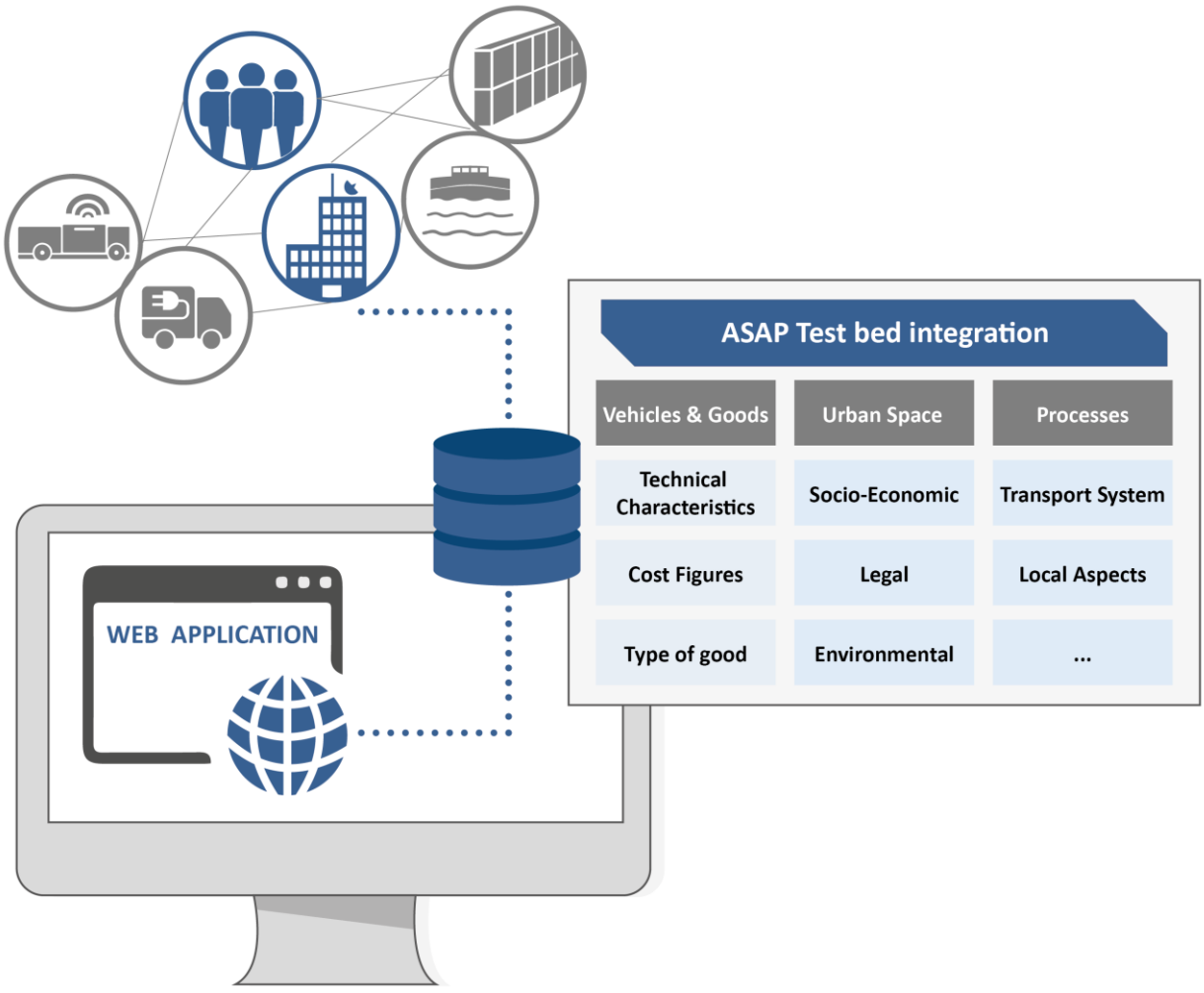
AWAKEN SLEEPING ASSETS PROJECT

Monitoring and evaluation plan incl. description of indicators (linked to SDGs) & how to operationalise & measure them



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D3.1: Monitoring and evaluation plan incl. description of indicators (linked to SDGs) & how to operationalise & measure them

