

D3.1– Urban logistics cooperation Framework

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Acronyms

Acronym	Meaning
LEZ	Low Emissions Zone
IDSA	International Data Spaces Association
KPIs	Key Performance Indicators
KPAs	Key Performance Areas.
SUMPs	Sustainable Urban Mobility Plans
SULPs	Sustainable Urban Logistics Plans
LEV	Light Electric Vehicles
UFT	Urban Freight Transport

Executive Summary

The executive summary outlines the main objectives and findings of the deliverable focused on advancing sustainable and zero-emissions Urban Freight Distribution (UFD) through coordinated efforts with local authorities and the logistics industry.

The following key points are included in this deliverable:

- The report identifies suitable frameworks for data exchange, essential data types for enhancing policymaking in Sustainable Urban Mobility Plans (SUMPs) and Sustainable Urban Logistics Plans (SULPs), and stakeholder requirements regarding privacy, security, and accountability.
- Barriers and drivers for data sharing in freight transportation are explored, along with considerations such as access levels, aggregation, anonymization, and data ownership.
- The KERs of the use cases demonstrate how data-sharing frameworks are applied, emphasizing gender perspectives in logistics data and ethical considerations across project deliverables.
- The International Data Spaces Association (IDSA) is selected as the preferred data-sharing framework for its emphasis on security, interoperability, and scalability.
- Detailed analyses of Key Performance Indicators (KPIs), Sub-indicators, and associated datasets across four categories already identified in D2.3 (Environment and Social Impact, Urban Planning, Traffic Management, and Service Efficiency) highlight critical data needs and access considerations.
- Findings underscore the importance of collaborative data sharing among stakeholders—logistic companies, fleet managers, urban planners—to optimize logistics operations and achieve sustainability goals.

Overall, the executive summary highlights the strategic importance of robust data frameworks and collaborative partnerships in fostering sustainable urban logistics and enhancing efficiency in freight distribution.

1. Introduction

The main objectives of this deliverable are to coordinate with local authorities and the logistics industry, and establish public-private cooperation agreements and data-sharing frameworks to advance towards a sustainable and zero-emissions Urban Freight Distribution (UFD). Through literature reviews, source and data searches, and dedicated workshops with stakeholders, the following have been identified:

1. The most suitable frameworks for data exchange.
2. The type of data needed for the city to improve its policymaking and the strategies outlined in the Sustainable Urban Mobility Plans (SUMPs) and the Sustainable Urban Logistics Plans (SULPs).

3. The requirements of large, medium, and small urban logistics stakeholders related to privacy, security, standards, accountability, and competence, thus defining the framework conditions for sharing the different types of data generated.
4. The barriers and drivers for data sharing in freight transportation, and clarification of the conditions (who can access the information, level of aggregation, anonymization, etc.).
5. Different use cases (KERs) will be shown for each type of data and, in the definition of the “use contracts”, and in the data type + conditions pairs for the information shared by the data owners.

To this end, this report analyzes through various points:

- The gender perspective in logistics data and the gender approach for each of the KPIs identified earlier in the project (point 2), as well as ethics and data-related issues present in all project deliverables.
- The review of the main data-sharing platforms related to logistics, as well as the presentation of the framework chosen for our project, which, as we will see in Section 3, is the IDSA.
- Next, we identify and present the relationship between KPIs (indicators), Sub-indicators (sub-indicators), and datasets through a matrix that indicates the datasets we need to calculate each KPA. At the same time, it tells us which are the most "necessary" datasets, the level of access, aggregation, and who owns the data. Finally, how each KPI in the four categories is calculated: environmental and social impact, urban planning, service efficiency.
- Section 4 shows which KPIs are associated with each KER through a workshop held with the project partners in Madrid. If we know which KPIs are associated with each KER, we can indirectly know which Sub-indicators and datasets are needed.
- Finally, Section 5 shows the results of collecting the necessary datasets in each KER, collected by the project partners involved in the development of each KER, as well as the different connectors that the platform must have to share data.

2. Gender, ethics and data related issues

2.1. Gender related issues

The collection and analysis of gender-disaggregated data in the logistics sector are crucial for understanding and addressing existing gender inequalities and for designing more inclusive policies and practices. Here are some key aspects and examples of relevant gender-disaggregated data for urban logistics.

2.1.1. Key Aspects of Gender-Disaggregated Data in Logistics

1. Labor participation:

- Employment rate by gender: The proportion of men and women employed in the logistics sector.
- Roles and positions: Distribution of men and women across different roles and hierarchical levels, from operational to leadership positions.

2. Wages and working conditions:

- Working conditions: Comparison of working conditions, including working hours, job security, and access to benefits.

3. Access to training and development opportunities:

- Training programs: Participation of men and women in training and professional development programs.
- Promotions and advancements: Rate of promotions and advancement opportunities disaggregated by gender.

4. Mobility patterns and use of infrastructure:

- Travel patterns: Differences in mobility patterns between men and women, including modes of transportation used and travel times.
- Access to infrastructure: Use of logistics infrastructure (such as warehouses and distribution centers) by gender.

5. Perception and experience in the sector:

- Work experience: Perception of men and women regarding their work experience in the logistics sector, including job satisfaction and sense of belonging.
- Barriers and challenges: Identification of specific barriers faced by women in the logistics sector, such as discrimination or lack of support.

2.1.2. Examples of Gender-Disaggregated Data in Logistics

1. Labor participation:

- In many countries, women represent a smaller proportion of the total workforce in the logistics sector.

2. Gender pay gap:

- Data might reveal that women in operational roles earn on average 15% less than their male counterparts, with the gap potentially being even larger in leadership positions.

3. Access to training:

- Analysis might show that women have less access to advanced training programs, with only 30% female participation in professional development courses.

4. Mobility patterns:

- Mobility data could indicate that women tend to use public transportation more frequently than men and that their travel times are more concentrated at certain times of the day due to caregiving responsibilities.

2.1.3. Importance of Gender-Disaggregated Data

- **Inclusive policies:** Helps to design policies that promote gender equality and eliminate specific barriers faced by women.
- **Improvement of Working Conditions:** Enables identification and addressing of wage and working condition inequalities.
- **Increased female participation:** Facilitates the creation of training and professional development programs that encourage the participation and advancement of women in the logistics sector.
- **Urban planning and mobility:** Contribute to designing infrastructure and transportation services that are more accessible and safer for all genders.

In summary, the collection and analysis of gender-disaggregated data are essential for advancing towards a more inclusive, equitable, and efficient logistics sector.

2.1.1. Gender perspective in KPIs

Within this sub section, the 41 KPIs already identified in WP2 and included in D2.3, are analyzed from a gender perspective.

KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)

- To promote equal opportunities for both men and women to access training and use sustainable vehicles. To ensure that policies for acquiring and using these vehicles consider the equitable participation of women in the workforce.

KPI_2: Fuel consumption

- To evaluate if there are gender differences in fuel consumption due to factors such as preferred routes, driving styles, or types of vehicles assigned. To implement training programs that include more women drivers.

KPI_3: GHG emissions

- To encourage sustainable practices involving all genders and to assess whether there are differences in emissions related to the participation of women and men in various logistics roles.

KPI_4: Particles (PM2.5 and/or PM10)

- To analyze how exposure to particles differently affects men and women, especially those involved in driving and logistics operations in urban areas.

KPI_5: Noise level

- To assess the impact of noise on logistics workers of different genders, considering that women may have greater safety concerns in noisy environments.

KPI_6: Gender/ethnicity of workers in freight-related industries & occupations

- To collect and analyze gender- and ethnicity-disaggregated data to identify and address disparities in representation and working conditions of workers.

KPI_7: Employment rate and annual average income for freight employees in the city

- To analyze wage and employment differences between men and women in logistics, to implement policies to reduce the wage gap, and to promote employment equity.

KPI_8: Carbon footprint of deliveries

- To ensure that strategies to reduce the carbon footprint include promoting gender diversity, to allow more women to participate in the implementation of sustainable practices.

KPI_9: Nitrogen Oxide (NO2)

- To evaluate whether there are gender differences in NO2 exposure among logistics workers, and to implement adequate protective measures for all.

KPI_10: Number of logistic centers, platforms, hubs, lockers

- To ensure that the location and design of logistic centers are safe and accessible for women, considering their specific needs and safety concerns.

KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics

- To ensure that loading and unloading areas are safe and accessible for all genders, with special considerations for safety and adequate lighting

KPI_12: Policy related

- To develop and review policies to ensure they promote gender equality and address the specific needs of women in logistics, such as implementing flexible schedules and safety measures.

KPI_13: Stakeholder engagement

- To encourage the equitable participation of men and women in decision-making and consultation processes related to urban logistics.

KPI_14: Energy use and infrastructure available at warehouses, microplatforms, etc.

- To evaluate whether there are gender differences in access to and use of energy infrastructure, and to promote equality in the availability and use of sustainable resources.

KPI_15: Time window in the city for urban logistics

- To analyze whether the time windows for urban logistics operations are convenient for women, especially those with caregiving responsibilities, and to adjust schedules to promote inclusivity.

KPI_16: Revenue from LEZ access fee (EUR)

- To ensure that fee policies are fair and equitable, considering the financial impact on small businesses and female-led logistics operators.

KPI_17: Number of commercial outlets having a cargo area within a 75 m radius

- To evaluate if the proximity of cargo areas affects men and women differently, and to ensure that the areas are safe and accessible for all.

KPI_18: Percentage of freight vehicles in total vehicular traffic

- To promote the equal representation of women as drivers of freight vehicles and ensure that traffic policies include considerations for safety and accessibility

KPI_19: Congestion

- To analyze how congestion impacts men and women differently, and to develop solutions that consider these differences, such as alternative routes and schedules.

KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc.)

- Evaluate whether there are gender differences in the incidence and consequences of freight-related accidents, implementing specific safety measures to reduce risks.

KPI_21: Severe violations (Speed violations, drivers testing positive for alcohol or drugs)

- Examine if there are gender differences in committing severe violations and address underlying causes, such as training and awareness.

KPI_22: Soft violations (unauthorized parking in loading zones, etc.)

- To evaluate whether there are gender differences in the incidence and consequences of freight-related accidents, and to implement specific safety measures to reduce risks

KPI_23: Customer satisfaction with the delivery

- To collect and analyze satisfaction data disaggregated by gender to understand differences in expectations and experiences of delivery services between men and women.

KPI_24: km traveled by commercial vehicles

- To analyze whether there are differences in distances traveled by vehicles driven by men and women, and to explore underlying causes such as route preferences and safety concerns

KPI_25: Loading/unloading time - time per delivery

- To evaluate whether there are gender differences in loading and unloading times, considering factors such as safety and efficiency in logistics operations (and develop policies that promote equity through flexible allowed times.)

KPI_26: Reliability of just-in-time freight deliveries

- To ensure that just-in-time delivery practices are equitable and non-discriminatory, promoting equal participation in all aspects of the supply chain.

KPI_27: Increased utilization of load capacity of vehicles

- To promote training and ensure equitable access to technologies and practices that enhance vehicle load capacity utilization, benefiting both men and women in logistics

KPI_28: Modal split

- To analyze modal split with a gender perspective to understand how different modes of transportation affect men and women and to develop policies that promote equity.

KPI_29: Freight logistic intensity // delivery productivity

- To ensure that productivity and efficiency metrics consider gender differences in work practices and worker responsibilities

KPI_30: Costs of the last mile per delivery/pick-up

- To evaluate whether there are gender differences in last-mile costs and to develop strategies to reduce costs and improve efficiency inclusively

KPI_31: Percentage of total vehicle-kilometers that run empty

- To promote practices that reduce empty vehicle-kilometers and ensure that these strategies are inclusive and benefit drivers of all genders.

KPI_32: Recipient awareness of sustainable delivery options (index) // Recipient willingness to pay for sustainable delivery (index)

- To analyze whether there are gender differences in awareness and willingness to pay for sustainable delivery options, and to develop awareness campaigns that address these differences.

KPI_33: Hours that vehicles are in service, e.g., deliveries, pick-ups, transporting, weighting, loading/unloading over 24 hours

- To evaluate whether there are gender differences in work patterns and service hours, to promote flexible schedules and equitable working conditions

KPI_34: Night deliveries

- To analyze women's participation in night deliveries and ensure that these operations are safe and accessible for all genders, with adequate safety measures.

KPI_35: Average age of freight vehicles

- To ensure that fleet renewal policies consider gender equity and promote equal access to newer and more efficient vehicles.

KPI_36: Average utilization of the warehouse or distribution centers

- To evaluate whether there are gender differences in the utilization of logistics facilities and to develop strategies to optimize the use of these spaces inclusively.

KPI_37: Occupancy of (un)loading/parking areas

- To analyze whether there are gender differences in the occupancy of loading and parking areas, ensuring these areas are safe and accessible for all.

KPI_38: Privacy

- To evaluate how privacy data is handled in logistics and to ensure policies protect the privacy of all workers and customers, regardless of gender.

KPI_39: Time spent to find parking/(un)loading area

- To analyze whether there are gender differences in the time required to find parking and loading areas, and to implement solutions to improve efficiency and accessibility for all.

KPI_40: Reservation of parking areas

- To ensure that parking area reservation systems are inclusive and accessible for all genders, promoting equity in urban logistics.

KPI_41: Constraints identified during the last mile stage

- To evaluate last-mile constraints from a gender perspective and to develop solutions that address the specific needs and concerns of men and women in logistics.

2.2. Ethics related issues

No people external to the UNCHAIN project consortium have participated in the activities reported in this document, so ethics related issues are not applicable.

2.3. Data related issues

Data included in this report have been provided by partners, coming from their own sources (service's technical requirements) or from public sources (datasets nomenclature and features and KPIs' calculation algorithms). These data have been managed by ETRA and IBV, by adhering to the GDPR requirements and the project's data management plan.

3. Framework

To design the data-sharing framework, we first conducted a review of existing frameworks at both European and global levels. This allowed us to identify the common and essential features needed to develop our platform within the scope of this project.

Subsequently, we selected the IDSA (International Data Spaces Association) framework as the appropriate model for data sharing.

3.1. Review of logistic data platforms

Next, we present the review of the main logistics platforms worldwide:

1. PrepDSpace4Mobility: European Mobility Data Space.
2. EuroStat
3. EUs Open Data Platform
4. Statista – Transportation and Logistics
5. Transport/Logistics and Container Tracking Datasets
6. Cargonaut
7. Telekom Data Intelligence Hub
8. Shippeo
9. FourKites
10. Intermodal Map
11. Movement by project44
12. International Service Reliability – ISR
13. Commercial Responsibility Database – COREDA
14. Open Railway Freight EDI User System – ORFEUS
15. Web Data Interface – WDI
16. Others:
 - TradeLens
 - CargoSmarT
 - GT Nexus (Infor Nexus)
 - Transporeon
 - Descartes Systems Group
 - Project44
 - FourKites
 - Samsara
 - Convey
 - IDSA

Table 1. Description of the logistics platform PrepDSpace4Mobility: European Mobility Data Space.

Name	3.1.1. PrepDSpace4Mobility: European Mobility Data Space
Owner	European Commission
Geographical scope	Europe
Content/Description	PrepDSpace4Mobility lays the foundation for a secured and controlled way of pooling and sharing mobility data across Europe.

	<p>The 12-month Coordination and Support Action (CSA) contributes to the development of the common European mobility data space by mapping existing data ecosystems, identifying gaps and overlaps within, and proposing common building blocks and governance frameworks found in existing data space architectures.</p> <p>The project has created a catalogue summarising all relevant data ecosystems including valuable information about the type and quality of data. The catalogue includes a total of 264 datasets, 14 of which are data ecosystems collecting data on freight and logistics transport.</p> <p>For each data ecosystem the following information is provided:</p> <ul style="list-style-type: none"> - Name of the platform/ecosystem - Operator - URL - Ownership of operator (public/private) - Country - Traffic mode (freight and logistics, multiple traffic modes, air transport, bike transport, inland water way transport, maritime transport, rail transport, road transport)
Data format	PDF (catalogue) and website (mapping)
Gaps	
URL	https://mobilitydataspace-csa.eu/inventory/

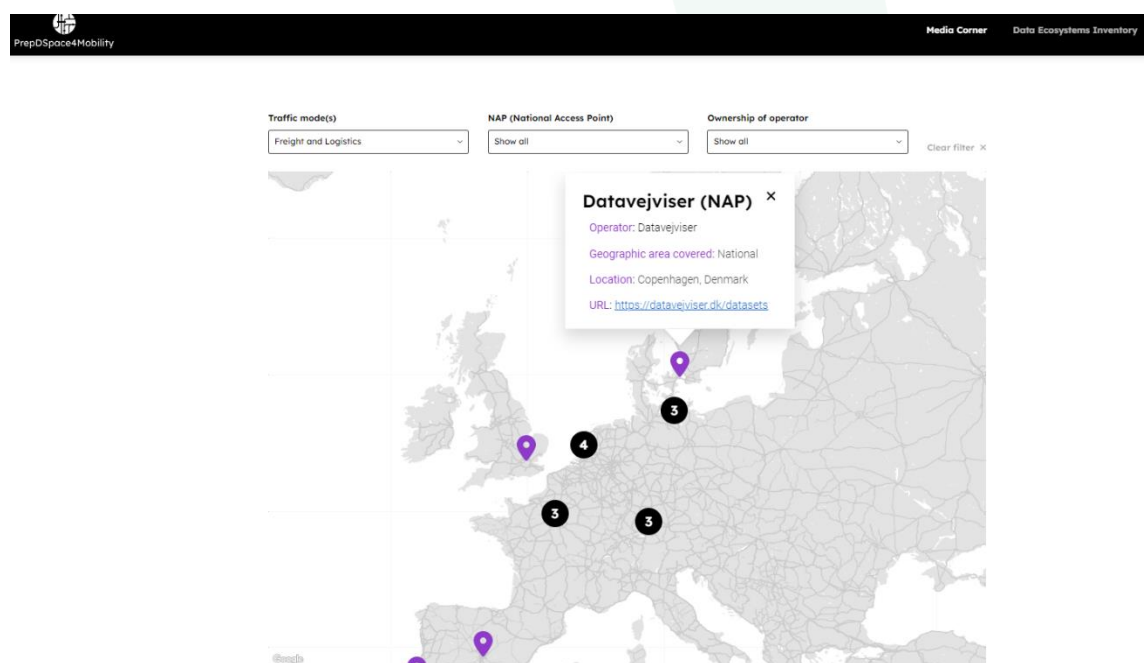


Table 2. Description of the logistics platform EuroStat

Name	3.1.2. EuroStat
Owner	European Commission
Geographical scope	Europe
Content/Description	<p>Different datasets containing freight information, based on the transport mode. There are 7 main categories, each one with different indicators.</p> <ul style="list-style-type: none"> • Multimodal data (tran) • Railway transport (rail) • Road transport (road) • Inland waterways transport (iww) • Oil pipeline transport (pipe) • Maritime transport (mar) • Air transport (avia)
Data format	.xlsx, .csv, .tsv, .xml, .json
Gaps	Data available at national level.
URL	https://ec.europa.eu/eurostat/web/transport/data/database

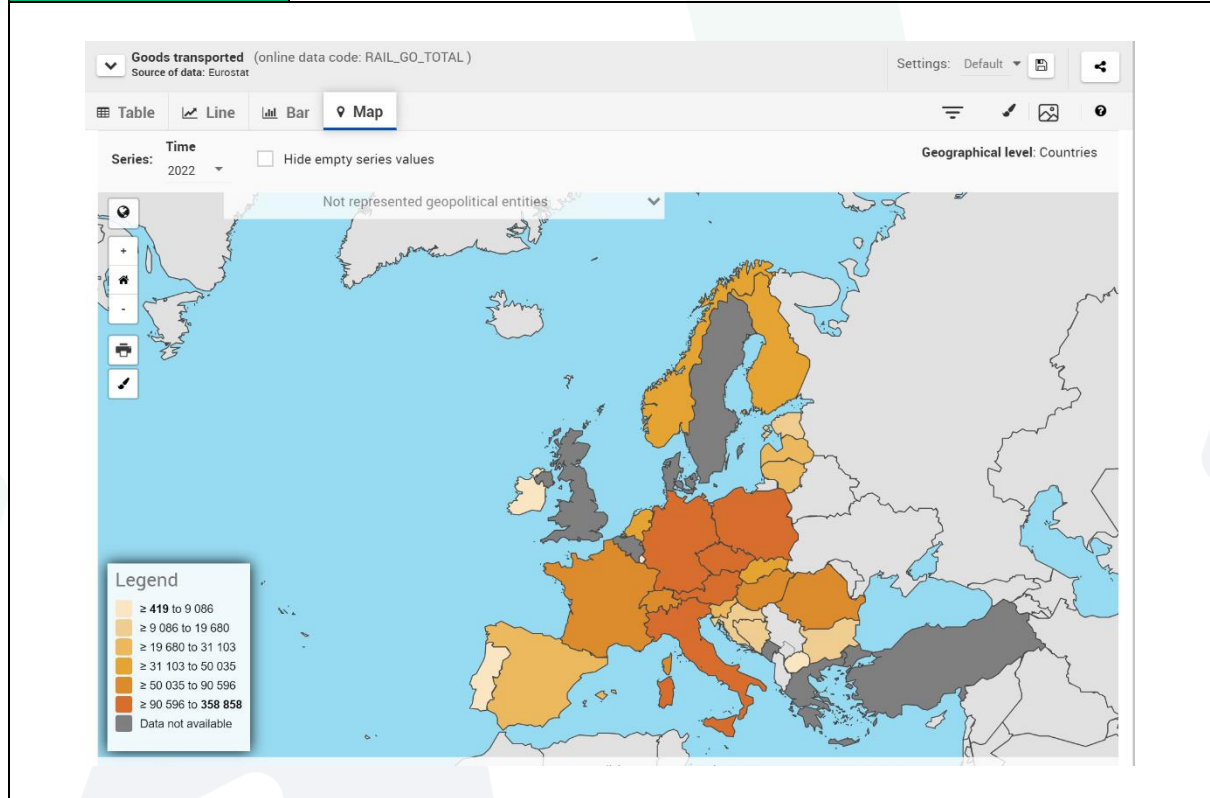
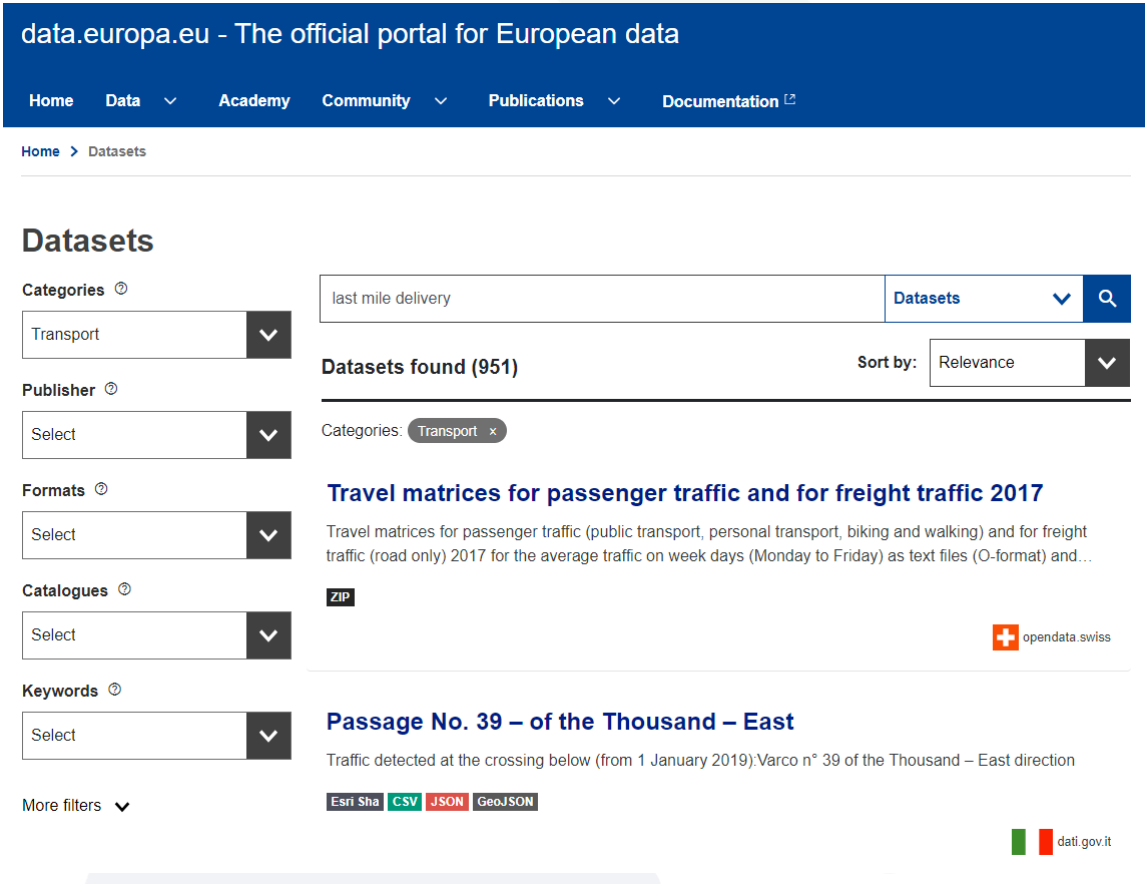


Table 3. Description of the logistics platform EUs Open Data Platform

Name	3.1.3. EUs Open Data Platform
Owner	European Commission
Geographical scope	Europe
Content/Description	The EU's open data portal already has almost 53,000 datasets in the transport category. Different datasets from different European countries can be easily accessible and in different formats.
Data format	.csv, .html, .wms, .json, .zip, .xlsx, .pdf, .shp, .xml, .geojson, .wfs, .xls, .kml, .tsv, .gml, .rdf, .json-stat, .px, .txt, .tiff, .json-ld, .ods, .dxf, .xsd, api, .wmts, .geoTIFF, .sql.
Gaps	Open data platform containing all type of data, not only logistic data.
URL	Open EU Datasets Official Portal for EU Data data.europa.eu



The screenshot shows the 'data.europa.eu' website interface. At the top, there is a navigation bar with links for Home, Data, Academy, Community, Publications, and Documentation. Below the navigation bar, the page title is 'data.europa.eu - The official portal for European data'. The main content area is titled 'Datasets' and features several search filters: Categories (Transport), Publisher (Select), Formats (Select), Catalogues (Select), and Keywords (Select). A search bar contains the text 'last mile delivery' and shows 'Datasets found (951)'. The results are sorted by 'Relevance'. Two dataset results are visible: 'Travel matrices for passenger traffic and for freight traffic 2017' (ZIP format, from opendata.swiss) and 'Passage No. 39 – of the Thousand – East' (Esri Shapefile, CSV, JSON, GeoJSON formats, from dati.gov.it).

Table 4. Description of the logistics platform Statista

Name	3.1.4. Statista – Transportation and Logistics
Owner	Statista
Geographical scope	World
Content/Description	<p>Statista provides a wide range of reports and data insights under the transportation and logistics umbrella. These are comprised of in-depth coverage of vehicles and road traffic, aviation, rail transport, water transport, logistics, as well as public transport and mobility services. Statista’s logistics coverage further provides historical data and recent developments in postal services, third-party logistics, as well as courier and express parcels.</p> <p>The main logistics datasets available are listed below:</p> <ul style="list-style-type: none"> • Postal services in Europe - statistics & facts. Overview: Postal industry revenue worldwide 2011-2020; European postal services revenue 2014-2020; Europe: number of postal offices and agencies 2004-2020; European enterprises providing postal services 2012-2020; Europe: number of letter boxes 2004-2020; EU28: postal services employment figures 2008-2019. Mail traffic: European letter mail services revenue 2014-2020; Domestic letter mail traffic in Europe 2012-2020; Domestic letter mail traffic in Europe by country 2020; European domestic letter delivered on time by country 2012-2020; European international standard letter delivery prices by country 2012-2020. Parcel delivery: Revenue of the parcel market in Europe 2015-2021; Total volume of parcels in Europe 2012-2020; Total international parcel services traffic in Europe 2013-2020; Domestic parcel traffic in Europe by selected country 2021; European domestic parcel delivery prices by country 2012-2020; International inbound parcel services traffic in Europe by country 2020; International outbound parcel services in Europe by country 2020. Companies: Deutsche Post DHL Group - annual revenue 2006-2021; Deutsche Post DHL Group - revenue from the letter sector 2005-2021; Annual revenue of the Royal Mail FY 2010-2022; Revenue distribution of the Royal Mail Group plc FY 2018-2022, by business segment; Royal Mail: volume of letters and parcels delivered in the UK FY 2017-2022; Revenue of PostNL 2014-2021; Operating of PostNL 2021, by business segment; Volume of mail and parcels of PostNL 2014-2021; Le Groupe La Poste's consolidated revenue 2018-2022; Revenue of An Post 2010-2021.

- European courier, express and parcels market - statistics & facts. **Overview:** Parcel shipping revenue worldwide 2017-2020; Revenue share of postal services worldwide by product 2007-2020; Parcel shipping volume worldwide by country 2020; Parcel shipping volume worldwide 2013-2027; Total international parcel services traffic in Europe 2013-2020; Express and small parcels market size in Europe 2012-2020; Growth rate of the express and small parcels market in Europe 2012-2020. **Segments:** Total volume of parcels in Europe 2012-2020; Domestic parcel traffic in Europe by selected country 2021; International inbound parcel services traffic in Europe 2012-2020; International inbound parcel services traffic in Europe by country 2020; International outbound parcel services traffic in Europe 2013-2020; International outbound parcel services in Europe by country 2020. **Companies:** Deutsche Post DHL Group - revenue by region 2021; Deutsche Post DHL Group - revenue from express post sector 2005-2021; Hermes Group's revenue in Europe 2015-2019; Hermes Group's worldwide parcel delivery 2015-2019; Revenue of DPD worldwide 2017-2021; Parcels delivered by DPD worldwide 2017-2021; DPD group's parcel delivery by type worldwide 2017-2020; Revenue distribution of the Royal Mail Group plc FY 2018-2022, by business segment.
- Rail freight industry in Europe - statistics & facts: Projected global rail freight market size 2020-2026; Rail freight traffic worldwide, by region 2019-2020; Rail freight demand in key markets 2019, European rail traffic in key countries 2019; Rail freight traffic in Europe 2012-2019; European rail freight load factor in key countries 2020; European rail traffic distribution in key countries 2020; Length of railway lines in use in Europe in 2020, by country.
- Reverse logistics - statistics & facts. **Overview:** Parcel shipping volume worldwide 2013-2027; Parcel shipping volume worldwide by country 2020; Global retail e-commerce sales 2014-2026; E-commerce as share of total retail sales worldwide 2015-2027; Global reverse logistics market size forecast 2022-2029; Return deliveries - costs by region 2015-2019. **Segments:** Reverse logistics market size in North America 2015-2019; Return deliveries - costs in U.S. 2017-2020; Cost of online retail returns in the U.S. 2019-2022; Cost of retail returns in the U.S. 2007-2022; Reverse logistics market size in South America 2015-2019; Reverse logistics market size in EMEA 2015-2019; Reverse logistics market size in Asia-Pacific 2015-2019. **Companies:**


	<p>E-commerce companies planning to offer free returns 2021; Global e-commerce market share of leading e-retailers 2021; Alibaba's annual e-commerce revenue FY 2013-FY 2023, by region; Rakuten Group's quarterly domestic e-commerce GMS 2014-2023; Annual net sales of Amazon 2004-2022; eBay: annual net revenue in the United States 2013-2022; Revenues of online retailer OTTO 2012-2022/23. Consumer behaviour: Leading incentives driving purchases among internet users shopping online 2020; Methods used by global consumers to return an online purchase 2019; Online shoppers' satisfaction with the returns process by country 2019; Average product return rates among digital shoppers in Europe 2021; Common reasons for returns in the world 2019; Preferred return methods for online shoppers in the U.S. 2022.</p>
Data format	.PNG, .PDF, .XLS.
Gaps	Statista Account needed for unlimited access
URL	Transportation & Logistics Statista
	

Table 5. Description of the logistics platform Transport/Logistics and Container Tracking Datasets.




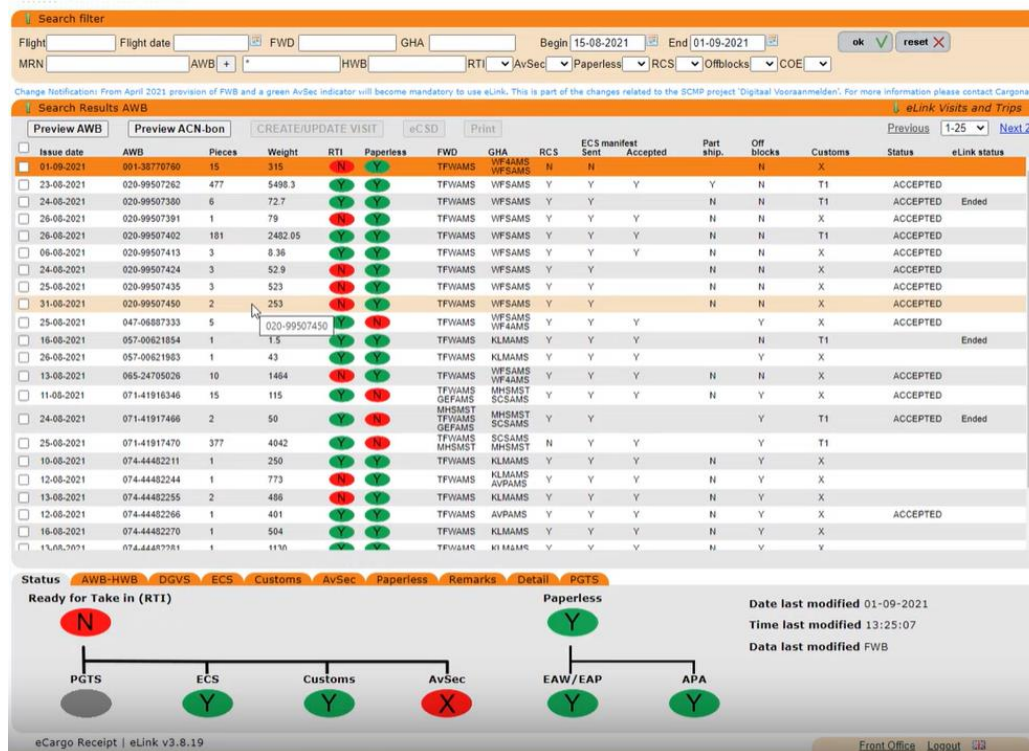
Name	3.1.5. Transport/Logistics and Container Tracking Datasets																																						
Owner	GREPSR																																						
Geographical scope	World																																						
Content/Description	<p>As retail increasingly moves online, the cost of last-mile delivery has skyrocketed. In order to remain profitable, businesses must optimize their logistics. These data are gathered through location data, such as current fleet coordinates and routes, map details, and road or route information.</p> <p>Logistics tracking includes the methods and systems used to track resources as they move and are stored. With logistics tracking data, it is possible to know where products, materials, or other resources are physically located and what's on the way.</p> <p>Free sample available.</p>																																						
Data format	.bin, .json, .xml, .csv, .xls, .sql, .txt																																						
Gaps	Private platform, data access is not free.																																						
URL	Transport/Logistics and Container Tracking Datasets Grepsr Datarade																																						
<p>▼ [Sample] Transport & Logistics Sample Datasets.csv</p> <table border="1"> <thead> <tr> <th>Attribute</th> <th>Type</th> <th>Example</th> <th>Mapping</th> </tr> </thead> <tbody> <tr> <td>Type</td> <td>String</td> <td>Kombi-terminal</td> <td></td> </tr> <tr> <td>Latitude</td> <td>Float</td> <td>49.23885</td> <td># Latitude</td> </tr> <tr> <td>Longitude</td> <td>Float</td> <td>8.37243</td> <td># Longitude</td> </tr> <tr> <td>ID</td> <td>Integer</td> <td>28421</td> <td></td> </tr> <tr> <td>Name</td> <td>String</td> <td>Terminal Germersheim</td> <td></td> </tr> <tr> <td>Address </td> <td>String</td> <td>XXXXXXXXXX XXXX</td> <td>T Address</td> </tr> <tr> <td>City</td> <td>String</td> <td>Germersheim</td> <td>T City Name</td> </tr> <tr> <td>Zip</td> <td>Integer</td> <td>76726</td> <td></td> </tr> </tbody> </table>				Attribute	Type	Example	Mapping	Type	String	Kombi-terminal		Latitude	Float	49.23885	# Latitude	Longitude	Float	8.37243	# Longitude	ID	Integer	28421		Name	String	Terminal Germersheim		Address 	String	XXXXXXXXXX XXXX	T Address	City	String	Germersheim	T City Name	Zip	Integer	76726	
Attribute	Type	Example	Mapping																																				
Type	String	Kombi-terminal																																					
Latitude	Float	49.23885	# Latitude																																				
Longitude	Float	8.37243	# Longitude																																				
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Address 	String	XXXXXXXXXX XXXX	T Address																																				
City	String	Germersheim	T City Name																																				
Zip	Integer	76726																																					

Table 6. Description of the logistics platform Cargonaut.

