tool

Solution Profile	Assessment
Market type	Existing market
Primary customer	Municipalities and/or Metropolitan Authorities, Logistics Operators managing parcel lockers networks
Customer need	Data-driven optimisation of parcel locker locations and urban logistics infrastructure planning
Competitive environment	GIS platforms, urban planning software, logistics planning tools and consultancy services
Differentiation strategy	Dedicated optimisation tool specifically designed for parcel infrastructure planning, integrating logistics-specific datasets and spatial analytics to support evidence-based decision making

This classification reflects a solution that competes within an established market while offering a higher level of specialisation than existing planning tools. Rather than creating new demand, the Parcel Location Tool responds to an increasingly recognised need for more sophisticated planning methodologies capable of supporting the rapid transformation of urban parcel distribution systems. Its commercial success will therefore depend on demonstrating superior analytical capabilities, ease of integration with existing planning processes and measurable improvements in infrastructure planning outcomes compared with conventional spatial analysis approaches.

4.3.5. Comparative discussion

The market segmentation analysis demonstrates that the Twinning Living Lab portfolio addresses a broad range of commercial opportunities across the urban logistics ecosystem. Rather than competing within the same market space, the four KERs target complementary customer needs and operate under different market dynamics, reinforcing the overall commercial strength of the DISCO portfolio. Compared with the Starring Living Labs, which primarily focused on enabling digital infrastructures supporting data sharing and collaborative planning, the Twinning Living Labs introduce operational solutions designed to address specific urban logistics challenges with clearly identifiable customer groups and commercial applications.

The Curbside Management Tool and **the Parcel Location Tool** operate within established markets where municipalities and logistics operators already invest in digital planning and traffic management solutions. Their commercial success will therefore depend primarily on demonstrating superior analytical capabilities, ease of integration and measurable operational benefits compared with existing software platforms and planning methodologies. Both solutions compete through technological differentiation rather than market creation.

The E-pods with Internal Lockers occupy a different position by targeting a specialised niche within the broader last-mile delivery market. While parcel lockers and urban consolidation centres are well-established logistics concepts, the proposed solution differentiates itself through the introduction of a flexible, mobile infrastructure model capable of adapting to changing operational requirements. The commercial opportunity therefore lies in serving logistics operators whose operational needs cannot be fully addressed by conventional fixed infrastructure.

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In contrast, **the Urban Logistics Disaster Plan** addresses an emerging market driven by the increasing importance of climate resilience and emergency preparedness within urban logistics. Rather than improving an existing operational process, the solution introduces an integrated service combining governance, digital decision-support and operational methodologies specifically designed for disaster logistics management. The growing frequency of climate-related emergencies and the increasing policy emphasis on urban resilience create favourable conditions for the development of this market, positioning the solution as a potential first mover within an expanding commercial domain.

Overall, the analysis confirms that the four KERs exhibit a high degree of commercial complementarity. Together they address different customer segments, respond to distinct operational challenges and follow differentiated market entry strategies, ranging from technology-driven competition within established markets to the creation of innovative service offerings in emerging domains. This diversity reduces internal competition among the project results while strengthening the overall exploitation potential of the DISCO portfolio. Moreover, the market segmentation analysis illustrates the evolution of DISCO innovations from enabling digital platforms towards operational solutions capable of generating direct commercial value for municipalities, logistics operators and public authorities. These findings provide the foundation for the subsequent market maturity analysis, which examines how the development stage of each target market may influence future commercial deployment and long-term growth opportunities.

4.4. Results of the Market Maturity

Unlike the market readiness assessment, which evaluates the maturity of each KER, the Product Life Cycle analysis focuses on the maturity of the target market in which the solution will compete. Consequently, a technologically mature solution may still operate within an emerging market if customer adoption, competitive dynamics and commercial diffusion remain at an early stage.

Table 30 Market maturity: Twinning LLs solutions

Solution	Product Life Cycle Stage	Market Characteristics
Curbside Management Tool	Growth	Expanding smart curb management market driven by increasing urban congestion, digital mobility policies and growing adoption of AI-based traffic monitoring solutions by municipalities.
E-pods with Internal Lockers	Introduction	Emerging market for flexible and mobile parcel delivery infrastructure characterised by limited adoption, pilot-driven implementation and experimentation with innovative last-mile delivery models.
Urban Logistics Disaster Plan	Introduction	Emerging market for urban logistics resilience and emergency preparedness, stimulated by the increasing frequency of climate-related disruptions and the growing recognition of disaster logistics within urban planning.
Parcel Location Tool	Growth	Rapidly expanding market for data-driven parcel infrastructure planning supported by the continued growth of e-commerce, increasing parcel volumes and the digitalisation of urban logistics planning.

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4.4.1. Curbside Management Tool

The Curbside Management Tool operates within the rapidly evolving market for intelligent urban mobility and curbside management solutions. Over the last decade, municipalities have progressively shifted from static parking management approaches towards digital, data-driven systems capable of supporting dynamic regulation of urban space. This transition has been accelerated by the implementation of LEZs and UVARs, increasing freight activity associated with e-commerce and broader smart city initiatives. As a result, public authorities are increasingly investing in technologies that improve the monitoring and management of curbside infrastructure. Despite this growing demand, the market continues to evolve rapidly. Artificial intelligence, computer vision and automated traffic analytics are progressively replacing traditional monitoring approaches, while municipalities are increasingly integrating these technologies into wider digital mobility platforms. The number of commercial providers has expanded significantly in recent years, accompanied by increasing standardisation of technologies and procurement practices. At the same time, market penetration remains uneven across Europe, with adoption largely concentrated in larger metropolitan areas pursuing ambitious digital transformation strategies.

The implementation within the Barcelona Twinning Living Lab reflects these broader market dynamics. Rather than demonstrating a technology entering an entirely new market, the project validated a solution capable of responding to an already recognised customer demand through improved technological performance. The commercial opportunity therefore lies primarily in expanding adoption across municipalities that are progressively modernising their urban mobility management systems, rather than creating entirely new market demand.