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Abbreviations

ASAP *Awaken Sleeping Assets Project*

DMP *Data Management Plan*

GHG *Greenhouse Gas*

KPI *Key Performance Indicator*

LSP *Logistics Service Provider*

MAMCA *Multi Actor Multi Criteria*

SDG *Sustainable Development Goal*

SLOCAT *Partnership on Sustainable, Low Carbon Transport*

SULP *Sustainable Urban Logistic Plan*

UN *United Nations*

WP *Work Package*

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1. Introduction

The purpose of this deliverable is to elaborate the monitoring and evaluation plan to identify and assess impacts of the “Awaken Sleeping Assets Project” (ASAP) testbeds in the cities of Paris, Stockholm, Versailles and Vienna. The monitoring and evaluation plan is meant to be used for assessing how well the testbeds perform with respect to indicators related to the Sustainable Development Goals (SDGs) defined by the United Nations (UN). Furthermore, this deliverable is meant to be a guiding document for ASAP partners, especially the ones involved in data-related work as data originators (testbed leaders) and data processors. The leaders of the existing and intended testbeds are a crucial source of information for the SDG-related assessment. To achieve the goals mentioned above, the content of this deliverable is divided into three chapters.

In the following chapter results from the literature review are presented. First, the thematic delimitations as well as the scientific background of the deliverable’s scope in terms of urban logistics, data and sustainability are defined and elaborated. In a subsequent step, existing indicators to measure urban logistics processes as well as evaluation framework are examined. To do so, different initiatives, publications and other European projects are reflected.

The fourth chapter of this deliverable covers the approach followed in ASAP for the monitoring and evaluation plan. First, derivations from the literature review are highlighted which represent guiding foundations for the work conducted in ASAP. In a second step, the actual monitoring and evaluation plan will be elaborated by connecting identified indicators in the field of urban logistics and SDGs. Last, the (upcoming) data collection and processing procedure is presented briefly.

Last, the deliverable will be framed by a short conclusion and the next steps with connection to the monitoring and evaluation are outlined.

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2. Monitoring and Evaluation Plan within ASAP

This deliverable is part of Work Package (WP) 3 “Evaluation of Existing Testbeds” which has the specific objective to understand, assess and capture data and information of the ASAP testbeds to understand their impact on sustainability in a (mainly) quantitative manner. Chapter 3.1.3 focusses on existing sustainability framework in more detail. Therefore, identifying and defining a systematic approach in recording all the relevant data is necessary in advance. Furthermore, this deliverable is also connected to other tasks and WPs within ASAP. These relations are presented below to underline the interplays between the expected outcomes of the different tasks.

- The local stakeholder groups (**WP 2, Task 2.1**) will bring different stakeholders in the testbed cities together to regularly involve consultation and feedback in the ongoing project and testbeds. One goal of this task is that stakeholders have the possibility to co-create and develop processes, get the opportunity to exchange know-how with stakeholders from other cities and can use the ASAP channels for disseminating their measures. This deliverable can serve as one platform to discuss and confirm the availability and sharing of KPIs and data as well as their relevance for the involved stakeholders beyond the scope of WP 3. Furthermore, partners can express their needs and requirements regarding data evaluation in general. The involvement of both, private and public actors, makes the local stakeholder groups a valuable source of input for the monitoring and evaluation plan.
- The in-depth analysis of existing SULPs in relation to SDGs (**WP 2, Task 2.3**) aims at screening selected examples of SULPs, by identifying their set goals in short-, mid- and long-terms, evaluation methods, stakeholder inclusion, underlying requirements, and the SDGs, which were addressed. Content already produced was used to derive relevant SDGs as impact areas for this deliverable.
- As Task 3.1 represents the first task within **WP 3**, there are direct connections to **Task 3.2** and **Task 3.3**. Task 3.2 is about defining the Data Management Plan (DMP) of ASAP. As data needs to be exchanged between partners within the consortium and disseminate to a greater audience, it will be important to have a guiding document of how to handle, process and store (sensitive) data. Furthermore, this ensures that the data sovereignty remains with the respective partner, but also valuable insights can be derived based on the shared data. Task 3.3 puts the data collection and evaluation into practice. Regular contact with testbed operators (existing in WP 3 and intended in WP 5) and other local project partners ensures a smooth and continuous flow of information and data. This deliverable aims to be the foundation for discussions regarding KPIs and insight derivations.
- **WP 5** is about the initiation and simulation of new testbeds. There will be interrelations between the monitoring and evaluation plan and **Task 5.3 and 5.4**. The tasks aim inter alia at providing four digital testbeds implemented in a multi-agent simulation environment to assess the potential of new tools for urban logistics. One of the subtasks is the definition of objectives and KPIs for simulation which are directly linked to this deliverable and WP as guiding document.