Name	3.1.6. Cargonaut
Owner	Cargonaut
Geographical scope	The Netherlands
Content/Description	Cargonaut provides information for the air freight hub and gives all market parties and the government the control necessary for fast and error-free handling. In this way, Cargonaut unburdens logistics chains that run through airports. How? By providing complete, reliable and relevant data at the right time via our Information Exchange. Cargonaut processes and combines this data for logistics chain parties at Schiphol and beyond.
Data format	-
Gaps	Air freight information, not containing information from other freight transport modes. Private platform, data access is not free
URL	Cargonaut.nl – Cargonaut



The screenshot displays the Cargonaut platform interface. At the top, there is a search filter with fields for Flight, Flight date, FWD, GHA, Begin (15-08-2021), and End (01-09-2021). Below the search filter is a table of search results for AWB (Air Waybill) numbers. The table columns include Issue date, AWB, Pieces, Weight, RTI, Paperless, FWD, GHA, RCS, ECS manifest Sent, Accepted, Part ship, Off blocks, Customs, Status, and eLink status. The table lists various flight records with their respective details and statuses.

Below the table, there is a status diagram showing the flow of information and actions. The diagram includes a central 'Ready for Take in (RTI)' status with a red 'N' icon. Below it, there are several status icons: PGTS (grey), ECS (green 'Y'), Customs (green 'Y'), AvSec (red 'X'), Paperless (green 'Y'), and EAW/EAP (green 'Y'). To the right, there are additional status icons: Paperless (green 'Y'), EAW/EAP (green 'Y'), and APA (green 'Y'). The diagram also shows the date last modified (01-09-2021) and the time last modified (13:25:07).

Table 7. Description of the logistics platform Telekom Data Intelligence Hub.

Name	3.1.7. Telekom Data Intelligence Hub
Owner	Deutsche Telekom
Geographical scope	-
Content/Description	<p>Telekom Data Intelligence Hub (DIH) is a pioneer in developing trustful and sovereign end-to-end data sharing services. It enables businesses to collaborate within standardized data-driven ecosystems to create value, become compliant to regulations and foster business innovation. Organisations can connect with others securely and trustfully to share, process, and analyse data on their terms with data sovereignty protection</p> <p>The Telekom Data Intelligence Hub has been a founding partner of Gaia-X, on the board of the IDSA, and shaping technology as well as business adoption as an active participant in the three leading dataspaces in automotive, Mobilithek/ Mobility Data Space, Gaia-X 4 Future Mobility, and Catena-X.</p>
Data format	-
Gaps	Private platform, data access is not free. The type of datasets included are not clearly identified on the website.
URL	Telekom Data Intelligence Hub

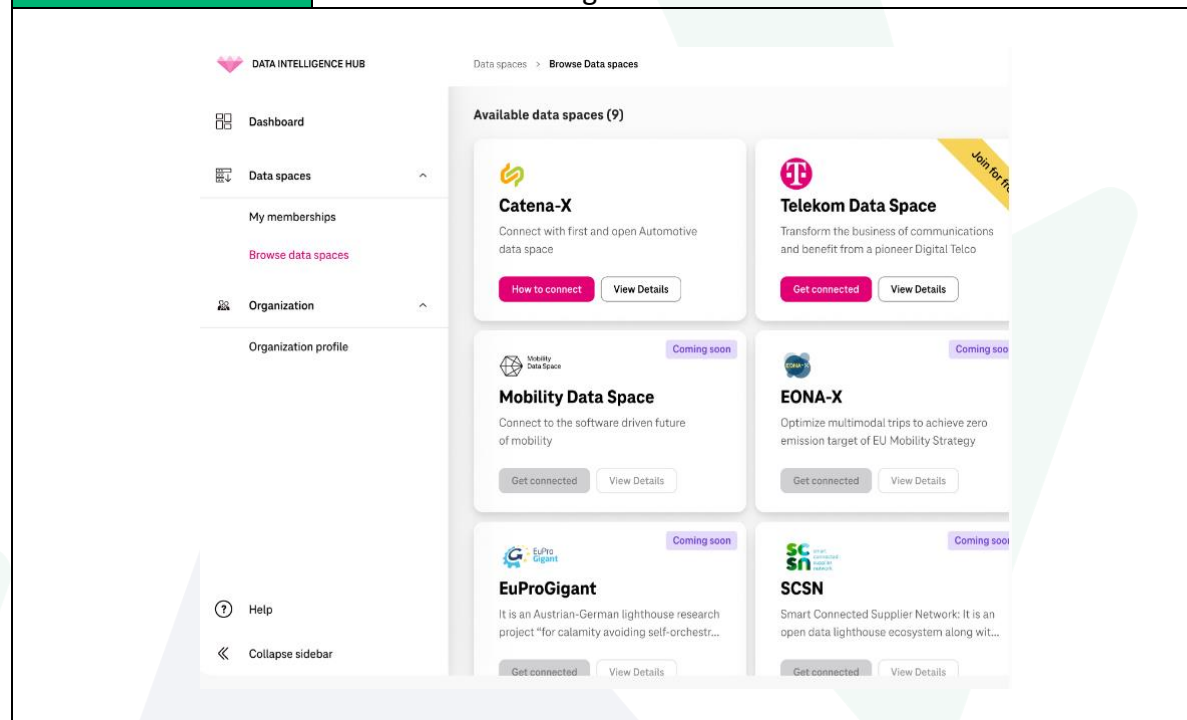


Table 8. Description of the logistics platform Shippeo.

Name	3.1.8. Shippeo
Owner	Shippeo
Geographical scope	Worldwide
Content/Description	Shippeo platform provides real-time visibility, insights and predictions for all transport modes to unlock greater value across supply chains. It tracks shipments (real-time status, location and predictive Estimated Time of Arrival (ETA)) across all modes of transport, and integrates with more than 875 Transport Management Systems (TMS), telematics and Electronic Logging Device (ELD) systems.
Data format	-
Gaps	Private platform, data access is not free.
URL	https://www.shippeo.com/

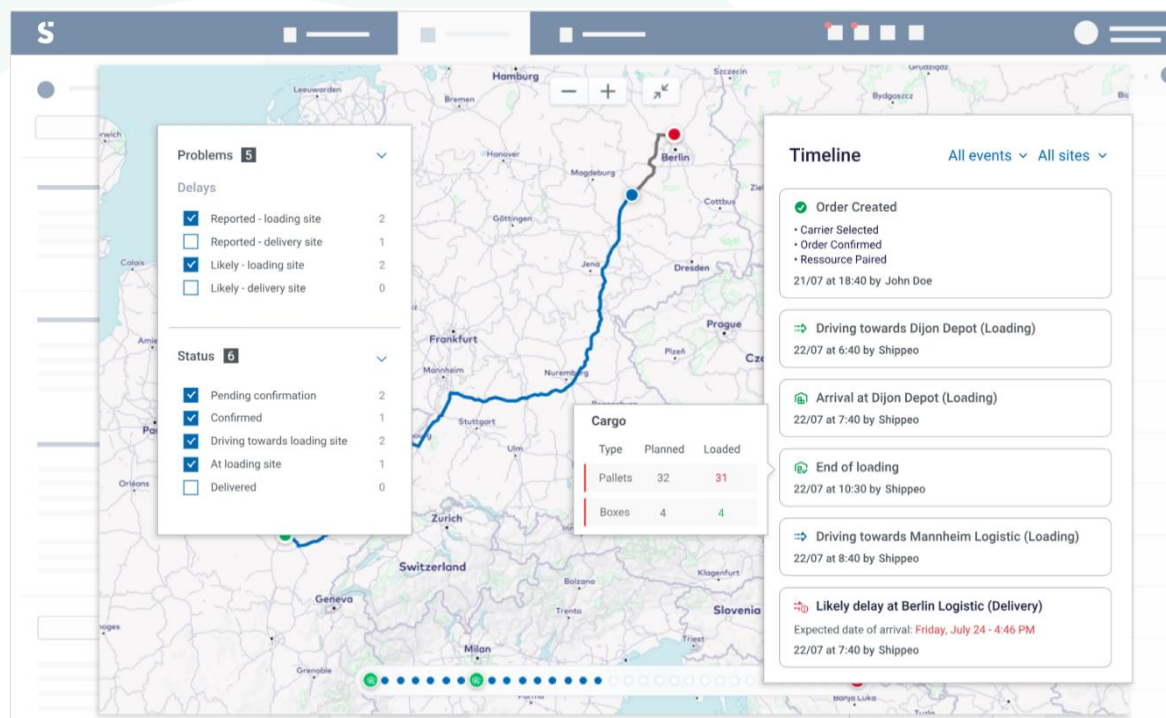
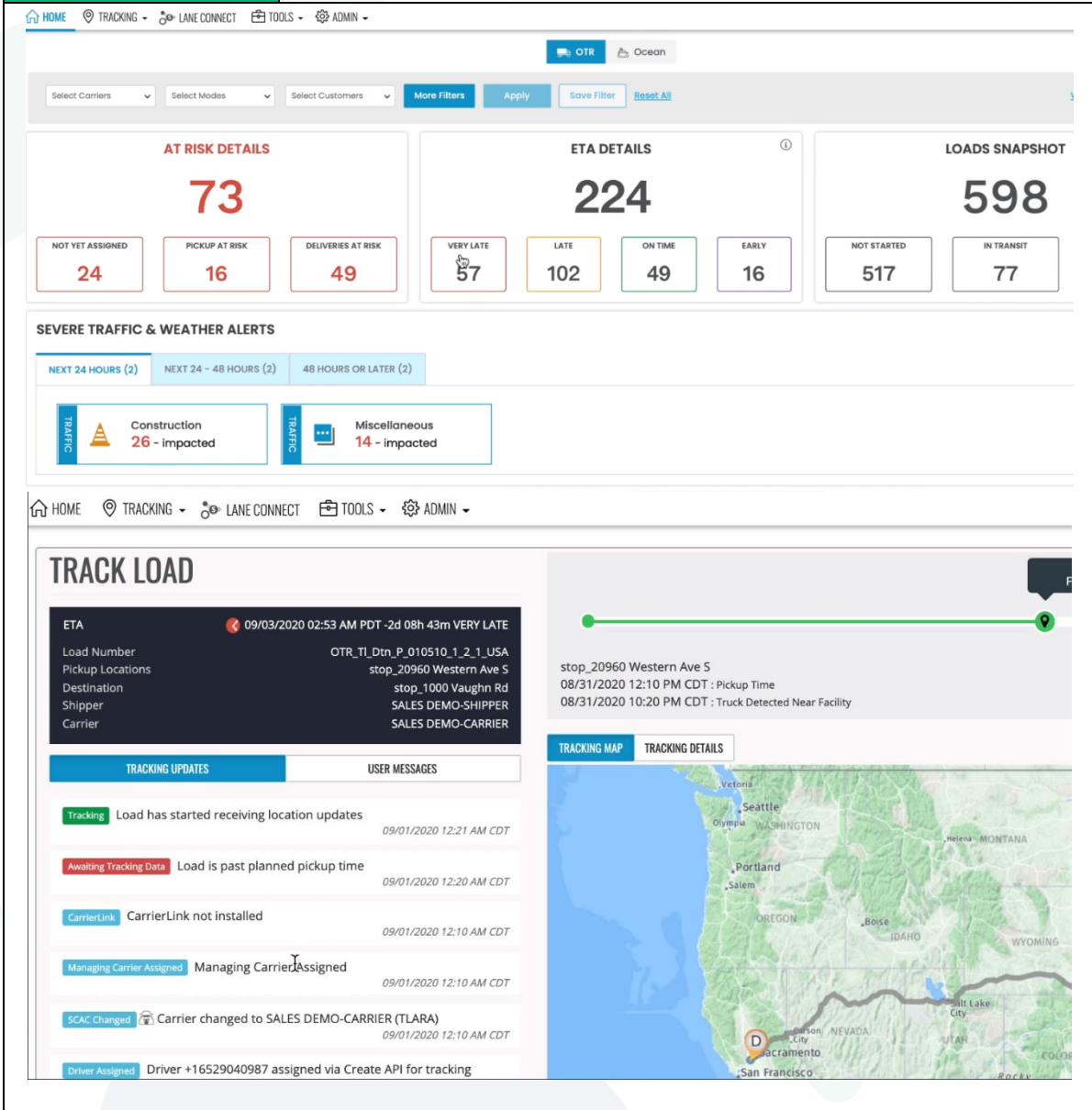


Table 9. Description of the logistics platform FourKites.

Name	3.1.9. FourKites
Owner	FourKites
Geographical scope	Worldwide (200+ countries)
Content/Description	Visibility platform tracking over 3 million Shipments daily for their global customer base. It offers real-time visibility with predictive ETAs and real-time status for shipments in transit and in the yard.
Data format	-
Gaps	Private platform, data access is not free.
URL	https://www.fourkites.com/



The screenshot displays the FourKites dashboard with the following sections:

- Navigation:** HOME, TRACKING, LANE CONNECT, TOOLS, ADMIN.
- Filters:** Select Carriers, Select Modes, Select Customers, More Filters, Apply, Save Filter, Reset All.
- AT RISK DETAILS:** 73 total. Sub-categories: NOT YET ASSIGNED (24), PICKUP AT RISK (16), DELIVERIES AT RISK (49).
- ETA DETAILS:** 224 total. Sub-categories: VERY LATE (57), LATE (102), ON TIME (49), EARLY (16).
- LOADS SNAPSHOT:** 598 total. Sub-categories: NOT STARTED (517), IN TRANSIT (77).
- SEVERE TRAFFIC & WEATHER ALERTS:**
 - Construction: 26 - impacted
 - Miscellaneous: 14 - impacted
- TRACK LOAD:**
 - ETA:** 09/03/2020 02:53 AM PDT -2d 08h 43m VERY LATE
 - Load Number:** OTR_TL_Dtn_P_010510_1_2_1_USA
 - Pickup Locations:** stop_20960 Western Ave S
 - Destination:** stop_1000 Vaughn Rd
 - Shipper:** SALES DEMO-SHIPPER
 - Carrier:** SALES DEMO-CARRIER
- TRACKING UPDATES:**
 - Tracking:** Load has started receiving location updates (09/01/2020 12:21 AM CDT)
 - Awaiting Tracking Data:** Load is past planned pickup time (09/01/2020 12:20 AM CDT)
 - CarrierLink:** CarrierLink not installed (09/01/2020 12:10 AM CDT)
 - Managing Carrier Assigned:** Managing Carrier Assigned (09/01/2020 12:10 AM CDT)
 - SCAC Changed:** Carrier changed to SALES DEMO-CARRIER (TLARA) (09/01/2020 12:10 AM CDT)
 - Driver Assigned:** Driver +16529040987 assigned via Create API for tracking
- TRACKING MAP:** Map showing the route from Sacramento, CA to San Francisco, CA.

Table 10. Description of the logistics platform Intermodal maps.

Name	3.1.10. Intermodal Map
Owner	SGKW
Geographical scope	Worldwide (mainly focused on Europe)
Content/Description	<p>Comprehensive representation of Combined Transport (CT) terminals in Europe and beyond. It contains a range of information such as the handling equipment, terminal services, contact details, CT connections, among other things and is also completely free of charge.</p> <p>Potential applications: Shippers who are interested in identifying alternative transport options; service providers, manufacturers of terminal equipment and public authorities, who are contemplating the plans for a new CT terminal. The Transport Planners can also quickly get information on transport infrastructure in starting and destination regions of new transports.</p> <p>Data included:</p> <ul style="list-style-type: none"> • Representation of all CT-Terminals in Europe and beyond • Information on the CT connections and the CT Truckers for the pre- and post-carriage • Inclusive of extensive information about transshipment facilities and relations • Filtering option according to specific transport modes and facility type • Completely free access to all users • Free of charge representation for all Terminals, Depots, Rail transport companies and CT Operators
Data format	-
Gaps	Data cannot be downloaded.
URL	https://www.intermodal-map.com/

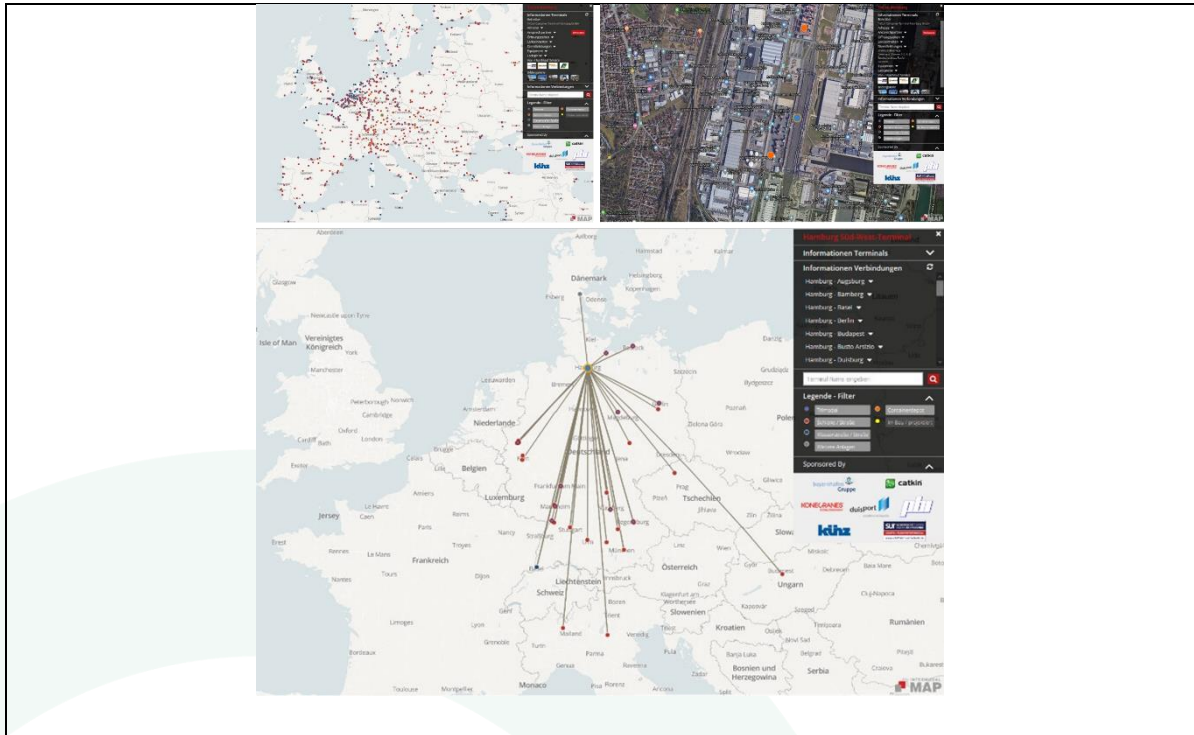


Table 11. Description of the logistics platform Movement by project44.

Name	3.1.11.Movement by project44
Owner	Project44
Geographical scope	Worldwide
Content/Description	Supply chain visibility platform delivering visibility, insights, and workflow tools — all seamlessly integrated with each shippers, carriers, and LSP systems.
Data format	-
Gaps	Private platform, data access is not free.
URL	https://www.project44.com/



Table 12. Description of the logistics platform International Service Reliability- ISR.

Name	3.1.12. International Service Reliability- ISR
Owner	RailData (International Union of Railways – UIC)
Geographical scope	Europe
Content/Description	<p>ITS is an information system developed and operated by RailData. It is a common tool of ISR railway undertakings for concentration and exchange information about movements of freight wagons in international traffic through a central platform. It makes possible to track both loaded and empty freight wagons and consignments across significant part of Europe.</p> <p>ISR offers the following data:</p> <ul style="list-style-type: none"> • Wagon Status: ISR registers position and status of freight wagons. Railway Undertakings (RUs) involved in transport of the wagon or responsible for the wagon can see or get information where the wagon is and what is happening with it. Information is available on ISR web centre or is automatically sent to ISR Users with means of messages. Event information is stored for two months. Many different wagon event types are followed. • Train running: information about movements of freight trains is stored in RTIS database (Running Train Information System). It is used mainly for advanced wagon tracking based on the real time position of trains while running. RTIS also makes train run information available to RUs through web interface and also means of data messages. • Wagon performance: ISR collects wagon performance data (km) from some RUs and estimates distance done by wagons on behalf of other RUs using own calculation engine. Performance data are sent to interested Users and to the wagon keepers through the RSRD2 database (will be switched to the GCU Broker). • Experienced plan: after a transport has finished, a part of the transport description as well as the first and last event is used to create an Experienced Transport Plan (ETP). For new transports running in the same relation and departing the same week day, ETPs can be used to estimate the arrival date & time (ETA). <p>In average there are about 780 000 events reported each day. ISR processes more than 280 million of wagon events yearly.</p>
Data format	-

Gaps	Data access is not free, and it is only available under some conditions (being an active freight Railway Undertaking, having a RICS code, paying the ISR annual fee, delivering data to ISR).
URL	https://www.raildata.coop/services/isr
	

Table 13. Description of the logistics platform Open Railway Freight EDI User System - ORFEUS.



Name	3.1.13. Open Railway Freight EDI User System- ORFEUS
Owner	RailData (International Union of Railways – UIC)
Geographical scope	Europe
Content/Description	<p>It is an information system developed and operated by RailData. It ensures the exchange of railway CIM consignment notes and CUV wagon notes data between the co-operating railway undertakings (RU) using a Central Data management System (CDS). Orfeus functions are listed below:</p> <ul style="list-style-type: none"> • CIM/CUV data: Railway Undertakings send data content of the consignment/wagon notes to ORFEUS, which distributes these data to other carriers involved in the transport. The CIM/CUV notes in paper form exist and accompany the wagons still. • Electronic Notes: Data Exchange is performed as above, but the data fulfil the role of the Electronic Consignment Note (ECN). There is no paper note issued nor transported anymore. <p>In average there are about 110 000 consignments reported via ORFEUS monthly. ORFEUS processes more than about 2,7 million messages yearly.</p>
Data format	Messages use modern XML syntax.
Gaps	Data access is not free, and it is only available under some conditions (being an active freight Railway Undertaking, having a RICS code, paying the ORFEUS annual fee, delivering data to ORFEUS).
URL	https://www.raildata.coop/services/orfeus
	

Table 14. Description of the logistics platform Commercial Responsibility Database- COREDA

Name	3.1.14. Commercial Responsibility Database- COREDA
Owner	RailData (International Union of Railways – UIC)
Geographical scope	Europe
Content/Description	<p>It is central database of freight wagons, where authorized companies can find who is wagon’s keeper and mainly which railway undertaking is currently commercially responsible for the wagon. This is needed because each keeper can delegate rights for use of the wagon to another party. This database was designed by RailData on request and functional order from the UIC Wagon users Study group. This tool provides an important IT support for the European freight railway undertakings. COREDA functions are listed below:</p> <ul style="list-style-type: none"> • Wagon Database: COREDA database includes list of wagon numbers with indications of its keeper (means of Vehicle Keeper Marking) and commercial/operational responsible RU. Because the situation of wagon changes in time, there is also interval of validity and last modification date. Records are kept online for two years and the offline history is stored for 10 years. There are also functions for conflict management, access rights steering and for billing for database usage. COREDA also maintains needed reference data for validity checks. • Communications: Users can upload their wagon changes (insert, update, delete) as data in form of csv of xml files over communication interface (web service or FTP/SFTP). Received data are validated and stored. In opposite direction, Users can get wagon data periodically or download on request when needed. Distribution options are specific for communication interface, and enable to get data for given wagons, changes from a date, daily changes up to general download. • Web Centre: Web application enables to authorised users to create, update or delete wagon records. Web also responds queries concerning current wagon situation or history of wagon keeper and commercial responsible. Users can alternatively upload files with wagon changes or request download data selected by various parameters. Of course user management and authentication is included too.
Data format	.CSV, .XML

Gaps	Data access is not free, and it is only available under some conditions (being an active freight Railway Undertaking, having a RICS code, paying the ORFEUS annual fee, delivering data to ORFEUS).
URL	https://www.raildata.coop/services/coreda
	

Table 15. Description of the logistics platform Web Data Interface -WDI.

Name	3.1.15. Web Data Interface- WDI
Owner	RailData (International Union of Railways – UIC)
Geographical scope	
Content/Description	<p>The aim of WDI (Web Data Interface) is to offer to RUs having low or small IT facilities a user-friendly web interface to operate electronic message exchange with RailData railway undertakings. WDI functions are listed below:</p> <ul style="list-style-type: none"> • Train Pre-Advice: WDI enables to capture data for the Train composition pre-advice message for the collaborating railway undertaking, which will take over the train. When completed, the tool sends out so called Hermes 30 message to the partner RU. In opposite direction, WDI can receive H30 messages from RU partners, who are going to hand over a train. It makes the data available for the WDI user. • Wagon Status: WDI also allows capture wagon status information (e.g. arrival, departure or delivered), which is then sent to the ISR application. This way, tracking of wagons is also possible at first/last mile operators.
Data format	WDI User can see the train data on the web, with option to print or download the data for internal use
Gaps	Data access is free of charge, but only Railway Undertaking willing to exchange data through WDI with another RailData ISR User can have access to it.
URL	https://www.raildata.coop/services/wdi
	

3.1.16. Other logistics platforms are:

1. **TradeLens:** Developed by IBM and Maersk, TradeLens is a blockchain-based platform connecting global supply chain participants.

Link: <https://www.tradelens.com/>

Features:

- Transparent and secure recording of supply chain events.
- Real-time collaboration among different parties.
- Enhanced visibility and efficiency in the supply chain.

2. **CargoSmart:** Offers digital solutions for supply chain management, including collaboration among different stakeholders.

Link: <https://www.cargosmart.com/>

Features:

- Real-time tracking of shipments.
- Collaboration and communication tools for business partners.
- Data analytics to improve operational efficiency.

3. **GT Nexus (Infor Nexus):** Provides a cloud-based platform for global supply chain management.

Link: <https://www.gtnexus.com/>

Features:

- End-to-end visibility of the supply chain.
- Collaboration among multiple business partners.
- Integrated order management and fulfillment.

4. **Transporeon:** Focuses on logistics process optimization and collaboration in the supply chain.

Link: <https://www.transporeon.com/es>

Features:

- Efficient carrier assignment and shipment tracking.
- Real-time information exchange between carriers and businesses.

5. **Descartes Systems Group:** Offers solutions for supply chain management, including collaboration and visibility.

Link: <https://www.descartes.com/home>

Features:

- Global network platform for collaboration among business partners.
 - Shipment tracking and event management.
6. **Project44** (<https://www.project44.com/>): Project44 is a logistics visibility platform that provides real-time visibility into global shipping processes. It connects shippers, carriers, and logistics service providers.
 7. **FourKites** (<https://www.fourkites.com/es/>): FourKites is a real-time supply chain visibility platform that helps organizations track and manage their shipments. It provides predictive analytics and collaborative tools.
 8. **Samsara** (<https://www.samsara.com/>): Samsara offers an integrated platform for fleet management, including real-time tracking, route optimization, and performance analytics. It is designed to improve efficiency in transportation and logistics.
 9. **Convey**: Convey provides a logistics management platform that focuses on enhancing the end-to-end visibility of shipments and improving customer experiences through predictive analytics.
 10. **IDSA (International Data Space Association)**: The International Data Spaces Association (IDSA) is a global initiative focused on creating a secure, standardized framework for data sharing across organizations and sectors. It aims to facilitate data sovereignty, allowing data owners to maintain control over their data and how it is used. The IDSA's framework supports interoperability and trust among participants, fostering innovation and collaboration in the digital economy. By setting guidelines and standards for data exchange, the IDSA seeks to enable the safe and efficient utilization of data in various industries.

3.2. Common features of logistic data platforms

Here are some common features of logistics data-sharing platforms:

1. **Real-time visibility**: Platforms offer real-time tracking and monitoring of shipments, providing stakeholders with immediate access to critical data.
2. **Collaboration tools**: Collaboration features facilitate communication and information exchange between different parties involved in the supply chain, fostering efficient coordination.
3. **End-to-End connectivity**: Platforms often provide end-to-end connectivity, linking various stakeholders such as shippers, carriers, suppliers, and distributors for seamless data sharing.
4. **Document management**: Document sharing capabilities allow for the secure and efficient exchange of important logistics documents, reducing paperwork and streamlining processes.

5. **Predictive analytics:** Some platforms incorporate predictive analytics to forecast potential disruptions, delays, or issues in the supply chain, enabling proactive decision-making.
6. **Security and Compliance:** Robust security measures ensure the confidentiality and integrity of shared data, and compliance features help adhere to industry regulations and standards.
7. **Data standardization:** Standardized data formats and protocols help ensure consistency in information exchange, promoting interoperability among different systems.
8. **Automation of processes:** Automation features help optimize logistics processes, reducing manual intervention and enhancing overall operational efficiency.
9. **Performance analytics:** Platforms often include analytics tools to assess the performance of logistics operations, enabling data-driven decision-making and continuous improvement.
10. **Multi-Modal integration:** Integration capabilities across various transportation modes (road, rail, sea, air) provide a comprehensive view of the entire supply chain, irrespective of the transportation method.
11. **Visibility into inventory:** Some platforms offer visibility into inventory levels, helping stakeholders monitor stock levels and anticipate potential shortages or surpluses.
12. **Scalability:** Scalability features allow the platform to adapt to the changing needs and growing scale of the logistics operations, accommodating increased data volumes and user numbers.
13. **Environmental impact tracking:** Certain platforms include features to track and analyze the environmental impact of logistics operations, supporting sustainability initiatives.
14. **Notification and alert systems:** Instant notification and alert systems inform stakeholders about critical events, disruptions, or changes in the supply chain, enabling timely response.
15. **User-Friendly interface:** Intuitive and user-friendly interfaces enhance the adoption of the platform across different stakeholders, promoting effective use of the shared data.

3.3. IDSA (Internacional Data Space Association)

Based on the review shown in the previous section and as explained and developed in deliverable 3.2, the platform chosen as the most suitable is the IDSA. Below, a brief introduction, basic features, main objectives, advantages, and structure are presented. Additionally, the advantages of IDSA as a platform for data sharing in urban logistics and delivery are discussed.

3.3.1. Introducción to IDSA

The International Data Spaces Association (IDSA) is a global initiative dedicated to creating a secure, standardized framework for data sharing across organizations and sectors. Established to foster trust and interoperability in the digital economy, the IDSA focuses on ensuring data sovereignty, allowing data owners to maintain control over their data and its usage. By setting guidelines and standards for data exchange, the IDSA aims to enable safe and efficient data utilization, driving innovation and collaboration across various industries. The association brings together a diverse group of stakeholders, including companies, research institutions, and public bodies, to collectively develop and implement solutions that support secure and fair data ecosystems.

3.3.2. Basic Characteristics

The basic characteristics of the International Data Spaces Association (IDSA) are:

1. **Data Sovereignty:** Ensures that data owners retain control over their data, including how it is used and shared.
2. **Standardization:** Develops and promotes standardized frameworks and protocols for secure data exchange across different organizations and sectors.
3. **Interoperability:** Facilitates seamless data sharing and integration between diverse systems and platforms.
4. **Security:** Emphasizes robust security measures to protect data from unauthorized access and breaches.
5. **Trust:** Builds trust among participants through transparent and auditable data usage policies and practices.
6. **Innovation:** Encourages innovation by enabling new business models and data-driven solutions.
7. **Collaboration:** Brings together a wide range of stakeholders, including companies, research institutions, and public bodies, to collaborate on developing and implementing data sharing solutions.
8. **Data Ecosystem:** Supports the creation of a fair and efficient data ecosystem that benefits all participants by enabling value creation from shared data.

3.3.3. Objectives

The main objectives of IDSA are:

- **Data Sovereignty:** Ensure data owners retain full control over their data, including access and usage rights.
- **Standardization:** Develop and promote standardized frameworks and protocols for secure and efficient data exchange.
- **Interoperability:** Enable seamless data integration and sharing across diverse systems and platforms.

- **Security:** Implement robust security measures to protect data from unauthorized access, breaches, and misuse.
- **Trust Building:** Foster trust among participants through transparent, auditable data usage policies and practices.
- **Innovation Facilitation:** Encourage the development of new business models and data-driven solutions.
- **Collaborative Ecosystem:** Promote collaboration among companies, research institutions, and public bodies to drive collective progress in data sharing technologies.
- **Fair Data Economy:** Support the creation of a fair and efficient data economy where all participants can benefit from shared data.

3.3.4. Advantages

The advantages are:

- **Enhanced Data Control:** Data owners have full control over their data, ensuring it is used according to their terms.
- **Improved Security:** Strong security protocols protect data from unauthorized access and breaches.
- **Increased Trust:** Transparent and auditable processes build trust among data-sharing participants.
- **Interoperability:** Standardized frameworks enable easy data exchange between different systems and platforms.
- **Innovation Opportunities:** Access to shared data fosters innovation and the creation of new data-driven business models.
- **Collaborative Growth:** The association promotes collaboration, leading to shared advancements and solutions in data technologies.
- **Efficiency:** Standardized data sharing processes streamline operations and reduce costs associated with data integration.
- **Market Competitiveness:** Organizations can gain competitive advantages through efficient data utilization and new service offerings.

3.3.5. IDSA framework structure

The IDSA framework is designed to facilitate secure, interoperable, and standardized data sharing across various organizations and sectors. Its structure includes several key components:

1. **Data Sovereignty Principles:**
 - Ensures data owners retain control over their data.
 - Defines clear policies for data access, usage, and sharing.
2. **Reference Architecture Model:**
 - Provides a comprehensive blueprint for implementing data spaces.
 - Consists of multiple layers including business, functional, and technical layers.

- Ensures alignment with industry standards and best practices.
- 3. Connector Framework:**
 - Defines standard interfaces and protocols for connecting different data systems.
 - Ensures interoperability between diverse IT systems and platforms.
 - Provides secure and trusted data exchange mechanisms.
- 4. Security and Trust Mechanisms:**
 - Implements robust security protocols to protect data integrity and confidentiality.
 - Includes authentication, authorization, and encryption techniques.
 - Utilizes trust certification processes to verify participant credentials.
- 5. Governance Framework:**
 - Establishes rules and guidelines for data space operation and management.
 - Defines roles and responsibilities of participants.
 - Ensures compliance with legal and regulatory requirements.
- 6. Data Usage Control:**
 - Enables fine-grained control over how data is accessed and used.
 - Implements policy enforcement points to manage data usage according to predefined rules.
- 7. Standardization and Interoperability Guidelines:**
 - Provides standardized data models and vocabularies.
 - Ensures data can be easily shared and understood across different systems.
- 8. Monitoring and Auditing Tools:**
 - Offers tools for monitoring data transactions and usage.
 - Provides auditing capabilities to ensure compliance and transparency.
- 9. Collaboration and Ecosystem Support:**
 - Promotes collaboration among stakeholders including businesses, research institutions, and public bodies.
 - Supports the development of a vibrant data ecosystem through community engagement and shared resources.
- 10. Innovation and Development:**
 - Encourages the creation of innovative data-driven solutions and business models.
 - Provides a sandbox environment for testing and developing new applications.

All the IDSA features described in this section match seamlessly to UNCHAIN project, which to achieve its main objectives requires data exchange. Indeed, on the one hand, datasets are required to calculate the KPIs measuring the impact of the project services in urban logistics at urban level. On the other hand, the project services tested in the project Living Labs and Follower cities need dynamic datasets to progress in efficiency and sustainability of logistics services.

4. KPIs and datasets.

In this section, we present the KPIs and associated Sub-indicators¹ related to the field of logistics, which we have grouped into four categories:

1. Environment and social impact
2. Urban Planning (land use, infrastructure, public participation)
3. Traffic management
4. Service Efficiency

First, the 41 KPIs (Section 4.1) are shown, followed by a detailed examination of the four categories and the definition of Sub-indicators for each KPI. Additionally, the necessary datasets (Section 4.2.1) for calculating Sub-indicators (and indirectly KPIs), the formulas to calculate them, and aspects such as who can access the information, level of aggregation, and anonymization, among others, are defined.

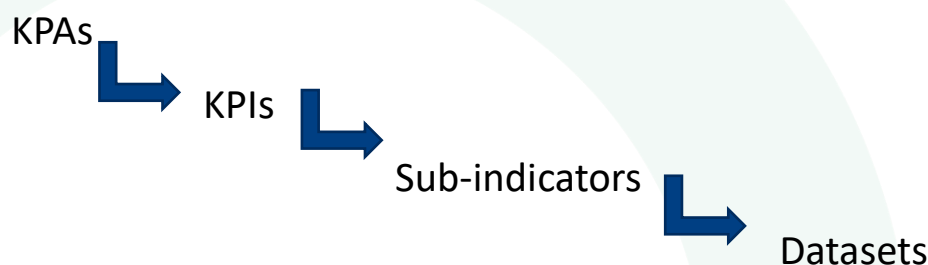


Figure 1. Relational data structure around logistics.

4.1.KPIs

Table 16 shows the list of KPIs identified throughout the project, which serves as a starting point for defining the possible datasets that make up the initial list. This list needs to be cross-referenced with the different profiles participating in data sharing: companies, cities, and database services.