Considering the increasing number of deployments, expanding customer base and growing competitive landscape, the target market can be considered to have progressed beyond the initial introduction phase. Nevertheless, it has not yet reached widespread saturation, and substantial growth opportunities remain as cities continue to digitalise urban freight management and invest in intelligent transport infrastructure.

The available evidence therefore indicates that the Curbside Management Tool operates within a Growth market. Customer awareness is well established, demand continues to expand, commercial competition is increasing and technological innovation remains a key driver of differentiation. Future market expansion is expected to be supported by continued investments in smart city technologies, urban digitalisation and sustainable mobility policies.

Table 31 Market maturity: Curbside management tool

Market Maturity Assessment	Result
PLC Stage	Growth
Supporting evidence	Increasing deployment of AI-based traffic management solutions, wider implementation of smart mobility policies and demonstrated operational value within the Barcelona Living Lab
Current market dynamics	Smart city investments, digital transformation of urban mobility, Urban Vehicle Access Regulations (UVARs), sustainability policies and increasing freight monitoring requirements

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Strategic implication	Continued market expansion with increasing competition and wider adoption across municipalities of different sizes

4.4.2. E-pods with internal lockers

The E-pods with Internal Lockers operate within the broader last-mile delivery market, one of the fastest-growing segments of urban logistics due to the continuous expansion of e-commerce and increasing customer expectations for flexible delivery services. While parcel lockers, micro-consolidation centres and alternative delivery models have become well-established components of urban logistics systems, the concept of mobile parcel lockers remains relatively new. The solution developed by NEXT introduces a novel operational model that combines secure parcel storage, temporary consolidation and flexible deployment within a single mobile asset, offering capabilities that are not yet widely available in the current market.

The growth of e-commerce and the progressive introduction of urban access restrictions have created favourable conditions for innovative last-mile delivery solutions capable of reducing congestion and emissions while maintaining high service levels. Nevertheless, most existing commercial solutions continue to rely on fixed parcel lockers or permanent logistics infrastructure. Mobile parcel lockers therefore represent a relatively recent evolution of the market, where customer awareness is still developing and commercial adoption remains limited to pilot projects and early commercial initiatives.

The implementation in the Padua Twinning Living Lab confirms this market situation. The project successfully demonstrated the technical feasibility and operational benefits of the solution, validating its ability to complement existing logistics networks through a more flexible infrastructure model. At the same time, the demonstration highlighted that the commercial viability of the concept still depends on further market acceptance, operational integration within existing delivery networks and the development of sustainable business models capable of supporting fleet deployment and utilisation.

Although the broader last-mile delivery market is already well established, the specific market addressed by mobile parcel lockers is still emerging. The number of commercial providers remains limited, market standards are still evolving and customer adoption is largely driven by innovation-oriented logistics operators willing to experiment with new delivery concepts. Considerable effort is therefore still required to demonstrate long-term economic benefits and encourage wider market acceptance.

The available evidence therefore indicates that the E-pods with Internal Lockers operate within the Introduction stage of the Product Life Cycle. The market exhibits strong growth potential supported by long-term trends such as e-commerce expansion, urban sustainability policies and increasing demand for flexible logistics infrastructure. Nevertheless, commercial diffusion remains at an early stage, with significant opportunities for market development before widespread adoption is achieved.

Table 32 Market maturity: E-pods with internal lockers

Market Maturity Assessment	Result

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PLC Stage	Introduction
Supporting evidence	Successful validation of a novel mobile parcel locker concept in the Padua Living Lab; growing demand for flexible last-mile delivery solutions; limited number of comparable commercial deployments
Current market dynamics	Expansion of e-commerce, stricter urban access regulations, increasing demand for low-emission logistics and greater operational flexibility in last-mile delivery
Strategic implication	Significant long-term growth potential as logistics operators progressively adopt more flexible and sustainable urban delivery models and demonstrate the economic viability of mobile logistics infrastructure

4.4.3. Urban Logistics Disaster Plan

The Urban Logistics Disaster Plan operates within the emerging market for urban resilience and disaster preparedness solutions, a sector that has gained importance in recent years due to the growing frequency and intensity of climate-related events, natural disasters and other large-scale disruptions. While emergency management and civil protection have long been established public responsibilities, the integration of urban logistics planning, digital decision-support and multi-stakeholder governance into comprehensive resilience frameworks represents a relatively recent area of innovation. Consequently, the commercial market for integrated urban logistics resilience solutions remains in its early stages of development.

Recent European policies, including the European Green Deal, the EU Climate Adaptation Strategy and the Union Civil Protection Mechanism, have reinforced the importance of strengthening urban resilience and improving preparedness for future emergencies. At the same time, municipalities are increasingly recognising that efficient logistics systems are essential not only for daily urban operations but also for maintaining the continuity of essential services during crises. This growing awareness is creating demand for structured methodologies capable of supporting preparedness, response and recovery activities through coordinated planning and digital technologies.

The implementation within the Valencia Twinning Living Lab clearly reflects these evolving market conditions. The validation of the methodology during the DANA floods demonstrated that the solution is technically and operationally mature, providing valuable evidence of its applicability under real emergency conditions. Nevertheless, this successful deployment should not be interpreted as evidence of a mature market. On the contrary, it highlights the existence of an emerging demand for integrated urban logistics resilience solutions that is only now beginning to be recognised by public authorities. The commercial landscape remains characterised by a limited number of specialised providers, the absence of widely adopted market standards and procurement models that are still evolving.

This distinction between product maturity and market maturity is particularly relevant in this case. The Urban Logistics Disaster Plan itself has reached a high level of operational readiness, but it addresses a market that is still developing. Customer awareness continues to increase as cities experience more frequent climate-related disruptions, while institutional investments in resilience planning are progressively expanding. These conditions are characteristic of the introduction stage

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of the Product Life Cycle, where market potential is significant but widespread commercial adoption has not yet been achieved.
The available evidence therefore indicates that the Urban Logistics Disaster Plan operates within an Introduction market. Although demand is expected to increase substantially over the coming years, the market remains relatively immature, with considerable opportunities for first movers capable of establishing recognised methodologies and trusted operational frameworks. Future growth will likely be driven by climate adaptation policies, increasing public investment in resilience, and the progressive institutionalisation of urban logistics preparedness within municipal planning processes.