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- Last, the development of the ASAP web-application in **WP 4** is based on the input created in all WPs. The goal is to design the platform as user-oriented as possible. Therefore, stakeholder perspectives and user requirements are to be integrated. This also includes the evaluation of existing and intended testbeds as part of sustainability improvement processes in cities and how urban logistics can contribute.

As presented, dialogue with other ASAP partners, especially testbed leaders, to understand the different testbeds, to (pre-)define Key Performance Indicators (KPIs) and its units of measurement as well as their finalisation is and will be essential. Furthermore, the interrelationships between different tasks and WPs are essential to improve the processes and the targeted results in ASAP.

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3. Literature Review

The monitoring and evaluation plan of ASAP is based on existing knowledge in the field of urban logistics. To do so, literature review, studying documentation from other EU projects and including ASAP partners' perspectives regarding KPIs was conducted.

The main goal is to design a SDG-related framework to evaluate urban logistics concepts of different kinds in a standardised manner. Therefore, it is necessary to define a set of comparable indicators and measurement methods in advance. By examining literature as well as existing frameworks, previous experiences and definitions of indicators can be integrated and gaps in designing a SDG-related framework for urban logistics can be derived.

Therefore, the term of urban logistics in the context of ASAP will be defined first. Next, data (categories) and possible sources for (measuring) the impact of urban logistics will be highlighted. In a third step, concepts of sustainability and the relationship to the sector of transportation are examined. Last, existing evaluation frameworks in the field of urban logistics and other European projects will be presented and their relevance for ASAP will be elaborated.

3.1. Urban Logistics, Data and Sustainability

3.1.1. Urban Logistics

European countries are highly urbanised (2020: 74.9%) and the UN expects that 83.7% of the European population will live in cities by 2050 (United Nations 2018). Cities are melting pots of a multitude of interests concerning mobility and logistics as many stakeholders share the same infrastructures. Key problems of urban logistics are inter alia the limited space and time to satisfy the different needs. On the one hand, local retailers require on-time deliveries to ensure complete assortment or regarding companies functioning production processes. On the other hand, logistics service providers (LSP) often aim at operating as cost-efficient as possible while citizens like to benefit from convenient delivery options while not being disturbed by urban logistics processes. Local authorities must harmonise these requirements while handling negative externalities caused by urban logistics like congestion, air and noise pollution, or also safety issues.

Furthermore, the field of urban logistics becomes increasingly more complex. "(…) To deliver the right product, in the right quantity and the right condition, to the right place at the right time for the right customer at the right price" (Swamidass (Ed.) 2000, p. 684) has always been key for (urban) logistics. But entry restrictions like time windows for deliveries or low/zero-emission zones are just two examples that affect the business of companies dependent on logistics services. These measures implemented by municipalities aim at fostering the sustainable use of infrastructures within the city borders.

In the context of ASAP, urban logistics is defined based on the European project NOVELOG as "the movement of freight vehicles whose primary purpose is to carry goods into, out of and within urban areas" (MDS Transmodal Limited 2012, p. 2). As this definition is not limited to any specific logistics

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operation or vehicle type, it fits into the broad scope of ASAP. This is due to the context of ASAP in which different testbeds are evaluated. These cover inter alia the transport of goods from outside of the city borders into the city as well as within the city borders. Furthermore, the project investigates different kinds of goods, but also waste disposal transports as it is representing a type of good within the circular economy.

It should also be emphasised that this work focuses on the urban area of global logistics systems (see Figure 1). This implies that quantitative monitoring and evaluation is solely limited to this area while one also must be aware of the implications of testbed implementations for the whole supply chain, also beyond the city borders.

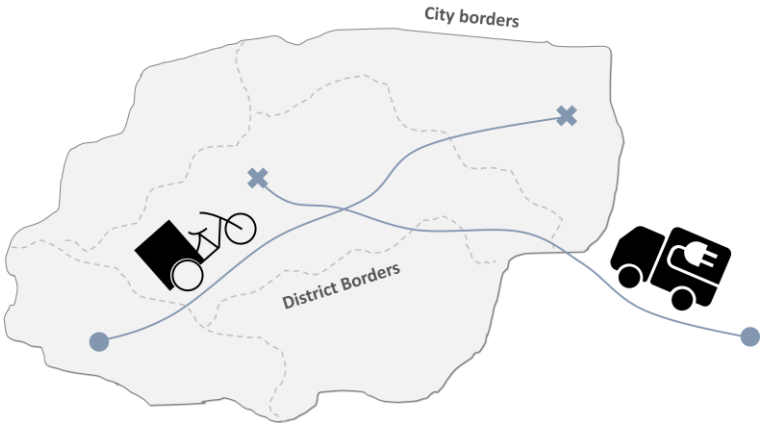

Figure 1: Area of Investigation within ASAP

To measure impacts of urban logistics quantitatively, data-driven approaches are necessary. In the next chapter the relevance of data and possible sources for evaluating urban logistics will be presented.