Table 16. List of identified KPIs

Categories	KPI
Environmental and social impact	(1) Number of sustainable commercial or freight vehicles (LEV, ZEV)
	(2) Fuel consumption
	(3) GHG emissions
	(4) Particles (PM2.5 and/or PM10)
	(5) Noise level

¹ Deliverable D2.3. (https://unchainproject.eu/content/uploads/2024/06/20240430-IBV-UNCHAIN-D2.3_Technical-and-legal-requirements-KPIs-and-use-cases_vf-1.pdf)

	(6) Gender/ethnicity of workers in freight-related industries & occupations
	(7) Employment rate and annual average income for freight employees in city
	(8) Carbon footprint of deliveries
	(9) Nitrogen Oxide (NO ₂)
Urban Planning (land use, infrastructure, public participation)	(10) Number of logistic centres, platforms, hubs, lockers
	(11) Number of loading/unloading areas - public space dedicated to urban logistics
	(12) Policy related
	(13) Stakeholder engagement
	(14) Energy use and infrastructure available at warehouses, microplatforms, etc
	(15) Time window in city for urban logistics
	(16) Revenue from LEZ access fee (EUR)
	(17) N. of commercial outlets having a cargo area within a 75 m radius.
Traffic management	(18) Percentage of freight vehicles in total vehicular traffic
	(19) Congestion
	(20) Freight-related accidents (accidents, people injured, vehicles involved, etc)
	(21) Severe violations (Speed violation, drivers testing positive on alcohol or drugs)
	(22) Soft violations (unauthorized parking in loading zones // commercial vehicles with parking-related fines)
Service Efficiency	(23) Customer satisfaction with the delivery
	(24) Km traveled by commercial vehicles
	(25) Loading/unloading time - time per delivery
	(26) Reliability of just-in-time freight deliveries
	(27) Increased utilisation of load capacity of vehicles
	(28) Modal split
	(29) Freight logistic intensity // delivery productivity
	(30) Costs of the last mile per delivery/ pick up
	(31) Percentage of total vehicle-kilometers that run empty
	(32) Recipient awareness of sustainable delivery options (index) // Recipient willingness to pay for sustainable delivery (index)
	(33) Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours
	(34) Night deliveries
	(35) Average age of freight vehicles
	(36) Average utilization of the warehouse or distribution centers
	(37) Occupancy of (un)loading/parking areas
	(38) Privacy
	(39) Time spent to find parking/(un)loading area
(40) Reservation of parking areas	

(41) Constraints identified during the last mile stage
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4.2. Environment and social impact

The following sub section 4.2.1 presents the KPIs, Sub-indicators, and datasets associated with topic “Environment and Social Impact”. Additionally, it analyzes how they are calculated, the datasets most commonly used, and finally, aspects related to who can access the information, level of aggregation and anonymization, among others.

This KPA (category) consists of: 9 KPIs, 53 sub-indicators, and 133 datasets.

4.2.1. KPIs and Sub-indicators in Environment and social impact

In this section, we will define the datasets needed for each sub-indicator related to "Environmental and Social Impact." The Sub-indicators are:

Table 17. KPIs and Sub-indicators in Environment and social impact

KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)
1. Subsidized Clean Vehicles
2. Sustainable Commercial Vehicles in Restricted Traffic Areas
3. Emissivity Class of Vehicles
4. Electric Vehicles
5. Percentage of Alternative Fuel Vehicles
6. Share of LEVs and ZEVs in Urban Freight Vehicle Fleet
7. Renewable Fuel Sources for Low and Zero-Emission Vehicles
8. Type of Vehicle
9. Clean Delivery Vehicles
10. Total Number of Vehicles
11. Vehicles per Business
12. Fleet Composition
13. Micromobility Vehicles
14. Shared Vehicles
KPI_2: Fuel consumption
15. Annual Fuel Consumption per Capita
16. Average Fuel Consumption per 100 Vehicle-km
17. Fuel Consumption for In-Boundary Transportation per Fuel Type
18. Type of fuel
KPI_3: GHG emissions
19. Emissions from logistics buildings: Share of emissions from logistics buildings to total logistics operations (%)
20. GHG emissions from the freight sector (Road freight transport): Average GHG emitted from the freight sector annually within the city (ton CO ₂ e/year gCO ₂ /ton-km)

21. GHG emissions from the freight sector (Road freight transport): Percentage of emissions from freight amongst total transport-related GHG emissions (%)
22. GHG emissions according to the type of vehicle: Average GHG emissions from different types of vehicles per km (gCO2 emissions/km)
23. Exposure to vulnerable communities – air pollution: Percentage of transport-related pollutants (NOx, PM) emissions that are emitted by urban freight in transport-related emissions at neighborhoods with low-income population or vulnerable communities (%)
24. Greenhouse gas emissions (GHG): Well-to-wheels GHG emissions by all urban area passenger and freight transport modes (t CO2 equivalent)
25. GHG emission from transport: greenhouse gas emissions from the operations of vehicles (source: SUMI) (t CO2 equivalent)
KPI_4: Particles (PM2.5 and/or PM10)
26. Particles (PM10 and PM2.5) Measurements
27. Air Quality Index (AQI) - Particulate Matter (PM10 and PM2.5) Exposures
28. Air Pollutant Emissions from Passenger and Freight Transport
KPI_5: Noise level
29. Noise Level: Data collected through sensors and surveys geared at local traders
30. Day noise exposure: Percentage of inhabitants exposed to Lden noise levels higher than 55 dB (ISO 1996-1:2016)
31. Night noise exposure: Percentage of inhabitants exposed to Lnight noise levels higher than 50 dB (ISO 1996-1:2016)
32. Life years lost to noise
KPI_6: Gender/ethnicity of workers in freight-related industries & occupation
33. Gender Distribution in the Freight Industry
34. Gender Pay Gap in the Freight Industry
35. Ethnic Diversity in Managerial Positions in the Freight Industry
36. Income Disparities Among Different Ethnic Groups in the Freight Industry
KPI_7: Employment rate and annual average income for freight employees in city
37. Employment Rate
38. Annual Average Income
KPI_8: Carbon Footprint of Deliveries
39. Emission Data by Transportation Mode
40. Vehicle Efficiency and Fuel Type
41. Delivery Routes and Optimization
42. Package Size and Weight
43. Last-Mile Delivery Data
44. Alternative Transportation Adoption
45. Emission Factors by Region
46. Vehicle Maintenance and Upkeep
47. Green Delivery Initiatives
48. Delivery Company Carbon Policies
49. Consumer Behavior and Preferences
50. Carbon Offsetting Practices

51. Traffic Conditions and Congestion
52. Regulatory Compliance Data
KPI_9: Nitrogen Oxide (NO ₂)
53. Air Quality Dataset - Nitrogen Dioxide (NO ₂)

These two screenshots (**Error! Reference source not found.** and **Error! Reference source not found.**) show the generated matrix that relates KPIs and Sub-indicators with the datasets needed to understand and calculate them. In the future, these matrices can be employed to implement a data-sharing platform that guides users on the specific data needed to calculate the KPIs (which consist of sub-indicators). In the context of the UNCHAIN project, these matrices will serve as the reference for calculating KPIs related to the environmental and social impacts generated by the implementation of KERs during the project's pilot tests.

4.2.2. Datasets of Environment and social impact

From the initial list of datasets were defined/proposed by the service developers of the consortium and refined by all the partners, a list of necessary datasets has been compiled that would provide information on each KPA. The previous matrix indicates which datasets are required for each KPA. Below, Table 18, is the list of datasets with a unique numerical code. Annex (8.1) contains the description of what each dataset entails.

Table 18. Datasets in Environment and social impact

1	Vehicle Type
2	Number of Subsidized Vehicles
3	Number of Vehicles / Total Number of Cars
4	Restricted Traffic Area (ZTL) Extension (km²)
5	Emissivity Class
6	Total Registered Cars
7	Number of Electric Vehicles
8	(%) Alternative Fuel Vehicles / Percentage of LEVs and ZEVs
9	Renewable Energy Share
10	Business Name
11	Fleet Type
12	Number of Shared Vehicles
13	Date / Time / Temporal Data / Timestamp (Date and Time)
14	Year
15	Location (Neighborhood, City, Region, Country etc.)
16	Population
17	Total Fuel Consumption (in liters or another unit)
18	Fuel Consumption per Capita (calculated as Total Fuel Consumption / Population)
19	Total Vehicle-km Traveled
20	Average Fuel Consumption per 100 Vehicle-km (calculated as Total Fuel Consumption / Total Vehicle-km * 100)
21	Fuel Type
22	Emissions (in units specified by the GHG Protocol for cities)
23	Source (GHG Protocol for cities)
24	Total logistics operations emissions (ton CO₂e/year)
25	Emissions from logistics buildings (ton CO₂e/year)
26	Share of emissions from logistics buildings to total logistics operations (%)

- 27 Annual GHG emissions from road freight (ton CO₂e/year) / GHG emissions from road freight (ton CO₂e/year)
- 28 Average GHG emissions per ton-km (gCO₂/ton-km) / Average GHG emissions per km (gCO₂ emissions/km)
- 29 Total transport-related GHG emissions (ton CO₂e/year)
- 30 Percentage of emissions from freight amongst total transport-related GHG emissions (%)
- 31 Percentage of NO_x emissions from urban freight in vulnerable communities (%)
- 32 Percentage of PM emissions from urban freight in vulnerable communities (%)
- 33 Well-to-wheels GHG emissions from passenger transport (t CO₂ equivalent)
- 34 Well-to-wheels GHG emissions from freight transport (t CO₂ equivalent)
- 35 Source (SUMI or other)
- 36 GHG emissions from the operations of vehicles (t CO₂ equivalent)
- 37 PM₁₀ (µg/m³)
- 38 PM_{2.5} (µg/m³)
- 39 Percentage of Inhabitants Exposed to PM₁₀ Exceedances (%)
- 40 Percentage of Inhabitants Exposed to PM_{2.5} Exceedances (%)
- 41 Transport Mode (Passenger Car, truck, ...)
- 42 Exhaust Emissions (g/km)
- 43 Non-Exhaust Emissions for PM_{2.5} (g/km)
- 44 Location (Latitude and Longitude)
- 45 Noise Level (dB)
- 46 Data Source (Sensor or Survey)
- 47 Percentage of Inhabitants
- 48 Threshold (Day 55dB and Night 50 dB)
- 49 Life Years Lost
- 50 Occupation
- 51 Gender (Male/Female)
- 52 Percentage of Male Workers
- 53 Percentage of Female Workers
- 54 Average Income for Males
- 55 Average Income for Females
- 56 Pay Gap Percentage (Difference between male and female incomes)
- 57 Occupation Level (Managerial Positions)
- 58 Ethnicity/Race
- 59 Percentage Representation in Managerial Positions
- 60 Comparison with Overall Workforce Representation
- 61 Average Income for Each Ethnic Group
- 62 Comparative Analysis with Similar Sectors
- 63 Total Workforce (Total number of workers in the city)
- 64 Freight Employment (Number of workers employed in the freight sector)
- 65 Employment Rate (%) (Percentage of workers employed in the freight sector)
- 66 Market Sector (Retail, Express, Hotel, Construction, Waste)
- 67 Source (Source of the data)

68	Average Annual Income (Average annual income of workers in the specified market sector)
69	Comparable Role (Similar roles for income comparison)
70	Emission Type (CO2, Nox)
71	Emission Value
72	Vehicle ID
73	CO2 Emissions (g/km) / Carbon Emissions Data
74	Engine Size (liters)
75	Power Output (hp)
76	Acceleration (0-60 mph)
77	Efficiency Rating / fuel efficiency
78	Location ID
79	Location Name
80	Route ID
81	Origin Location
82	Destination Location
83	Distance (km)
84	Estimated Travel Time (hrs)
85	Traffic Restrictions
86	Traffic Condition
87	Package Dimensions
88	Package Weight
89	Delivery Records
90	Vehicle Tracking Data
91	Delivery Frequency Data
92	Vehicle Specifications (capacity, etc.)
93	Geospatial Data
94	Traffic and Road Conditions Data
95	Customer Data
96	Delivery Routes and Addresses
97	Delivery Time Logs
98	Weather Data
99	Customer/Consumer Preferences, Feedback and Satisfaction Surveys
100	Inventory and Order Data
101	Electric Bike Adoption Data
102	Drone Adoption Data
103	Innovative Transportation Solutions Data
104	Carbon Emission Reduction Data
105	Energy Mix Data
106	Environmental Conditions Data
107	Emission Factors Data
108	Delivery Location Data
109	Vehicle Maintenance Records
110	Vehicle Performance Metrics
111	Vehicle Age and Mileage
112	Maintenance Costs

113	Environmental Impact Data
114	Green Delivery Initiatives Data
115	Subsidies and Incentives Data
116	Fuel and Energy Consumption Data
117	Demographic Data
118	Delivery Company Operations Data
119	Environmental Policies and Practices Data
120	Regulatory Compliance Data / Local, National, or International Regulations
121	Performance Metrics Data
122	Third-Party Certifications and Reports
123	Historical Delivery Data
124	Delivery Company Initiatives Data
125	Tree Planting Data
126	Renewable Energy Investment Data
127	Carbon Offset Program Participation Data
128	Congestion levels
129	Delivery areas
130	Nitrogen Dioxide (NO₂) Levels (in µg/m³)
131	Air Quality Index (AQI)
132	Exceedance Status (Yes/No)
133	Percentage of Inhabitants Exposed:

4.2.3. Datasets most used to calculate KPIs / Sub-indicators in Environment and Social Impact

The characterization of the most used data depends on the type of monitoring and impact assessment decisions that one would like to make, e.g strategic, tactical, operational decisions, use data sets with different spatial, temporal granularity and at different level of aggregation. In this section we are providing a general characterization, which might be modified according to the intended purpose of the KPIs and sub-indicators that the data sets will estimate. This might imply that depending on the nature and the objectives of the different UNCHAIN KERs different types of data sets might be considered as the most used.

As seen in the previous section, there are many datasets needed to understand and calculate the Sub-indicators, specifically 133, but there are 13 that are most frequently repeated and therefore important to know, as shown in the following figure (Figure 4):

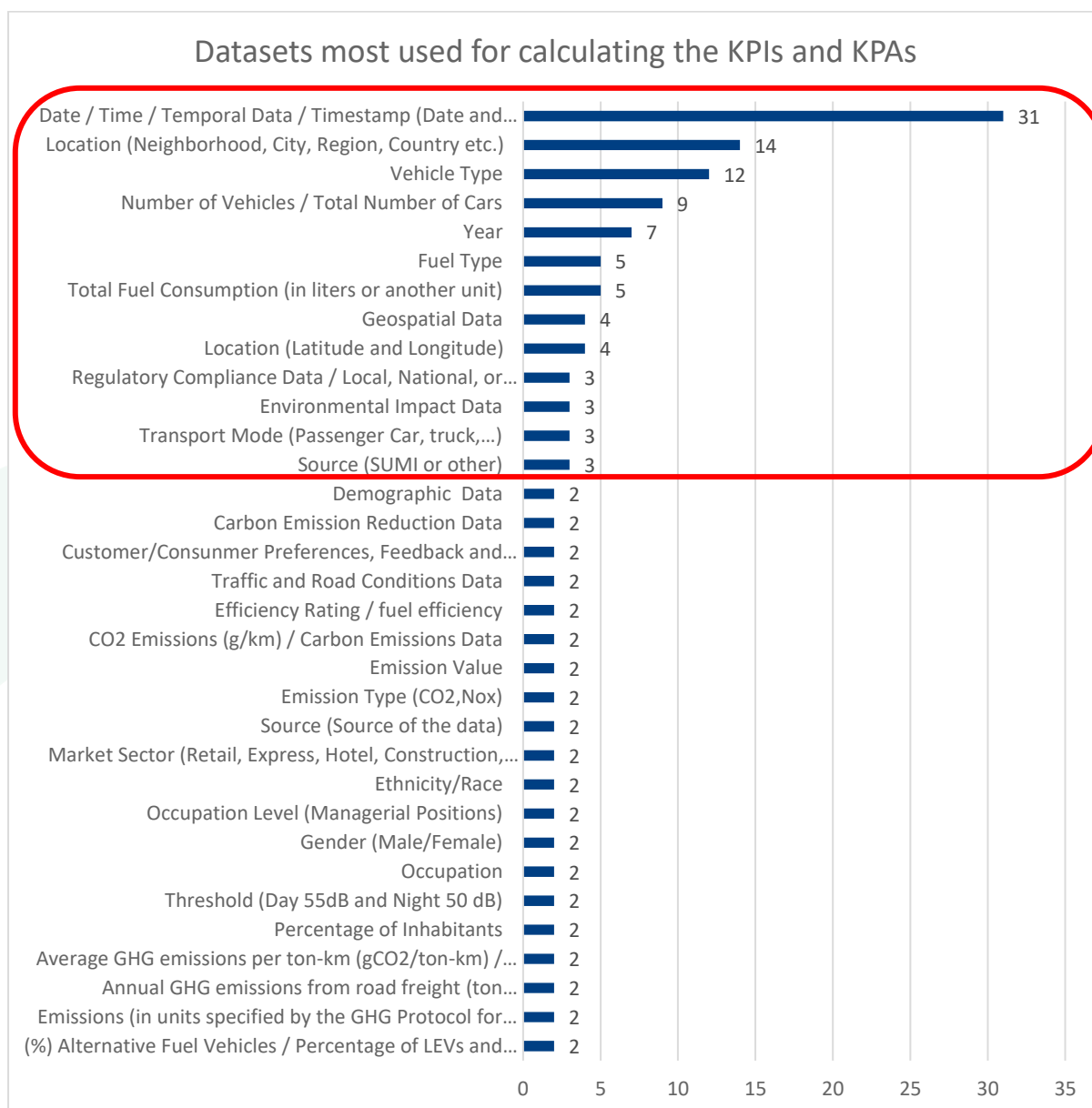


Figure 4. Datasets most used for calculated KPIs and Sub-indicators of Environment and Social Impact

The datasets most used are, in descending order of usage:

- Date / Time / Temporal Data / Timestamp (Date and Time)
- Location (Neighborhood, City, Region, Country etc.)
- Vehicle Type
- Number of Vehicles / Total Number of Cars
- Year
- Total Fuel Consumption (in liters or another unit)
- Fuel Type
- Location (Latitude and Longitude)
- Geospatial Data
- Transport Mode (Passenger Car, truck...)
- Environmental Impact Data

- Regulatory Compliance Data / Local, National, or International Regulations
- Source (SUMI or other)

4.2.1. Level of access, level of aggregation and anonymization and ownership of the datasets

Below, the access level, aggregation level, anonymization level, and data holders are shown. This information is derived from a review of the literature and workshops.

4.2.1.1. Level of access

In the following table, an example of classification of the access level of the most necessary data to calculate the KPIs and Sub-indicators for the category Environment and Social Impact is shown.

- **1 (Public):** Generally accessible to the public without restrictions.
- **2 (Varies):** Access level can vary; it might be public in some cases (with limitations) or restricted (requiring authorization or special conditions).

Table 19. Level of acces for each dataset (Enviroment and Social Impact).

Data Type	Access Level	Example Access
Date / Time / Temporal Data / Timestamp	1 (Public)	Publicly available
Location (Neighborhood, City, Region, Country etc.)	2 (Varies)	Public (general locations) / Restricted (specific addresses)
Vehicle Type	1 (Public)	Publicly available
Number of Vehicles / Total Number of Cars	2 (Varies)	Public (aggregate statistics) / Restricted (specific entity data)
Year	1 (Public)	Publicly available
Total Fuel Consumption (in liters or another unit)	2 (Varies)	Public (aggregate data) / Restricted (specific or detailed data)
Fuel Type	1 (Public)	Publicly available
Location (Latitude and Longitude)	2 (Varies)	Public (general coordinates) / Restricted (precise or sensitive locations)
Geospatial Data	2 (Varies)	Public (general maps) / Restricted (detailed or sensitive data)
Transport Mode (Passenger Car, truck, etc.)	1 (Public)	Publicly available
Environmental Impact Data	2 (Varies)	Public (general data) / Restricted (specific or sensitive data)

Regulatory Compliance Data / Local, National, or International Regulations	2 (Varies)	Public (general regulations) / Restricted (specific compliance details)
Source (SUMI or other)	2 (Varies)	Public (general sources) / Restricted (specific or proprietary sources)

This table provides a structured overview of access levels based on typical classifications for each type of dataset.

We can observe that 50% of the data would be public, and the other 50% could vary between public, with limitations, or restricted. There is no case of restricted data.

4.2.1.2. Level of aggregation

In the following table, the level of aggregation of the most necessary data to calculate the KPIs and Sub-indicators for the category Environment and Social Impact is shown:

Aggregation levels:

- **Detailed:** Data is aggregated at a fine granularity (e.g., by seconds, specific locations).
- **Generally Detailed:** Aggregation covers various levels of detail depending on context.
- **General:** Data is aggregated broadly without detailed breakdowns.
- **Aggregated:** Data is summarized into totals, averages, or similar metrics.
- **Discrete Temporal Unit:** Aggregated based on discrete time periods (e.g., years).
- **Varies:** Aggregation level can vary depending on specific data characteristics or needs.

Table 20. Level of aggregation for each dataset (Environment and Social Impact).

Data Type	Aggregation Level	Example Aggregation
Date / Time / Temporal Data / Timestamp	Detailed	Aggregated by seconds, minutes, hours, etc.
Location (Neighborhood, City, Region, Country etc.)	Generally Detailed	Aggregated by different levels of granularity
Vehicle Type	General	Aggregated by standard vehicle types (e.g., cars, trucks)
Number of Vehicles / Total Number of Cars	Aggregated	Totals or averages
Year	Discrete Temporal Unit	Aggregated by year
Total Fuel Consumption (in liters or another unit)	Aggregated	Totals or averages
Fuel Type	General	Aggregated by standard fuel types (e.g., gasoline, diesel)
Location (Latitude and Longitude)	Detailed	Aggregated by specific geographic coordinates

Geospatial Data	Varies	Aggregated based on geographic regions or specific points
Transport Mode (Passenger Car, truck, etc.)	General	Aggregated by common transport modes
Environmental Impact Data	Varies	Aggregated by measurement units or specific metrics
Regulatory Compliance Data / Local, National, or International Regulations	Varies	Aggregated by specific regulations or compliance requirements
Source (SUMI or other)	Varies	Aggregated from individual sources or multiple sources

This table provides a structured overview of aggregation levels for each dataset type, reflecting common practices and potential variations based on data specifics.

4.2.1.3. Anonymization level

In the following table, the level of anonymization of the data is shown; only in 2 out of 13 cases (15.4%) the level is high.

Anonymization levels:

- **1 (Low)**: Little to no anonymization needed; data is generally non-sensitive.
- **2 (Moderate)**: Some anonymization required to protect privacy or sensitive details.
- **3 (High)**: Significant anonymization needed due to high sensitivity or potential for identification.

Table 21. Anonymization level for each dataset (Environment and Social Impact).

Data Type	Anonymization Level	Notes
Date / Time / Temporal Data / Timestamp (Date and Time)	3 (High)	Specific timestamps can identify individual events
Location (Neighborhood, City, Region, Country etc.)	2 (Moderate)	General locations less sensitive, but specific addresses need more anonymity
Vehicle Type	1 (Low)	Basic vehicle types usually non-sensitive
Number of Vehicles / Total Number of Cars	2 (Moderate)	Aggregated data is less sensitive
Year	1 (Low)	Year alone is generally non-sensitive
Total Fuel Consumption (in liters or another unit)	2 (Moderate)	Can be sensitive if linked to specific entities
Fuel Type	1 (Low)	General information usually non-sensitive

Location (Latitude and Longitude)	3 (High)	Precise coordinates can identify specific locations
Geospatial Data	2 (Moderate)	General maps are less sensitive, detailed data needs more anonymity
Transport Mode (Passenger Car, truck, etc.)	1 (Low)	General transport mode information usually non-sensitive
Environmental Impact Data	2 (Moderate)	Can be sensitive depending on the level of detail
Regulatory Compliance Data / Local, National, or International Regulations	2 (Moderate)	General regulations are less sensitive, specific compliance data needs more anonymity
Source (SUMI or other)	2 (Moderate)	General source information less sensitive, specific sources might need anonymity

4.2.1.4. Who has access

Table 22. Entities that have access to the data (Environment and Social Impact).

Data Type	Who Has Access
Date / Time / Temporal Data / Timestamp (Date and Time)	Public entities, transport agencies, researchers
Location (Neighborhood, City, Region, Country etc.)	Public entities, government agencies, mapping services
Vehicle Type	Vehicle manufacturers, transport agencies, researchers
Number of Vehicles / Total Number of Cars	Government agencies, transport authorities, researchers
Year	Public entities, transport agencies, researchers
Total Fuel Consumption (in liters or another unit)	Fuel companies, transport agencies, government agencies
Fuel Type	Fuel companies, transport agencies, vehicle manufacturers
Location (Latitude and Longitude)	Public entities, mapping services, transport agencies
Geospatial Data	Public entities, government agencies, mapping services
Transport Mode (Passenger Car, truck, etc.)	Transport agencies, researchers, vehicle manufacturers
Environmental Impact Data	Environmental agencies, researchers, government agencies
Regulatory Compliance Data / Local, National, or International Regulations	Government agencies, regulatory bodies, researchers

Source (SUMI or other)	Data providers (e.g., SUMI), researchers, transport agencies
------------------------	--

Description of Entities:

- **Public entities:** Organizations or institutions that provide services to the public and hold open data, such as city councils or public transportation systems.
- **Government agencies:** National, regional, or local government bodies responsible for various sectors, including transportation, environment, and regulatory compliance.
- **Transport agencies:** Organizations that manage and operate transportation systems, including public transport and infrastructure planning. Also includes the ULOs.
- **Researchers:** Academic or private sector researchers who analyze data for studies or innovation.
- **Vehicle manufacturers:** Companies that produce vehicles and often collect data on vehicle types, fuel consumption, and compliance.
- **Fuel companies:** Companies involved in the production, distribution, and sale of fuel.
- **Mapping services:** Companies and organizations that create and manage geospatial data and mapping services (e.g., Google Maps, national mapping agencies).
- **Environmental agencies:** Organizations dedicated to monitoring and protecting the environment, often holding data on environmental impacts and regulations.
- **Regulatory bodies:** Organizations responsible for ensuring compliance with local, national, or international regulations in various sectors.
- **Data providers (e.g., SUMI):** Organizations that collect, process, and distribute data, which might be specific to transportation or environmental metrics.

The profiles most likely to have the most needed data are:

- **Transport agencies and researchers (61.5%)**
- **Government agencies (46.1%)**
- **Public entities (38.46%)**

4.2.2. How Sub-indicators are calculated- Environmental and social impact

In the following table, a preliminary approach is shown on how Sub-indicators related to the category Environment and Social Impact can be calculated:

Table 23. Sub-indicators and formulas

Sub-indicators	Formula
1. Subsidized Clean Vehicles	Number of subsidized clean vehicles / Total vehicles x 100
2. Sustainable Commercial Vehicles in Restricted Traffic Areas	Number of sustainable commercial vehicles in restricted traffic areas / Total commercial vehicles x 100

3. Emissivity Class of Vehicles	Classification of vehicles according to their emission levels (e.g., Euro 1-6)
4. Electric Vehicles	Number of electric vehicles / Total vehicles x 100
5. Percentage of Alternative Fuel Vehicles	Number of vehicles using alternative fuels / Total vehicles x 100
6. Share of LEVs and ZEVs in Urban Freight Vehicle Fleet	Number of LEVs and ZEVs / Total urban freight vehicles x 100
7. Renewable Fuel Sources for Low and Zero-Emission Vehicles	Number of vehicles using renewable fuel sources / Total low and zero-emission vehicles x 100
8. Type of Vehicle	Classification of vehicles by type (e.g., trucks, vans, bicycles)
9. Clean Delivery Vehicles	Number of clean delivery vehicles / Total delivery vehicles x 100
10. Total Number of Vehicles	Total count of registered vehicles
11. Vehicles per Business	Number of vehicles operated per business / Total businesses
12. Fleet Composition	Distribution of fleet by vehicle type, size, and capacity
13. Micromobility Vehicles	Number of micromobility vehicles (e.g., bicycles, scooters) / Total vehicles x 100
14. Shared Vehicles	Number of shared vehicles / Total vehicles x 100
15. Annual Fuel Consumption per Capita	Total annual fuel consumption / Total population
16. Average Fuel Consumption per 100 Vehicle-km	Total fuel consumption / (Total kilometers traveled / 100)
17. Fuel Consumption for In-Boundary Transportation per Fuel Type	Fuel consumption by fuel type within city limits
18. Type of Fuel	Classification of fuels used (e.g., gasoline, diesel, electric)
19. Emissions from logistics buildings	(Emissions from logistics buildings / Total logistics operations emissions) x 100
20. GHG emissions from the freight sector	Annual GHG emissions from freight transport sector (ton CO ₂ e/year)
21. GHG emissions from the freight sector	(Freight transport emissions / Total transport-related emissions) x 100
22. GHG emissions according to the type of vehicle	Average GHG emissions per vehicle type per km (gCO ₂ /km)
23. Exposure to vulnerable communities – air pollution	(Pollutant emissions from transport in vulnerable communities / Total transport-related emissions) x 100
24. Greenhouse gas emissions (GHG)	Well-to-wheels GHG emissions for all urban passenger and freight transport modes (t CO ₂ equivalent)
25. GHG emission from transport	GHG emissions from vehicle operations (t CO ₂ equivalent)

26. Particles (PM10 and PM2.5) Measurements	Measurement of PM10 and PM2.5 particle concentrations ($\mu\text{g}/\text{m}^3$)
27. Air Quality Index (AQI) - Particulate Matter (PM10 and PM2.5) Exposures	Calculation of AQI based on PM10 and PM2.5 exposures
28. Air Pollutant Emissions from Passenger and Freight Transport	Air pollutant emissions from passenger and freight transport (NO _x , PM)
29. Noise Level	Noise level data collected by sensors and surveys of local merchants
30. Day noise exposure	Percentage of population exposed to daytime noise levels >55 dB (ISO 1996-1:2016)
31. Night noise exposure	Percentage of population exposed to nighttime noise levels >50 dB (ISO 1996-1:2016)
32. Life years lost to noise	Years of life lost due to noise exposure
33. Gender Distribution in the Freight Industry	Gender distribution in the freight industry (percentage of men and women)
34. Gender Pay Gap in the Freight Industry	Income difference between men and women in the freight industry
35. Ethnic Diversity in Managerial Positions in the Freight Industry	Ethnic diversity in managerial positions in the freight industry
36. Income Disparities Among Different Ethnic Groups in the Freight Industry	Income disparities among different ethnic groups in the freight industry
37. Employment Rate	Employment rate in the freight industry
38. Annual Average Income	Annual average income of workers in the freight industry
39. Emission Data by Transportation Mode	Emission data by transportation mode
40. Vehicle Efficiency and Fuel Type	Vehicle efficiency and fuel type used
41. Delivery Routes and Optimization	Data on delivery routes and optimization
42. Package Size and Weight	Size and weight of packages
43. Last-Mile Delivery Data	Data on last-mile deliveries
44. Alternative Transportation Adoption	Adoption of alternative transportation means
45. Emission Factors by Region	Emission factors by region
46. Vehicle Maintenance and Upkeep	Data on vehicle maintenance and upkeep
47. Green Delivery Initiatives	Green delivery initiatives
48. Delivery Company Carbon Policies	Carbon policies of delivery companies

49. Consumer Behavior and Preferences	Consumer behavior and preferences
50. Carbon Offsetting Practices	Carbon offsetting practices
51. Traffic Conditions and Congestion	Traffic conditions and congestion
52. Regulatory Compliance Data	Regulatory compliance data
53. Air Quality Dataset - Nitrogen Dioxide (NO2)	Air quality dataset - Nitrogen Dioxide (NO2)

In Annex (8.8), the origin of the formulas and the list of bibliographic references are described.

4.3. Urban Planning (land use, infrastructure, public transport)

The following presents the KPIs, Sub-indicators, and datasets associated with topic “Urban planning”. Additionally, it analyzes how they are calculated, the datasets most commonly used, and finally, aspects related to who can access the information, level of aggregation, anonymization, etc.

This KPA (category) consists of: 8 KPIs, 44 sub-indicators, and 170 datasets.

4.3.1. KPIs and Sub-indicators in Urban Planning

In this section, we will define the datasets needed for each sub-indicator related to "Urban planning" The Sub-indicators are:

Table 24. KPIs and Sub-indicators in Urban Planning

KPI_10: Number of logistic centres, platforms, hubs, lockers
54. Types and characteristics of logistics centers
55. Number of logistic centres
56. Number of microplatforms
57. Number of lockers
58. Sustainability of the urban distribution of goods (last mile): Number of centers in the city / Urban area (km2)) x 100
59. Multi modal hubs
60. Number of pickup micro hubs
61. Interoperability
KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics
62. Number of monitored loading & unloading areas
63. Number of loading & unloading areas
64. Number of public parking places for freight vehicles
65. More efficient use of existing public space: Public space used for UFT activities (hrs per m2)

66. Density of loading zones
67. Charging points freight
68. Count of delivery spaces
69. Zoning data
70. Availability
71. Availability of parking spaces on streets
72. Available municipal space
73. Delivery parking places
74. Parking data and information
75. Land authorization for use
76. Areas designated as Urban Logistics (UL) areas
KPI_12: Policy related
77. Overall and integrated regulatory system (goods and passengers) to be implemented through tariff policies for vehicle access (ZTL paid access) rewarding an eco-sustainable last mile
78. Policy existence: The level of political and managerial vision and support for public participation related to Sustainable Urban Freight/ EcoLogistics strategy and how far the senior staff and politicians lead the policy both strategically and at an implementation level.
79. Existence of a politically endorsed policy on safety: Addresses road safety at the Sustainable Urban Mobility Plan/EcoLogistics strategy that is politically endorsed and implemented
80. Speed regime
KPI_13: Stakeholder engagement
81. Set up of a permanent FQP (stakeholder collaboration)
82. Contact persons for each municipality adhering to the permanent FQP, or annual meetings with the FQP
83. Participation rate of freight agents in discussion forum for freight logistics: Number of registrations
84. Existence of Stakeholder working group and extent of participation: Percentage of actual participants in ecologistics-related stakeholder meetings and working groups.
85. Existence of Stakeholder working group and extent of participation: Percentage of participation representing marginal or underrepresented community groups, e.g., people of color, poor income group, impacted communities
86. Existence of Stakeholder working group and extent of participation: The degree to which the city investigates the current and future needs of all supply chain users and collects relevant baseline data on the ecologistics status (freight- related data, livability, safety) of the city and the public participation process to understand their views.
87. Trust
88. Involvement degree
89. Level of duty
KPI_14: Energy use and infrastructure available at warehouses, microplatforms, etc
90. Number of EV charging points in microplatforms
91. Energy consumption at warehouses: Energy use for each floor space (m2)
92. Energy consumption at warehouses: Energy use for a cubic capacity of shelf space (m3)
93. Electricity consumption

KPI_15: Time window in city for urban logistics

94. Delivery hours

95. Time city authorisation

KPI_16: Revenue from LEZ access fee (EUR)

96. Revenue from LEZ access fee (EUR)

KPI_17: N. of commercial outlets having a cargo area within a 75 m radius.

97. N. of commercial outlets having a cargo area within a 75 m radius.

These two screenshots (**Error! Reference source not found.** and **Error! Reference source not found.**) show the generated matrix that relates KPIs and Sub-indicators with the datasets needed to understand and calculate them. In the future, this matrix will help implement a data-sharing platform that guides its users on which data they need to calculate the KPIs (which are composed of Sub-indicators). This will help users and unify concepts and terms, as well as dataset names.

4.3.2. Datasets of Urban Planning (land use, infrastructure, public participation)

From the search on how to calculate the Sub-indicators, a list of necessary datasets has been compiled that would provide information on each KPA. The previous matrix indicates which datasets are required for each KPA. Below is the list of datasets with a unique numerical code. Annex (8.2) contains the description of what each dataset entails.

Table 25. Datasets in Urban Planning.