Table 33 Market maturity: Urban Logistics Disaster Plan

Market Maturity Assessment	Result
PLC Stage	Introduction
Supporting evidence	Successful validation during the DANA floods in Valencia; increasing policy attention to climate adaptation and disaster preparedness; limited availability of integrated commercial urban logistics resilience solutions
Current market dynamics	Climate change adaptation policies, increasing frequency of extreme weather events, public investment in resilience, strengthening of civil protection strategies and growing emphasis on urban preparedness
Strategic implication	Strong long-term growth potential as urban resilience becomes an integral component of municipal planning and emergency management, creating increasing demand for integrated logistics preparedness methodologies and supporting digital platforms

4.4.4. Parcel Location Tool

The Parcel Location Tool operates within the expanding market for digital decision-support solutions supporting urban logistics planning and parcel infrastructure optimisation. The rapid growth of e-commerce over the last decade has significantly increased the demand for parcel collection networks, prompting municipalities and logistics operators to invest in parcel lockers, collection points and alternative delivery infrastructure capable of improving the efficiency and sustainability of last-mile distribution. As these networks continue to expand, the ability to identify optimal locations for parcel infrastructure has become an increasingly important strategic requirement.
The market addressed by the Parcel Location Tool builds upon the broader digital transformation of urban planning and logistics management. GIS, spatial analytics and decision-support software are already widely used by both public authorities and private organisations. Nevertheless, the specific application of these technologies to parcel infrastructure planning remains relatively underdeveloped, creating opportunities for specialised solutions capable of integrating logistics demand, accessibility analysis and urban planning considerations into a single analytical framework.
The implementation within the Zaragoza Twinning Living Lab demonstrated the capability of the tool to support evidence-based decision-making through the integration of multiple urban and logistics datasets. The solution successfully generated recommendations for parcel infrastructure placement while demonstrating the practical benefits of replacing conventional planning

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approaches with data-driven methodologies. The evaluation activities further confirmed that improved infrastructure planning can contribute to reducing delivery distances, increasing accessibility and supporting more efficient last-mile logistics operations. These results illustrate that customer demand is moving beyond simple infrastructure deployment towards more sophisticated planning tools capable of maximising operational performance.

The competitive landscape has evolved considerably in recent years, with increasing investments in smart city platforms, urban digital twins and logistics planning software. At the same time, the continued expansion of parcel locker networks across European cities is generating sustained demand for analytical tools capable of supporting strategic investment decisions. Customer awareness is therefore already well established, and organisations increasingly recognise the value of data-driven planning for improving urban logistics efficiency. Although specialised competitors remain relatively limited, the market is experiencing increasing commercial activity as digital planning solutions become progressively integrated into municipal decision-making processes.

The available evidence therefore indicates that the Parcel Location Tool operates within the Growth stage of the Product Life Cycle. The market is characterised by expanding demand, increasing customer awareness and a growing number of specialised digital solutions addressing urban logistics planning. While significant opportunities for further market expansion remain, the underlying customer need is already well recognised and adoption is expected to accelerate as municipalities continue investing in smart urban logistics infrastructure and data-driven planning methodologies.

Table 34 Market maturity: Parcel Location Tool

Market Maturity Assessment	Result
PLC Stage	Growth
Supporting evidence	Successful demonstration in the Zaragoza Living Lab; increasing deployment of parcel locker networks; growing adoption of digital planning tools by municipalities and logistics operators; demonstrated operational benefits of data-driven infrastructure planning
Current market dynamics	Expansion of e-commerce, continued investment in parcel collection infrastructure, digital transformation of urban planning, smart city strategies and increasing demand for efficient last-mile logistics
Strategic implication	Continued market expansion driven by the growth of parcel delivery networks and increasing adoption of advanced decision-support tools capable of optimising urban logistics infrastructure and supporting sustainable mobility objectives

4.4.5. Comparative discussion

The Product Life Cycle analysis confirms that the four Twinning Living Lab KERs operate in markets characterised by different levels of maturity, despite all demonstrating advanced levels of technological and commercial readiness. This finding further reinforces the distinction between product maturity and market maturity introduced in the proposed methodology. While the previous market readiness assessment evaluated the commercial preparedness of each solution, the Product Life Cycle analysis examines the maturity of the markets in which these solutions are expected to

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compete. Consequently, a highly mature solution may still operate within an emerging market if customer adoption, competitive dynamics and commercial diffusion remain at an early stage.

The Curbside Management Tool and the **Parcel Location Tool** operate within growth markets driven by the ongoing digital transformation of urban logistics and increasing investments in smart city technologies. Both markets are characterised by expanding customer demand, increasing competition and growing adoption of data-driven planning solutions by municipalities and logistics operators. Commercial success in these markets will therefore depend primarily on rapid market penetration, technological differentiation and the establishment of strategic partnerships capable of supporting large-scale deployment before the markets reach maturity.

In contrast, **the E-pods with Internal Lockers** and the **Urban Logistics Disaster Plan** address markets that remain in the introduction stage of the Product Life Cycle. Although both respond to well-recognised societal challenges, namely sustainable last-mile logistics and urban resilience, their specific market segments are still emerging. Mobile parcel lockers represent a relatively new operational concept within urban logistics, while integrated urban logistics resilience frameworks are only beginning to attract systematic attention from municipalities and public authorities as climate-related disruptions become increasingly frequent. These markets therefore present substantial long-term growth opportunities but still require continued awareness raising, demonstration activities and progressive market development before widespread commercial adoption can be achieved.