3.1.2. Data

As shown above, urban logistic processes include many actors and just as many measures to design and (re-)shape them. To evaluate the benefits of certain measures and deduce their advantages and disadvantages, a sound quantitative database is necessary. A survey conducted inter alia by Rupprecht (2021, p. 20) concluded that only 29 % of the sampled cities collect data on urban logistics. Often, there is a lack of agreement with private actors in the logistics sector and/or insufficient knowledge as well as scarcity of resources regarding collecting and evaluating urban logistics related data from a city's perspective.

To foster the understanding and stress the relevance of data and their sources for evaluating urban logistics, this chapter focuses on possibilities for municipalities, as well as other interested parties, to gain more insights into underlying processes. Bengel & Mauch (2021) assign data sources with relevance for urban logistics to four main categories as seen in Figure 2. These different categories of data sources are defined below.

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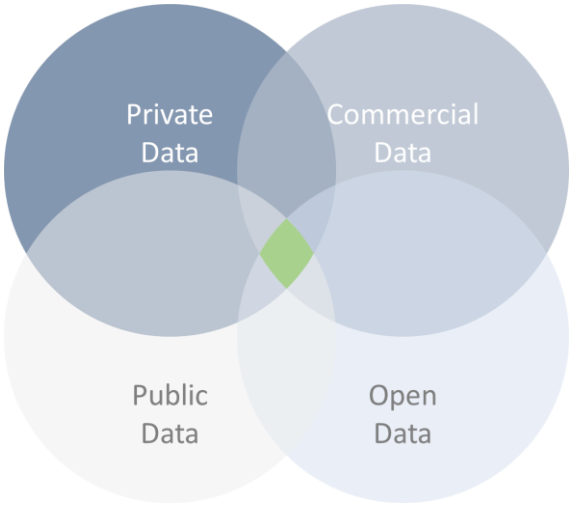

Figure 2: Data Categories (see Bengel & Mauch (2021, p. 30 f.))

Public Data

Municipalities and their departments themselves often possess logistics-related knowledge, e. g. about population and land use plans. This knowledge is highly valuable to enrol mobility as well as urban logistics measurements. To a certain point, data (e. g. socio-demographic data) is publicly accessible and thus also falls into the category of open data. If data is additionally geo-referenced, it allows a detailed analysis, sometimes broken down to street-level. In contrast, it is also possible that responsibilities are distributed among different departments which have the rights to keep the data under lock and key, which can make coordination more difficult.

Open Data

Open data refers to data with free access beyond the public data mentioned above, e. g. provided by non-governmental organizations or other stakeholder associations. Nevertheless, many communities and cities already provide their own open data platforms. For data analysis, it is necessary to enable the access to the raw data beneath (also of visualizations). Usually, users can download tabulated documents or get access to the data via a free interface. Bengel & Mauch (2021, p. 30 f.) underline that, depending on the data source and provider, great differences in quality can occur.

Commercial Data

Commercial data as third category are data sets that must be purchased from a third party. Examples for these data sets can be information about retailers as well as information about locations and areas from tradespeople. The access is either realised through an interface of a provider (e. g. Google) or by means of an external commissioning of a third-party report (e. g. retail concept).

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Private Data

The fourth category covers private data as municipalities often have no insights into the logistics processes itself. Therefore, the integration of private companies' perspective as well as their expertise is crucial. Often on the one hand, private data is available in a highly detailed format. For example, LSPs coordinate incoming and outgoing consignments of goods as well as their fleet. Thus, they usually have geo- and time-referenced information on the good flows on the last mile. This includes inter alia data from loading transport to the location data of the addressees and the journey itself. However, on the other hand, such data is usually seen as sensitive, hence only selective information about operational data can be expected (2021 Bengel & Mauch p. 35 f., 2019 SULP, p. 21 f.).

Van den Bossche et. al (2017, p. 6) underline that prior to the collection of data, the purpose of the model and the description of how the data will be provided as input need to be clarified. One must stress that the type of data needed to review urban logistics depends on the specific context of application. Bengel & Mauch (2021, p. 7) give the example of demographics which is relevant in estimating B2C-consignments while other factors, e. g. the volume of vehicles and consignments are of greater importance for the municipality for almost every purpose of urban logistics.