134	Logistic Centers Characteristics (size, capacity, functions, and services)
135	Ownership/Operator Information
136	Type of Handled Goods
137	Storage Capacity
138	Nearby Transportation Infrastructure
139	Logistic centers within the specified area
140	Microplatforms within the specified area
141	Lockers available for logistics within the area
142	Number of centers in the city / Urban area (km²) x 100
143	Multi-modal hubs within the area
144	Pickup micro hubs within the area
145	Assessment of the degree of interoperability among logistics centers, platforms, and hubs
44	Location (Latitude, Longitude)
13	Date / Time / Temporal Data / Timestamp (Date and Time)
146	Duration
147	Vehicles Present
1	Vehicle Type
148	Activity
149	Compliance with Regulations
150	Notes/Comments
151	Type of area (loading, unloading, or both) / Type of Loading Zones
152	Capacity of the area / Size/Capacity of Loading Zones
153	Status (active or inactive)
154	Number of public parking places for freight vehicles
155	Type of Public Space (street parking, loading docks, delivery zones, etc)
156	Hours per Square Meter (UFT Activities)
157	Data Source(s)
158	Geographic Area
159	Number of Loading Zones
160	Usage Patterns
161	Accessibility Features
162	Charging Point ID
163	Type of Charging Infrastructure

164	Charging Capacity
165	Availability
166	Other Relevant Attributes
167	Number of Spaces
168	Type of Spaces
169	Restrictions
170	Zoning district dataset
171	Land use regulations dataset
172	Building regulations dataset
173	Lot coverage and floor area ratio dataset
174	Parking regulations dataset
175	Special zoning regulations dataset
176	Additional zoning regulations dataset
177	Street Name
178	Total Parking Spaces
179	Occupied Spaces
180	Available Spaces
181	Time-based Availability
182	Parking Space Type
183	Accessibility Features
184	Area (square meters)
185	Usage
186	Address
187	Parking Locations
188	Parking Capacity
189	Parking Availability
190	Parking Pricing
191	Parking Restrictions
192	Parking Types
193	Parking Amenities
194	Parking Utilization
195	Parking Enforcement
196	Parking Lot ID
197	Hours of Operation
198	Fees
199	Accessibility
200	Security
201	Type of Authorization
202	Issuing Authority
203	Conditions
204	Legal Status
205	Spatial data outlining UL areas
206	Geographic coordinates of UL areas
207	Classification/zoning codes for UL designation
208	Attributes describing UL area characteristics/regulations
209	Metadata providing dataset information (source, accuracy, etc.)
210	ZTL Access
211	Tariff Policies
212	Vehicle Emissions

213	Last Mile Delivery
214	Passenger Transport
113	Environmental Impact Data /assesment
215	Compliance and Enforcement
216	Sustainable Urban Freight/EcoLogistics policy dataset
217	Government resolutions/decrees dataset
218	Supportive reports/publications dataset
219	Meeting/forum records dataset
220	Public participation documentation dataset
99	Customer/Consumer Preferences, Feedback and Satisfaction Surveys
221	Meeting minutes/transcripts dataset
15	City/Region
222	Sustainable Urban Mobility Plan (SUMP) or EcoLogistics Strategy
223	Presence of Safety Policies
224	Endorsement Status
225	Implementation Details
226	Speed regime dataset
227	Dataset Name
228	Description
229	Data Fields/Attributes
230	Frequency of Updates
231	Geographic Coverage
232	Temporal Coverage
233	Access Restrictions
234	Data Format
235	Data License
236	Data Quality
237	Use Cases/Examples
238	Contact information (e.g., name, title, email, phone number) for municipal representatives in the permanent FQP
239	Meeting schedules, attendees, and related details (e.g., agenda, minutes) for annual FQP meetings
240	Number of registrations in the discussion forum for freight logistics
241	Existence of ecologistics-related stakeholder working groups
242	Percentage of actual participants in stakeholder meetings
243	Percentage of Participation representing Marginalized or Underrepresented Community Groups
244	Investigation of Current and Future Needs
245	Ecologistics Status Baseline Data
246	Public Participation Process Data
247	Stakeholder Group
248	Trust Level (Scale)
249	Engagement Activities
250	Metrics for assessing engagement (stakeholder engagement, such as number of interactions or diversity of participants)
251	Quantitative measures (stakeholder input frequency and extent of involvement.)
252	Qualitative assessments (engagement effectiveness, including satisfaction surveys or perception studies)

253	Benchmark data (Comparative data from similar urban planning projects or initiatives for benchmarking purposes.)
254	Land Use Data
255	Transportation Data
117	Demographic Data
256	Economic Data
257	Infrastructure Data
258	Microplatform Data
259	Warehouse Data
260	Energy Use Data
261	Electricity Consumption (kWh)
262	Heating Fuel Consumption (kWh)
263	Cooling Energy Use (kWh)
264	Floor Space (m²)
265	Lighting System
266	HVAC System
267	Insulation Level
268	Renewable Energy Installation
269	Microplatform ID
270	Microplatform Size (m²)
271	Microplatform Energy Consumption (kWh)
116	Fuel and Energy Consumption Data
272	Cubic Capacity of Shelf Space Data
106	Environmental Conditions / Factors Data
273	Building Characteristics Data
274	Geographical Data
98	Weather Data
275	Occupancy Data
94	Traffic and Road Conditions Data
93	Geospatial Data
16	Urban Population Data / Population
276	Retail Data
123	Historical Delivery Data
120	Regulatory Compliance Data / Local, National, or International Regulations
277	Public Transportation Data
90	Vehicle Tracking Data
278	Customer Behavior Data
279	Event Data
280	City Boundaries Data
281	Logistics Data
282	Access Fee Rates
283	Revenue Collection Records
284	Time Period
285	Commercial Outlet Data
286	Cargo Area Data
287	GIS Software or Tools

4.3.3. Datasets most used to calculated KPIs / Sub-indicators in Urban Planning

The characterization of the most used data depends on the type of monitoring and impact assessment decisions that one would like to make, e.g strategic, tactical, operational decisions, use data sets with different spatial, temporal granularity and at different level of aggregation. In this section we are providing a general characterization, which might be modified according to the itended purpose of the KPIs and sub-indicators that the data sets will estimate. This might imply that depending on the nature and the objectives of the different UNCHAIN KERs different types of data sets might be considered as the most used.

As seen in the previous section, there are many datasets needed to understand and calculate the Sub-indicators, specifically 170, but there are 13 that are most frequently repeated and therefore important to know, as shown in the following figure (Figure 7):

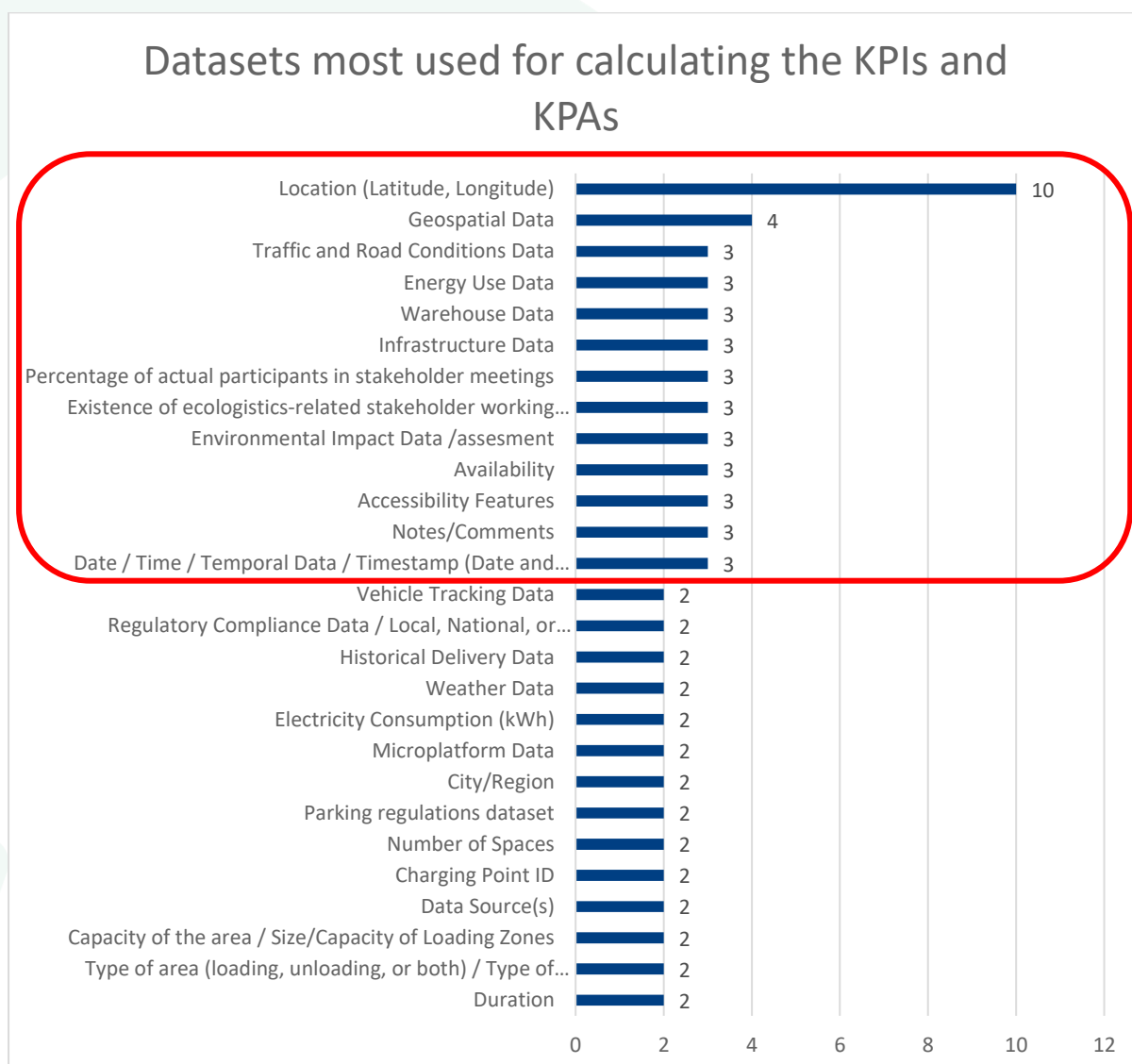


Figure 7. Datasets most used for calculated KPIs and Sub-indicators of Urban Planning

The datasets most used are, in descending order of relevance:

- Location (Latitude, Longitude)
- Geospatial Data
- Notes/Comments
- Accessibility Features
- Availability
- Environmental Impact Data /assessment
- Existence of ecologistics-related stakeholder working groups
- Percentage of actual participants in stakeholder meetings
- Infrastructure Data
- Warehouse Data
- Energy Use Data
- Traffic and Road Conditions Data
- Date / Time / Temporal Data / Timestamp (Date and Time)

4.3.4. Level of access, level of aggregation and anonymization and ownership of the datasets

Below, the access level, aggregation level, anonymization level, and data holders are shown. This information is derived from a review of the literature and workshops.

4.3.4.1. Level of access

In the following table, an example of classification of the access level of the most necessary data to calculate the KPIs and Sub-indicators for the category Urban Planning is shown.

- **1 (Public):** Generally accessible to the public without restrictions.
- **2 (Varies):** Access level can vary; it might be public in some cases (with limitations) or restricted (requiring authorization or special conditions).
- **3 (Restricted):** Access is limited to authorized personnel or entities due to privacy, security, or proprietary reasons.

Table 26. Level of acces for each dataset (Urban Planning).

Dataset	Access classification
Location (Latitude, Longitude)	1 (Public) or 3 (Restricted) (based on sensitivity)
Geospatial Data	1 (Public) or 3 (Restricted)
Notes/Comments	3 (Restricted)
Accessibility Features	3 (Restricted)
Availability	3 (Restricted)
Environmental Impact Data / Assessment	3 (Restricted)
Existence of ecologistics-related stakeholder working groups	3 (Restricted)

Percentage of actual participants in stakeholder meetings	3 (Restricted)
Infrastructure Data	3 (Restricted)
Warehouse Data	3 (Restricted)
Energy Use Data	3 (Restricted)
Traffic and Road Conditions Data	3 (Restricted)
Date / Time / Temporal Data / Timestamp (Date and Time)	1 (Public) or 3 (Restricted) (based on sensitivity)

This table 26 provides a structured overview of access levels based on typical classifications for each type of dataset.

In this case, most of the datasets (76.9%) are restricted.

4.3.4.2. Level of aggregation

In the following table, the level of aggregation of the most necessary data to calculate the KPIs and Sub-indicators for the category Urban Planning is shown:

Aggregation levels:

1. **Individual Data Points:** Refers to specific data entries that are distinct and typically not combined with other entries.
2. **Aggregated Data:** Refers to data that is summarized or combined from multiple sources or instances.

Table 27. Level of aggregation for each dataset (Urban Planning).

Dataset	Aggregation Level
Location (Latitude, Longitude)	Individual Data Points
Geospatial Data	Aggregated Data (Spatial datasets)
Notes/Comments	Individual Data Points
Accessibility Features	Aggregated Data (Features)
Availability	Aggregated Data (Availability)
Environmental Impact Data / Assessment	Aggregated Data (Impact assessment)
Existence of ecologistics-related stakeholder working groups	Individual Data Points
Percentage of actual participants in stakeholder meetings	Aggregated Data (Percentage)
Infrastructure Data	Aggregated Data
Warehouse Data	Aggregated Data
Energy Use Data	Aggregated Data
Traffic and Road Conditions Data	Aggregated Data
Date / Time / Temporal Data / Timestamp	Individual Data Points

4.3.4.3. Anonymization level

In the following table, the level of anonymization of the data is shown; only in 3 out of 13 cases (23.1%) the level is moderate, and none have a high level.

Anonymization levels:

- **1 (Low)**: Little to no anonymization needed; data is generally non-sensitive.
- **2 (Moderate)**: Some anonymization required to protect privacy or sensitive details.
- **3 (High)**: Significant anonymization needed due to high sensitivity or potential for identification.

Table 28. Anonymization level for each dataset (Urban Planning).

Dataset Description	Level of Anonymization
Location (Latitude, Longitude)	1 (Low)
Geospatial Data	1 (Low)
Notes/Comments	2 (Moderate)
Accessibility Features	1 (Low)
Availability	1 (Low)
Environmental Impact Data / Assessment	2 (Moderate)
Existence of ecologistics-related stakeholder working groups	1 (Low)
Percentage of actual participants in stakeholder meetings	2 (Moderate)
Infrastructure Data	1 (Low)
Warehouse Data	1 (Low)
Energy Use Data	1 (Low)
Traffic and Road Conditions Data	1 (Low)
Date / Time / Temporal Data / Timestamp (Date and Time)	1 (Low)

4.3.4.4. Who has access

Table 29. Entities that have access to the data (Urban Planning).

Dataset Description	Entities with Access
Location (Latitude, Longitude)	Public, Government Agencies, Specific Service Providers
Geospatial Data	Government Agencies, Researchers, Public
Notes/Comments	Authorized Personnel, Public
Accessibility Features	Government Agencies, Accessibility Organizations
Availability	Public, Researchers
Environmental Impact Data / Assessment	Environmental Agencies, Researchers
Existence of ecologistics-related stakeholder working groups	Stakeholders, Researchers

Percentage of actual participants in stakeholder meetings	Stakeholders, Researchers
Infrastructure Data	Government Agencies, Public
Warehouse Data	Logistics Companies, Researchers
Energy Use Data	Government Agencies, Researchers
Traffic and Road Conditions Data	Government Agencies, Public
Date / Time / Temporal Data / Timestamp (Date and Time)	Public, Researchers

The profiles that possess the most important datasets in the Urban Planning category are:

- Public and researchers (53.8%)
- Government agencies (46.1%)

4.3.5 How Sub-indicators are calculated- Environmental and social impact

In the following table 30, a preliminary approach is shown on how Sub-indicators related to the category Urban Planning can be calculated:

Table 30. Sub-indicators and formulas (Urban Planning)

Sub-indicators	Formula
1. Types and characteristics of logistics centers:	Listing types and characteristics (size, capacity, functions, services).
2. Number of logistic centres	Total count of logistics centers
3. Number of microplatforms	Total count of microplatforms
4. Number of lockers:	Total count of lockers
5. Sustainability of the urban distribution of goods (last mile):	$(\text{Number of centers in the city} / \text{Urban area (km}^2)) \times 100$
6. Multi modal hubs:	Total count of multimodal hubs
7. Number of pickup micro hubs:	Total count of micro pickup hubs
8. Interoperability	Number of efficient connections between centers / Total number of possible connections
9. Number of monitored loading & unloading areas	Count of total monitored areas
10. Number of loading & unloading areas:	Count total of loading and unloading areas
11. Number of public parking places for freight vehicles	Count total parking spaces.
12. More efficient use of existing public space:	Total hours of UFT activities / Area (m ²)
13. Density of loading zones:	Number of loading zones / Urban area (km ²) loading
14. Charging points freight	Total count of charging points for cargo vehicles
15. Count of delivery spaces	Count total delivery spaces

16.Zoning data	Listing and analyzing zoning data
17.Availability	Number of available items / Total number of items
18.Availability of parking spaces on streets	Number of available spaces / Total number of spaces
19.Available municipal space	Total area of available space (m ²)
20.Delivery parking places	Count total number of delivery parking spaces
21.Parking data and information	Collection and analysis of parking data
22.Land authorization for use	Number of authorizations issued
23.Areas designated as Urban Logistics (UL) areas	Count total of areas designated as UL
24.Overall and integrated regulatory system	Description of the regulatory system and access policies (ZTL)
25.Policy existence	Evaluate level of political support and leadership.
26. Existence of a politically endorsed policy on safety	Verify if the security policy is approved and in implementation
27.Speed regime	Listing and analyzing speed limits.
28.Set up of a permanent FQP (stakeholder collaboration):	Verify the existence and activity of the FQP
29.Contact persons for each municipality adhering to the permanent FQP	List contacts by municipality
30.Participation rate of freight agents in discussion forum for freight logistics	Number of freight agent registrations / Total number of invited freight agents
31.Existence of Stakeholder working group and extent of participation	Number of actual participants / Total expected participants × 100
32.Percentage of participation representing marginal or underrepresented community groups	Number of participants from marginalized groups / Total number of participants × 100
33.The degree to which the city investigates the current and future needs	Qualitative and quantitative assessment of the research conducted
34.Trust	Measurement of confidence through surveys and analysis of results.
35.Involvement degree	Number of interactions and active participations / Total number of participants

36. Level of duty	Qualitative assessment of fulfilling responsibilities
37. Number of EV charging points in microplatforms	Count total EV charging points
38. Energy consumption at warehouses (Energy use for each floor space):	Total energy consumption of the warehouse (kWh) / Total area of the warehouse (m ²)
39. Energy consumption at warehouses (Energy use for a cubic capacity of shelf space):	Total energy consumption of the warehouse (kWh) / Total cubic capacity (m ³)
40. Electricity consumption	Σ (Electricity consumption (kWh))
41. Delivery hours	Total delivery operation hours
42. Time city authorisation	Average time to obtain municipal authorizations
43. Revenue from LEZ access fee (EUR):	Σ (Revenue generated from access fees)
44. N. of commercial outlets having a cargo area within a 75 m radius	Count total businesses with loading area within 75 m

In Annex (8.8), the origin of the formulas and the list of bibliographic references are described.

4.4. Traffic management

The following presents the KPIs, Sub-indicators, and datasets associated with topic “Traffic Management”. Additionally, it analyzes how they are calculated, the datasets most commonly used, and finally, aspects related to who can access the information, level of aggregation, anonymization, etc.

This KPA (category) consists of: 5 KPIs, 38 sub-indicators, and 105 datasets.

4.4.1. KPIs and Sub-indicators in Traffic management

In this section, we will define the datasets needed for each sub-indicator related to "Traffic Management" The Sub-indicators are:

Table 31. KPIs and Sub-indicators in Traffic Management

KPI_18: Number of logistic centres, platforms, hubs, lockers

98. Share of freight vehicles

99. Number of freight trucks

KPI_19: Congestion

100. Reduction of congestion (ratio between the total time spent on a congested road network and the total "virtual" time spent in the absence of congestion)

101. Road congestion

102. Congestion: Average duration of delay due to traffic congestion or a vehicle in a day (mins/vehicle/day)

103. Congestion: Percentage of freight traffic at main traffic corridors (%)

104. Reduced congestion: Obstruction of other road users during loading / unloading (Veh/hrs)

105. Reduced congestion: UFT (urban freight transport) vehicles travelling on congested streets / shared spaces (Veh/hrs)

106. Traffic indicator

107. Traffic congestion

108. Traffic flow intensity

109. Traffic intensity

110. Traffic counters

111. Floating car data

112. Traffic movement

113. Sensors of traffic

114. Smart city control room

KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc)

115. Freight vehicles involvement rate: Percentage of incidents involving freight vehicles in the total traffic incidents (including LGVs and HGVs) (%)

116. Freight vehicles involvement rate: Percentage of freight-related incidents according to road-user types (pedestrians, cyclists, car drivers, truck drivers) (%)

117. Freight vehicles involvement rate: Percentage of freight-related fatalities according to road-user types (pedestrians, cyclists, car drivers, truck drivers) (%)

118. Delivery drivers' injuries/fatalities: The number of drivers injured or killed on the job per year (e.g., via crashes, vehicle/tire malfunction) (Number of drivers/year)

119. Freight employees' injuries/fatalities: The number of employees injured or killed on the job per year (e.g., warehouse accidents. (Number of warehouse workers/ year)

120. Improved traffic safety: Road accidents, injuries and fatalities (number)

121. Improved traffic safety: Damages to freight vehicles (number)

122. Improved traffic safety: Perceived safety (index)

KPI_21: Severe violations (Speed violation, drivers testing positive on alcohol or drugs)

123. Driver safety: Percentage of freight drivers testing positive on alcohol or drug use versus total drivers tested

124. Speed violations: The number of speed violators

125. Security

126. Accidents vru
127. Road safety
128. Safety
129. Number of all crashes
130. Crash mapper
131. Police historical data
132. nformation from police
KPI_22: Soft violations (unauthorized parking in loading zones // commercial vehicles with parking-related fines)
133. Loading and unloading in a zone: Percentage of unauthorized parking in loading zones for HGV
134. Loading and unloading in a zone: Total number of commercial vehicles with parking-related fines per million freight vehicle km
135. Data fine

These two screenshots (**Error! Reference source not found.** and **Error! Reference source not found.**) show the generated matrix that relates KPIs and Sub-indicators with the datasets needed to understand and calculate them. In the future, this matrix will help implement a data-sharing platform that guides its users on which data they need to calculate the KPIs (which are composed of Sub-indicators). This will help users and unify concepts and terms, as well as dataset names.

4.4.3. Datasets of Traffic management

From the search on how to calculate the Sub-indicators, a list of necessary datasets has been compiled that would provide information on each KPA. The previous matrix indicates which datasets are required for each KPA. Below is the list of datasets with a unique numerical code. Annex (8.3) contains the description of what each dataset entails.

Table 32. *Datasets in Traffic Management.*

288	Traffic Volume Data
289	Freight Vehicle Count Data
93	Geospatial / Spatial Data
290	Traffic Flow Data
291	Vehicle Classification Data
292	Freight Truck Count Data
128	Congestion level Data /metrics
293	Road Network Data
84	Travel Time Data
294	Historical Traffic Data
295	Delay Data
13	Time-of-Day Data /Time stamp data / Temporal Data
296	Location Data
297	Loading and Unloading Activity Data
298	Duration of Obstruction
299	Vehicle Flow Patterns
300	UFT Vehicle Tracking Data
301	Traffic Speed Data
302	Traffic Incident Data
98	Weather Data
16	Population and Demographic Data
303	Traffic Signal Data /Traffic Signal Timing Data
304	Vehicle GPS Tracking Data
277	Public Transportation Data
305	Traffic Density Data
279	Event Data
306	Vehicle Location Data
307	Vehicle Speed Data
1	Vehicle Type Data
308	Traffic Camera Data
309	Public Transit Data
310	Traffic Sensor Data
311	Real-Time Data Feeds / Real-Time Traffic Data

312	Smart City Infrastructure
313	Road User Data
314	Vehicle Data / Vehicle Characteristics Data
315	Road Accident Data /Traffic Accident data
316	Vehicle Registration Data / Vehicle Ownership and Registration Data
317	Injury/Fatality Data /fatality records
274	Geographical Data
109	Vehicle Maintenance Records
318	Occupational Injury Records
319	Vehicle Accident Reports
320	Health and Safety Reports / Public Safety Reports
321	Warehouse Worker Data
322	Law Enforcement Data
323	Damages Data
324	Safety Improvement Initiatives Data
325	Perceived Safety Survey Data
326	Road Infrastructure Data
327	Crime Data / Crime Incident Reports / Crime Mapping Data / incident reports
99	Public Opinion Surveys
328	Drug and Alcohol Testing
329	Driver Identification / Driver information / Driver Demographic Data / Driver Characteristics Data
330	Geographic Information System (GIS) Data
331	Speed Limit Data
332	Violation Records / Violation Data
333	Citation Records / Traffic Citations and Summons
334	Severity Classification Data / Accident Severity Data / Injury severity
335	Medical and Toxicology Reports
336	Traffic Enforcement Policies and Regulations Data
337	Public Health Records
338	Vehicle and Driver Information
339	Injury and Casualty Data
94	Road Conditions Data
340	Historical Accident Records
341	Driver Behavior Data
342	Crash Data / Historical Crash Data
343	Emergency Response Data / Emergency Calls and Dispatch Records
106	Environmental Factors Data
344	Traffic Control Devices Data
345	Pedestrian and Cyclist Data
254	Land Use and Zoning Data
346	Legal and Regulatory Data
347	Vehicle Technology Data
99	Community Engagement and Feedback Data / Customer/Consumer Preferences, Feedback and Satisfaction Surveys
348	Transportation Planning and Policy Data
256	Economic Impact Data / Economic data
349	Spatial Analysis Tools and Software
350	Roadway Design and Engineering Standards Data

351	Arrest Records
352	Case Files
353	Incident Response Logs
354	Court Records
355	Patrol and Dispatch Logs
356	Use of Force Reports
357	Complaints and Internal Affairs Records
358	Personnel Records
359	Crime Clearance Rates
360	Police Department Budget
361	Calls for Service Data
362	Community Policing Programs
363	Police Policies and Procedures
364	Community Survey Data
159	Loading Zone Data / Number of Loading Zones
365	Unauthorized Parking Data
366	Heavy Goods Vehicle (HGV) Data
367	Traffic and parking Violations Data
174	Parking Regulations and Policies Data
368	CCTV and Surveillance Data
369	Public Complaints or Reports Data
250	Stakeholder Engagement Data
370	Parking Fine, Fine and Penalty Records
371	Freight Transportation Regulations and Policies Data
372	Public Records or Surveys on Parking Behavior

4.4.4. Datasets most used to calculated KPIs / Sub-indicators in Traffic Management

The characterization of the most used data depends on the type of monitoring and impact assessment decisions that one would like to make, e.g strategic, tactical, operational decisions, use data sets with different spatial, temporal granularity and at different level of aggregation. In this section we are providing a general characterization, which might be modified according to the intended purpose of the KPIs and sub-indicators that the data sets will estimate. This might imply that depending on the nature and the objectives of the different UNCHAIN KERs different types of data sets might be considered as the most used.

As seen in the previous section, there are many datasets needed to understand and calculate the Sub-indicators, specifically 105, but there are 47 that are most frequently repeated and therefore important to know, as shown in the following figure (Figure 10):

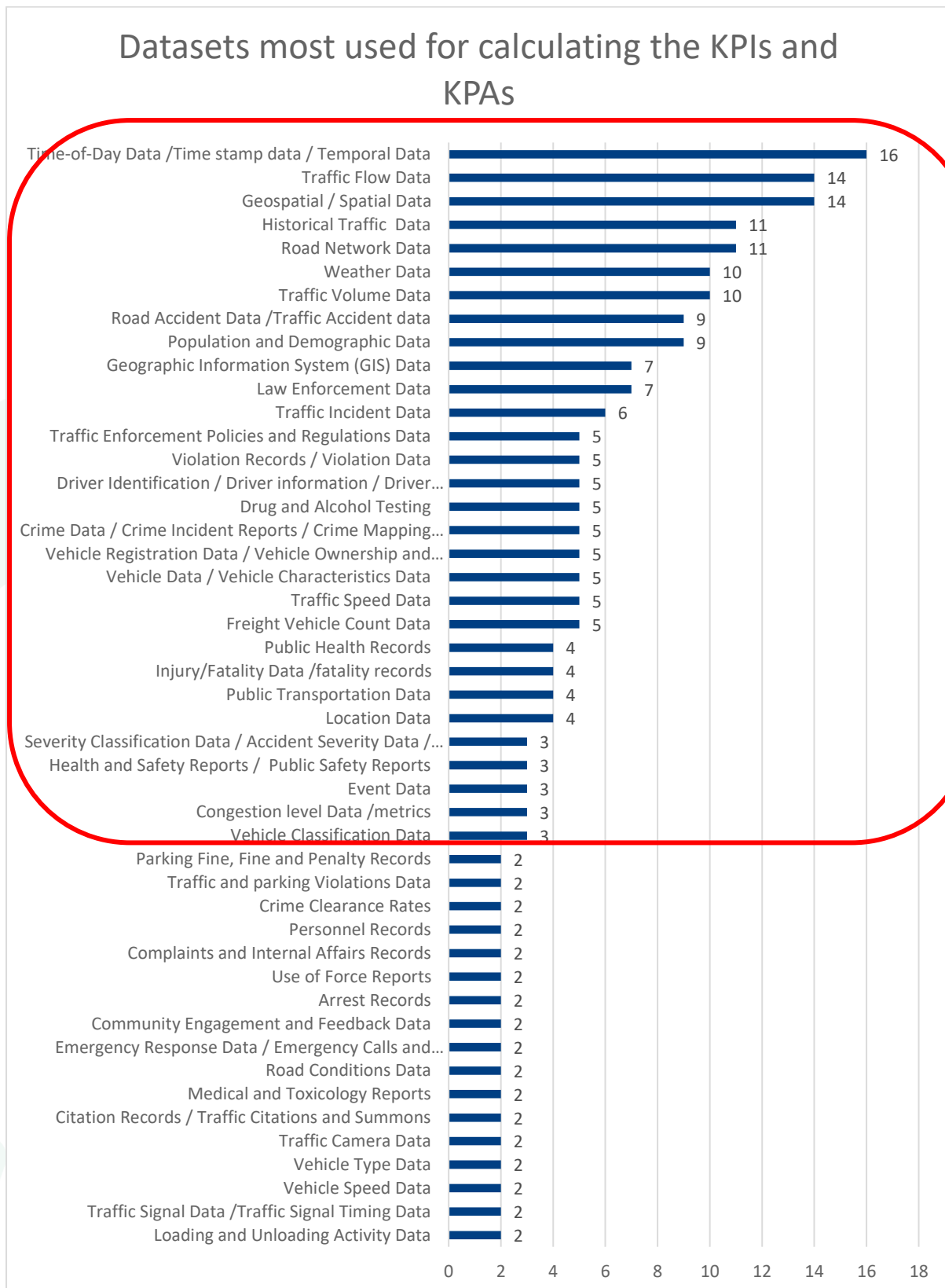


Figure 10. Datasets most used for calculated KPIs and Sub-indicators of Traffic Management

The most important datasets, as they are the most used, are:

- Time-of-Day Data /Time stamp data / Temporal Data
- Geospatial / Spatial Data
- Traffic Flow Data
- Road Network Data
- Historical Traffic Data
- Traffic Volume Data
- Weather Data
- Population and Demographic Data
- Road Accident Data /Traffic Accident data
- Law Enforcement Data
- Geographic Information System (GIS) Data
- Traffic Incident Data
- Freight Vehicle Count Data
- Traffic Speed Data
- Vehicle Data / Vehicle Characteristics Data
- Vehicle Registration Data / Vehicle Ownership and Registration Data
- Crime Data / Crime Incident Reports / Crime Mapping Data / Incident Reports
- Drug and Alcohol Testing
- Driver Identification / Driver information / Driver Demographic Data / Driver Characteristics Data
- Violation Records / Violation Data
- Traffic Enforcement Policies and Regulations Data
- Location Data
- Public Transportation Data
- Injury/Fatality Data /fatality records
- Public Health Records
- Vehicle Classification Data
- Congestion level Data /metrics
- Event Data
- Health and Safety Reports / Public Safety Reports
- Severity Classification Data / Accident Severity Data / Injury severity

4.4.1. Level of access, level of aggregation and anonymization and ownership of the datasets

Below, the access level, aggregation level, anonymization level, and data holders are shown. This information is derived from a review of the literature and workshops.

4.4.1.1. Level of access

In the following table, an example of classification of the access level of the most necessary data to calculate the KPIs and Sub-indicators for the category Traffic Management is shown.

- **0 (Open):** Accessible to anyone without any restrictions
- **1 (Public):** Generally accessible to the public without restrictions.
- **2 (Varies):** Access level can vary; it might be public in some cases (with limitations) or restricted (requiring authorization or special conditions).
- **3 (Restricted):** Access is limited to authorized personnel or entities due to privacy, security, or proprietary reasons.
- **4 (Confidential):** Access is highly restricted to a select group of individuals or entities, typically due to the sensitive or proprietary nature of the information.

Table 33. Level of access for each dataset (Urban Planning).

Data Type	Access Level
Geospatial / Spatial Data	0 (Open)
Traffic Flow Data	3 (Restricted)
Road Network Data	0 (Open)
Historical Traffic Data	3 (Restricted)
Traffic Volume Data	3 (Restricted)
Weather Data	0 (Open)
Population and Demographic Data	1 (Public)
Road Accident Data / Traffic Accident data	3 (Restricted)
Law Enforcement Data	4 (Confidential)
Geographic Information System (GIS) Data	Open Access
Traffic Incident Data	3 (Restricted)
Freight Vehicle Count Data	3 (Restricted)
Traffic Speed Data	3 (Restricted)
Vehicle Data / Vehicle Characteristics Data	3 (Restricted)
Vehicle Registration Data / Vehicle Ownership and Registration Data	4 (Confidential)
Crime Data / Crime Incident Reports / Crime Mapping Data / Incident Reports	4 (Confidential)
Drug and Alcohol Testing	4 (Confidential)
Driver Identification / Driver information / Driver Demographic Data / Driver Characteristics Data	4 (Confidential)
Violation Records / Violation Data	4 (Confidential)
Traffic Enforcement Policies and Regulations Data	Public Access
Location Data	3 (Restricted)
Public Transportation Data	Public Access
Injury/Fatality Data / fatality records	4 (Confidential)
Public Health Records	4 (Confidential)
Vehicle Classification Data	3 (Restricted)
Congestion level Data / metrics	3 (Restricted)
Event Data	3 (Restricted)
Health and Safety Reports / Public Safety Reports	4 (Confidential)
Severity Classification Data / Accident Severity Data / Injury severity	4 (Confidential)

This table provides a structured overview of access levels based on typical classifications for each type of dataset.

In this case, the majority of the most used data would have restricted or confidential access (75.8%). Additionally, 34.5% of the data are confidential, related to health, violations, or crime.

4.4.1.1. Level of aggregation

In the following table, the level of aggregation of the most necessary data to calculate the KPIs and Sub-indicators for the category Traffic Management is shown:

This categorization is based on the typical granularity and scope of the data, where:

- **High** aggregation indicates data that is more generalized or aggregated over large areas or populations.
- **Medium** aggregation indicates data that is moderately detailed, often aggregated over smaller areas or specific intervals.
- **Low** aggregation indicates highly detailed data, often at the level of individual records or events.

Table 34. Level of aggregation for each dataset (Traffic Management).

Data Type	Level of Aggregation
Geospatial / Spatial Data	3 (High)
Traffic Flow Data	2 (Medium)
Road Network Data	3 (High)
Historical Traffic Data	2 (Medium)
Traffic Volume Data	2 (Medium)
Weather Data	2 (Medium)
Population and Demographic Data	3 (High)
Road Accident Data / Traffic Accident Data	1 (Low)
Law Enforcement Data	1 (Low)
Geographic Information System (GIS) Data	3 (High)
Traffic Incident Data	1 (Low)
Freight Vehicle Count Data	2 (Medium)
Traffic Speed Data	2 (Medium)
Vehicle Data / Vehicle Characteristics Data	1 (Low)
Vehicle Registration Data / Vehicle Ownership Data	1 (Low)
Crime Data / Crime Incident Reports / Crime Mapping	1 (Low)
Drug and Alcohol Testing	1 (Low)
Driver Identification / Driver Demographic Data	1 (Low)
Violation Records / Violation Data	1 (Low)
Traffic Enforcement Policies and Regulations Data	3 (High)
Location Data	2 (Medium)
Public Transportation Data	2 (Medium)
Injury/Fatality Data / Fatality Records	1 (Low)

Public Health Records	2 (Medium)
Vehicle Classification Data	2 (Medium)
Congestion Level Data / Metrics	2 (Medium)
Event Data	2 (Medium)
Health and Safety Reports / Public Safety Reports	2 (Medium)
Severity Classification Data / Accident Severity Data	1 (Low)

4.4.1.2. Anonymization level

In the following table, the level of anonymization of the data is shown; only in 3 out of 29 cases (10.34%) the level is high.

Anonymization levels:

- **1 (Low)**: Little to no anonymization needed; data is generally non-sensitive.
- **2 (Moderate)**: Some anonymization required to protect privacy or sensitive details.
- **3 (High)**: Significant anonymization needed due to high sensitivity or potential for identification.

Table 35. Anonymization level for each dataset (Traffic Management).