The Urban Logistics Disaster Plan provides a particularly illustrative example of the distinction between solution maturity and market maturity. Despite being classified as the KER closest to full commercialisation due to its successful validation during the DANA floods and the achievement of Technology Readiness Level 8, it operates within a market that remains at an early stage of development. This demonstrates that commercial readiness should not be interpreted as evidence of market maturity, highlighting the importance of analysing both dimensions independently when defining exploitation strategies.

Overall, the Product Life Cycle analysis complements the previous assessments by demonstrating that commercialisation strategies should be tailored not only to the maturity of the individual solutions but also to the characteristics of the markets they address. Growth markets require rapid commercial expansion, customer acquisition and technological differentiation to consolidate competitive positions, whereas introduction markets require ecosystem development, stakeholder engagement and continued demonstration of value to accelerate market formation. Together with the market readiness and market segmentation analyses, these findings provide a comprehensive strategic framework for the development of business models and exploitation pathways presented in Task 6.3.

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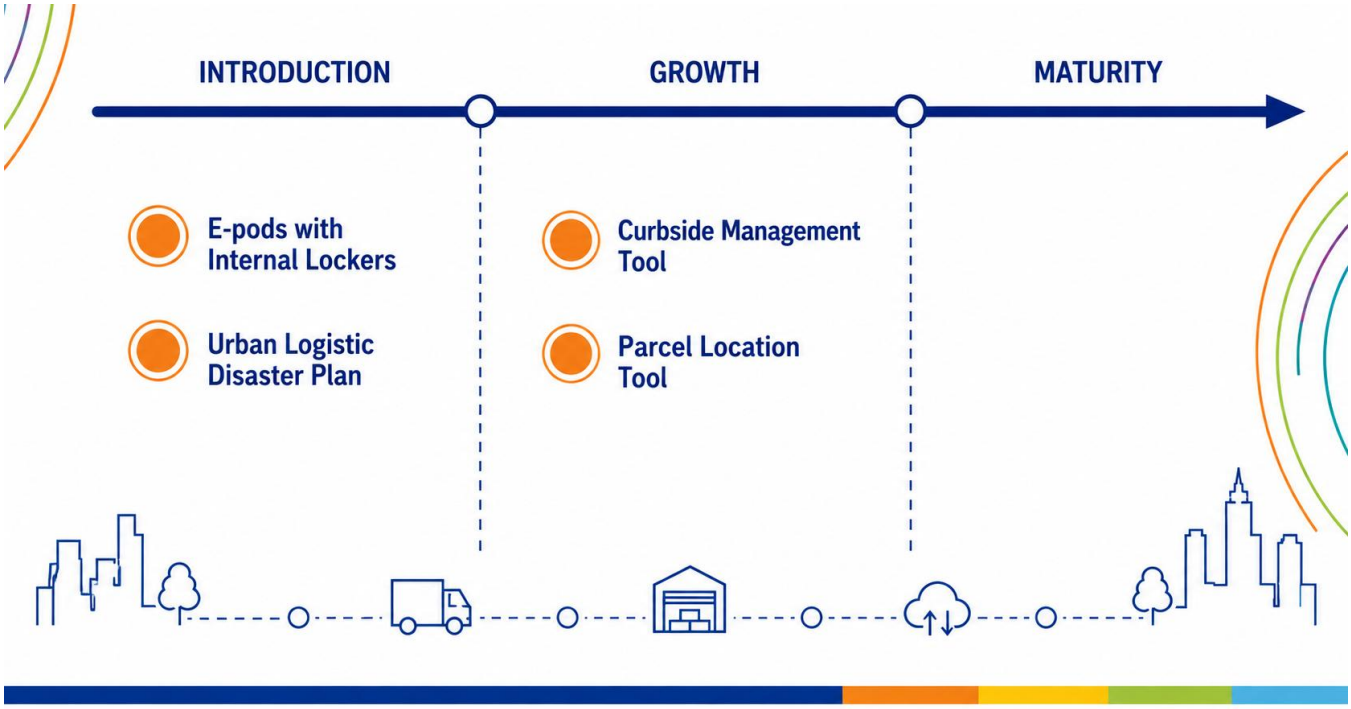

Figure 9 Product Life Cycle of the DISCO Twinning Living Lab KERs

5. Identified horizontal solutions

5.1. Identified solutions

During the whole duration of the project, two main solutions have been identified with high potential for commercialization for the horizontal support they can give to authorities, logistic operators and in general to all the staeholders involved in the urban logistics value chain. The horizontal solutions differ from the Living Lab KERs because they constitute enabling infrastructures supporting multiple DISCO innovations rather than standalone operational services. Consequently, they are assessed separately while applying the same analytical framework.

- **The Meta Model Suite (developed by CERTH):** it is a novel framework that supports the implementation and adoption of green last-mile delivery solutions in urban areas, based on the PI-led DISCO-X innovations (i.e DISCOCURB – Mixed use and dynamic streets space management; DISCOPROXI – Shared lands; DISCOESTATE – Multi-purpose, flexible and temporary use of building space; DISCOBAY – Multimodal bays; DISCOLLECTION – Samrt data collection methods). The suite consists of four main functionalities: (1) guidance to cities on the different DISCO innovations and their requirements, (2) definition of the transition path for each DISCO city to achieve a smooth transition to PI-led innovations and incorporate them into their SULP, (3) planning and operational tools for designing and implementing the different DISCO-X solutions, and (4) guidance to cities on the data requirements of each DISCO-X and how to develop their own dataspaces.

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- **The Urban Freight dataspace (developed by INLECOM):** The DISCO UF Data Space is the underlying digital enabler for the deployment of data-driven collaborative planning services. It provides a trustworthy framework for sharing data related to transportation, delivery, space use, and supply chain operations in urban areas across decentralised networks, whilst introducing semantic interoperability. The latter is particularly critical for establishing a common understanding of data meaning and context across diverse sources and the DISCO-X applications. Through the DISCO UF Data Space data sovereignty, transparency and fairness are ensured, creating the ground for stakeholders' onboarding. Data connectors will facilitate seamless data exchange services while incorporating robust data security enforcement mechanisms. A catalogue of key reusable services will further support the development of sustainable urban logistics strategies.