In the previous chapter, different data categories and sources were presented. In most cases, an interplay of these is necessary to fully understand and evaluate different urban logistics concepts. While municipalities often possess static information e. g. about its population, they have almost no data and information from private companies and LSPs which use the city's infrastructure. The integration of private and commercial data can help to foster the understanding of urban logistics for city representatives as well as underline the requirements and restraints to (re-)shape urban logistics in a more sustainable manner, also from the perspective of LSPs.

As ASAP covers a range of different testbeds with different topical backgrounds, this deliverable follows a funnel approach in defining data sources and KPIs (see Chapter 4). By having the different data sources above in mind, involved partners of ASAP can provide at first information about what kind of data they are able and willing to share. Subsequently, approaches and other data sources to circumvent (possible) data gaps can be implemented and integrated.

3.1.3. Sustainability

As presented in the previous chapters, efficient city logistics is essential for a functioning city. Furthermore, the relevance of data to evaluate different urban logistics concepts was stressed as well as different data categories and sources were presented. Additionally, urban logistics as part of the transportation sector plays an important role in achieving sustainability improvements, as it represents the most pollutant sector in the EU (European Commission 2021, p. 127).

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One of the most common sustainability concepts is based on the **three-pillar model of sustainability** containing the aspects of economy, environment, and society (Purvis et al. 2018). Within the three pillars, it is possible to work out and define guidelines and key objectives for sustainable behaviour. The essence of this concept is that all pillars are of equal rank and weight, while not all pillars are always met adequately. In an economic-driven environment the economic sustainability and viability often represents the most important pillar. Nevertheless, sustainable development can only be achieved through the simultaneous implementation of environmental, economic, and social objectives as the different goals are mutually dependent.

A more diversified approach is provided by the UN with its SDGs. In 2015, the General Assembly of the UN adopted the 2030 Agenda for Sustainable Development. It represents a future-oriented blueprint for actions to foster peace and prosperity with respect to the people and environment in a global context. 17 SDGs represent the main pillars (see Figure 3) and 169 targets relate to the different SDGs. In the resolution by the UN, it is stressed that sustainability is a multi-facetted construct, and it is necessary to tackle all SDGs simultaneously to achieve prosperity for humanity.

Figure 3: 17 SDGs (see UN (2015))

Regarding transportation, the Partnership on Sustainable, Low Carbon Transport (SLOCAT) stresses that “safe, efficient, low carbon, and affordable mobility for all is essential to sustainable human development and must be enabled in all sustainable development policies” (SLOCAT 2019, p. 5). According to SLOCAT the transportation sector is affecting several SDGs, targets and indicators (see Figure 4) as it is crucial for the well-being of people and the global economy while also having negative consequences on climate and pollution if fossil-fuelled vehicles are used.

Nevertheless, the authors conclude that there is a gap in promoting and achieving SDGs in real life. One key aspect is, among other reasons, the difficulty of quantifying sustainability impacts. SLOCAT stresses out that the sustainability assessment of the transportation sectors needs to be tackled prioritised with more effort and in decision-making processes for transport policies (SLOCAT 2019, p. 33 f.).

The work provided by SLOCAT, and other frameworks will be examined in detail in the following chapter.

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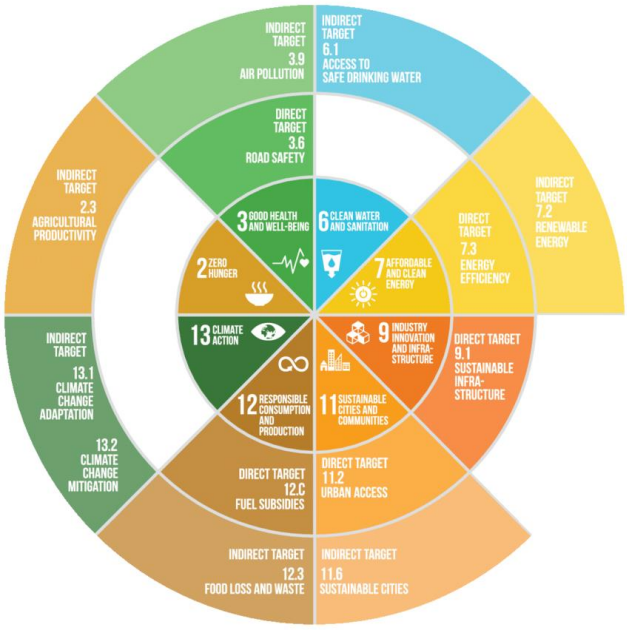

Figure 4: Direct and Indirect Transport SDG Targets (see SLOCAT (2019))

3.2. Sustainability Indicators and Evaluation Frameworks

In this chapter, data-related frameworks, based on literature review and other European projects, will be examined and their implications for the SDG-related monitoring and evaluation plan of ASAP will be derived.