Data Type	Level of Anonymization
Geospatial / Spatial Data	1 (Low)
Traffic Flow Data	1 (Low) to 2 (Moderate)
Road Network Data	3 (High)
Historical Traffic Data	1 (Low) to 2 (Moderate)
Traffic Volume Data	1 (Low)
Weather Data	3 (High)
Population and Demographic Data	2 (Moderate) to 3 (High)
Road Accident Data / Traffic Accident Data	1 (Low) to 2 (Moderate)
Law Enforcement Data	1 (Low)
Geographic Information System (GIS) Data	1 (Low)
Traffic Incident Data	1 (Low) to 2 (Moderate)
Freight Vehicle Count Data	2 (Moderate)
Traffic Speed Data	1 (Low)
Vehicle Data / Vehicle Characteristics Data	1 (Low)
Vehicle Registration Data / Vehicle Ownership and Registration Data	1 (Low)
Crime Data / Crime Incident Reports / Crime Mapping Data / Incident Reports	1 (Low)

Drug and Alcohol Testing	1 (Low)
Driver Identification / Driver Information / Driver Demographic Data / Driver Characteristics Data	1 (Low)
Violation Records / Violation Data	1 (Low)
Traffic Enforcement Policies and Regulations Data	3 (High)
Location Data	1 (Low)
Public Transportation Data	2 (Moderate)
Injury/Fatality Data / Fatality Records	1 (Low)
Public Health Records	1 (Low)
Vehicle Classification Data	2 (Moderate)
Congestion Level Data / Metrics	2 (Moderate)
Event Data	2 (Moderate)
Health and Safety Reports / Public Safety Reports	2 (Moderate)
Severity Classification Data / Accident Severity Data / Injury Severity	2 (Moderate)

4.4.1.3. *Who has access*

- **Insurance Companies:** Companies providing insurance services, often requiring access to traffic, accident, and vehicle data for risk assessment.
- **Emergency Responders:** Agencies involved in emergency response, including fire departments, ambulances, and disaster response teams.
- **Transportation Departments:** Government departments responsible for the development and maintenance of transportation infrastructure.
- **Logistics Companies:** Companies involved in the transportation and delivery of goods.
- **Automotive Manufacturers:** Companies that design, produce, and sell vehicles.
- **DMV (Department of Motor Vehicles):** State-level agencies that manage vehicle registration and driver licensing.
- **Public Safety Analysts:** Professionals analyzing data related to public safety to improve policies and response strategies.
- **Medical Facilities:** Hospitals and clinics involved in drug and alcohol testing and public health records.
- **App Developers:** Companies and individuals developing applications that use location and mapping data.
- **Event Organizers:** Individuals or companies planning and managing public and private events.
- **Public Transportation Agencies:** Organizations managing public transport systems like buses, trains, and subways.
- **Health Departments:** Government agencies focused on public health, monitoring health records and safety reports.
- **Public Safety Organizations:** Entities focused on maintaining public safety, including non-profits and governmental organizations.

- **Researchers:** Academics and scientists studying various aspects of transportation, public safety, and urban planning.
- **Meteorological agencies:** Organizations focused on weather forecasting and climate data, impacting transportation and public safety.
- **Law enforcement:** Police departments and other agencies enforcing laws, conducting investigations, and ensuring public safety.

Table 36. Entities that have access to the data (Traffic Management).

Data Type	Access
Geospatial / Spatial Data	Government agencies, mapping services, GIS analysts
Traffic Flow Data	Traffic management authorities, urban planners
Road Network Data	Government agencies, transportation departments
Historical Traffic Data	Researchers, traffic management authorities
Traffic Volume Data	Traffic management authorities, urban planners
Weather Data	Meteorological departments, public
Population and Demographic Data	Government agencies, researchers
Road Accident Data / Traffic Accident Data	Law enforcement, insurance companies
Law Enforcement Data	Police departments, legal entities
Geographic Information System (GIS) Data	GIS analysts, urban planners
Traffic Incident Data	Traffic management authorities, emergency responders
Freight Vehicle Count Data	Transportation departments, logistics companies
Traffic Speed Data	Traffic management authorities, urban planners
Vehicle Data / Vehicle Characteristics Data	Automotive manufacturers, traffic management authorities
Vehicle Registration Data / Vehicle Ownership and Registration Data	DMV (Department of Motor Vehicles), law enforcement
Crime Data / Crime Incident Reports / Crime Mapping Data / Incident Reports	Law enforcement, public safety analysts
Drug and Alcohol Testing	Medical facilities, law enforcement
Driver Identification / Driver Information / Driver Demographic Data / Driver Characteristics Data	DMV, insurance companies
Violation Records / Violation Data	Law enforcement, DMV
Traffic Enforcement Policies and Regulations Data	Government agencies, traffic management authorities
Location Data	Mapping services, app developers
Public Transportation Data	Public transportation agencies, urban planners
Injury/Fatality Data / Fatality Records	Public health departments, law enforcement
Public Health Records	Health departments, medical researchers
Vehicle Classification Data	Transportation departments, traffic management authorities
Congestion Level Data / Metrics	Urban planners, traffic management authorities
Event Data	Event organizers, urban planners
Health and Safety Reports / Public Safety Reports	Health departments, public safety organizations

Severity Classification Data / Accident Severity Data / Injury Severity	Insurance companies, public health departments
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The profiles that possess the most important datasets in the Traffic management category are:

- Traffic management authorities (31.0%)
- Urban planners (24.1%)
- Law enforcement (20.7%)

4.4.2. How Sub-indicators are calculated- Traffic Management

In the following table, a preliminary approach is shown on how Sub-indicators related to the category Traffic Management can be calculated:

Table 37. Sub-indicators and formulas (Traffic Management)

Sub-indicators	Formula
1. Share of freight vehicles	$(\text{Number of freight vehicles} / \text{Total number of vehicles}) \times 100$
2. Number of freight trucks	$\sum \text{Freight trucks observed in a specific period}$
3. Reduction of congestion	$\text{Total time spent on congested roads} / \text{Total virtual time spent without congestion}$
4. Road congestion:	$\text{Total delay time due to congestion} / \text{Number of vehicles}$
5. Congestion: Average duration of delay	$\text{Total delay time} / \text{Total number of vehicles (mins/vehicle/day)}$
6. Congestion: Percentage of freight traffic at main traffic corridors:	$(\text{Freight traffic at main corridors} / \text{Total traffic at main corridors}) \times 100$
7. Reduced congestion: Obstruction of other road users during loading/unloading:	$\sum \text{Duration of loading/unloading activities (Veh/hrs)}$
8. Reduced congestion: UFT² vehicles travelling on congested streets/shared spaces	$\text{UFT vehicles on congested streets} = \sum \text{UFT vehicle hours on congested/shared streets (Veh/hr)}$
9. Traffic indicator	Composite index of traffic flow, intensity, and congestion
10. Traffic congestion	$\text{Total congestion time} / \text{Total time period}$
11. Traffic flow intensity	$\text{Number of vehicles passing a point} / \text{Time period}$
12. Traffic intensity	$\text{Total vehicle kilometers} / \text{Time period}$
13. Traffic counters:	Sum of vehicle counts at designated points
14. Floating car data	Average speed and travel time from GPS - enabled vehicles
15. Traffic movement:	Sum of vehicle movements in the network
16. Sensors of traffic	Data collected from traffic sensors (vehicle count, speed, etc.)
17. Smart city control room	Real-time data from various urban sensors and systems

² UFT stands for Urban Freight Transport. It refers to the movement of goods within urban areas, often involving the use of specialized vehicles designed to navigate the unique challenges of city environments, such as congestion and limited parking. UFT vehicles are typically used for last-mile delivery services, ensuring that goods reach their final destinations efficiently in densely populated areas.

18. Freight vehicles involvement rate: Percentage of incidents involving freight vehicles in the total traffic incidents	$(\text{Incidents involving freight vehicles} / \text{Total traffic incidents}) \times 100$
19. Freight vehicles involvement rate: Percentage of freight-related incidents according to road-user types	$(\text{Freight-related incidents for user type} / \text{Total freight-related incidents}) \times 100$
20. Freight vehicles involvement rate: Percentage of freight-related fatalities according to road-user types:	$(\text{Freight-related fatalities for user type} / \text{Total freight-related fatalities}) \times 100$
21. Delivery drivers' injuries/fatalities:	$\sum \text{Number of injured/killed delivery drivers per year}$
22. Freight employees' injuries/fatalities:	$\sum \text{Number of injured/killed warehouse employees per year}$
23. Improved traffic safety: Road accidents, injuries, and fatalities:	$\sum \text{Number of road accidents, injuries, and fatalities}$
24. Improved traffic safety: Damages to freight vehicles:	$\sum \text{Number of damages reported to freight vehicles}$ Perceived safety index=Survey results on safety perceptions
25. Driver safety: Percentage of freight drivers testing positive on alcohol or drug use versus total drivers tested:	$(\text{Freight drivers testing positive} / \text{Total drivers tested}) \times 100$
26. Speed violations: The number of speed violators:	$\sum \text{Number of speed violations recorded}$
27. Security	Security incidents recorded per time period
28. Accidents vru	$\sum \text{Number of accidents involving vulnerable road users}$
29. Road safety	$\sum \text{Number of road safety incidents reported}$
30. Safety	$\sum \text{Number of safety incidents recorded}$
31. Number of all crashes	$\sum \text{Number of crashes reported}$
32. Crash mapper	Geospatial distribution of crashes
33. Police historical data	Historical data on traffic incidents from police records
34. Information from police	Current and relevant data from police reports
35. Loading and unloading in a zone: Percentage of unauthorized parking in loading zones for HGV:	$(\text{Number of unauthorized HGV parking} / \text{Total HGV parking in loading zones}) \times 100$
36. Loading and unloading in a zone: Total number of commercial vehicles with parking-related fines per million freight vehicle km	$(\text{Number of parking-related fines} / \text{Total freight vehicle km}) \times 106$
37. Data fine	Summarized data on fines related to parking violations

4.5. Service Efficiency

The following presents the KPIs, Sub-indicators, and datasets associated with topic “Service Efficiency”. Additionally, it analyzes how they are calculated, the datasets most commonly used, and finally, aspects related to who can access the information, level of aggregation, anonymization, etc.

This KPA (category) consists of: 19 KPIs, 84 sub-indicators, and 365 datasets.

4.5.1. KPIs and Sub-indicators in Service Efficiency

In this section, we will define the datasets needed for each sub-indicator related to "Service Efficiency" The Sub-indicators are:

Table 38. KPIs and Sub-indicators in Service Efficiency

KPI_23: Customer satisfaction with the delivery
136. Level of satisfaction with the urban mobility system with focus on weak users (pedestrians, disabled people, elderly people, children) on the freight side: (index)
137. Customer satisfaction: Percentage of distributors and end customer that are satisfied with delivery times (%)
138. Same or better level of service as existing schemes and increased acceptance: On time in full (OTIF) (%)
139. Same or better level of service as existing schemes and increased acceptance: Customer satisfaction(index)
140. Same or better level of service as existing schemes and increased acceptance: Level of acceptance (%)
141. End user satisfaction
KPI_24: Km traveled by commercial vehicles
142. Light commercial vehicle mileage: (miles)
143. Distance travelled by freight vehicles: Traffic counts through car plates, complemented with a survey:()
144. Total km traveled by LEVs and ZEVs: The total distance traveled by LEVs and ZEVs(km)
145. Vehicle-kilometers traveled: Total kilometers traveled per day according to LDV, LGV, and HGV (Distance traveled by a vehicle multiplied by the number of vehicles) (Vehicle-kilometers traveled)
146. Loading and unloading in a zone: Distance covered for loading and unloading in a zone, per vehicle, per activity (Number of km covered for one delivery/ pickup)
147. Delivery organization: Average distance traveled per delivery/pickup (from urban delivery hub to core servicing areas) (km)
148. The distance of warehouse from city center: Average distance between logistics centers/ warehouses/distribution hubs and delivery points within the urban core(km)
149. Route kms
KPI_25: Loading/unloading time - time per delivery

150. Loading/unloading time: (min)
151. Parking time for freight operations: Sensors or empirical observation ()
152. Loading and unloading in a zone: The average number of minutes of on-street parking for delivery or pickup in a zone, per vehicle (Mins/vehicle)
153. Loading and unloading timeliness: The average standard deviation of loading/unloading time for bulk goods (Mins)
154. Loading and unloading timeliness: The average standard Deviation of loading/unloading time for container goods (Mins)
155. Loading and unloading timeliness: The average standard deviation of loading/unloading time for a package (Mins)
KPI_26: Reliability of just-in-time freight deliveries
156. On-time deliveries: Percentage of on-time deliveries vs. total deliveries (%)
157. On-time deliveries: Percentage of on-time deliveries on the road (%)
158. On-time deliveries: Percentage of on-time deliveries on the rail (%)
159. On-time deliveries: Percentage of on-time deliveries on inland waterways (%)
160. Reliability of just-in-time freight deliveries: number and percentage of just-in-time freight deliveries that arrive within an acceptable interval around the planned times (number & %)
161. Delivery on time
KPI_27: Increased utilisation of load capacity of vehicles
162. Capacity utilization: The load capacity of different freight vehicles (%)
163. Load factors: Average loading percentage of the freight vehicles passing at reference points (%)
164. Increased utilisation of load capacity of vehicles: Vehicle load factor (percentage (%)) (%)
165. Increased utilisation of load capacity of vehicles: Integration of goods and passenger flows (number)(number)
166. Load percentage
KPI_28: Modal split
167. Low emission delivery: The share of low emission delivery in total km traveled (%)
168. Modal split: Percentage of total inland freight ton-km (%)
169. Modal Split goods: Percentage of goods (described in parcels, tons, etc) using each (sub) mode (e.g.: heavy and light trucks, tram, train, cargobikes, etc.) during a day (weekday, weekend day) or per hour (peak hour, off-peak hour) for a specific target group. (%)
170. Number of freight movements: number of freight vehicles (per day or per hour) passing at reference points (e.g. entering the city centre) divided over different type of vehicles: heavy trucks, light trucks, e-cargo bikes, etc. ()
171. Number of goods movements: Total goods (parcels, tons, etc) to be transported departing or arriving in a specific area during a chosen period: hour, day, year (for all modes together).(goods/time)
172. Modal split (for freight transport): (goods vehicles kilometres ran)
173. Modal split (for freight transport): (freight tonnes kilometres ran)
174. Overall transited cargo in the city split by transport mode (road, rail, air, water)
175. Type of goods delivered

176. Modal split
177. Type of goods
KPI_29: Freight logistic intensity // delivery productivity
178. Freight logistic intensity: Traffic counts through car plates
179. Speed (within urban core during peak hours): Average speed per delivery excluding stops, per type of vehicle (Km/hr)
180. Delivery productivity: Average tons of goods delivered per kilometer(tons/km)
181. Delivery productivity: Average number of deliveries a vehicle can accomplished in a day (based on the sum of time spent on operations) (per type of vehicle: LDV, LGV, HGV) (Number of deliveries/operationaltime/ vehicle)
182. Delivery organization: Average deliveries per round per vehicle (parcel, express, and courier) (number of deliverues)
183. Increased speed of delivery: Time per delivery / pick up(minutes)
184. Increased speed of delivery: Number of delivery attempts(number)
185. More efficient use of vehicle fleet: Deliveries per tour per vehicle(number)
186. More efficient use of vehicle fleet: Dimension weight / day per vehicle (kg, m3)
187. More efficient use of vehicle fleet: Drop density per vehicle (%)
188. More efficient use of vehicle fleet: Days in operation per vehicle (%)
189. N. of deliveries
190. Total freight per day
191. Packages per month
192. Number of stops per day
193. Deliveries per stop
194. Time to delivery
KPI_30: Costs of the last mile per delivery/ pick up
195. Economically sustainable business models: Last mile delivery cost per delivery / pick up (%)
196. Economically sustainable business models: Distribution and warehouse cost per delivery / pick up (%) (Km/hr)
197. Economically sustainable business models: Investment costs for the city (%) (tons/km)
KPI_31: Percentage of total vehicle-kilometers that run empty
198. Percentage of total vehicle-kilometers that run empty
KPI_32: Recipient awareness of sustainable delivery options (index) // Recipient willingness to pay for sustainable delivery (index)
199. Recipient awareness of sustainable delivery options (index)
200. Recipient willingness to pay for sustainable delivery (index)
KPI_33: Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours

201. Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours
KPI_34: Night deliveries
202. % delivery vehicles from 22h to 7h/total
KPI_35: Average age of freight vehicles
203. Average age of freight vehicles
KPI_36: Average utilization of the warehouse or distribution centers
204. Warehouse utilisation: Average utilization of the warehouse or distribution centers (%)
205. Occupancy time of hubs
KPI_37: Occupancy of (un)loading/parking areas
206. Occupancy status of load and unloading parking spots
207. Use of loading areas
208. UL areas occupation
209. Parking slots occupancy
210. Parking lots occupancy
211. Occupancy time loading unloading bays
KPI_38: Privacy
212. Privacy
KPI_39: Time spent to find parking/(un)loading area
213. Time to find parking
214. Time lost to find parking
215. Time spent finding parking
KPI_40: Reservation of parking areas
216. Reservation of parking areas
KPI_41: Constraints identified during the last mile stage
217. Constraints identified during the last mile stage

4.5.1. Matrix relating KPIs and Sub-indicators with datasets (Service Efficiency)

KPIs	Sub-indicators	DATASETS										KPIs : Customer satisfaction with the delivery										KPIs : Km traveled by commercial vehicles																																													
		373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438
KPI_23: Customer satisfaction with the delivery	136. Level of satisfaction with the urban mobility system with	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							
	137. Customer satisfaction: Percentage of distributors and end																																																																		
	138. Same or better level of service as existing schemes and																																																																		
	140. Same or better level of service as existing schemes and																																																																		
KPI_24: Km traveled by commercial vehicles	141. End user satisfaction																																																																		
	142. Light commercial vehicle mileage: (miles) through car plates, complemented with a survey: (traveled by LEVs and ZEVs)(km)																																																																		
	143. Average speed of commercial vehicles (km/h) according to LDV, LGV, and HGV (distance traveled by a loading and unloading in a zone, per vehicle, per delivery/pickup (from urban delivery hub to core servicing distance between logistics centers/ warehouses/distribution																																																																		
	148. Route kms																																																																		
KPI_25: Loading/unloading time per delivery	150. Loading/unloading time: (min) (observations)																																																																		
	151. Minutes of on-street parking for delivery or pickup in a zone, deviation of loading/unloading time for bulk goods(Mins)																																																																		
	152. Deviation of loading/unloading time for container goods																																																																		
	153. Loading and unloading timeliness: The average standard																																																																		
KPI_26: Reliability of just-in-time freight deliveries	156. On-time deliveries: Percentage of on-time deliveries vs.																																																																		
	157. On-time deliveries: Percentage of on-time deliveries on																																																																		
	158. On-time deliveries: Percentage of on-time deliveries on																																																																		
	159. On-time deliveries: Percentage of on-time deliveries on																																																																		
KPI_27: Increased utilization of load capacity of vehicles	160. Reliability of just-in-time freight deliveries: number and																																																																		
	161. Delivery on time																																																																		
	162. Capacity utilization: The load capacity of different freight																																																																		
	163. Load factor: Average loading percentage of the freight																																																																		
KPI_28: Modal split	164. Increased utilization of load capacity of vehicles: Vehicle																																																																		
	165. Increased utilization of load capacity of vehicles: Vehicle																																																																		
	166. Load percentage																																																																		
	167. Low emission delivery: The share of low emission delivery																																																																		
KPI_29: Freight logistic intensity // delivery productivity	168. Modal split: Percentage of total inland freight ton-km(%)																																																																		
	169. Modal Split goods: Percentage of goods (described in																																																																		
	170. Number of freight movements: number of freight vehicles																																																																		
	171. Number of goods movements: Total goods (parcels, tons,																																																																		
KPI_30: Costs of the last mile per delivery/pick up	172. Modal split (for freight transport): (freight tonnes)																																																																		
	173. Modal split (for freight transport): (freight tonnes)																																																																		
	174. Overall transited cargo in the city split by transport mode																																																																		
	175. Type of goods delivered																																																																		
KPI_31: Recipient awareness of sustainable delivery options (index) // Recipient willingness	176. Modal split																																																																		
	177. Type of goods																																																																		
	178. Freight logistic intensity: Traffic counts through car plates																																																																		
	179. Speed (within urban core during peak hours): Average																																																																		
KPI_32: Percentage of total vehicle kilometers that run empty	180. Delivery productivity: Average tons of goods delivered per																																																																		
	181. Delivery productivity: Average number of deliveries a																																																																		
	182. Delivery organization: Average deliveries per round per																																																																		
	183. Increased speed of delivery: Time per delivery / pick																																																																		
KPI_33: Hours that vehicles are in service, e.g. deliveries, pickups, transporting	184. Increased speed of delivery: Number of delivery																																																																		
	185. More efficient use of vehicle fleet: Deliveries per tour per																																																																		
	186. More efficient use of vehicle fleet: Dimension weight /																																																																		
	187. More efficient use of vehicle fleet: Drop density per																																																																		
KPI_34: Night deliveries	188. More efficient use of vehicle fleet: Days in operation per																																																																		
	189. N. of deliveries																																																																		

These four screenshots (Figure 11, Figure 12, Figure 13 and Figure 14) show the generated matrix that relates KPIs and UFT stands for Urban Freight Transport. It refers to the movement of goods within urban areas, often involving the use of specialized vehicles designed to navigate the unique challenges of city environments, such as congestion and limited parking. UFT vehicles are typically used for last-mile delivery services, ensuring that goods reach their final destinations efficiently in densely populated areas. Sub-indicators with the datasets needed to understand and calculate them. In the future, this matrix will help implement a data-sharing platform that guides its users on which data they need to calculate the KPIs (which are composed of Sub-indicators). This will help users and unify concepts and terms, as well as dataset names.

4.5.1. Datasets of Service Efficiency

From the search on how to calculate the Sub-indicators, a list of necessary datasets has been compiled that would provide information on each KPA. The previous matrix indicates which datasets are required for each KPA. Below is the list of datasets with a unique numerical code. Annex (8.4) contains the description of what each dataset entails.

Table 39. Datasets in Service Efficiency.

373	Urban Mobility Survey Data
374	Demographic and User Profile Data
375	Freight Transport Data / Freight Transport Activity Data / Transporting Data / Inland Freight Transport Data
376	Accessibility Data / Accessibility Features / Accessibility and Inclusivity Data
377	Transportation Infrastructure Data
378	Mobility Services Usage Data
379	Pedestrian Safety and Accident Reports
380	Disability Accessibility Compliance Data
381	Elderly Mobility Patterns Data
382	Child Safety and Transportation Data
99	Community Engagement and Feedback Data / Customer/Consumer Preferences, Feedback and Satisfaction Surveys
384	Accessibility Improvement Projects Data
385	Environmental Quality and Pollution Data
386	Local Government Policies and Initiatives Data
304	Delivery Time Records / GPS or Tracking Data / Delivery Time Logs /Delivery time data
100	Order Processing Data
387	Delivery Tracking Data
123	Historical Delivery Data / Historical Data
388	Customer Complaints Data / Customer Support Interaction Logs / Customer Retention and Churn Data / Customer Loyalty Metrics
389	Customer Feedback Data / User Feedback Data / Complaints and Feedback Data
390	Logistics Centers/Warehouses Data / Warehouse and Distribution Center Data
391	Logistics Performance Metrics
392	Route Optimization Data
393	Existing Service Level Data
394	Transportation and Logistics Operations Data / Freight and Logistics Operations Data / Logistics and Freight Data

395	Supply Chain Management Data / Logistics and Supply Chain Data
396	Quality Assurance and Control Data
253	Performance Benchmarking Data
397	Technological Infrastructure and Tools Data
398	Market Research and Demand Forecasting Data
120	Legal and Regulatory Compliance Data / Enforcement and Compliance Data
399	Employee Training, Development and Awareness Data/Records
400	Financial Performance, Cost, Budgetary and economic Analysis Data
113	Environmental Impact Assessment Data
330	Geographic Information System (GIS) Data / GIS Software or Tools
401	IT Systems Integration and Data Interoperability
62	Comparative Analysis Data
160	Usage and Demand Data / Usage Patterns
402	Service Improvement Initiatives Data
403	Acceptance Rate Data
99	Public Opinion Polls
404	Case Studies and Best Practices
405	Regulatory and Policy Framework Data / Documents
406	Communication and Outreach Materials
407	Performance Metrics and Key Performance Indicators (KPIs)
408	Safety and Security Data
409	Cultural and Social Context Data
410	Governance and Decision-Making Processes Data
411	Net Promoter Score (NPS) Data
412	Product/Service Usage Data
413	User Experience (UX) Testing Results
414	Social Media Sentiment Analysis / Online Reviews and Ratings
415	Competitor Analysis
416	Purchase History and Loyalty Program Participation
417	Brand Perception Surveys
252	Focus Group Discussions
316	Vehicle Registration Data
418	Vehicle Odometer Readings
17	Fuel Consumption Data
109	Vehicle Maintenance Records / Vehicle Maintenance and Depreciation Costs
419	Vehicle Telematics Data
420	Vehicle Inspection Reports
421	Fleet Management System Data
422	Transport and Logistics Records
423	Road Usage and Toll Data
13	Time and Temporal Data
1	Vehicle Type and Classification Data / Vehicle Specifications Data / Vehicle Type and Specifications
90	Vehicle Tracking Data
424	Trip Logs
425	Vehicle Mileage Data
116	Energy Consumption Data
163	Charging Infrastructure Data
426	Traffic Count Data

427	License Plate Recognition (LPR) Data
428	Traffic Analysis Zones (TAZ) Data
429	Transportation Surveys Data
293	Road Network Data
430	Vehicle Usage Data / Daily Vehicle Usage Data
288	Traffic Volume Data
158	Geographic Area Data / Geographic Data / Geographic and Spatial Data / Geographic Coordinates of UL Areas
96	Delivery Route Data and Address / Route and Network Data / Transport Route Information
94	Traffic and Road Conditions Data
431	Urban Planning and Zoning Data / Urban Planning and Policy Data
98	Weather Data / Weather and Environmental Conditions Data
432	Urban Area Boundaries Data
186	Customer Address and Location Data
433	Digital Mapping and Navigation Services Data
106	Environmental Factors Data
434	Delivery Points Data
435	Distance Calculation Tools
349	Spatial Analysis Software
436	City Center Definition Data
437	Transportation Network Data
438	Traffic Management Data / Traffic Monitoring Data
254	Land Use and Zoning Data
439	Infrastructure Inventory
440	Census Data
297	Loading and Unloading Logs / Loading and Unloading Data
441	Transportation Schedule Data
442	Facility Operation Logs
443	Inventory Management System Data
444	Labor and Workforce Data
445	Equipment Utilization Data
446	Parking Sensor Data / Sensor Data
447	Parking Duration Records / Parking Duration Data
448	Traffic and Congestion Data
89	Delivery Records / Delivery and Pickup Records
449	Freight Operations Logs
174	Parking Regulation and Policy Data
450	Local Economic and Business Activity Data
451	Historical Parking Usage and Trends Data
452	On-Street Parking Data
453	Loading and Unloading Zone Locations
16	Urban Area Demographic Data
454	Local Regulations and Policies Data
277	Public Transportation Data / Public Transportation Usage Data
93	Geospatial Data / Geospatial and Mapping Data
455	Loading and Unloading Time Records / Loading and Unloading Records / Historical Loading and Unloading Records
456	Bulk Goods Inventory Data
457	Transportation Logistics Data

458	Supplier and Vendor Performance Data / Supplier Data / Supplier and Manufacturer Data
459	Facility Capacity and Utilization Data
460	Quality Control and Compliance Data
461	Container Goods Information
462	Time Tracking Data
463	Historical Performance Data
464	Equipment and Resource Allocation Data
87	Package Information
13	Time Stamp Data
465	Personnel Assignment Data
466	Facility Layout and Equipment
467	Route Planning Data
468	Customer Order Data
469	Delivery Performance Metrics / Delivery Performance Data
470	Service Level Agreements (SLAs)
336	Traffic Enforcement Data
471	Rail Transport Data / Rail Freight Data
472	Shipment Tracking Data / Shipment data / Freight Shipment Data / Inbound and Outbound Shipment Data
473	Schedule Adherence Data
474	Railway Infrastructure Data
475	Operations and Maintenance Logs
476	Government Regulations and Standards Data
477	Freight Management System Data
478	Rail Network Performance Metrics
479	Inland Waterway Transportation Data
480	Traffic and Navigation Data
481	Shipping Company Operations Data / Shipping Data / Shipping Carrier Data
482	Cargo Tracking and Monitoring Data
483	Infrastructure Maintenance Records
371	Transportation Policies and Regulations
256	Economic Data / Economic and Market Data / Economic indicators
484	Freight Delivery Schedule Data / Delivery Schedule
485	Actual Freight Delivery Data
486	Transportation Mode Data
84	Route and Distance Data / Travel Time
487	Urban Infrastructure Data
95	Customer Data and Information
100	Inventory and Order Data
289	Freight Vehicle Data / Freight Vehicle registration / Delivery Vehicle Data
488	Cargo Loading Data
348	Transportation Planning Data
326	Road Infrastructure Data
349	Real-time Load Monitoring Data
350	Load Capacity Data
351	Weigh-in-Motion (WIM) Data
352	Loading Percentage Calculation Algorithm
290	Traffic Flow and Density Data
353	Vehicle Load Data / Vehicle Load Capacity Data

255	Transportation Data
281	Inventory and Logistics Data
489	Cargo Manifests and Shipment Records / Shipment Records
490	Weight and Measurement Records
346	Compliance and Regulatory Data
491	Vehicle Utilization Data / Vehicle Utilization Metrics
492	Passenger Flow Data
493	Goods Flow Data
494	Vehicle Capacity Data
495	Transport Demand Data
496	Modal Shift Data
497	Infrastructure Capacity Data
498	Demographic and Socioeconomic Data
499	Historical Demand Data
500	Transportation Costs Data
501	Delivery Fleet Data / Fleet Composition Data / Transport Fleet Data
22	Emissions Data
502	Delivery Volume Data
337	Public Health Records
503	Industry Reports and Studies
504	Ton-km Data
505	Modal Share Data
506	Transport Network Infrastructure Data
507	Freight Transport Policies and Regulations Data
508	Freight Transport Demand and Supply Data
509	Economic and Trade Data / Economic and Trade Data / Customs and Trade Data
510	Historical Freight Transport Data
511	Transport Accessibility and Connectivity Data
512	Goods Transportation Data
513	Modal Split Data
514	Target Group Demographic Data
515	Public Policy and Regulatory Data
289	Vehicle Count Data
516	Entry/Exit Point Data / Vehicle Entry and Exit Data
517	Sensor and Automated Counting Data
518	Regulation and Policy Data
519	Freight Operation Schedules
520	Goods Movement Data
521	Departure and Arrival Data
522	Freight Traffic Data / Traffic Data
523	Port and Terminal Data
524	Carrier and Logistics Provider Data
525	Vehicle Kilometres Travelled (VKT) Data
526	Freight Terminal Data
527	Cargo Volume / Weight Data
528	Logistics Company Data
529	Customs and Import/Export Data / Customs Data
530	Inventory Data
531	Product Catalog / Product Classification Data

532	Packaging Data / Eco-friendly Packaging Data
533	Transaction Data / Anonymized Transaction Data
534	Returns Data / Returns and Refunds Data
535	Household Travel Survey Data
536	Private Vehicle Usage Data
537	Non-Motorized Transport Data
538	Commuter Surveys
539	Survey Methodology Details
540	Sales Data / Historical Sales and Revenue Data
276	Retail Data
259	Warehouse Management System (WMS) Data / Warehouse Inventory Data
541	Procurement Data
542	E-commerce Data
543	Freight Volume Data
544	Stop Data / stop event data / event data
307	Vehicle Speed Data
545	Operational Time Data / Time Data / Operational Logs
546	Stop Time Data
547	Driver Shift Data
91	Delivery Frequency Data
548	Vehicle Fleet Data
549	Driver Work Logs / Driver Logs
550	Delivery Load Data
551	Driver Performance Data
110	Vehicle Performance Data
552	Delivery Instructions
553	Delivery Attempt Data
554	Delivery Personnel Data
555	Delivery Infrastructure Data
556	Delivery Equipment Data
557	Tour Data
558	Trip Data
559	Delivery and Pickup Schedules / Delivery and Pickup Data
560	Vehicle Telemetry Data
561	Vehicle Operation Logs
562	Vehicle Availability Schedules
563	Rental and Leasing Records
564	Seasonal/Operational Calendar
565	Driver Assignment Logs
566	Inspection Records
567	Delivery Service Provider Data
568	Delivery Failure Data
569	Air Cargo Data
570	Freight Operator Data
571	Driver Activity Logs
572	Delivery/Service Logs
573	Order Placement Data
574	Transit Time Data
575	Delivery Confirmation Data

576	Customer Location Data
577	Courier Route Data
578	Warehouse Location Data
579	Sustainability Ratings
580	Delivery and Pickup Costs
581	Number of Deliveries and Pickups
582	Labor Costs / Labor Costs Data
583	Vehicle Maintenance and Depreciation Costs
584	Packaging and Handling Costs
585	Overhead Costs
586	Order Volume and Frequency
587	Technology, Infrastructure and Equipment Costs Data
588	Distribution Costs Data
589	Warehouse Costs Data
590	Overhead Expenses Data
591	Investment Costs Data
592	Infrastructure Investment Data
593	City Budget and Expenditure Data
594	Cost-Benefit Analysis Reports
595	Market Analysis Reports
596	Sustainability Metrics and Indicators
597	Industry and Sector-specific Data
598	Innovation and Technology Adoption Data
599	Cost Estimation Models and Tools
600	Public-Private Partnership (PPP) Agreements
601	Risk Assessment and Management Reports
602	Government Grants and Funding Programs
603	Trip Records
604	Delivery Orders Data
605	Pickup and Drop-off Locations Data
606	Business Operations Data / Business Operation Hours
607	Marketing and Promotional Materials
608	Pricing Data / Parking Fees and Pricing Data
609	Delivery Preferences and Behavior Data
610	Environmental Awareness Data
611	Product Delivery Costs Data
612	Sustainability Ratings and Certifications Data
613	Transport and Logistics Costs Data
614	Weighing Data
615	Time-specific Delivery Records
72	Vehicle Identification Data
616	Vehicle Manufacturing Data
617	Vehicle Retirement Data
618	Fleet Ownership Data
619	Warehouse Capacity Data
620	Warehouse Layout and Space Utilization Data
621	Inventory Turnover Data
622	Order Fulfillment Data
623	Seasonal and Demand Forecast Data

624	Space Utilization Reports
625	Operational Efficiency Metrics / Service Efficiency Metrics
626	Hub Identification Data
627	Hub Capacity Data
628	Arrival and Departure Logs
629	Vehicle Scheduling Data
630	Real-Time Occupancy Data
631	Historical Occupancy Data
632	Hub Usage Patterns
633	Maintenance and Downtime Records
187	Parking Spot Location Data / Parking Area Locations / Parking Lot Location Data
634	Parking Spot Status Data
635	Usage Duration Data
636	Nearby Business and Commercial Activity Data
637	Loading Zone Usage Data
638	Vehicle Arrival and Departure Times
639	Loading Zone Capacity Data
367	Parking Violations Data
640	Spatial Data Outlining UL Areas
641	Classification/Zoning Codes for UL Designation
642	Attributes Describing UL Area Characteristics
643	Building Footprint Data
171	Land Use Regulations
157	Data Source(s)
643	Parking Slot Identification
189	Parking Slot Availability / Parking Availability Data
645	Parking Facility Details / Parking Facility Infrastructure Data
646	Payment Records / Parking Payment Data
178	Total Parking Spaces
179	Occupied Parking Spaces
646	Parking Lot Type
647	Loading/Unloading Bay Locations
648	Usage Logs
649	Bay Capacity
650	Bay Status
651	Occupancy Sensors Data
652	Privacy Policy Compliance Data
653	Network and IT Infrastructure Data
654	Data Access and Permissions Records
655	Compliance and Regulatory Audit Data
656	Employee Training and Awareness Data
275	Parking Occupancy Data / Parking Lot Occupancy Data
341	Driver Behavior Data
657	Parking Search Time Data
329	Driver Demographics Data
16	Urban Population Data
658	Parking Area Capacity
659	Parking Reservation Data / Reservation System Logs
660	User Information

4.5.2. Datasets most used to calculate KPIs / Sub-indicators in Service Efficiency

The characterization of the most used data depends on the type of monitoring and impact assessment decisions that one would like to make, e.g. strategic, tactical, operational decisions, use data sets with different spatial, temporal granularity and at different level of aggregation. In this section we are providing a general characterization, which might be modified according to the intended purpose of the KPIs and sub-indicators that the data sets will estimate. This might imply that depending on the nature and the objectives of the different UNCHAIN KERs different types of data sets might be considered as the most used.