5.2. Results of the Market Readiness Assessment

As discussed in Section 2, the market readiness assessment combines the Business-Oriented Self-Assessment Tool (BOSAT) with complementary evidence extracted from the technical deliverables describing the development, implementation and validation of each KER. Unlike the operational solutions assessed in the Starring Living Labs, but similarly to the Twinning Living Labs, no dedicated Market Readiness Assessment was carried out for the Meta Model Suite (MMS) and the Urban Freight Data Space (UFDS). Therefore, their evaluation was reconstructed by integrating the BOSAT results with evidence regarding their technical maturity, implementation status, validation activities, governance model and anticipated deployment pathways. In particular, the assessment draws upon D2.3 DISCO Meta Model Suite Architecture, D2.5 DISCO-X & Meta Model Suite Interoperability and D3.4 DISCO Data Space Open Software Repository and Implementation Guide. Table 35 summarises the overall market readiness classification of the two KERs analysed.

Table 35 Market readiness assessment: Horizontal solutions

Solution	Market Readiness Stage	Overall Assessment
MMS	Early Market	Successfully developed and validated as a comprehensive decision-support framework guiding cities in the adoption of Physical Internet-inspired urban logistics solutions. Future commercialisation depends on establishing sustainable governance, maintenance and service delivery models together with broader adoption by municipalities.
UFDS	Early Market	Successfully implemented and validated as a federated data-sharing infrastructure supporting trusted and interoperable urban freight data exchange. Future market uptake depends on expanding the ecosystem of participating organisations, establishing long-term governance arrangements and achieving critical mass for sustainable data sharing beyond the project lifetime.

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5.2.1. The Meta Model Suite

The Meta Model Suite (MMS) is a comprehensive decision-support framework designed to support cities in planning and implementing Physical Internet-inspired urban logistics solutions. Rather than functioning as a standalone operational application, the MMS provides municipalities with guidance on the adoption of DISCO-X innovations, supports the definition of transition pathways, offers planning and operational tools, and assists cities in identifying the data requirements needed to establish interoperable urban freight data spaces. Throughout the project, the framework has evolved into an integrated environment combining technical guidance, maturity assessment methodologies, implementation support and interoperability assessment, providing a structured approach for authorities seeking to modernise urban logistics systems.

The market readiness assessment indicates that the MMS has successfully progressed beyond the proof-of-concept phase. The framework has been fully developed and validated within DISCO, demonstrating its capability to support planning and decision-making processes while reducing the complexity associated with the adoption of innovative urban logistics solutions. However, despite its strong technical maturity, the solution has not yet reached widespread commercial deployment. Future progress will depend less on additional technological development and more on establishing sustainable governance, maintenance and service delivery models capable of supporting long-term adoption by municipalities.

Table 36 Market readiness assessment summary for the Meta Model Suite

Table 36 Market readiness assessment: MMS

Assessment criterion	Result
Market Readiness Stage	Early Market
Key supporting evidence	Comprehensive framework fully developed and validated within DISCO; integration of transition planning methodologies, implementation guidance, planning tools and interoperability assessment; technical validation through D2.3 and D2.5; clear value proposition supporting municipalities in adopting Physical Internet-inspired urban logistics solutions
Main barriers to commercialisation	Absence of an established commercial delivery model; need for long-term governance and maintenance arrangements; dependence on adoption by municipalities and public authorities; limited evidence of commercial deployments beyond the project
Next step towards the following stage	Establish sustainable governance and service delivery mechanisms, validate the framework through additional city deployments, integrate the MMS within urban planning processes, and consolidate partnerships supporting long-term operation beyond the project lifetime

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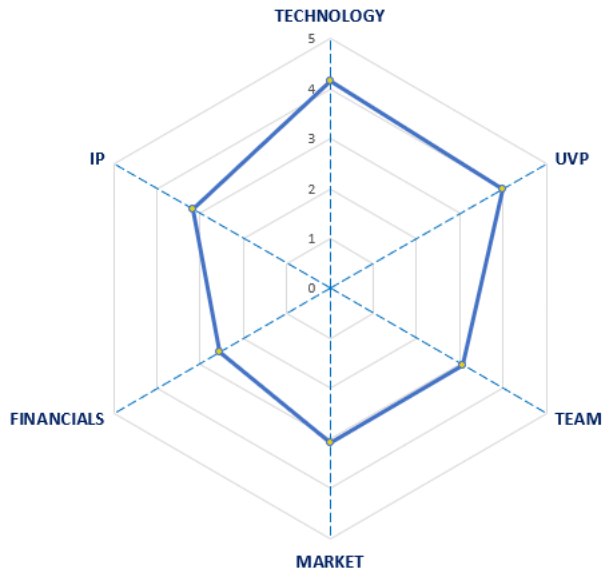

Figure 10 Radar Chart MMS

Overall, the MMS can be considered technically mature but commercially emerging. The primary challenge is no longer demonstrating technical feasibility but transforming the framework into a sustainable decision-support service adopted by cities beyond the DISCO project.

5.2.2. The Urban Freight Data Space

The Urban Freight Data Space (UFDS) constitutes the digital backbone of the DISCO ecosystem, enabling secure, trustworthy and semantically interoperable exchange of urban freight data among multiple stakeholders. The platform provides the technological infrastructure required to support collaborative planning services through federated data sharing while ensuring data sovereignty, transparency and interoperability across heterogeneous data sources. The final implementation includes reusable services, trusted data connectors and semantic models supporting the deployment of DISCO-X applications.

The market readiness assessment demonstrates that the UFDS has achieved a high level of technical implementation and operational validation. The platform has been successfully deployed, integrating numerous data connectors and datasets while demonstrating interoperability with external European initiatives. Nevertheless, as with many digital platforms based on network effects, commercial readiness depends primarily on the development of a sufficiently large ecosystem of participating organisations rather than on further technological improvements.