Dziekan et al. (2013, p. 13) state that evaluations are performed to “measure the performance, learn for future projects and exchange experiences.” Furthermore, they underline that for the evaluation of any impact or effect it is important to collect and analyse data before (baseline) and after implementation (ex-post) (Dziekan et al. 2013, p. 23 f.). By doing so, one can compare both situations and draw conclusions. Especially in urban areas as high-density spaces the attribution of changes due to a specific concept must be elaborated carefully.

One aim of this deliverable is to **harmonise sustainability goals and possible indicators within the field of urban logistics by building upon the SDGs** provided by the UN. By doing so, this deliverable wants to support decision makers to inter alia improve future planning, as they should better understand the impact of certain urban logistics concepts in different facets. Furthermore, other parties like LSPs should benefit from a sound evaluation to promote their concepts to a greater audience. As ASAP is a project involving partners from different European countries, standardised evaluations, as well as lessons learned from other (European) projects, help to design a well-functioning monitoring and evaluation plan.

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This reinforces the importance of acquiring knowledge as part of the preparation of the ASAP monitoring and evaluation plan. Following, frameworks in the field of or with connections to urban logistics will be examined. These cover on the one hand approaches to evaluate urban logistics measures and on the other hand provide indicators which allow to derive implications for the monitoring and evaluation plan of ASAP.[1]

3.2.1. 2021 Bengel & Mauch

Bengel & Mauch (2021) elaborated guidelines for the use of data as a basis for planning municipal city logistics. The publication is part of the MobiDig project funded by the Ministry of Transport Baden-Württemberg, Germany.

Two chapters of the publication mainly focus on relevant data and collection methods as well as possible categories and sources within the field of urban logistics. The categories were presented in Chapter 3.1.2. The findings of the guidelines are based on research into the existing data situation and interviews with experts in the German municipalities of Aalen, Heidelberg and Stuttgart about data collection and analyses. The authors selected these municipalities due to different sizes and business structures.

The publication does not aim to provide guidance in elaborating long-term visions for urban logistics or a collaborative framework between different stakeholders rather than highlighting a range of KPIs and their origins.

Furthermore, the process of the derivation of data needs and the collection of data in the context of city logistics, the weighting of this data according to its relevance, the identification of data gaps, the collection of data considering city-specific characteristics and the final data evaluation is sketched.

3.2.2. 2019 Sustainable Urban Logistics Plans

To foster a systematic approach in designing the urban logistics context in a more sustainable way, the framework of Sustainable Urban Logistic Plans (SULP) was designed (Aifandopoulou et al. 2019). A SULP is an approach that aims contributing to solve problems of urban logistics. Both private and public stakeholders can contribute with initiatives. The European policy making process and the role of data collection are also discussed in the framework of SULPs. Eleven steps are identified in SULPs, of which four address data collection:

- **Step 3:** Analyse the mobility situation and develop scenarios (Preparation & analysis)

[1] The frameworks are presented in order of appearance descending from the most recent to the oldest.

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- **Step 6:** Set priorities and measurable targets (Strategy development)
- **Step 7:** Build monitoring and assessment into the plan (Measure planning)
- **Step 12:** Learn the lessons (Implementation & monitoring)

The intention of the process is comparable to the intention of data evaluation proposed by Dziekan et al. (2013), who underline the importance of analysing the situation before and after the implementation of a certain measure.

Figure 5: SULP Cycle (see Aifandopoulou et al. (2019))

Furthermore, the annex of this publication contains an extensive list of urban freight related data divided by the investigated type of urban freight aspect (inter alia vehicle or goods related) and different techniques that exist on how this data can be collected. It must be stressed that for further information and details concerning data and collection methods the authors refer to the NOVELOG framework (see Chapter 3.2.7).

3.2.3. 2019 SLOCAT

SLOCAT (2019) has elaborated a framework providing a step-by-step methodological approach to assist transport sector policymakers in:

- Translating SDGs in national sector plans, strategies and budgets;
- Designing policy interventions to target resources at root bottlenecks; and
- Providing coordinated and pooled policy support for sustainable transport development.