As seen in the previous section, there are many datasets needed to understand and calculate the Sub-indicators, specifically 365, but there are 27 that are most frequently repeated and therefore important to know, as shown in the following figure (Figure 15):

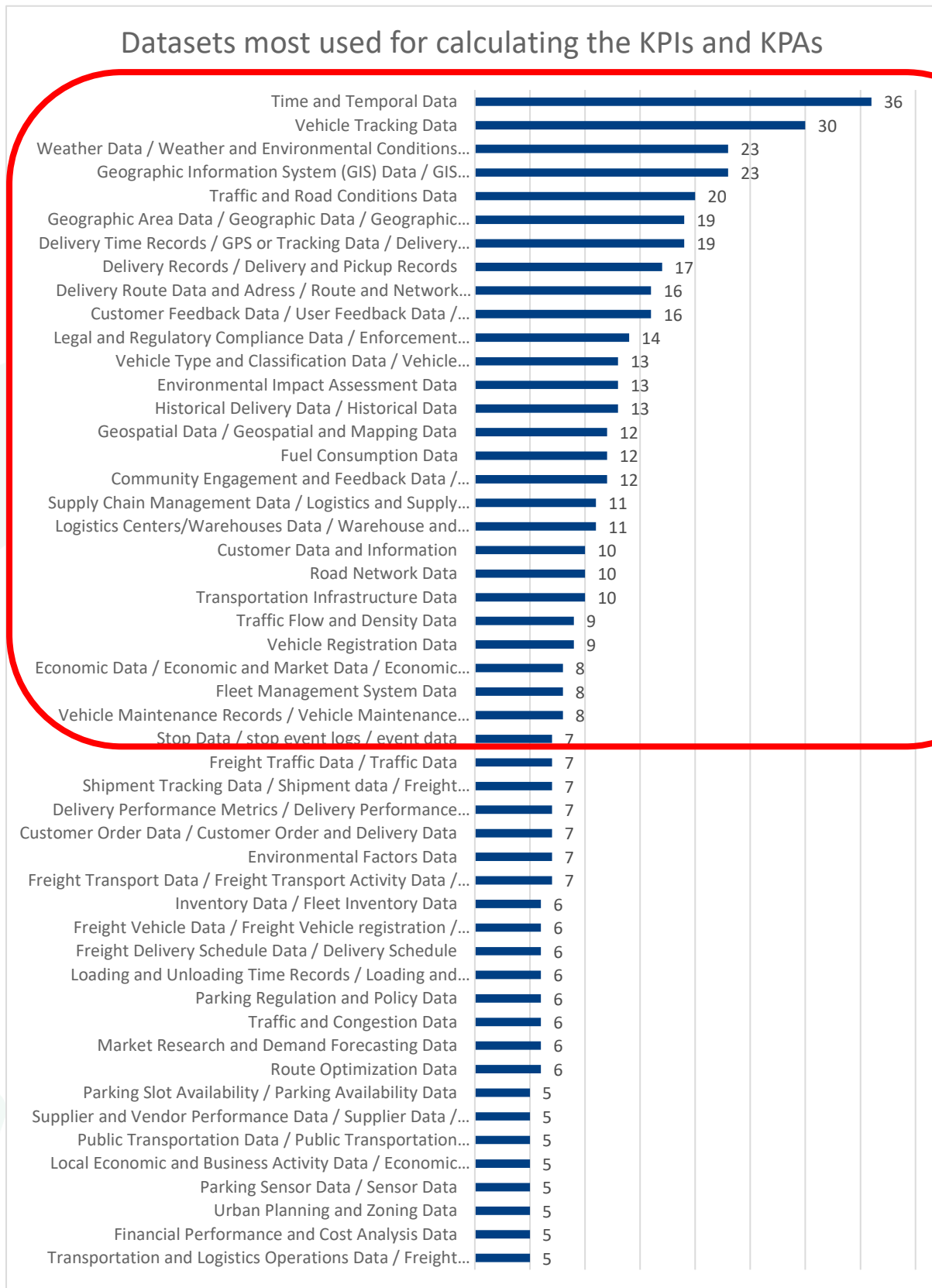


Figure 15. Datasets most used for calculated KPIs and Sub-indicators of Service Efficiency.

The most important datasets, as they are the most used, are:

- Time and Temporal Data
- Vehicle Tracking Data
- Geographic Information System (GIS) Data / GIS Software or Tools
- Weather Data / Weather and Environmental Conditions Data
- Traffic and Road Conditions Data
- Delivery Time Records / GPS or Tracking Data / Delivery Time Logs / Delivery time data
- Geographic Area Data / Geographic Data / Geographic and Spatial Data / Geographic Coordinates of UL Areas
- Delivery Records / Delivery and Pickup Records
- Customer Feedback Data / User Feedback Data / Complaints and Feedback Data
- Delivery Route Data and Address / Route and Network Data / Transport Route Information
- Legal and Regulatory Compliance Data / Enforcement and Compliance Data
- Historical Delivery Data / Historical Data
- Environmental Impact Assessment Data
- Vehicle Type and Classification Data / Vehicle Specifications Data / Vehicle Type and Specifications
- Community Engagement and Feedback Data / Customer/Consumer Preferences, Feedback and Satisfaction Surveys / Survey Data
- Fuel Consumption Data
- Geospatial Data / Geospatial and Mapping Data
- Logistics Centers/Warehouses Data / Warehouse and Distribution Center Data
- Supply Chain Management Data / Logistics and Supply Chain Data
- Transportation Infrastructure Data
- Road Network Data
- Customer Data and Information
- Vehicle Registration Data
- Traffic Flow and Density Data
- Vehicle Maintenance Records / Vehicle Maintenance and Depreciation Costs
- Fleet Management System Data
- Economic Data / Economic and Market Data / Economic indicators

4.5.1. Level of access, level of aggregation and anonymization and ownership of the datasets

Below, the access level, aggregation level, anonymization level, and data holders are shown. This information is derived from a review of the literature and workshops.

4.5.1.1. Level of access

In the following table, an example of classification of the access level of the most necessary data to calculate the KPIs and Sub-indicators for the category Service Efficiency is shown.

- **0 (Open):** Accessible to anyone without any restrictions

- **1 (Public):** Generally accessible to the public without restrictions.
- **2 (Varies):** Access level can vary; it might be public in some cases (with limitations) or restricted (requiring authorization or special conditions).
- **3 (Restricted):** Access is limited to authorized personnel or entities due to privacy, security, or proprietary reasons.
- **4 (Confidential):** Access is highly restricted to a select group of individuals or entities, typically due to the sensitive or proprietary nature of the information.

Table 40. Level of access for each dataset (Service Efficiency).

Data Type	Level of Access
Time and Temporal Data	3 (Restricted)
Vehicle Tracking Data	3 (Restricted)
Geographic Information System (GIS) Data / GIS Software or Tools	2 (Varies)
Weather Data / Weather and Environmental Conditions Data	1 (Public)
Traffic and Road Conditions Data	1 (Public)
Delivery Time Records / GPS or Tracking Data / Delivery Time Logs / Delivery Time Data	3 (Restricted)
Geographic Area Data / Geographic Data / Geographic and Spatial Data / Geographic Coordinates of UL Areas	2 (Varies)
Delivery Records / Delivery and Pickup Records	3 (Restricted)
Customer Feedback Data / User Feedback Data / Complaints and Feedback Data	3 (Restricted)
Delivery Route Data and Address / Route and Network Data / Transport Route Information	2 (Varies)
Legal and Regulatory Compliance Data / Enforcement and Compliance Data	3 (Restricted)
Historical Delivery Data / Historical Data	2 (Varies)
Environmental Impact Assessment Data	1 (Public)
Vehicle Type and Classification Data / Vehicle Specifications Data / Vehicle Type and Specifications	2 (Varies)
Community Engagement and Feedback Data / Customer/Consumer Preferences, Feedback and Satisfaction Surveys / Survey Data	2 (Varies)
Fuel Consumption Data	3 (Restricted) or 2 (Varies)
Geospatial Data / Geospatial and Mapping Data	2 (Varies)
Logistics Centers/Warehouses Data / Warehouse and Distribution Center Data	2 (Varies)
Supply Chain Management Data / Logistics and Supply Chain Data	3 (Restricted)
Transportation Infrastructure Data	1 (Public)
Road Network Data	1 (Public)
Customer Data and Information	3 (Restricted)
Vehicle Registration Data	3 (Restricted)
Traffic Flow and Density Data	1 (Public)
Vehicle Maintenance Records / Vehicle Maintenance and Depreciation Costs	3 (Restricted)

Fleet Management System Data	3 (Restricted)
Economic Data / Economic and Market Data / Economic Indicators	1 (Public)

This table provides a structured overview of access levels based on typical classifications for each type of dataset.

In this case, most of the datasets (44%) have restricted access. Only the 25.9% are public access.

4.5.1.2. Level of aggregation

In the following table, the level of aggregation of the most necessary data to calculate the KPIs and Sub-indicators for the category Service Efficiency is shown:

This categorization is based on the typical granularity and scope of the data, where:

- **3 (High):** aggregation indicates data that is more generalized or aggregated over large areas or populations.
- **2 (Medium):** aggregation indicates data that is moderately detailed, often aggregated over smaller areas or specific intervals.
- **1 (Low):** aggregation indicates highly detailed data, often at the level of individual records or events.

Table 41. Level of aggregation for each dataset (Service Efficiency).

Data Type	Level of Aggregation
Time and Temporal Data	3 (High)
Vehicle Tracking Data	3 (High)
Geographic Information System (GIS) Data / GIS Software or Tools	2 (Medium)
Weather Data / Weather and Environmental Conditions Data	3 (High)
Traffic and Road Conditions Data	2 (Medium)
Delivery Time Records / GPS or Tracking Data / Delivery Time Logs / Delivery time data	3 (High)
Geographic Area Data / Geographic Data / Geographic and Spatial Data / Geographic Coordinates of UL Areas	2 (Medium)
Delivery Records / Delivery and Pickup Records	3 (High)
Customer Feedback Data / User Feedback Data / Complaints and Feedback Data	Low
Delivery Route Data and Address / Route and Network Data / Transport Route Information	2 (Medium)
Legal and Regulatory Compliance Data / Enforcement and Compliance Data	1 (Low)
Historical Delivery Data / Historical Data	3 (High)
Environmental Impact Assessment Data	2 (Medium)
Vehicle Type and Classification Data / Vehicle Specifications Data / Vehicle Type and Specifications	1 (Low)

Community Engagement and Feedback Data / Customer/Consumer Preferences, Feedback and Satisfaction Surveys / Survey Data	1 (Low)
Fuel Consumption Data	2 (Medium)
Geospatial Data / Geospatial and Mapping Data	2 (Medium)
Logistics Centers/Warehouses Data / Warehouse and Distribution Center Data	2 (Medium)
Supply Chain Management Data / Logistics and Supply Chain Data	2 (Medium)
Transportation Infrastructure Data	2 (Medium)
Road Network Data	2 (Medium)
Customer Data and Information	1 (Low)
Vehicle Registration Data	1 (Low)
Traffic Flow and Density Data	2 (Medium)
Vehicle Maintenance Records / Vehicle Maintenance and Depreciation Costs	1 (Low)
Fleet Management System Data	2 (Medium)
Economic Data / Economic and Market Data / Economic indicators	2 (Medium)

4.5.1.3. Anonymization level

In the following table, the level of anonymization of the data is shown; 48.1% have a moderate level.

Anonymization levels:

- **1 (Low)**: Little to no anonymization needed; data is generally non-sensitive.
- **2 (Moderate)**: Some anonymization required to protect privacy or sensitive details.
- **3 (High)**: Significant anonymization needed due to high sensitivity or potential for identification.

Table 42. Anonymization level for each dataset (Service Efficiency).

Data Type	Anonymization Level
Time and Temporal Data	1 (Low)
Vehicle Tracking Data	3 (High)
Geographic Information System (GIS) Data / GIS Software or Tools	2 (Moderate)
Weather Data / Weather and Environmental Conditions Data	1 (Low)
Traffic and Road Conditions Data	2 (Moderate)
Delivery Time Records / GPS or Tracking Data / Delivery Time Logs / Delivery time data	3 (High)
Geographic Area Data / Geographic Data / Geographic and Spatial Data / Geographic Coordinates of UL Areas	2 (Moderate)
Delivery Records / Delivery and Pickup Records	3 (High)
Customer Feedback Data / User Feedback Data / Complaints and Feedback Data	3 (High)

Delivery Route Data and Address / Route and Network Data / Transport Route Information	3 (High)
Legal and Regulatory Compliance Data / Enforcement and Compliance Data	2 (Moderate)
Historical Delivery Data / Historical Data	3 (High)
Environmental Impact Assessment Data	2 (Moderate)
Vehicle Type and Classification Data / Vehicle Specifications Data / Vehicle Type and Specifications	1 (Low)
Community Engagement and Feedback Data / Customer/Consumer Preferences, Feedback and Satisfaction Surveys / Survey Data	2 (Moderate)
Fuel Consumption Data	1 (Low)
Geospatial Data / Geospatial and Mapping Data	2 (Moderate)
Logistics Centers/Warehouses Data / Warehouse and Distribution Center Data	2 (Moderate)
Supply Chain Management Data / Logistics and Supply Chain Data	3 (High)
Transportation Infrastructure Data	2 (Moderate)
Road Network Data	2 (Moderate)
Customer Data and Information	3 (High)
Vehicle Registration Data	3 (High)
Traffic Flow and Density Data	2 (Moderate)
Vehicle Maintenance Records / Vehicle Maintenance and Depreciation Costs	1 (Low)
Fleet Management System Data	3 (High)
Economic Data / Economic and Market Data / Economic indicators	1 (Low)

4.5.1.4. Who has access

Table 43. Entities that have access to the data (Service Efficiency).

Data Type	Access Entities
Time and Temporal Data	Logistics Companies, Fleet Managers, Data Analysts
Vehicle Tracking Data	Logistics Companies, Fleet Managers, Security Agencies
Geographic Information System (GIS) Data / GIS Software or Tools	GIS Specialists, Urban Planners, Logistics Companies
Weather Data / Weather and Environmental Conditions Data	Meteorological Agencies, Logistics Companies, Drivers
Traffic and Road Conditions Data	Traffic Management Centers, Logistics Companies, Fleet Managers
Delivery Time Records / GPS or Tracking Data / Delivery Time Logs / Delivery Time Data	Logistics Companies, Fleet Managers, Data Analysts
Geographic Area Data / Geographic Data / Geographic and Spatial Data / Geographic Coordinates of UL Areas	GIS Specialists, Urban Planners, Logistics Companies

Delivery Records / Delivery and Pickup Records	Logistics Companies, Fleet Managers, Customers
Customer Feedback Data / User Feedback Data / Complaints and Feedback Data	Customer Service Teams, Logistics Companies, Quality Assurance Teams
Delivery Route Data and Address / Route and Network Data / Transport Route Information	Logistics Companies, Fleet Managers, Drivers
Legal and Regulatory Compliance Data / Enforcement and Compliance Data	Regulatory Agencies, Legal Teams, Logistics Companies
Historical Delivery Data / Historical Data	Data Analysts, Logistics Companies, Fleet Managers
Environmental Impact Assessment Data	Environmental Agencies, Logistics Companies, Urban Planners
Vehicle Type and Classification Data / Vehicle Specifications Data / Vehicle Type and Specifications	Fleet Managers, Vehicle Manufacturers, Regulatory Agencies
Community Engagement and Feedback Data / Customer/Consumer Preferences, Feedback and Satisfaction Surveys / Survey Data	Customer Service Teams, Market Researchers, Logistics Companies
Fuel Consumption Data	Fleet Managers, Logistics Companies, Environmental Agencies
Geospatial Data / Geospatial and Mapping Data	GIS Specialists, Urban Planners, Logistics Companies
Logistics Centers/Warehouses Data / Warehouse and Distribution Center Data	Logistics Companies, Warehouse Managers, Supply Chain Managers
Supply Chain Management Data / Logistics and Supply Chain Data	Supply Chain Managers, Logistics Companies, Data Analysts
Transportation Infrastructure Data	Urban Planners, Traffic Management Centers, Regulatory Agencies
Road Network Data	Traffic Management Centers, Urban Planners, Logistics Companies
Customer Data and Information	Customer Service Teams, Logistics Companies, Data Analysts
Vehicle Registration Data	Regulatory Agencies, Fleet Managers, Vehicle Manufacturers
Traffic Flow and Density Data	Traffic Management Centers, Urban Planners, Data Analysts

Vehicle Maintenance Records / Vehicle Maintenance and Depreciation Costs	Fleet Managers, Maintenance Teams, Logistics Companies
Fleet Management System Data	Fleet Managers, Logistics Companies, Data Analysts
Economic Data / Economic and Market Data / Economic Indicators	Economic Analysts, Market Researchers, Logistics Companies

85.2% of the most used data can be accessed by logistic companies, followed by fleet managers (44.4%) and urban planners (25.9%).

4.5.1. How Sub-indicators are calculated- Service Efficiency

In the following table, a preliminary approach is shown on how Sub-indicators related to the category Service Efficiency can be calculated:

Table 44. Sub-indicators and formulas (Service Efficiency)

Sub-indicators	Formula
136. Level of satisfaction with the urban mobility system with focus on weak users (index):	Survey results on satisfaction levels from weak users (index)
137. Customer satisfaction	$(\text{Number of satisfied distributors and customers} / \text{Total number of distributors and customers}) \times 100$
138. Same or better level of service as existing schemes and increased acceptance: On time in full (OTIF):	$(\text{Number of deliveries on time and in full} / \text{Total number of deliveries}) \times 100$
139. Same or better level of service as existing schemes and increased acceptance: Customer satisfaction:	Survey results on customer satisfaction levels
140. Same or better level of service as existing schemes and increased acceptance: Level of acceptance:	$(\text{Number of customers accepting the service} / \text{Total number of customers}) \times 100$
141. End user satisfaction:	Survey results on end user satisfaction levels
142. Light commercial vehicle mileage:	$\sum \text{Miles traveled by light commercial vehicles}$
143. Distance travelled by freight vehicles:	Traffic counts from car plates + Survey results
144. Total km traveled by LEVs and ZEVs:	$\sum \text{Distance traveled by LEVs and ZEVs (km)}$
145. Vehicle-kilometers traveled:	$\sum (\text{Distance traveled by each vehicle} \times \text{Number of vehicles})$
146. Loading and unloading in a zone: Distance covered for loading and unloading in a zone:	$\sum (\text{Distance covered for one delivery/pickup} \times \text{Number of activities})$

147.Delivery organization: Average distance traveled per delivery/pickup:	Total distance from delivery hub to service areas / Total number of deliveries/pickups
148.The distance of warehouse from city center:	Average distance from warehouse to city center Sum of distances from warehouses to city center / Number of warehouses
149.Route kms:	∑Kilometers of delivery routes
150. Loading/unloading time:	Empirical observation of loading/unloading duration (min)
151.Parking time for freight operations:	Observation or sensor data on parking duration for freight vehicles
152.Loading and unloading in a zone: Average number of minutes of on-street parking for delivery or pickup in a zone:	Total on-street parking time for delivery/pickup / Number of vehicles
153.Loading and unloading timeliness: Standard deviation of loading/unloading time for bulk goods:	$\sqrt{\frac{\sum(x_i - \bar{x})^2}{N}}$
where x_i is the loading/unloading time for each observation and \bar{x} is the mean loading/unloading	
154.Loading and unloading timeliness: Standard deviation of loading/unloading time for container goods:	$\sqrt{\frac{\sum(x_i - \bar{x})^2}{N}}$
155.Loading and unloading timeliness: Standard deviation of loading/unloading time for a package:	$\sqrt{\frac{\sum(x_i - \bar{x})^2}{N}}$
156.On-time deliveries: Percentage of on-time deliveries vs. total deliveries:	(Number of on-time deliveries / Total number of deliveries) × 100
157.On-time deliveries on the road:	(Number of on-time road deliveries / Total number of road deliveries) × 100
158.On-time deliveries on the rail:	(Number of on-time rail deliveries / Total number of rail deliveries) × 100
159. On-time deliveries on inland waterways:	(Number of on-time waterway deliveries / Total number of waterway deliveries) × 100
160.Reliability of just-in-time freight deliveries:	(Number of just-in-time deliveries / Total number of planned deliveries) × 100
161.Delivery on time:	(Number of on-time deliveries / Total number of deliveries) × 100
162.Capacity utilization:	(Space Used / Total Space) × 100
163. Load factors:	Load Factor (Weight) = (Weight of Transported Cargo / Total Weight Capacity)×100 Or

	$\text{Load Factor (Volume)} = \frac{\text{Volume of Transported Cargo}}{\text{Total Volume Capacity}} \times 100$
164. Increased utilization of load capacity of vehicles:	$(\text{Average load} / \text{Vehicle capacity}) \times 100$
165. Increased utilization of load capacity of vehicles: Integration of goods and passenger flows:	Number of integrated services
166. Load percentage:	Number of integrated services
167. Low emission delivery:	$\text{Distance traveled by low emission vehicles} / \text{Total distance traveled} \times 100$
168. Modal split: Percentage of total inland freight ton-km:	$(\text{Freight ton-km by mode} / \text{Total freight ton-km}) \times 100$
169. Modal Split goods:	$(\text{Goods volume by mode} / \text{Total goods volume}) \times 100$
170. Number of freight movements:	$\text{Total freight vehicles passing reference points} / \text{Time period}$
171. Number of goods movements:	$\text{Total goods (parcels, tons) transported} / \text{Time period}$
172. Modal split (for freight transport):	$(\text{Freight vehicle kilometers by mode} / \text{Total freight vehicle kilometers}) \times 100$
173. Modal split (freight tonnes kilometers):	$(\text{Freight tonne kilometers by mode} / \text{Total freight tonne kilometers}) \times 100$
174. Overall transited cargo in the city split by transport mode:	Cargo volume split by mode (road, rail, air, water)
175. Type of goods delivered:	Classification of delivered goods by type
176. Modal split:	$(\text{Freight transport by mode} / \text{Total freight transport}) \times 100$
177. Type of goods:	Classification of goods by type
178. Freight logistic intensity:	Traffic counts through car plates
179. Speed (within urban core during peak hours):	$\text{Average speed per delivery} = \frac{\text{Total distance traveled}}{\text{Total time excluding stops}}$
180. Delivery productivity: Average tons delivered per km=	$\text{Total tons delivered} / \text{Total kilometers traveled}$
181. Delivery productivity: Average deliveries per day =	$\text{Total number of deliveries} / \text{Total operational time}$
182. Delivery organization:	$\text{Average deliveries per round} = \frac{\text{Total deliveries}}{\text{Total delivery rounds}}$
183. Increased speed of delivery:	$\text{Time per delivery} = \frac{\text{Total delivery time}}{\text{Total deliveries}}$
184. Increased speed of delivery:	$\text{Number of delivery attempts} = \frac{\text{Total number of delivery attempts}}{\text{Total deliveries}}$

185.More efficient use of vehicle fleet:	Deliveries per tour = Total deliveries / Total tours
186.More efficient use of vehicle fleet:	Dimension weight per day=Total dimension weight / Total days
187.More efficient use of vehicle fleet:	Drop density per vehicle = (Number of drops / Total vehicle capacity) x 100
188.More efficient use of vehicle fleet	(Total days in operation / Total vehicles) x100
189.Number of deliveries:	Total number of deliveries
190.Total freight per day:	Total weight of freight delivered per day
191.Packages per month:	Total number of packages delivered /Total months
192.Number of stops per day:	Total stops / Total days
193.Deliveries per stop:	Total deliveries / Total stops
194.Time to delivery:	Total delivery time / Total deliveries
195. Economically sustainable business models: Last mile delivery cost per delivery / pick up:	Last mile delivery cost per delivery=Total last mile delivery cost / Total deliveries/pickups
196.Economically sustainable business models: Distribution and warehouse cost per delivery / pick up:	Distribution and warehouse cost per delivery = Total distribution and warehouse cost / Total deliveries/pickups
197.Business models: Investment costs for the city:	Investment costs for the city = Total investment cost
198.Percentage of total vehicle-kilometers that run empty	Percentage of empty vehicle-kilometers= (Total empty kilometers / Total vehicle kilometers) x 100
199.Recipient awareness of sustainable delivery options:	Recipient awareness index = Survey results on recipient awareness
200.Recipient willingness to pay for sustainable delivery:	Survey results on willingness to pay <i>(*) Note: From 190 to 200 all sensitive data</i>
201.Hours that vehicles are in service:	Hours in service = \sum Hours vehicles are active over 24 hours
202.% delivery vehicles from 22h to 7h/total:	%delivery vehicles from 22h to 7h = (Number of vehicles active from 22h to 7h / Total number of vehicles) x 100
203.Average age of freight vehicles:	\sum Age of each vehicle / Total number of vehicles
204.Warehouse utilization:	(Total utilized space / Total warehouse space) x 100
205.Occupancy time of hubs:	Total time hubs are occupied
206.Occupancy status of loading and unloading parking spots:	Occupancy status = Percentage of time parking spots are occupied
207.Use of loading areas:	Percentage of time loading areas are used
208.UL areas occupation:	Percentage of time UL areas are occupied

209.Parking slots occupancy:	Percentage of time parking slots are occupied
210.Parking lots occupancy:	Percentage of time parking lots are occupied
211. Occupancy time loading / unloading bays	Percentage of time loading/unloading bays are occupied
212.Privacy:	Level of data protection and confidentiality measures
213.Time to find parking:	Total time spent finding parking / Number of parking attempts
214.Time lost to find parking:	Total additional time spent due to parking unavailability
215.Time spent finding parking:	Total time spent finding parking
216.Reservation of parking areas:	Percentage of reserved parking areas
217.Constraints identified during the last mile stage:	List and analysis of constraints encountered

5. KPIs and KERs

This section relates the KERs to the KPIs analyzed earlier, so indirectly we can also identify the most associated Sub-indicators, how they are calculated, and the datasets linked to them.

- First, the methodology, sample, and participant profile are presented.
- Second, the analysis of the KERs as a whole.
- Finally, the analysis of each KER: 4, 5, 6, 8, 9, 10, 11, 12, and 13.

5.1.1. Methodology to associate KERs and KPIs

This section presents the results of the work with the project partners during the meeting in Madrid. First, the KERs were associated with the KPIs through a questionnaire (Annex 8.5). Second, we worked on defining the datasets needed for each KER. The participants in the meeting and questionnaire comprise a sample of 29 people with the following professional profiles:

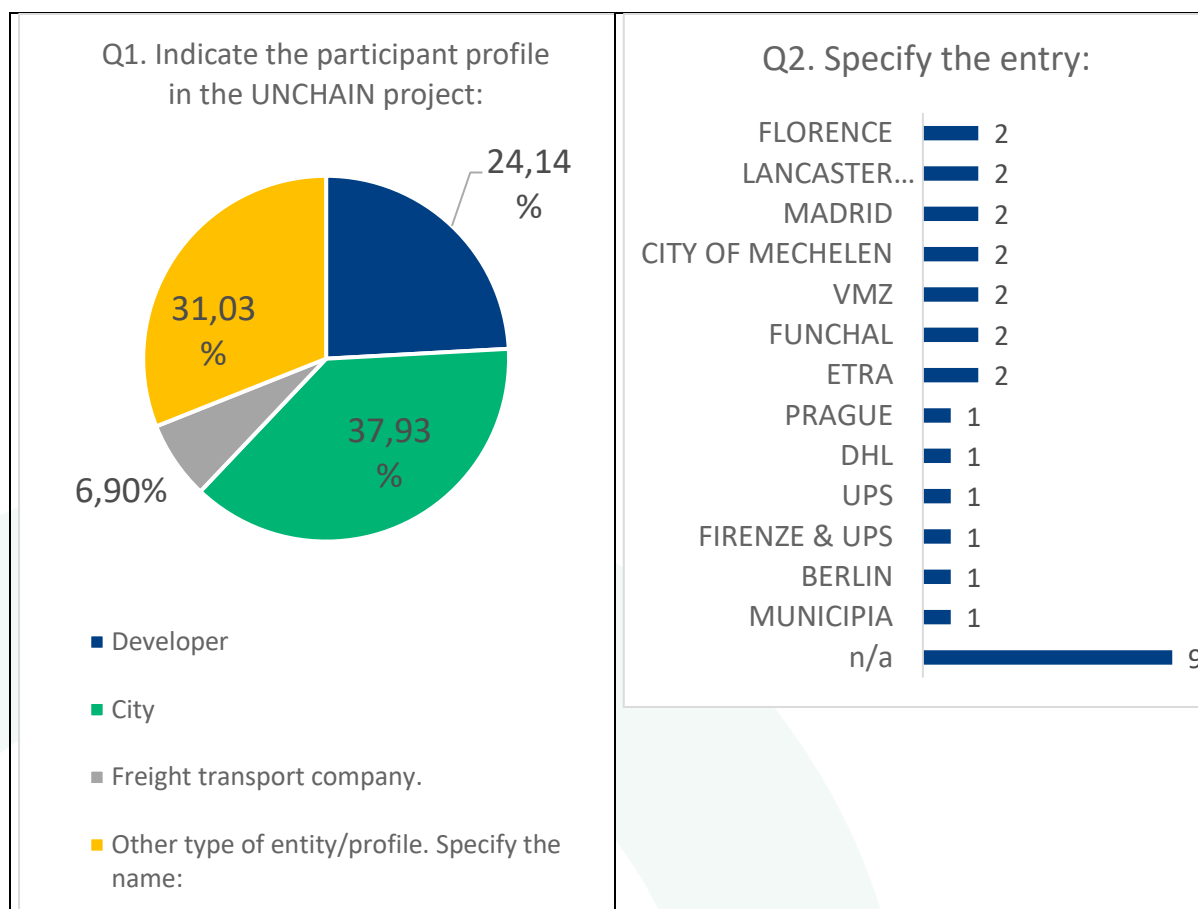


Figure 16. Profile of participants.

5.1.2. KERs and KPIs

If we analyze all the KERs together (KER 4, 5, 6, 8, 9, 10, 11, 12, and 13), the KPIs chosen by more than 40% and therefore the most important are:

- KPI_8: Carbon footprint of deliveries (57.89%).
- KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics (56.14%).
- KPI_22: Soft violations (unauthorized parking in loading zones.) (52.63%).
- KPI_19: Congestion (51.75%).
- KPI_18: Percentage of freight vehicles in total vehicular traffic (50%).
- KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV) (42.98%).
- KPI_3: GHG emissions (42.12%).

The most important KPIs are part of the Traffic Management category (38.25%) and Urban Planning category (25.77%).

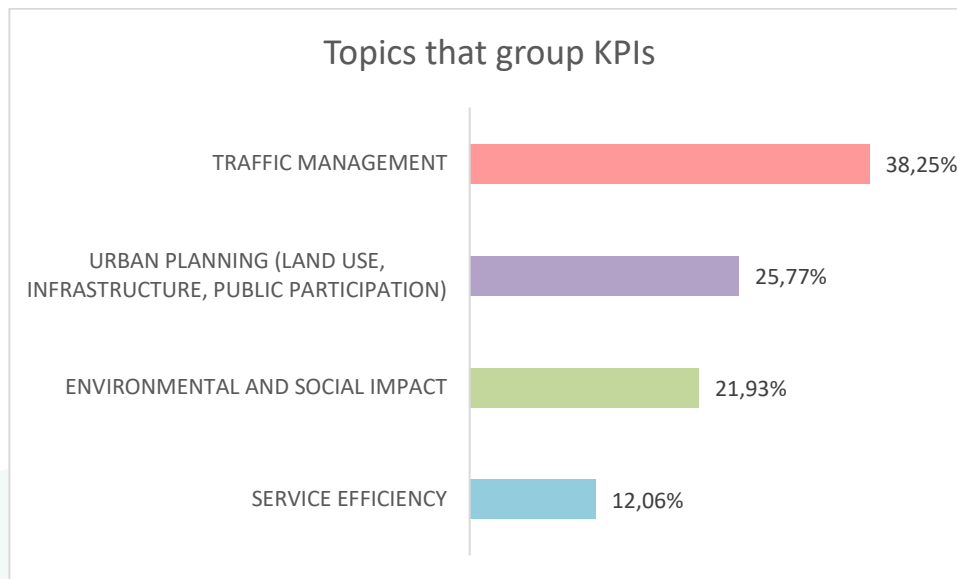


Figure 17. Categories to which the KPIs most associated with the KERs belong

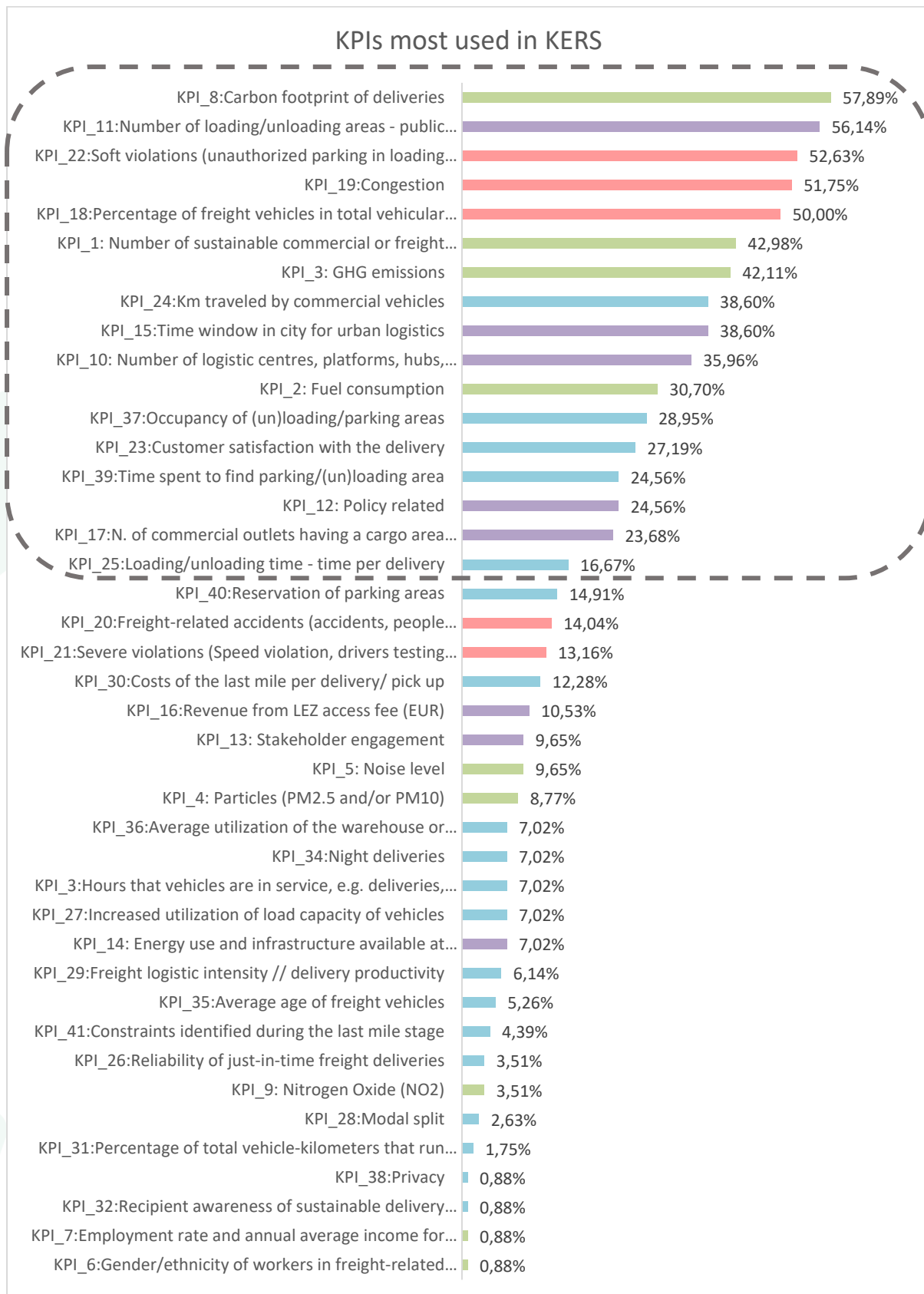


Figure 18. KPIs most associated with the KERS.

5.1.3. KER 4

The participants in the workshop and project partners associate KER 4 primarily with the following KPIs, with an association above 40%:

- KPI_10: Number of logistic centres, platforms, hubs, lockers (100%)
- KPI_18: Percentage of freight vehicles in total vehicular traffic (84.62%)
- KPI_19: Congestion (76.92%)
- KPI_2: Fuel consumption (61.54%)
- KPI_8: Carbon footprint of deliveries (61.54%)
- KPI_17: N. of commercial outlets having a cargo area within a 75 m radius. (46.15%)
- KPI_24: Km traveled by commercial vehicles (42.86%), and
- KPI_37: Occupancy of (un)loading/parking areas (42.86%).

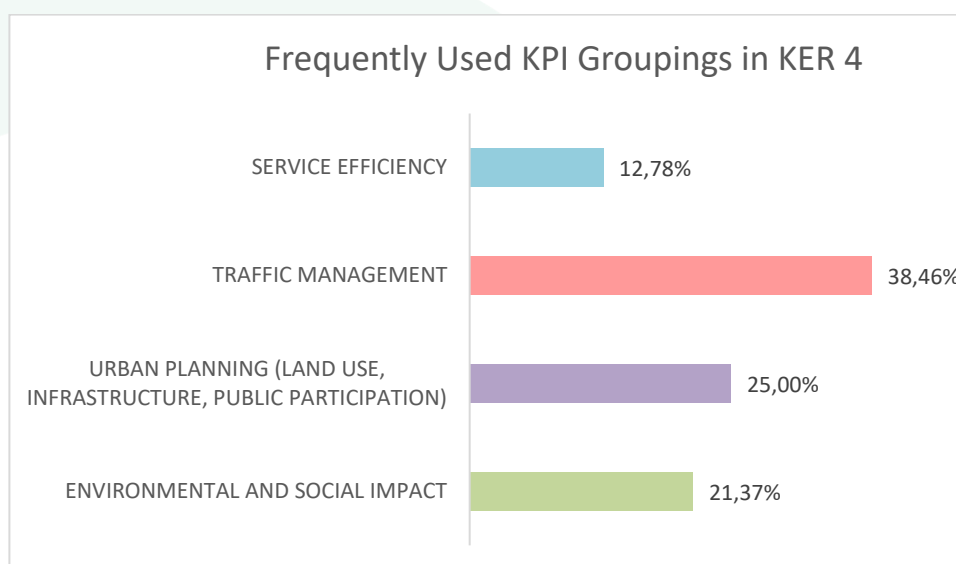


Figure 19. Categories to which the KPIs most associated with the KER 4.

The most important KPIs are part of the Traffic Management category (38.46%) and Urban Planning category (25.0%)

Table 45. KPIs most associated with KER 4.