Table 37 summarises the market readiness assessment for the Urban Freight Data Space.

Table 37 Market readiness assessment: UFDS

Assessment criterion	Result
Market Readiness Stage	Early Market
Key supporting evidence	Operational implementation of a federated urban freight data space; deployment of trusted connectors and reusable services; successful integration with external European initiatives; implementation documented through D3.4; demonstrated semantic interoperability and secure data-sharing capabilities

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Main barriers to commercialisation	Need to expand the ecosystem of participating organisations; establishment of sustainable governance and operational models; dependence on stakeholder willingness to share data; achievement of critical mass required to generate long-term value
Next step towards the following stage	Expand stakeholder onboarding, increase the number of connected organisations and services, consolidate governance arrangements, and demonstrate sustainable operation of the data ecosystem beyond the project lifetime

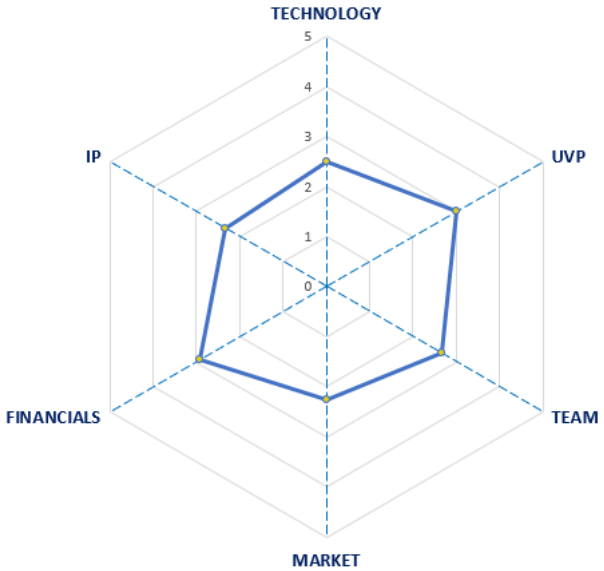

Figure 11 Radar Chart UFDS

Overall, the UFDS demonstrates strong technical readiness and operational maturity. Future commercial success will depend primarily on ecosystem expansion and governance rather than on additional technological development.

5.2.3. Comparative discussion

Both horizontal KERs achieve an overall Early Market classification, reflecting their successful technical development and validation within the DISCO project. The two solutions demonstrate high levels of technological maturity, strong implementation capabilities and comprehensive validation activities. However, their progression towards full commercialisation depends primarily on non-technical factors, including the establishment of sustainable governance models, broader stakeholder adoption and the definition of long-term service delivery mechanisms. While the Meta Model Suite focuses on supporting municipalities through structured planning and decision-making, the UFDS creates the trusted digital infrastructure required to enable interoperable data sharing across the urban logistics ecosystem. Consequently, future market readiness for both solutions will be driven by ecosystem adoption rather than further technological development.

Table 38 Market readiness assessment: comparative overview Horizontal solutions

Solution	Technology	Market	Business	Team	Living Lab Validation	Final Market Readiness
MMS	High	Medium	Medium	High	High	Early Market
UFDS	High	Medium	Medium	High	High	Early Market

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5.3. Results of the Market segmentation

The market segmentation analysis follows the same methodology already employed in the Living Labs and presented in Section 2. As enabling digital infrastructures rather than operational applications, the MMS and the UFDS target ecosystem-level adoption, supporting municipalities, logistics operators and other urban logistics stakeholders in planning, implementing and operating collaborative urban freight systems. Consequently, their market positioning reflects both the growing demand for digital transformation in urban logistics and the emergence of interoperable, data-driven governance models.
Table 39 summarises the results of the market segmentation analysis.

Table 39 Market segmentation: Horizontal solutions

Solution	Market Type	Primary Customers	Primary Customer Need	Differentiation Strategy
MMS	Re-segmented (niche) Market	Municipalities	Structured guidance supporting the planning, implementation and adoption of innovative urban logistics solutions	Integrated decision-support framework combining transition planning, implementation guidance, interoperability assessment and planning tools specifically tailored to Physical Internet-inspired urban logistics.
UFDS	New Market	Municipalities	Trusted, interoperable and sovereign exchange of urban freight data supporting collaborative planning and digital urban logistics services	Federated data-sharing infrastructure combining semantic interoperability, trusted data exchange and reusable digital services specifically designed for collaborative urban freight ecosystems

5.3.1. The Meta Model Suite

The Meta Model Suite (MMS) is positioned within a re-segmented (niche) market. Although urban planning platforms, decision-support systems and Sustainable Urban Logistics Plan (SULP) methodologies already exist, the MMS differentiates itself by addressing the specific challenge of supporting cities in the transition towards Physical Internet-inspired urban logistics systems. Rather than competing as a generic planning tool, it combines transition planning, implementation guidance, interoperability assessment and operational planning functionalities within a single framework tailored to urban freight transformation.
The primary customers are municipalities seeking support for implementing innovative logistics measures. The principal customer need is to reduce the complexity associated with selecting, planning and deploying new urban logistics solutions while ensuring interoperability and long-term scalability.

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Consequently, the MMS creates value by specialising an existing category of planning tools, positioning itself within a re-segmented market where differentiation is achieved through its integrated methodology and its exclusive focus on collaborative and data-driven urban freight planning.

5.3.2. The Urban Freight Data Space

The Urban Freight Data Space (UFDS) addresses a new market emerging from the increasing digitalisation of urban logistics and the growing adoption of European data spaces. Unlike traditional data-sharing platforms, the UFDS introduces a trusted, federated environment specifically designed for urban freight applications, combining semantic interoperability, data sovereignty and reusable digital services.

Its primary customers include municipalities seeking to establish or strengthen collaborative urban logistics ecosystems. Their common need is to securely exchange heterogeneous operational data while maintaining ownership and control over the shared information. Secondary users include logistics service providers, technology providers developing interoperable digital solutions, and data providers contributing mobility, logistics and infrastructure data to the ecosystem.