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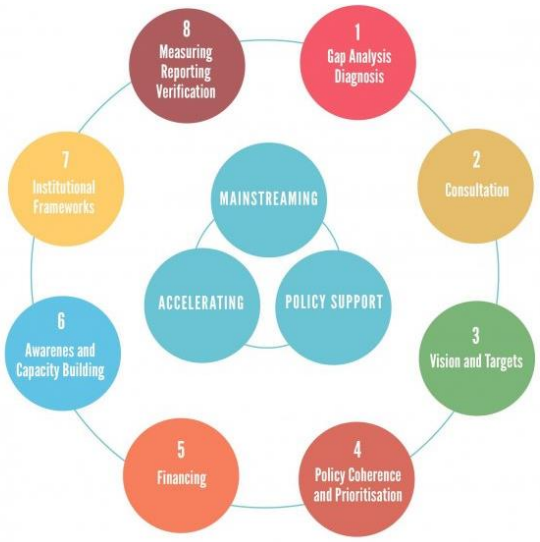

Figure 6: Framework to Accelerate SDG Implementation in the Transport Sector (see SLOCAT (2019, p. 36))

The eighth and last step of this framework is called “Measuring, Reporting and Verification (MRV)” containing inter alia the identification of data gaps as well as defining standardised transport indicators when tackling a transportation system. It is built upon the previous steps which represent a top-down-approach, meaning that based on relevant SDGs suitable indicators should be defined to support achieving SDGs (2019 SLOCAT, p. 39). The upstream steps are characterised by defining long-term visions in terms of SDGs and breaking them successively down to measurable targets and indicators which are not defined in this framework.

3.2.4. 2017 van den Bossche

In their publication, Van den Bossche et al. (2017) examined the common indicators, that are needed within an urban freight context. Also, data collection methods are used to obtain the data based on existing frameworks and literature. Based on their observations of data collection efforts and gaps in different European countries and cities, they derived an extensive list of indicators as well as common data collection methods to measure urban freight activities.

Nevertheless, the authors pointed out that in general there is a lack of data at urban level as well as that comparison is hindered due to non-systematic collection methodologies. They underline that due to the differences of specific situations the frameworks presented in their publication can only be seen as guiding documents and that the most suitable collection methods depend on the specific circumstances.

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3.2.5. 2017 TRIANGULUM

The European project TRIANGULUM's scope was to propose "(…) a novel form of smart district development that integrates energy, information and communication technology, and transportation to improve the efficiency of commerce and governance as well as reduce greenhouse gas emissions" (Evans et al. 2017, p. 12). To monitor and assess the impacts of the demonstration projects in the lead cities of Manchester, Eindhoven, and Stavanger a monitoring and impact assessment framework was elaborated. Main goals were the reduction of energy use and carbon emissions, enhancing quality of life and stimulating economic development.

In TRIANGULUM, a seven-stage methodology was adapted for developing indicators and calculating impacts (see **Fehler! Verweisquelle konnte nicht gefunden werden.**), also to replicate the approach in the project's follower cities. The methodology was elaborated together with city stakeholders based on a bottom-up approach. As illustrated, the impact assessment framework and indicators are co-produced by different task groups in the project.