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_10: Number of logistic centres, platforms, hubs, lockers	100.00%
TRAFFIC MANAGEMENT	KPI_18: Percentage of freight vehicles in total vehicular traffic	84.62%
TRAFFIC MANAGEMENT	KPI_19: Congestion	76.92%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_2: Fuel consumption	61.54%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_8: Carbon footprint of deliveries	61.54%

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_17: N. of commercial outlets having a cargo area within a 75 m radius.	46.15%
SERVICE EFFICIENCY	KPI_24: Km traveled by commercial vehicles	42.86%
SERVICE EFFICIENCY	KPI_37: Occupancy of (un)loading/parking areas	42.86%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_3: GHG emissions	38.46%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics	38.46%
SERVICE EFFICIENCY	KPI_30: Costs of the last mile per delivery/ pick up	28.57%
SERVICE EFFICIENCY	KPI_26: Reliability of just-in-time freight deliveries	21.43%
SERVICE EFFICIENCY	KPI_36: Average utilization of the warehouse or distribution centers	21.43%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)	15.38%
TRAFFIC MANAGEMENT	KPI_22: Soft violations (unauthorized parking in loading zones...)	15.38%
SERVICE EFFICIENCY	KPI_29: Freight logistic intensity // delivery productivity	14.29%
SERVICE EFFICIENCY	KPI_40: Reservation of parking areas	14.29%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_5: Noise level	7.69%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_9: Nitrogen Oxide (NO2)	7.69%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_12: Policy related	7.69%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_13: Stakeholder engagement	7.69%
TRAFFIC MANAGEMENT	KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc.)	7.69%
TRAFFIC MANAGEMENT	KPI_21: Severe violations (Speed violation, drivers testing positive on alcohol or drugs)	7.69%
SERVICE EFFICIENCY	KPI_23: Customer satisfaction with the delivery	7.14%
SERVICE EFFICIENCY	KPI_25: Loading/unloading time - time per delivery	7.14%
SERVICE EFFICIENCY	KPI_27: Increased utilization of load capacity of vehicles	7.14%
SERVICE EFFICIENCY	KPI_32: Recipient awareness of sustainable delivery options (index) // Recipient willingness to pay for sustainable delivery (index)	7.14%
SERVICE EFFICIENCY	KPI_33: Hours that vehicles are in service, e.g., deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours	7.14%

SERVICE EFFICIENCY	KPI_35: Average age of freight vehicles	7.14%
SERVICE EFFICIENCY	KPI_39: Time spent to find parking/(un)loading area	7.14%
SERVICE EFFICIENCY	KPI_41: Constraints identified during the last mile stage	7.14%

5.1.4. KER 5

The participants in the workshop and project partners associate KER 5 primarily with the following KPIs, with an association above 40%:

- KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics (93.33%).
- KPI_22: Soft violations (unauthorized parking in loading zones...) (75.00%).
- KPI_19: Congestion (58.33%).
- KPI_8: Carbon footprint of deliveries (57.14%).
- KPI_24: Km traveled by commercial vehicles (42.86%).
- KPI_17: N. of commercial outlets having a cargo area within a 75 m radius (40.00%).

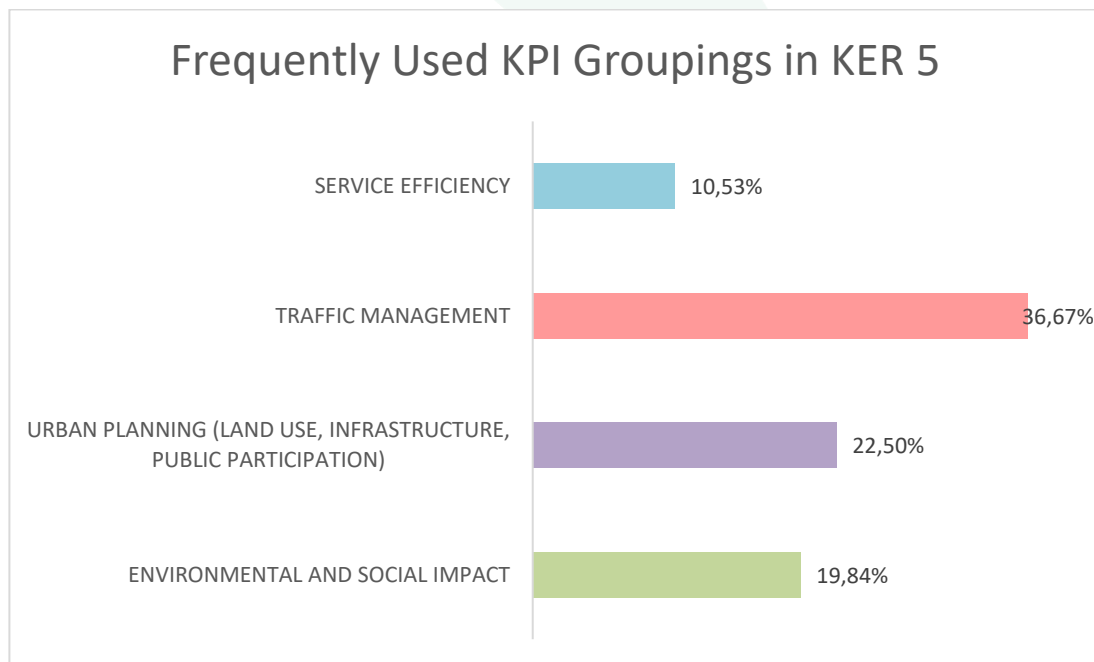


Figure 20. Categories to which the KPIs most associated with the KER 5.

The most important KPIs are part of the Traffic Management category (36.67%) and Urban Planning category (22.5%).

Table 46. KPIs most associated with KER 5.

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics	93.33%
TRAFFIC MANAGEMENT	KPI_22: Soft violations (unauthorized parking in loading zones...)	75.00%
TRAFFIC MANAGEMENT	KPI_19: Congestion	58.33%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_8: Carbon footprint of deliveries	57.14%
SERVICE EFFICIENCY	KPI_24: Km traveled by commercial vehicles	42.86%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_17: N. of commercial outlets having a cargo area within a 75 m radius.	40.00%
SERVICE EFFICIENCY	KPI_23: Customer satisfaction with the delivery	35.71%
SERVICE EFFICIENCY	KPI_39: Time spent to find parking/(un)loading area	35.71%
TRAFFIC MANAGEMENT	KPI_18: Percentage of freight vehicles in total vehicular traffic	33.33%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_2: Fuel consumption	28.57%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_3: GHG emissions	28.57%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_4: Particles (PM2.5 and/or PM10)	28.57%
SERVICE EFFICIENCY	KPI_25: Loading/unloading time - time per delivery	28.57%
SERVICE EFFICIENCY	KPI_37: Occupancy of (un)loading/parking areas	28.57%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_10: Number of logistic centres, platforms, hubs, lockers	26.67%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_5: Noise level	21.43%
TRAFFIC MANAGEMENT	KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc.)	16.67%
SERVICE EFFICIENCY	KPI_29: Freight logistic intensity // delivery productivity	14.29%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)	7.14%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_7: Employment rate and annual average income for freight employees in city	7.14%
SERVICE EFFICIENCY	KPI_30: Costs of the last mile per delivery/ pick up	7.14%
SERVICE EFFICIENCY	KPI_40: Reservation of parking areas	7.14%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_12: Policy related	6.67%

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_13: Stakeholder engagement	6.67%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_15: Time window in city for urban logistics	6.67%

5.1.5. KER 6

The participants in the workshop and project partners associate KER 6 primarily with the following KPIs, with an association above 40%:

- KPI_18: Percentage of freight vehicles in total vehicular traffic (92.86%).
- KPI_12: Policy related (66.67%).
- KPI_19: Congestion (64.29%).
- KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV) (62.50%).
- KPI_8: Carbon footprint of deliveries (56.25%).
- KPI_15: Time window in city for urban logistics (53.33%).
- KPI_16: Revenue from LEZ access fee (EUR). (53.33%).
- KPI_34: Night deliveries (40.0%).

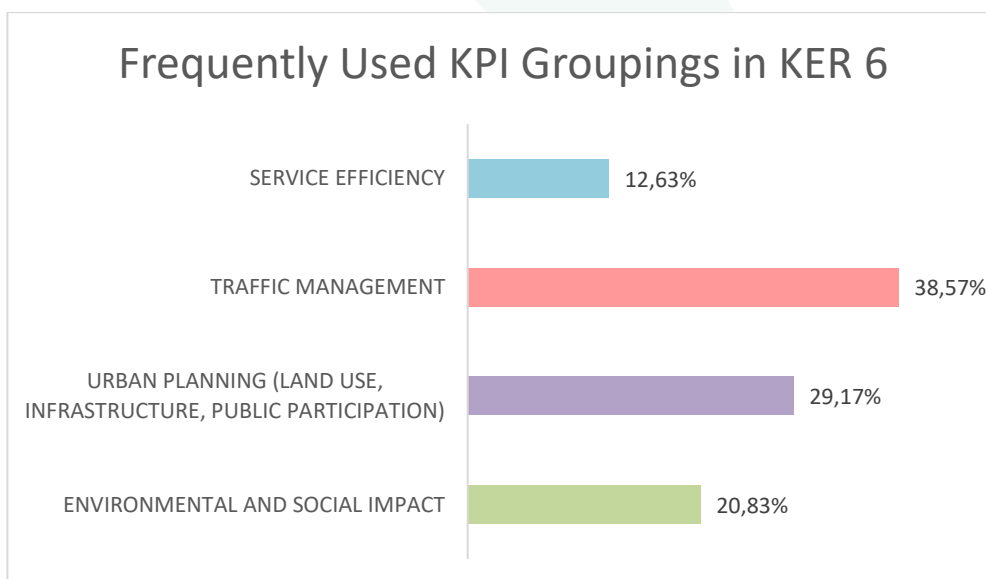


Figure 21. Categories to which the KPIs most associated with the KER 6.

The most important KPIs are part of the Traffic Management category (38.57%) and Urban Planning category (29.17%).

Table 47. KPIs most associated with KER 6.

TRAFFIC MANAGEMENT	KPI_18: Percentage of freight vehicles in total vehicular traffic	92.86%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_12: Policy related	66.67%
TRAFFIC MANAGEMENT	KPI_19: Congestion	64.29%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)	62.50%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_8: Carbon footprint of deliveries	56.25%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_15: Time window in city for urban logistics	53.33%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_16: Revenue from LEZ access fee (EUR)	53.33%
SERVICE EFFICIENCY	KPI_34: Night deliveries	40.00%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_3: GHG emissions	37.50%
SERVICE EFFICIENCY	KPI_24: Km traveled by commercial vehicles	33.33%
SERVICE EFFICIENCY	KPI_25: Loading/unloading time - time per delivery	26.67%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_2: Fuel consumption	25.00%
TRAFFIC MANAGEMENT	KPI_21: Severe violations (Speed violation, drivers testing positive on alcohol or drugs)	21.43%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_10: Number of logistic centres, platforms, hubs, lockers	20.00%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics	20.00%
SERVICE EFFICIENCY	KPI_39: Time spent to find parking/(un)loading area	20.00%
SERVICE EFFICIENCY	KPI_40: Reservation of parking areas	20.00%
TRAFFIC MANAGEMENT	KPI_22: Soft violations (unauthorized parking in loading zones...)	14.29%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_13: Stakeholder engagement	13.33%
SERVICE EFFICIENCY	KPI_23: Customer satisfaction with the delivery	13.33%
SERVICE EFFICIENCY	KPI_27: Increased utilization of load capacity of vehicles	13.33%
SERVICE EFFICIENCY	KPI_28: Modal split	13.33%
SERVICE EFFICIENCY	KPI_30: Costs of the last mile per delivery/ pick up	13.33%

SERVICE EFFICIENCY	KPI_35: Average age of freight vehicles	13.33%
SERVICE EFFICIENCY	KPI_36: Average utilization of the warehouse or distribution centers	13.33%
SERVICE EFFICIENCY	KPI_37: Occupancy of (un)loading/parking areas	13.33%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_17: N. of commercial outlets having a cargo area within a 75 m radius.	6.67%
SERVICE EFFICIENCY	KPI_41: Constraints identified during the last mile stage	6.67%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_5: Noise level	6.25%

5.1.6. KER 8

KER7 is not included in the analysis because it is a KER that aims to: "*KER7. Knowledge powerhouse for urban logistics UNCHAIN will set and maintain a knowledge hub to capitalize on expertise from the consortium and its networks (e.g., CIVITAS), and the international state-of-the-art. The platform will consolidate the R&I findings of the living labs and will set up the mechanisms to facilitate capacity building, interactive knowledge sharing, and good practices exchange among project partners, SEG members and external experts. ...*"

The participants in the workshop and project partners associate KER 8 primarily with the following KPIs, with an association above 40%:

- KPI_22: Soft violations (unauthorized parking in loading zones...) (78.57%).
- KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV) (71.43%).
- KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics (71.43%).
- KPI_15: Time window in city for urban logistics (57.14%).
- KPI_3: GHG emissions (50.0%).
- KPI_19: Congestion (50.0%).
- KPI_24: Km traveled by commercial vehicles (42.86%).

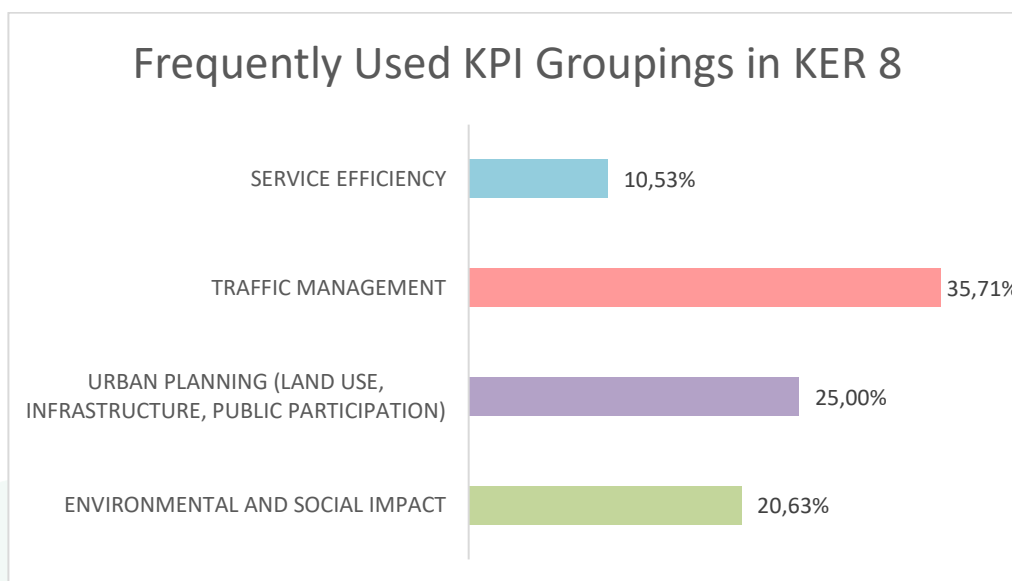


Figure 22. Categories to which the KPIs most associated with the KER 8.

The most important KPIs are part of the Traffic Management category (35.71%) and Urban Planning category (25.0%).

Table 48. KPIs most associated with KER 8.

TRAFFIC MANAGEMENT	KPI_22: Soft violations (unauthorized parking in loading zones...)	78.57%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)	71.43%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics	71.43%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_15: Time window in city for urban logistics	57.14%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_3: GHG emissions	50.00%
TRAFFIC MANAGEMENT	KPI_19: Congestion	50.00%
SERVICE EFFICIENCY	KPI_24: Km traveled by commercial vehicles	42.86%
SERVICE EFFICIENCY	KPI_23: Customer satisfaction with the delivery	35.71%
SERVICE EFFICIENCY	KPI_37: Occupancy of (un)loading/parking areas	35.71%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_2: Fuel consumption	28.57%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_8: Carbon footprint of deliveries	28.57%
TRAFFIC MANAGEMENT	KPI_18: Percentage of freight vehicles in total vehicular traffic	28.57%
SERVICE EFFICIENCY	KPI_39: Time spent to find parking/(un)loading area	28.57%

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_12: Policy related	21.43%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_17: N. of commercial outlets having a cargo area within a 75 m radius.	21.43%
SERVICE EFFICIENCY	KPI_25: Loading/unloading time - time per delivery	21.43%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_10: Number of logistic centres, platforms, hubs, lockers	14.29%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_13: Stakeholder engagement	14.29%
TRAFFIC MANAGEMENT	KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc.)	14.29%
SERVICE EFFICIENCY	KPI_30: Costs of the last mile per delivery/ pick up	14.29%
SERVICE EFFICIENCY	KPI_40: Reservation of parking areas	14.29%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_4: Particles (PM2.5 and/or PM10)	7.14%
TRAFFIC MANAGEMENT	KPI_21: Severe violations (Speed violation, drivers testing positive on alcohol or drugs)	7.14%
SERVICE EFFICIENCY	KPI_33: Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours	7.14%

5.1.7. KER 9

The participants in the workshop and project partners associate KER 9 primarily with the following KPIs, with an association above 40%:

- KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics (100.0%).
- KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV) (90.91%).
- KPI_22: Soft violations (unauthorized parking in loading zones...) (72.73%).
- KPI_37: Occupancy of (un)loading/parking areas (60.0%).
- KPI_3: GHG emissions (54.55%).
- KPI_15: Time window in city for urban logistics (54.55%).
- KPI_19: Congestion (54.55%).
- KPI_18: Percentage of freight vehicles in total vehicular traffic (45.45%).
- KPI_39: Time spent to find parking/(un)loading area (40.0%).

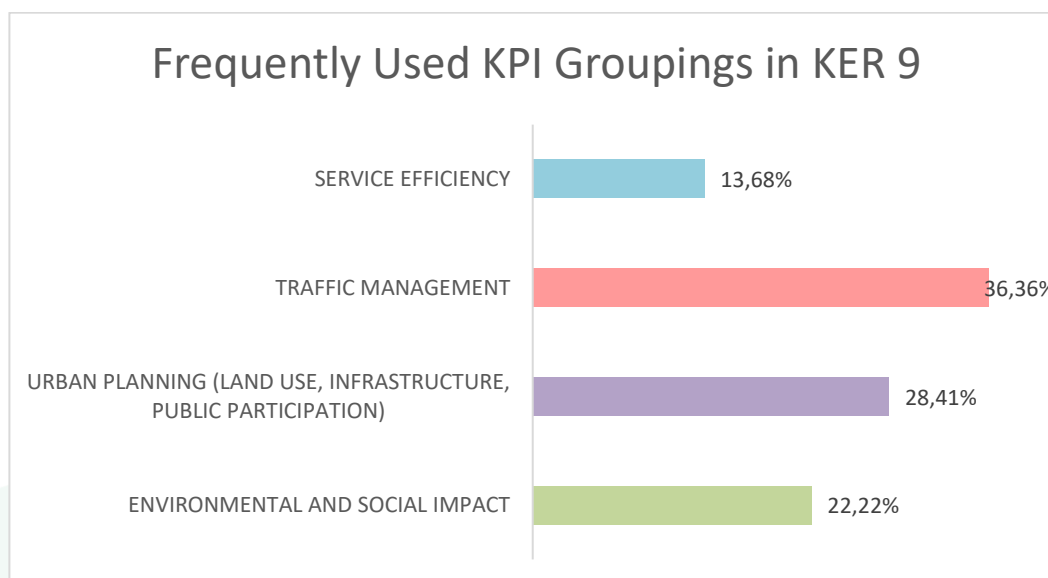


Figure 23. Categories to which the KPIs most associated with the KER 9.

The most important KPIs are part of the Traffic Management category (36.36%) and Urban Planning category (28.41%).

Table 49. KPIs most associated with KER 9.

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics	100.00%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)	90.91%
TRAFFIC MANAGEMENT	KPI_22: Soft violations (unauthorized parking in loading zones...)	72.73%
SERVICE EFFICIENCY	KPI_37: Occupancy of (un)loading/parking areas	60.00%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_3: GHG emissions	54.55%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_15: Time window in city for urban logistics	54.55%
TRAFFIC MANAGEMENT	KPI_19: Congestion	54.55%
TRAFFIC MANAGEMENT	KPI_18: Percentage of freight vehicles in total vehicular traffic	45.45%
SERVICE EFFICIENCY	KPI_39: Time spent to find parking/(un)loading area	40.00%
SERVICE EFFICIENCY	KPI_23: Customer satisfaction with the delivery	30.00%
SERVICE EFFICIENCY	KPI_25: Loading/unloading time - time per delivery	30.00%
SERVICE EFFICIENCY	KPI_40: Reservation of parking areas	30.00%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_10: Number of logistic centres, platforms, hubs, lockers	27.27%

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_13: Stakeholder engagement	27.27%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_5: Noise level	18.18%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_8: Carbon footprint of deliveries	18.18%
SERVICE EFFICIENCY	KPI_24: Km traveled by commercial vehicles	10.00%
SERVICE EFFICIENCY	KPI_27: Increased utilization of load capacity of vehicles	10.00%
SERVICE EFFICIENCY	KPI_33: Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours	10.00%
SERVICE EFFICIENCY	KPI_35: Average age of freight vehicles	10.00%
SERVICE EFFICIENCY	KPI_36: Average utilization of the warehouse or distribution centers	10.00%
SERVICE EFFICIENCY	KPI_38: Privacy	10.00%
SERVICE EFFICIENCY	KPI_41: Constraints identified during the last mile stage	10.00%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_2: Fuel consumption	9.09%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_4: Particles (PM2.5 and/or PM10)	9.09%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_12: Policy related	9.09%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_17: N. of commercial outlets having a cargo area within a 75 m radius.	9.09%
TRAFFIC MANAGEMENT	KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc.)	9.09%

5.1.8. KER 10

The participants in the workshop and project partners associate KER 10 primarily with the following KPIs, with an association above 40%:

- KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics (63.64%).
- KPI_8: Carbon footprint of deliveries (62.5%).
- KPI_18: Percentage of freight vehicles in total vehicular traffic (60.0%).
- KPI_19: Congestion (60.0%).
- KPI_22: Soft violations (unauthorized parking in loading zones...) (50.0%).
- KPI_39: Time spent to find parking/(un)loading area (44.44%).

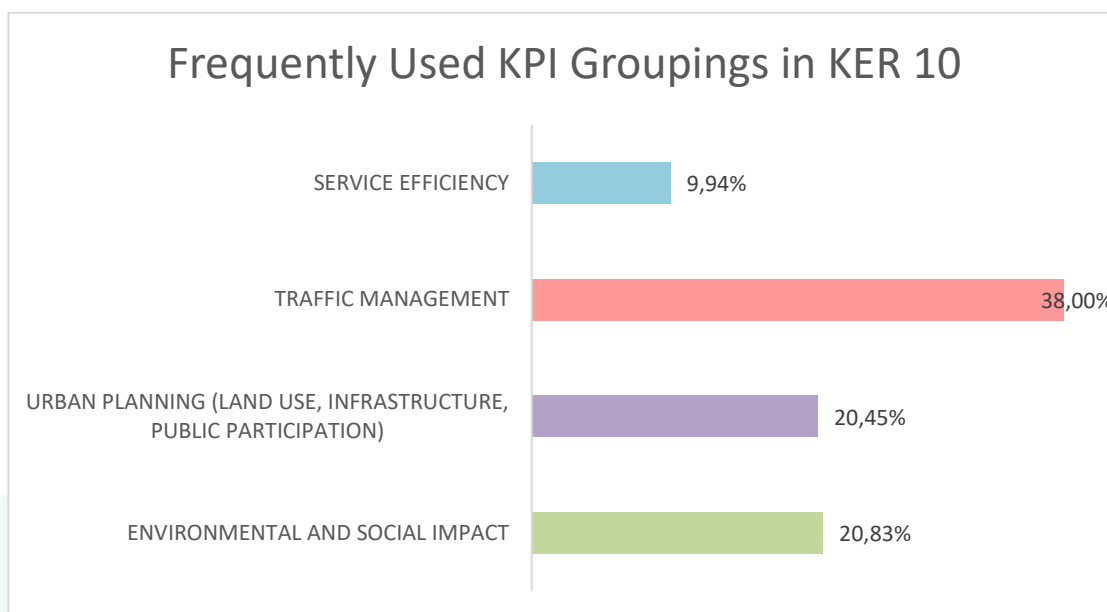


Figure 24. Categories to which the KPIs most associated with the KER 10.

The most important KPIs are part of the Traffic Management category (38.0%) and Environment and social impact (20.83%).

Table 50. KPIs most associated with KER 10.

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics	63.64%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_8: Carbon footprint of deliveries	62.50%
TRAFFIC MANAGEMENT	KPI_18: Percentage of freight vehicles in total vehicular traffic	60.00%
TRAFFIC MANAGEMENT	KPI_19: Congestion	60.00%
TRAFFIC MANAGEMENT	KPI_22: Soft violations (unauthorized parking in loading zones...)	50.00%
SERVICE EFFICIENCY	KPI_39: Time spent to find parking/(un)loading area	44.44%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)	37.50%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_3: GHG emissions	37.50%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_10: Number of logistic centres, platforms, hubs, lockers	36.36%
SERVICE EFFICIENCY	KPI_37: Occupancy of (un)loading/parking areas	33.33%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_17: N. of commercial outlets having a cargo area within a 75 m radius.	27.27%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_2: Fuel consumption	25.00%

SERVICE EFFICIENCY	KPI_29: Freight logistic intensity // delivery productivity	22.22%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_15: Time window in city for urban logistics	18.18%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_5: Noise level	12.50%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_6: Gender/ethnicity of workers in freight-related industries & occupations	12.50%
SERVICE EFFICIENCY	KPI_23: Customer satisfaction with the delivery	11.11%
SERVICE EFFICIENCY	KPI_24: Km traveled by commercial vehicles	11.11%
SERVICE EFFICIENCY	KPI_26: Reliability of just-in-time freight deliveries	11.11%
SERVICE EFFICIENCY	KPI_30: Costs of the last mile per delivery/ pick up	11.11%
SERVICE EFFICIENCY	KPI_31: Percentage of total vehicle-kilometers that run empty	11.11%
SERVICE EFFICIENCY	KPI_33: Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours	11.11%
SERVICE EFFICIENCY	KPI_36: Average utilization of the warehouse or distribution centers	11.11%
SERVICE EFFICIENCY	KPI_40: Reservation of parking areas	11.11%
TRAFFIC MANAGEMENT	KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc.)	10.00%
TRAFFIC MANAGEMENT	KPI_21: Severe violations (Speed violation, drivers testing positive on alcohol or drugs)	10.00%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_12: Policy related	9.09%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_14: Energy use and infrastructure available at warehouses, microplatforms, etc	9.09%

5.1.9. KER 11

The participants in the workshop and project partners associate KER 11 primarily with the following KPIs, with an association above 40%:

- KPI_8: Carbon footprint of deliveries (90.0%).
- KPI_22: Soft violations (unauthorized parking in loading zones...) (77.78%).
- KPI_15: Time window in city for urban logistics (72.73%).
- KPI_23: Customer satisfaction with the delivery (66.67%).
- KPI_24: km traveled by commercial vehicles (55.56%).
- KPI_12: Policy related (45.45%).
- KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV) (40.0%).
- KPI_3: GHG emissions (40.0%).

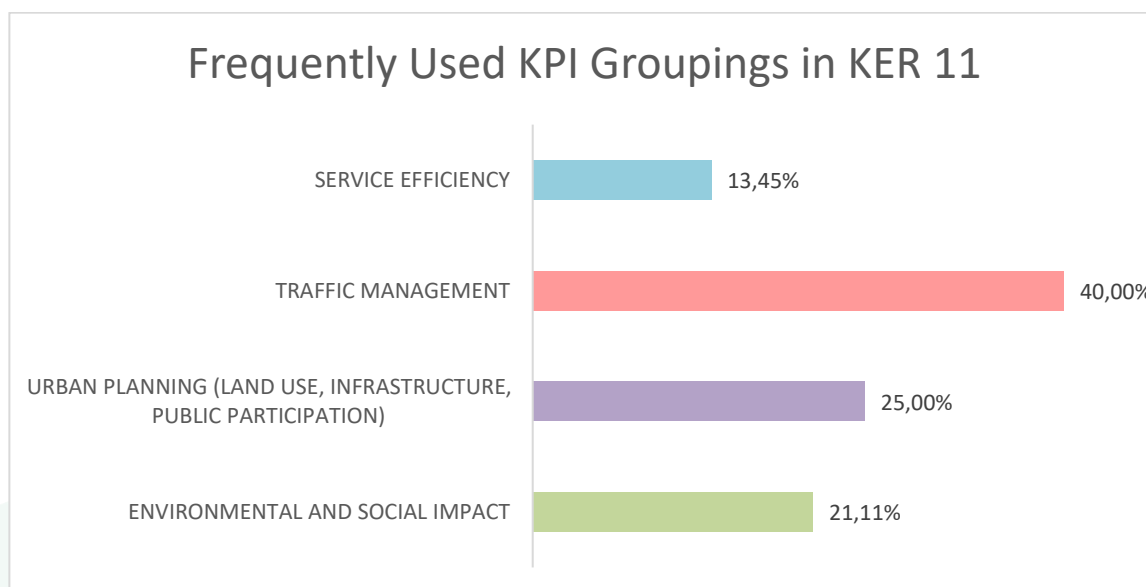


Figure 25. Categories to which the KPIs most associated with the KER 11.

The most important KPIs are part of the Traffic Management category (40.0%) and Urban Planning (25.0%).

Table 51. KPIs most associated with KER 11.

ENVIRONMENTAL AND SOCIAL IMPACT	KPI_8: Carbon footprint of deliveries	90.00%
TRAFFIC MANAGEMENT	KPI_22: Soft violations (unauthorized parking in loading zones...)	77.78%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_15: Time window in city for urban logistics	72.73%
SERVICE EFFICIENCY	KPI_23: Customer satisfaction with the delivery	66.67%
SERVICE EFFICIENCY	KPI_24: Km traveled by commercial vehicles	55.56%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_12: Policy related	45.45%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)	40.00%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_3: GHG emissions	40.00%
TRAFFIC MANAGEMENT	KPI_19: Congestion	33.33%
TRAFFIC MANAGEMENT	KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc.)	33.33%
TRAFFIC MANAGEMENT	KPI_21: Severe violations (Speed violation, drivers testing positive on alcohol or drugs)	33.33%
SERVICE EFFICIENCY	KPI_27: Increased utilization of load capacity of vehicles	33.33%

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_16: Revenue from LEZ access fee (EUR)	27.27%
TRAFFIC MANAGEMENT	KPI_18: Percentage of freight vehicles in total vehicular traffic	22.22%
SERVICE EFFICIENCY	KPI_34: Night deliveries	22.22%
SERVICE EFFICIENCY	KPI_35: Average age of freight vehicles	22.22%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_10: Number of logistic centres, platforms, hubs, lockers	18.18%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_14: Energy use and infrastructure available at warehouses, microplatforms, etc	18.18%
SERVICE EFFICIENCY	KPI_25: Loading/unloading time - time per delivery	11.11%
SERVICE EFFICIENCY	KPI_31: Percentage of total vehicle-kilometers that run empty	11.11%
SERVICE EFFICIENCY	KPI_33: Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours	11.11%
SERVICE EFFICIENCY	KPI_40: Reservation of parking areas	11.11%
SERVICE EFFICIENCY	KPI_41: Constraints identified during the last mile stage	11.11%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_2: Fuel consumption	10.00%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_4: Particles (PM2.5 and/or PM10)	10.00%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics	9.09%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_13: Stakeholder engagement	9.09%

5.1.10.KER 12

The participants in the workshop and project partners associate KER 12 primarily with the following KPIs, with an association above 40%:

- KPI_24: km traveled by commercial vehicles (100.0%).
- KPI_3: GHG emissions (69.23%).
- KPI_8: Carbon footprint of deliveries (69.23%).
- KPI_15: Time window in city for urban logistics (50.0%).
- KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc.) (50.0%).
- KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics (41.67%).

- KPI_19: Congestion (41.67%).
- KPI_21: Severe violations (Speed violation, drivers testing positive on alcohol or drugs) (41.67%).

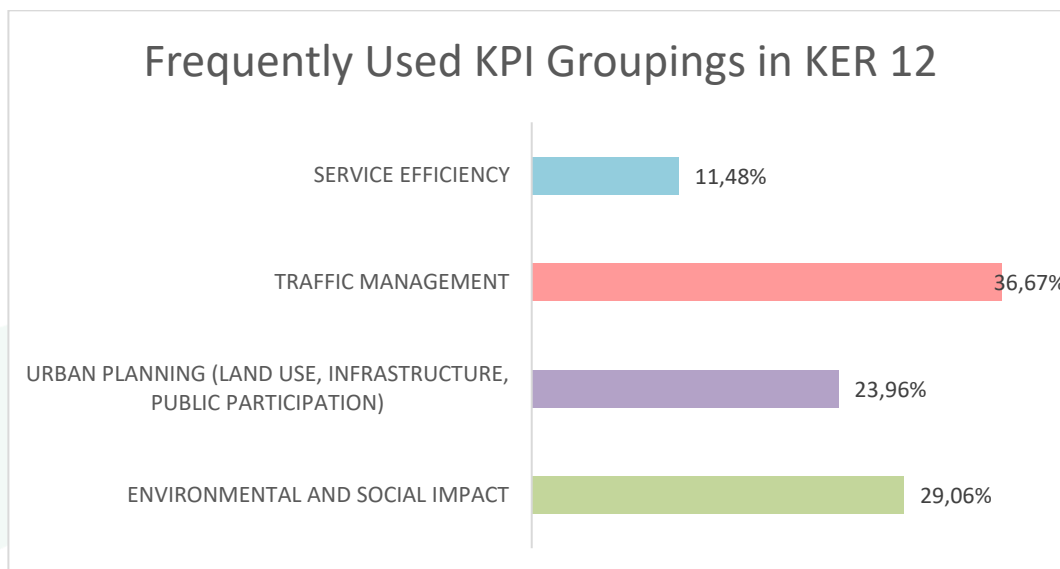


Figure 26. Categories to which the KPIs most associated with the KER 12.

The most important KPIs are part of the Traffic Management category (36.67%) and Environmental and social impact (29.06%).

Table 52. KPIs most associated with KER 12.

SERVICE EFFICIENCY	KPI_24: Km traveled by commercial vehicles	100.00%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_3: GHG emissions	69.23%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_8: Carbon footprint of deliveries	69.23%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_15: Time window in city for urban logistics	50.00%
TRAFFIC MANAGEMENT	KPI_20: Freight-related accidents (accidents, people injured, vehicles involved, etc.)	50.00%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics	41.67%
TRAFFIC MANAGEMENT	KPI_19: Congestion	41.67%
TRAFFIC MANAGEMENT	KPI_21: Severe violations (Speed violation, drivers testing positive on alcohol or drugs)	41.67%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_2: Fuel consumption	38.46%
SERVICE EFFICIENCY	KPI_30: Costs of the last mile per delivery/ pick up	36.36%

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_10: Number of logistic centres, platforms, hubs, lockers	33.33%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_12: Policy related	33.33%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)	30.77%
TRAFFIC MANAGEMENT	KPI_18: Percentage of freight vehicles in total vehicular traffic	25.00%
TRAFFIC MANAGEMENT	KPI_22: Soft violations (unauthorized parking in loading zones...)	25.00%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_4: Particles (PM2.5 and/or PM10)	23.08%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_9: Nitrogen Oxide (NO2)	23.08%
SERVICE EFFICIENCY	KPI_23: Customer satisfaction with the delivery	18.18%
SERVICE EFFICIENCY	KPI_25: Loading/unloading time - time per delivery	18.18%
SERVICE EFFICIENCY	KPI_33: Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours	18.18%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_14: Energy use and infrastructure available at warehouses, microplatforms, etc	16.67%
SERVICE EFFICIENCY	KPI_27: Increased utilization of load capacity of vehicles	9.09%
SERVICE EFFICIENCY	KPI_28: Modal split	9.09%
SERVICE EFFICIENCY	KPI_41: Constraints identified during the last mile stage	9.09%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_13: Stakeholder engagement	8.33%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_16: Revenue from LEZ access fee (EUR)	8.33%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_5: Noise level	7.69%

5.1.11.KER 13

Finally, the participants in the workshop and project partners associate KER 13 primarily with the following KPIs, with a correlation above 40%:

- KPI_22: Soft violations (unauthorized parking in loading zones...) (80.0%).
- KPI_8: Carbon footprint of deliveries (69.23%).
- KPI_18: Percentage of freight vehicles in total vehicular traffic (56.25%).

- KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics (47.06%).
- KPI_37: Occupancy of (un)loading/parking areas (43.75%).
- KPI_39: Time spent to find parking/(un)loading area (43.75%).
- KPI_17: N. of commercial outlets having a cargo area within a 75 m radius. (41.18%).
- KPI_2: Fuel consumption (40.0%).