The UFDS differentiates itself by enabling trusted and interoperable data exchange specifically tailored to urban freight operations. Rather than improving an existing software category, it contributes to establishing a new digital infrastructure market driven by European data space initiatives and the growing demand for collaborative data ecosystems.

5.3.3. Comparative discussion

The market segmentation analysis reveals two complementary commercial positioning strategies for the horizontal KERs. While both solutions contribute to the digital transformation of urban logistics, they address different market opportunities and customer needs.

The Meta Model Suite competes within a re-segmented market, differentiating itself through a specialised decision-support framework that extends traditional urban planning tools with transition methodologies, implementation guidance and interoperability assessment tailored to Physical Internet-inspired logistics. Its competitive advantage therefore lies in offering a more integrated and domain-specific solution than existing planning approaches.

In contrast, **the Urban Freight Data Space** addresses a new market, reflecting the emergence of trusted, interoperable urban freight data ecosystems enabled by European data space initiatives. Its value proposition is based on creating the digital infrastructure necessary to support collaborative planning services and secure data exchange among multiple stakeholders, rather than competing directly with conventional software platforms.

Overall, the two horizontal KERs occupy complementary positions within the urban logistics ecosystem. The MMS facilitates the planning and implementation of innovative logistics measures, while the UFDS provides the trusted digital infrastructure required to support data-driven collaboration. Together, they establish the strategic and technological foundations for the wider deployment of collaborative and interoperable urban freight systems.

5.4. Results of the Market maturity

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Unlike the market readiness assessment, which evaluates the maturity of each Key Exploitable Result (KER), the Product Life Cycle (PLC) analysis focuses on the maturity of the target market in which the solution will compete. Consequently, a technologically mature solution may still operate within an emerging market if customer adoption, competitive dynamics and commercial diffusion remain at an early stage.
The PLC analysis was performed by considering the commercial environment addressed by each horizontal KER, drawing upon the BOSAT assessment together with evidence from the technical deliverables regarding the intended deployment context, target users and anticipated adoption pathways. Table 40 summarises the market maturity classification of the Meta Model Suite (MMS) and the Urban Freight Data Space (UFDS).

Table 40 Market maturity: Horizontal solutions

Solution	Product Life Cycle Stage	Market Characteristics
MMS	Growth	Expanding market for digital decision-support systems and urban planning platforms, driven by the increasing digitalisation of urban logistics, wider adoption of Sustainable Urban Logistics Plans (SULPs) and growing demand for integrated planning tools supporting collaborative freight management
UFDS	Introduction	Emerging market for trusted urban freight data spaces characterised by limited large-scale adoption, evolving governance models and increasing policy support through European initiatives promoting interoperable and sovereign data-sharing ecosystems

5.4.1. The Meta Model Suite

The market targeted by the Meta Model Suite is positioned in the Growth stage of the Product Life Cycle. The increasing digitalisation of urban mobility planning, together with the widespread adoption of Sustainable Urban Mobility Plans (SUMPs) and Sustainable Urban Logistics Plans (SULPs), has created growing demand for decision-support platforms capable of assisting municipalities in designing and implementing innovative freight policies. Within this expanding market, the MMS differentiates itself by providing a structured framework specifically supporting the transition towards Physical Internet-inspired urban logistics through implementation guidance, planning tools and interoperability assessment.
Although competition is increasing as cities adopt digital planning solutions, market demand continues to expand due to European policy objectives promoting sustainable urban mobility, digital transformation and data-driven decision making. Consequently, future commercial success will depend primarily on demonstrating the added value of the integrated framework, strengthening adoption by municipalities and continuously evolving the suite to address emerging urban logistics challenges.

5.4.2. The Urban Freight Data Space

The Urban Freight Data Space addresses a market that is currently in the Introduction stage of the Product Life Cycle. While the need for secure and interoperable data sharing is widely recognised,

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trusted urban freight data spaces remain an emerging market characterised by limited commercial deployment and evolving governance models. Recent European initiatives promoting common data spaces and semantic interoperability are creating favourable conditions for future market development, although widespread adoption has yet to be achieved.
In this context, the UFDS represents an enabling digital infrastructure supporting collaborative urban logistics rather than a conventional software application. Its future growth will depend on the progressive expansion of participating organisations, the establishment of sustainable governance mechanisms and the achievement of sufficient ecosystem scale to generate value for all stakeholders. As European policies continue to encourage trusted data sharing across sectors, the market is expected to evolve from pilot implementations towards broader operational deployment.

5.4.3. Comparative discussion

The Product Life Cycle analysis highlights different levels of market maturity for the two horizontal Key Exploitable Results, despite both demonstrating a high level of technical development within the DISCO project.
The **Meta Model Suite** operates within an expanding market for digital planning and decision-support solutions, where increasing demand from municipalities creates favourable conditions for commercial growth. Its market is characterised by growing customer awareness, increasing competition and continuous innovation, all typical features of the **Growth** stage. Consequently, future success will depend on differentiation, service quality and broader institutional adoption rather than on creating market awareness.
Conversely, the **Urban Freight Data Space** addresses a market that is still emerging. Although policy initiatives at European level are accelerating the development of trusted data ecosystems, commercial deployment remains limited and the long-term governance and business models supporting urban freight data spaces are still evolving. As a result, the market exhibits the characteristics of the **Introduction** stage, where stakeholder engagement, ecosystem development and market education remain essential prerequisites for wider adoption.
Overall, the analysis demonstrates that the two horizontal KERs operate in complementary but distinct market environments. The MMS competes within a growing market where digital planning solutions are becoming increasingly established, whereas the UFDS contributes to shaping an emerging market for trusted urban freight data ecosystems. Together, they provide the strategic and digital foundations necessary to support the long-term transition towards collaborative, interoperable and data-driven urban logistics.

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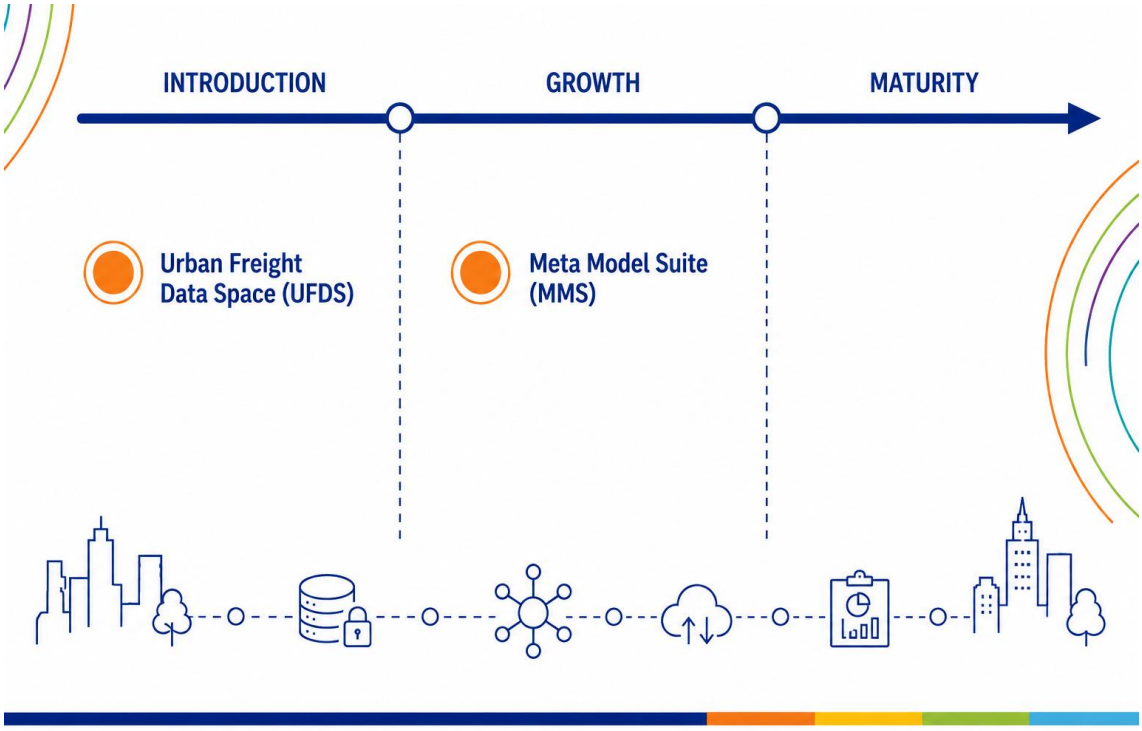

Figure 12 Product Life Cycle of the DISCO Horizontal KERs

6. Conclusions

This deliverable has presented a structured market assessment of the DISCO Key Exploitable Results (KERs), applying a common analytical methodology across all project solutions to evaluate their commercial potential and market positioning. Building upon the Business-Oriented Self-Assessment Tool (BOSAT) developed in Task 6.2, the assessment combined three complementary perspectives: Market Readiness, Market Segmentation and Market Maturity. Together, these analyses provide a comprehensive understanding of both the internal maturity of each solution and the external conditions influencing its future market uptake.

The Market Readiness Assessment demonstrated that the DISCO portfolio encompasses solutions at different stages of commercial development. While some KERs, such as WareM&O, have reached a high level of commercial maturity and are approaching full commercialisation, others, including the Smart Data Platform, Urban Freight Data Space and Meta Model Suite, remain in earlier phases where further validation, ecosystem development and stakeholder engagement are required. Digital Twin and Urban Access Control occupy an intermediate position, combining demonstrated technical maturity with the need for broader market deployment and customer adoption. These differences confirm that the project has generated a balanced innovation portfolio capable of addressing both short-term exploitation opportunities and longer-term strategic developments.

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The Market Segmentation analysis further highlighted that the DISCO solutions target markets with different competitive dynamics and adoption patterns. Most KERs operate within re-segmented markets, where the project introduces new value propositions through the integration of Physical Internet principles, collaborative data sharing and advanced digital technologies into existing urban logistics services. Conversely, the Urban Freight Data Space represents a New Market opportunity, contributing to the emergence of trusted urban logistics data ecosystems that are still at an early stage of development. This diversity reflects the broad innovation scope of DISCO while confirming that different commercialisation strategies will be required to maximise the impact of each solution.
The Product Life Cycle analysis complemented these findings by examining the maturity of the markets addressed by each KER. The assessment shows that the DISCO portfolio spans all major market maturity stages. Some solutions compete within mature and well-established markets characterised by stable demand and increasing competition, whereas others address rapidly growing or emerging markets where policy support, digital transformation and sustainability objectives are creating favourable conditions for future expansion. Understanding these market characteristics is essential for selecting appropriate business models, investment priorities and deployment strategies.
Taken together, the three analytical dimensions demonstrate that exploitation cannot follow a single pathway across the entire DISCO portfolio. Instead, each KER requires a commercialisation strategy that reflects its technological maturity, target market characteristics and competitive environment. Solutions approaching commercial deployment will benefit from activities focused on market penetration, customer acquisition and business scaling, while less mature innovations require further validation, ecosystem building and demonstration activities before entering the market. This differentiated approach represents one of the main outcomes of the methodology developed in Task 6.2.
Beyond the assessment of individual solutions, the methodology developed in this deliverable provides a transferable framework that can support future innovation projects, Living Labs and public authorities in evaluating the commercial potential of emerging urban logistics solutions. By combining technological readiness, market positioning and market maturity within a single analytical framework, the approach supports more informed decision-making throughout the innovation lifecycle and contributes to reducing the risks associated with market deployment.
The findings presented in this deliverable provide the analytical foundation for the subsequent activities of Task 6.3. Building upon the evidence generated through the market assessment, the next stage of the project will develop tailored exploitation pathways, business and operating models, governance approaches and deployment strategies for each DISCO KER, supporting their sustainable adoption and replication beyond the lifetime of the project.

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