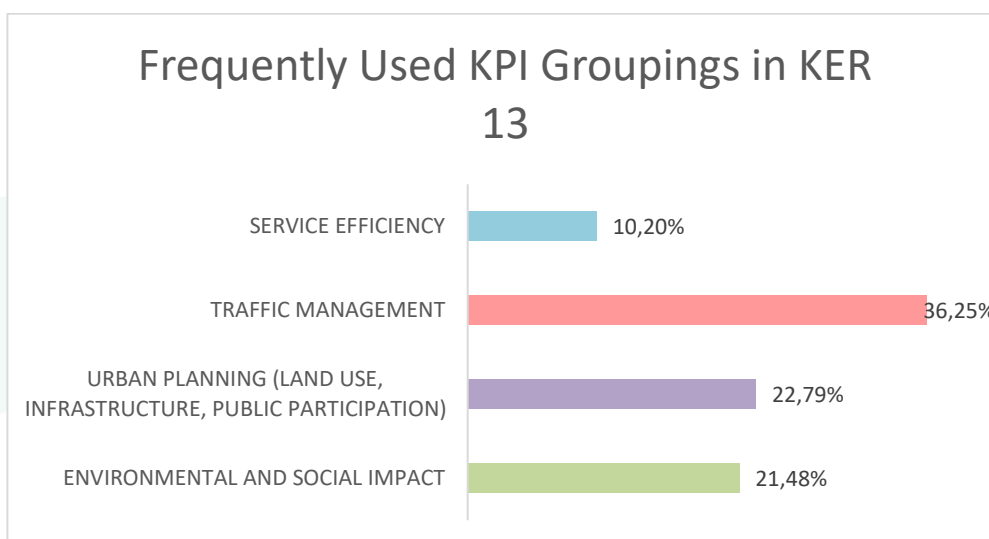


Figure 27. Categories to which the KPIs most associated with the KER 13.

The most important KPIs are part of the Traffic Management category (36.25%) and Urban Planning (22.79%).

Table 53. KPIs most associated with KER 13.

TRAFFIC MANAGEMENT	KPI_22: Soft violations (unauthorized parking in loading zones...)	81.25%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_8: Carbon footprint of deliveries	80.00%
TRAFFIC MANAGEMENT	KPI_18: Percentage of freight vehicles in total vehicular traffic	56.25%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_11: Number of loading/unloading areas - public space dedicated to urban logistics	47.06%
SERVICE EFFICIENCY	KPI_37: Occupancy of (un)loading/parking areas	43.75%
SERVICE EFFICIENCY	KPI_39: Time spent to find parking/(un)loading area	43.75%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_17: N. of commercial outlets having a cargo area within a 75 m radius.	41.18%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_2: Fuel consumption	40.00%
TRAFFIC MANAGEMENT	KPI_19: Congestion	37.50%
SERVICE EFFICIENCY	KPI_23: Customer satisfaction with the delivery	37.50%

URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_10: Number of logistic centres, platforms, hubs, lockers	35.29%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_1: Number of sustainable commercial or freight vehicles (LEV, ZEV)	33.33%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_15: Time window in city for urban logistics	29.41%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_3: GHG emissions	26.67%
SERVICE EFFICIENCY	KPI_40: Reservation of parking areas	25.00%
SERVICE EFFICIENCY	KPI_24: Km traveled by commercial vehicles	18.75%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_14: Energy use and infrastructure available at warehouses, microplatforms, etc	17.65%
ENVIRONMENTAL AND SOCIAL IMPACT	KPI_5: Noise level	13.33%
URBAN PLANNING (LAND USE, INFRASTRUCTURE, PUBLIC PARTICIPATION)	KPI_12: Policy related	11.76%
TRAFFIC MANAGEMENT	KPI_21: Severe violations (Speed violation, drivers testing positive on alcohol or drugs)	6.25%
SERVICE EFFICIENCY	KPI_25: Loading/unloading time - time per delivery	6.25%
SERVICE EFFICIENCY	KPI_29: Freight logistic intensity // delivery productivity	6.25%
SERVICE EFFICIENCY	KPI_33: Hours that vehicles are in service, e.g. deliveries, pick ups, transporting, weighting, loading/unloading over 24 hours	6.25%
SERVICE EFFICIENCY	KPI_36: Average utilization of the warehouse or distribution centers	6.25%

6. KERs and datasets

6.1. Identification of datasets to feed UNCHAIN services.

UNCHAIN services to be demonstrated in pilot tests, in both living labs and follower cities, require a sort of datasets to feed the algorithms managing the booking services to park the vehicles or the routes' optimization, among others. These datasets will be shared through the IDSA platform, which includes the roles of data PUBLISHERs and data CONSUMERs.

Data PUBLISHERs are the entities providing the datasets, while the data CONSUMERs are the entities employing these datasets to update the algorithms managing the services. Considering the different profiles taking part in the project demonstrations, it is expected that the municipalities and the logistics operators will be the data PUBLISHERs, and the service developers will be the data CONSUMERs. Nevertheless, in order to define a first collection of datasets, considering services are in their development process, we asked to service developers (ETRA, MUNI, and VMZ) to identify the required datasets per KER. As a result of this process, Table 54 presents the collection of datasets generated.

Table 54. First collection of datasets, required by KERs, according to service developers.

Dataset	KER 4	KER 5	KER 6	KER 8	KER 9	KER 10	KER 11	KER 12	KER 13
Loading and unloading street locations		✓			✓	✓	✓	✓	
Usage info of loading and unloading street locations		✓		✓	✓	✓	✓	✓	
Inhabitants per building or small zones		✓				✓			
Zones for hardware installation				✓	✓				
Special dates calendars						✓	✓	✓	
Delivery planning		✓			✓	✓		✓	
Traffic data		✓	✓	✓		✓	✓	✓	✓
Road shape and specifications		✓	✓			✓		✓	
Number of available parking space		✓		✓	✓	✓		✓	
Special restrictions based on council land use rules		✓	✓	✓		✓		✓	
Accident hotspots / areas to be avoided			✓					✓	
Forecast data on events related to traffic			✓					✓	
Information on construction sites			✓					✓	
Environmental impacts in the hub's neighbourhood	✓								
Distance to depots of logistics service providers	✓								

Population density	✓
Company density	✓
Connection to the main road network	✓
Density of cycle infrastructure (length in the area)	✓
Purchasing power in the delivery area	✓
Number of possible properties for microdepots	✓
Availability of commercial space	✓
Housing development	✓
Environmental regulations	✓
Traffic obstructions for larger vehicles	✓
Commercial rents	✓

In order to assess this first collection of datasets, by all the partners participating in the pilot test, a workshop was organised during the second General Assembly (GA), performed in Madrid during May 8th and 9th.

6.2. Workshop to assess the first collection of datasets.

The main of the workshop organised during MAD GA was to assess the collection presented in Table 54, and to gather information about the availability of the datasets required by the service developers, in the cities where these services were going to be demonstrated. For this purpose, we produced the table presented in Figure 28. Table produced to assess and to gather information related to datasets..

Work team 1: VMZ, FLO-SPES, MAD, BER					
KER4: MAD-FLO-BER	CONSUMER	PUBLISHER			DATASETS RESTRICTIONS
		MAD	FLO	BER	
(1) Environmental impacts in the hub's neighbourhood	VMZ				
(2) Distance to depots of logistics service providers	VMZ				
(3) Population density	VMZ				
(4) Company density	VMZ				
(5) Connection to the main road network	VMZ				
(6) Density of cycle infrastructure (length in the area)	VMZ				
(7) Purchasing power in the delivery area	VMZ				
(8) Number of possible properties for microdepots	VMZ				
(9) Availability of commercial space	VMZ				
(10) Housing development	VMZ				
(11) Environmental regulations	VMZ				
(12) Traffic obstructions for larger vehicles	VMZ				
(13) Commercial rents	VMZ				

Figure 28. Table produced to assess and to gather information related to datasets.

The table is organised around a KER, and includes all the datasets that this service requires. The datasets are identified by a number, due to the fact that, as *Table 54* shows, some datasets will be employed by diverse products. Note that datasets will be identical per demonstration site, and each demonstration site should have a unique PUBLISHER for that dataset. Indeed, two different KERs employing the same dataset will employ the same file, provided by the same PUBLISHER, but these files can be different for the same KER in two demonstration sites, as the PUBLISHER will be different. For this reason, the table presented in Figure 28. Table produced to assess and to gather information related to datasets. includes a unique column for CONSUMER (the KER developer), and diverse columns for PUBLISHERs (one per demonstration site). The table also groups under the term *Work team* the partners involved in the demonstration, according to *usage scenarios* presented in D2.3³.

³ https://unchainproject.eu/content/uploads/2024/06/20240430-IBV-UNCHAIN-D2.3_Technical-and-legal-requirements-KPIs-and-use-cases_vf-1.pdf

Work team 3: ETRA, FLO, MAD, MEC, PRA, RIG, DHL		KERS Datasets. COSUMERS & PUBLISHERs. Restr	
KERS: FLO-RIG			
(14) Loading and unloading street locations	DHL VA	KERS - RIG 14 - Not available but collectable - No restriction	(15) 14) like for 8 no 15 15) like for 15 no 15 16) not relevant for UPS 17) Difficult to provide, privacy issues + we don't know yet with a commercial law 18) useful for UPS 19) useful for UPS 20) useful for UPS 21) useful for UPS to avoid illegal use of packages
(15) Usage info of loading and unloading street locations	DHL VA	KERS - RIG 15 - Not available	
(27) Inhabitants per building or small zones		KERS - RIG 27 - Already public	
(17) Delivery planning		KERS - RIG 18 - Some data is available - Security profile	
(18) Traffic data	DHL ET	KERS - RIG 21 - Not sure	
(19) Road shape and specifications	DHL ET	KERS - RIG 22 - IN progress	
(21) Number of available parking space	DHL		
(22) Special restrictions based on council land use rules	DHL		

Figure 29. Flip chart generated by workshop's participants for KERS5.

An additional column for *Datasets restrictions* intends to collect information about the restrictions to share data included in the IDSA platform, which are:

- Provide Access. It must be established between which dates the use is allowed.
- Prohibit Access. It must be established between which dates the use is NOT allowed.
- N Times Usage. A lower or equal number of permitted uses must be established.
- Duration Usage. A number of hours of use must be established.
- Usage During Interval. Date range must be set.
- Usage Until Deletion. The date range between which it can be used and the date on which the data will be deleted must be established.
- Usage Logging. No restriction.
- Usage Notification. To add an URL where the use must be notified.
- Connector Restricted Usage. An URL must be added, so only one connector can use that data.
- Security Profile Restricted Usage. It requires to indicate the type of security among three options *Base security*, *Trust plus Security* and *Trust Security*.

The partners participating in the workshop were distributed in three groups, led by the service developers (ETRA, MUNI and VMZ). The fulfilled charts are presented in Annex 8.6 The contributions of the partners are presented in blue text. It is relevant to note that not only the service developers are interested in being data CONSUMERS, but also the logistics operators (DHL and UPS). In addition, these partners have the two roles, as some datasets, e.g., *Delivery planning*, are under only available for them.

6.3. Enrichment of the workshop results.

In order to complete the information collected in the workshop, and considering that the municipalities need to confirm the availability of some datasets, an online process to enrich the charts was launched. All the partners received the workshop results presented in Annex 8.6, and were asked to review and to enrich the contents.

The resulting tables of this process are presented in Annex 8.7. This result is the final collection of datasets for KERs. These tables also include the datasets identified by ULANC, as the required to feed the *Multi Criteria Decision Making* (MCDM) framework, a module that is part of the KER6 and KER11.

A total number of 122 datasets have been identified. 27 of these datasets will be shared among all the KERs included in the pilot tests, and 95 are exclusive of the MCDM. It is further clarified that the data requirements for the development of the MCDM framework, will be further specified with the relevant stakeholders, i.e cities and Urban Logistics Operators (ULOs), as part of the development of the MCDM framework in WP4 and WP5. These refinements are associated with the final selection of KPIs, the types of data needed to measure them, and the type of analysis (decisions) that will be made.

Furthermore, it should be noted that the identification of the required KPIs for each KER and the associated data needed for the measurement of these KPIs, have not considered yet the needs for the evaluation of the demonstrators that will be further defined as part of the evaluation plan development in WP6.

6.4. Connectors to exchange the data.

Table 55 presents a list including the partners which are data CONSUMERS and those being data PUBLISHERS, according to results presented in Annex 8.7. The exchange of datasets through the IDSA platform is made by means of a CONNECTOR.

Table 55. List of data CONSUMERS and data PUBLISHERS in the UNCHAIN's IDSA platform.

Data CONSUMER	Data PUBLISHER
ETRA	MAD
MUNI	FLO
ULANC	BER
VMZ	MEC
DHL	PRA
UPS	FUN
	RIG
	DHL
	UPS

This CONNECTOR is a small piece of software, individual for each partner participating in the IDSA platform. As a PUBLISHER, CONSUMER or even with both roles, partners will connect to the platform, that will facilitate a link between datasets and KERs.

Table 56. Datasets required by the KERs developers.

CONSUMER	PUBLISHER	KERs	DATASETS
ETRA	MAD	KER8 KER10 KER13	(14) Loading and unloading street locations
			(15) Usage info of loading and unloading street locations
			(16) Special dates calendars
	DHL	KER10	(18) Traffic data
			(19) Road shape and specifications
			(21) Number of available parking space
			(22) Special restrictions based on council land use rules
			(27) Inhabitants per building or small zones
			(26) Zones for hardware installation
			(17) Delivery planning
FLO	KER5 KER8 KER13	(14) Loading and unloading street locations	
		(15) Usage info of loading and unloading street locations	
		(16) Special dates calendars	
		(18) Traffic data	
		(19) Road shape and specifications	
		(21) Number of available parking space	
UPS	KER5	(22) Special restrictions based on council land use rules	
		(27) Inhabitants per building or small zones	
		(26) Zones for hardware installation	
MEC	KER13	(17) Delivery planning	
		(18) Traffic data	
PRA	KER8	(15) Usage info of loading and unloading street locations	
		(18) Traffic data	
		(21) Number of available parking space	
RIG	KER5	(22) Special restrictions based on council land use rules	
		(26) Zones for hardware installation	
		(14) Loading and unloading street locations	
		(15) Usage info of loading and unloading street locations	
		(18) Traffic data	
		(19) Road shape and specifications	
		(21) Number of available parking space	
(22) Special restrictions based on council land use rules			
(27) Inhabitants per building or small zones			
MUNI	FLO	KER6 KER9 KER11	(17) Delivery planning
			(14) Loading and unloading street locations
			(15) Usage info of loading and unloading street locations
			(16) Special dates calendars
			(18) Traffic data
			(19) Road shape and specifications
	UPS	KER9	(21) Number of available parking space
			(22) Special restrictions based on council land use rules
			(23) Accident hotspots / areas to be avoided
			(24) Forecast data on events related to traffic
UPS	KER9	(25) Information on construction sites	
		(26) Zones for hardware installation	
UPS	KER9	(17) Delivery planning	

	BER	KER6	(18) Traffic data (19) Road shape and specifications (22) Special restrictions based on council land use rules (23) Accident hotspots / areas to be avoided (24) Forecast data on events related to traffic (25) Information on construction sites
	MEC	KER6	(18) Traffic data (19) Road shape and specifications (22) Special restrictions based on council land use rules (23) Accident hotspots / areas to be avoided (24) Forecast data on events related to traffic (25) Information on construction sites
	PRA	KER9	(14) Loading and unloading street locations (26) Zones for hardware installation (17) Delivery planning (21) Number of available parking space
	FUN	KER9	(14) Loading and unloading street locations (26) Zones for hardware installation (17) Delivery planning (21) Number of available parking space
	RIG	KER6	(18) Traffic data (19) Road shape and specifications (22) Special restrictions based on council land use rules (23) Accident hotspots / areas to be avoided (24) Forecast data on events related to traffic (25) Information on construction sites
VMZ	MAD	KER4 KER12	(1) Environmental impacts in the hub's neighbourhood (2) Distance to depots of logistics service providers (3) Population density (4) Company density (5) Connection to the main road network (6) Density of cycle infrastructure (length in the area) (7) Purchasing power in the delivery area (8) Number of possible properties for microdepots (9) Availability of commercial space (10) Housing development (11) Environmental regulations (12) Traffic obstructions for larger vehicles (13) Commercial rents (14) Loading and unloading street locations (15) Usage info of loading and unloading street locations (16) Special dates calendars (18) Traffic data (19) Road shape and specifications (20) Bike paths and specifications (21) Number of available parking space (22) Special restrictions based on council land use rules (23) Accident hotspots / areas to be avoided (24) Forecast data on events related to traffic (25) Information on construction sites
	DHL	KER12	(17) Delivery planning
	FLO	KER4 KER12	(1) Environmental impacts in the hub's neighbourhood (2) Distance to depots of logistics service providers (3) Population density

			<ul style="list-style-type: none"> (4) Company density (5) Connection to the main road network (6) Density of cycle infrastructure (length in the area) (7) Purchasing power in the delivery area (8) Number of possible properties for microdepots (9) Availability of commercial space (10) Housing development (11) Environmental regulations (12) Traffic obstructions for larger vehicles (13) Commercial rents (14) Loading and unloading street locations (15) Usage info of loading and unloading street locations (16) Special dates calendars (18) Traffic data (19) Road shape and specifications (20) Bike paths and specifications (21) Number of available parking space (22) Special restrictions based on council land use rules (23) Accident hotspots / areas to be avoided (24) Forecast data on events related to traffic (25) Information on construction sites
	UPS	KER12	<ul style="list-style-type: none"> (17) Delivery planning
			<ul style="list-style-type: none"> (1) Environmental impacts in the hub's neighbourhood (2) Distance to depots of logistics service providers (3) Population density (4) Company density (5) Connection to the main road network (6) Density of cycle infrastructure (length in the area) (7) Purchasing power in the delivery area (8) Number of possible properties for microdepots (9) Availability of commercial space (10) Housing development (11) Environmental regulations (12) Traffic obstructions for larger vehicles (13) Commercial rents (14) Loading and unloading street locations (15) Usage info of loading and unloading street locations (16) Special dates calendars (18) Traffic data (19) Road shape and specifications (20) Bike paths and specifications (21) Number of available parking space (22) Special restrictions based on council land use rules (23) Accident hotspots / areas to be avoided (24) Forecast data on events related to traffic (25) Information on construction sites
	BER	KER4 KER12	<ul style="list-style-type: none"> (14) Loading and unloading street locations (15) Usage info of loading and unloading street locations (16) Special dates calendars (18) Traffic data (19) Road shape and specifications (20) Bike paths and specifications (21) Number of available parking space (22) Special restrictions based on council land use rules (23) Accident hotspots / areas to be avoided (24) Forecast data on events related to traffic (25) Information on construction sites
			(17) Delivery planning
DHL	MAD	KER8 KER10 KER13	<ul style="list-style-type: none"> (14) Loading and unloading street locations (15) Usage info of loading and unloading street locations (16) Special dates calendars (18) Traffic data (19) Road shape and specifications (21) Number of available parking space

			(22) Special restrictions based on council land use rules
UPS	FLO	KER6 KER9 KER11	(18) Traffic data (19) Road shape and specifications (21) Number of available parking space (22) Special restrictions based on council land use rules

The Table 56 presents the datasets required by the KERs developers. The data PUBLISHERs (cities and logistics operators), provide the datasets to the IDSA platform through the connector, but these files are employed by the different service developers, that are demonstrating the KERs in their cities.

7. Conclusions

Conclusion related gender

The conclusion of the provided information on gender-related issues in the logistics sector highlights the critical importance of collecting and analyzing gender-disaggregated data to address existing gender inequalities and design inclusive policies and practices. The key aspects include labor participation, wages and working conditions, access to training, mobility patterns, and perceptions and experiences within the sector. Examples of such data reveal significant disparities, such as lower female representation in the workforce, a gender pay gap, and reduced access to advanced training for women.

The importance of gender-disaggregated data lies in its ability to inform policies that promote gender equality, improve working conditions, increase female participation, and enhance urban planning and mobility. Furthermore, integrating a gender perspective into key performance indicators (KPIs) ensures that all logistics operations, from sustainable vehicle use to congestion management, consider and address gender differences. This comprehensive approach aims to create a more inclusive, equitable, and efficient logistics sector, benefiting all genders equally.

Conclusion related Framework platforms

We reviewed the main logistics platforms worldwide to understand their capabilities and features. The platforms assessed include PrepDSpace4Mobility, EuroStat, EU's Open Data Platform, Statista – Transportation and Logistics, Transport/Logistics and Container Tracking Datasets, Cargonaut, Telekom Data Intelligence Hub, Shippeo, FourKites, Intermodal Map, Movement by project44, International Service Reliability (ISR), Commercial Responsibility Database (COREDA), Open Railway Freight EDI User System (ORFEUS), and Web Data Interface (WDI). Additionally, other notable platforms such as TradeLens, CargoSmart, GT Nexus (Infor Nexus), Transporeon, Descartes Systems Group, Project44, FourKites, Samsara, and Convey were also considered. These platforms provide extensive data sharing, tracking, and analytical capabilities essential for improving efficiency, interoperability, and innovation in logistics and urban delivery systems. Their diverse functionalities contribute to a more integrated and streamlined approach to managing logistics operations, facilitating better decision-making and enhanced operational performance.

Some of these platforms have helped us choose the most suitable platform for the UNCHAIN project and how the review of these platforms contributed to the identification of the data types needed in the UNCHAIN project.

Conclusion related IDSA

In conclusion, the IDSA (International Data Spaces Association) was selected as the framework for data sharing in our project after reviewing existing European and global frameworks. The IDSA, a nonprofit organization, emphasizes identity-centric cybersecurity and offers a consortium of experts developing best practices and guidelines. Key advantages of IDSA for urban logistics and delivery include enhanced data security, interoperability, data sovereignty, standardization, scalability, trust, innovation, efficiency, and sustainability. These benefits

facilitate secure, efficient, and innovative data exchanges, optimizing urban logistics and fostering sustainable practices.

Conclusions related KPIs, Sub-indicators and datasets

In the analysis of KPIs related to logistics, four primary KPAs were identified: Environment and Social Impact, Urban Planning (land use, infrastructure, public participation), Traffic Management, and Service Efficiency. This study presents a comprehensive list of 41 KPIs and examines each category in detail, defining the Sub-indicators for each KPI, the necessary datasets, and the formulas to calculate them. Aspects such as data accessibility, level of aggregation, and anonymization are also addressed to ensure a holistic understanding of the KPIs and their practical implementation.

Our review has concluded with 41 KPIs distributed across 4 categories, 217 Sub-indicators associated with the KPIs, as well as a total of 661 datasets associated with the Sub-indicators and, in turn, with the KPIs. Now, the most used data, and therefore we assume the most important for logistics, are:

Table 57. Datasets most used for calculating Sub-indicators and KPIs.

Cod.dataset	Name	Frequency
13	Time and Temporal Data	86
98	Weather Data / Weather and Environmental Conditions Data	35
90	Vehicle Tracking Data	32
93	Geospatial Data / Geospatial and Mapping Data	30
1	Vehicle Type and Classification Data / Vehicle Specifications Data / Vehicle Type and Specifications	27
94	Traffic and Road Conditions Data	25
330	Geographic Information System (GIS) Data / GIS Software or Tools	23
290	Traffic Flow and Density Data	23
293	Road Network Data	21
304	Delivery Time Records / GPS or Tracking Data / Delivery Time Logs / Delivery time data	19
158	Geographic Area Data / Geographic Data / Geographic and Spatial Data / Geographic Coordinates of UL Areas	19
120	Legal and Regulatory Compliance Data / Enforcement and Compliance Data	19
113	Environmental Impact Assessment Data	19
89	Delivery Records / Delivery and Pickup Records	17
17	Fuel Consumption Data	17
389	Customer Feedback Data / User Feedback Data / Complaints and Feedback Data	16

96	Delivery Route Data and Address / Route and Network Data / Transport Route Information	16
15	Location (Neighborhood, City, Region, Country etc.)	16
123	Historical Delivery Data / Historical Data	15
99	Community Engagement and Feedback Data / Customer/Consumer Preferences, Feedback and Satisfaction Surveys / Survey Data	14
316	Vehicle Registration Data	14
390	Logistics Centers/Warehouses Data / Warehouse and Distribution Center Data	11
395	Supply Chain Management Data / Logistics and Supply Chain Data	11
289	Freight Vehicle Data / Freight Vehicle registration / Delivery Vehicle Data	11
294	Historical Traffic Data	11
377	Transportation Infrastructure Data	10
95	Customer Data and Information	10
288	Traffic Volume Data	10
277	Public Transportation Data / Public Transportation Usage Data	9
3	Number of Vehicles / Total Number of Cars	9
16	Population and Demographic Data	9
315	Road Accident Data /Traffic Accident data	9
109	Vehicle Maintenance Records / Vehicle Maintenance and Depreciation Costs	8
421	Fleet Management System Data	8
256	Economic Data / Economic and Market Data / Economic indicators	8
174	Parking Regulation and Policy Data	8
336	Traffic Enforcement Policies and Regulations Data	8
375	Freight Transport Data / Freight Transport Activity Data / Transporting Data / Inland Freight Transport Data	7
106	Environmental Factors Data	7
468	Customer Order Data / Customer Order and Delivery Data	7
469	Delivery Performance Metrics / Delivery Performance Data	7
472	Shipment Tracking Data / Shipment data / Freight Shipment Data / Inbound and Outbound Shipment Data	7
523	Freight Traffic Data / Traffic Data	7
307	Stop Data / stop event logs / event data	7
14	Year	7
322	Law Enforcement Data	7
392	Route Optimization Data	6
398	Market Research and Demand Forecasting Data	6

448	Traffic and Congestion Data	6
455	Loading and Unloading Time Records / Loading and Unloading Records / Historical Loading and Unloading Records	6
484	Freight Delivery Schedule Data / Delivery Schedule	6
531	Inventory Data / Fleet Inventory Data	6
302	Traffic Incident Data	6
394	Transportation and Logistics Operations Data / Freight and Logistics Operations Data / Logistics and Freight Data	5
400	Financial Performance and Cost Analysis Data	5
431	Urban Planning and Zoning Data	5
446	Parking Sensor Data / Sensor Data	5
450	Local Economic and Business Activity Data / Economic Activity Data	5
458	Supplier and Vendor Performance Data / Supplier Data / Supplier and Manufacturer Data	5
21	Fuel Type	5
301	Traffic Speed Data	5
314	Vehicle Data / Vehicle Characteristics Data	5
327	Crime Data / Crime Incident Reports / Crime Mapping Data / Incident Reports	5
328	Drug and Alcohol Testing	5
329	Driver Identification / Driver information / Driver Demographic Data / Driver Characteristics Data	5
332	Violation Records / Violation Data	5

Environment and Social Impact

For the Environment and Social Impact category, the KPIs, Sub-indicators, and associated datasets are explored in depth. A matrix is provided that correlates KPIs and Sub-indicators with the required datasets, facilitating the implementation of a data-sharing platform. This platform aims to guide users in identifying the necessary data for KPI calculation, thereby standardizing concepts, terms, and dataset names. Among the 133 datasets identified, 13 are most frequently used, including Date/Time, Location, Vehicle Type, Total Fuel Consumption, and Environmental Impact Data.

Access levels, aggregation levels, and anonymization of datasets are critical aspects discussed in this study. It is observed that 50% of the data required to calculate KPIs and Sub-indicators in the Environment and Social Impact category is public, while the rest varies between public with limitations and restricted. Aggregation levels vary according to data specifics, and anonymization is significant only in a few cases, with the majority of data requiring little to moderate anonymization.

The study also highlights the key data holders, indicating that transport agencies and researchers hold the majority of the necessary data (61.5%), followed by government agencies

(46.1%) and public entities (38.46%). This distribution underscores the importance of collaboration between various stakeholders to facilitate effective data sharing and ensure the accurate calculation of KPIs, ultimately contributing to improved logistics management and environmental sustainability.

Urban Planning

The analysis presents a comprehensive overview of KPIs, Sub-indicators, and datasets associated with the topic of Urban Planning. It defines the necessary datasets for each Sub-indicator related to Urban Planning, highlighting the importance of understanding the interrelationships between KPIs, Sub-indicators, and the required datasets. The generated matrix will facilitate the future implementation of a data-sharing platform, providing users with clear guidance on the data needed to calculate KPIs, thereby unifying concepts, terms, and dataset names.

From the analysis, a significant number of datasets (170) are identified as essential to understanding and calculating Sub-indicators. Among these, 13 datasets are most frequently used, emphasizing their importance. These include location data, geospatial data, notes/comments, accessibility features, availability, environmental impact data, stakeholder engagement, infrastructure data, warehouse data, energy use data, traffic and road conditions data, and temporal data.

The level of access to these datasets is crucial, with the majority (76.9%) being restricted. This restriction highlights the need for structured access policies to ensure the right stakeholders can obtain the necessary data. Additionally, the analysis identifies the primary holders of the most critical datasets in Urban Planning as public researchers (53.8%) and government agencies (46.1%), indicating a significant reliance on public and governmental sources for data.

Overall, the conclusions underscore the need for a well-organized data-sharing framework that considers access, aggregation, and anonymization levels, ensuring that key stakeholders have the necessary information to effectively utilize and calculate the relevant KPIs and Sub-indicators in Urban Planning.

Traffic Management

The analysis of the Traffic Management topic identifies the Key Performance Indicators (KPIs), Sub-indicators, and associated datasets, detailing how they are calculated, which datasets are most commonly used, and aspects related to data accessibility, aggregation, and anonymization. A matrix has been generated to link KPIs and Sub-indicators with the necessary datasets, providing a guide for implementing a data-sharing platform to calculate these indicators. This matrix aims to assist users by unifying concepts, terms, and dataset names.

A thorough search identified 105 necessary datasets to understand and calculate the Sub-indicators for Traffic Management, with 47 datasets being the most frequently used and crucial. These include temporal data, geospatial data, traffic flow data, road network data,

historical traffic data, and others such as weather data, demographic data, road accident data, and law enforcement data. The frequent use of these datasets highlights their importance in accurately calculating KPIs and Sub-indicators.

The level of access, aggregation, and anonymization for these datasets varies. Most of the critical datasets have restricted or confidential access (75.8%), with a significant portion being confidential due to their relation to health, violations, or crime (34.5%). The level of aggregation and anonymization of the data also varies, with only a few datasets having a high level of anonymization (10.34%).

The key profiles holding the most important datasets in the Urban Planning category include traffic management authorities (31.0%), urban planners (24.1%), and law enforcement (20.7%). This distribution underscores the collaborative effort required among different stakeholders to effectively manage and utilize traffic management data.

Service Efficiency

The analysis of Service Efficiency highlights the importance of key performance indicators (KPIs), Sub-indicators, and the associated datasets. A matrix was developed to relate KPIs and Sub-indicators with necessary datasets, which is essential for the future implementation of a data-sharing platform. This platform aims to unify concepts, terms, and dataset names, thus aiding users in calculating KPIs accurately.

A thorough examination identified 365 datasets required to understand and calculate Sub-indicators, with 27 being the most frequently used. These critical datasets include time and temporal data, vehicle tracking data, GIS data, weather data, traffic and road conditions data, delivery time records, geographic area data, customer feedback data, delivery route data, legal compliance data, historical delivery data, environmental impact data, vehicle specifications data, community engagement data, fuel consumption data, and others. These datasets play a crucial role in achieving service efficiency.

Access levels, aggregation levels, anonymization, and data ownership were also analyzed. The findings reveal that 44.4% of the essential data have restricted access, while 25.9% are publicly accessible. Most of the data used in calculating KPIs and Sub-indicators have a moderate level of anonymization, with 48.1% falling into this category. Logistic companies have access to 85.2% of the most used data, followed by fleet managers at 44.4% and urban planners at 25.9%.

In summary, the study underscores the complexity and breadth of data required for service efficiency. The development of a comprehensive data-sharing platform, along with clear guidelines on data access, aggregation, and anonymization, is vital for improving service efficiency and ensuring the effective use of KPIs and Sub-indicators.

Conclusions related KERs and KPIs

When analyzing all the KERs together (KER 4, 5, 6, 8, 9, 10, 11, 12, and 13), the most important KPIs, chosen by more than 40% of participants, are primarily related to the Traffic

Management and Urban Planning categories. These key KPIs include the carbon footprint of deliveries, the number of loading/unloading areas, soft violations (such as unauthorized parking), congestion, the percentage of freight vehicles in total traffic, the number of sustainable commercial or freight vehicles, and GHG emissions.

For KER 4, participants in the workshop and project partners primarily associate it with KPIs such as the number of logistic centers, the percentage of freight vehicles in total vehicular traffic, congestion, fuel consumption, the carbon footprint of deliveries, and the number of commercial outlets having a cargo area within a 75-meter radius. The most important KPIs for KER 4 fall under the Traffic Management and Urban Planning categories.

KER 5 is primarily associated with KPIs including the number of loading/unloading areas, soft violations, congestion, the carbon footprint of deliveries, kilometers traveled by commercial vehicles, and the number of commercial outlets having a cargo area within a 75-meter radius. Again, the Traffic Management and Urban Planning categories are the most significant for KER 5.

For KER 6, the KPIs with the highest preference include the percentage of freight vehicles in total vehicular traffic, policy-related KPIs, congestion, the number of sustainable commercial or freight vehicles, the carbon footprint of deliveries, the time window in the city for urban logistics, revenue from LEZ access fees, and night deliveries. As with the other KERs, Traffic Management and Urban Planning are the dominant categories. Across all KERs, Traffic Management consistently emerges as the most significant category, underscoring its critical role in urban logistics and planning.

For KER 8, participants and project partners primarily associate it with KPIs such as soft violations, the number of sustainable commercial or freight vehicles, the number of loading/unloading areas, the time window in the city for urban logistics, GHG emissions, congestion, and kilometers traveled by commercial vehicles. The most important KPIs for KER 8 belong to the Traffic Management and Urban Planning categories.

In the case of KER 9, the key associated KPIs include the number of loading/unloading areas, the number of sustainable commercial or freight vehicles, soft violations, the occupancy of loading/unloading areas, GHG emissions, the time window in the city for urban logistics, congestion, the percentage of freight vehicles in total vehicular traffic, and the time spent finding parking/loading areas. Similar to other KERs, the most significant KPIs for KER 9 fall under the Traffic Management and Urban Planning categories.

For KER 10, the primary KPIs are the number of loading/unloading areas, the carbon footprint of deliveries, the percentage of freight vehicles in total vehicular traffic, congestion, and soft violations. The most important KPIs for KER 10 are part of the Traffic Management category, with a significant focus also on environmental and social impact.

For KER 11, the participants in the workshop and project partners primarily associate it with KPIs such as the carbon footprint of deliveries, soft violations, the time window in the city for urban logistics, customer satisfaction with delivery, kilometers traveled by commercial vehicles, policy-related KPIs, the number of sustainable commercial or freight vehicles, and

GHG emissions. The most important KPIs for KER 11 are predominantly part of the Traffic Management and Urban Planning categories.

Regarding KER 12, the key KPIs include kilometers traveled by commercial vehicles, GHG emissions, the carbon footprint of deliveries, the time window in the city for urban logistics, freight-related accidents, the number of loading/unloading areas, and congestion. The most important KPIs for KER 12 are found in the Traffic Management category, with a significant portion also related to environmental and social impact.

Finally, for KER 13, the KPIs most associated with it include soft violations, the carbon footprint of deliveries, the percentage of freight vehicles in total vehicular traffic, the number of loading/unloading areas, the occupancy of loading/unloading areas, the time spent finding parking/loading areas, the number of commercial outlets having a cargo area within a 75-meter radius, and fuel consumption. As with the other KERs, the most critical KPIs for KER 13 are part of the Traffic Management and Urban Planning categories.

Conclusions related KERs and datasets

A list of datasets required for each KER, to be demonstrated in a pilot test (KER4, KER5, KER6, KER8, KER9, KER10, KER11, KER12, and KER13), have been produced. This dataset list has been initially proposed by the service developers (ETRA, MUNI and VMZ) and the MCDM module developer (ULANC). In a second stage, the dataset list has been assessed and enriched by all the consortium, including the cities.

It is worth noting here, that since the KERs are still under development and the consultation between the KER developers and the KER users is on-going, it is expected that further refinement of the data needed might emerge during the KER development and implementation process. Furthermore, the identified KPIs and associated data sets have not considered yet the WP6 data requirements. These requirements will emerge during the development of the WP6 evaluation process.

A collaboration framework to share the dataset required to feed the UNCHAIN services has been defined. Based on the IDSA platform this collaboration framework includes KERs developers and the MCDM module developer as data CONSUMERS, the Living Labs and the Follower Cities as data PUBLISHERS, and the logistics operators as both, data CONSUMERS and data PUBLISHERS.

The data CONSUMER profile withdraws data from the platform to feed algorithms, while the data PUBLISHER provides data, generated by systems monitoring operations (logistics operators) and events (Living Labs and Follower cities).

The data required to feed the services and the MCDM module is exchanged through a platform, where datasets are stored by the PUBLISHERS, and withdrawn by the CONSUMERS. The data exchange has some restrictions, that normally will fix the PUBLISHER.

The number of datasets identified to feed the services seems to be low (27), but this is deceiving, as datasets having the same name are different among the cities participating in services' demonstrations.

Each partner involved in the data exchange (KERS developers, cities and logistics operator), will communicate with the IDSA platform with a connector, that is unique for both, publishing or consuming data. This connector is part of the exchange platform, and will be a required link to communicate with the UNCHAIN partners, within the collaboration framework.

8. Annex (next document)