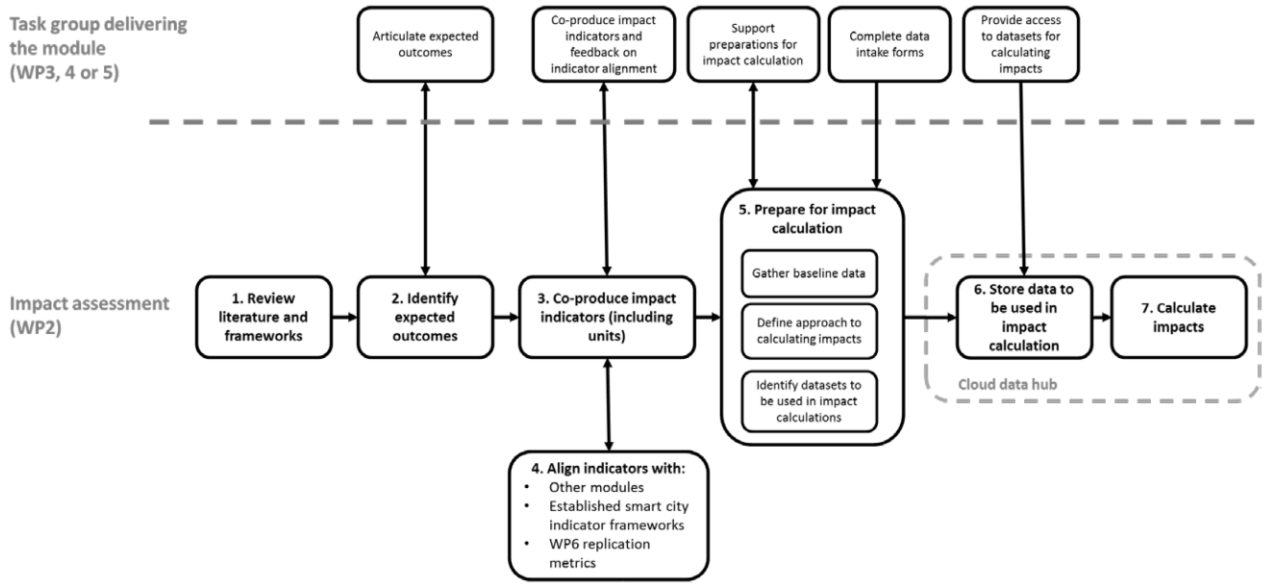

Figure 7: Seven-Stage Methodology for Developing Indicators and Calculating Impact (see Evans et al. (2017, p. 26 f.))

Even though not all indicators elaborated in TRIANGULUM relate to the transportation/logistics sector, the methodology for developing the indicators and calculating the impact is a valuable approach for ASAP to integrate the project partners as well as finding consensus in evaluating the different testbeds.

3.2.6. 2016 SUCCESS

The objective of the European project SUCCESS (Sustainable Urban Consolidation CentrES for construction) aimed "(…) to explore, find and test green and efficient solutions regarding various

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issues in Construction Supply Chain and material freight logistics in urban areas" (SUCCESS, 2022). Luxembourg City, Paris, Valencia and Verona represented testbeds of the project.

To evaluate potential positive and negative impacts of Construction Consolidation Centres (To-Be) against the current situation (As-Is), the authors pre-selected a list of 47 relevant indicators based on literature review and project partners' experience from other relevant projects inter alia on Urban Consolidation Centres (Ferrero, et al. 2015, p. 6). In a next step, the pre-selected list was evaluated and reviewed by the project partners based on the following questions:

- Is the indicator understandable?
- Is the indicator relevant?
- Is the data available?
- Is there any other relevant indicator which is missing?

The feedback from the SUCCESS partners was analysed and the initial list of indicators was shortened, reducing the number of KPIs to 19 indicators, covering categories like inter alia the journey time and route as well as environmental and economic impacts. Furthermore, the KPIs were assigned into the three-pillar concept of sustainability (see Chapter 3.1.3) and for every KPI the collection method is presented (Ferrero et al, 2015, p. 7 f.).

3.2.7. 2015 NOVELOG

The EU project NOVELOG (New cooperative business models and guidance for sustainable city logistics) focused on "(…) the enabling of knowledge and understanding of freight distribution and service trips by providing guidance for implementing effective and sustainable policies and measures" (Nathanail et al. 2016, p. 5). The project-related evaluation framework for city logistics measures aimed to assess the complexity of urban logistics systems by selecting a combination of performance indicators, recording divergent stakeholders' interests as well as conflicting business models and operations.

Therefore, the development of the NOVELOG evaluation framework was elaborated based on Life Cycle Sustainability Analysis components and Multi Actor Multi Criteria (MAMCA) decision making concept to cover all different stakeholders' objectives for each city case (Nathanail et al. 2016, p. 11 f.). Each case analysis was structured in the following modules:

1) Impact assessment (traffic, environmental and safety performance),

2) Social cost benefit (impact of logistics measure in monetary terms),

3) Transferability and adaptability (transferability to a wide range of urban contexts)

4) Risk analysis (risk identification and contingency planning)

Furthermore, seven impact areas of urban freight activities relate to these modules (Nathanail et al. 2016, p. 42 f.):

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(1) Economy and energy (Creation of a sustainable economy within environmental limits)

(2) Environment (Impact of logistics through Greenhouse Gas (GHG) emissions, air quality and noise impacts on communities)

(3) Transport and mobility (Improvement of transports of goods and mobility of people in terms of attractiveness, accessibility, level of service, safety as well as availability of infrastructure)

(4) Society (Logistics impact on sustainability, convenience and living standards of a community)

(5) Policy and measure maturity (involvement of stakeholders into the implementation of urban logistics activities)

(6) Social acceptance (social approval and regulations' compliance)

(7) User uptake (adaptability, flexibility, transferability and success of the implementation)

Specific criteria and indicators depend especially on the impact area. The evaluation framework considers 26 criteria and 137 indicators connected to the layers of impact areas and modules. NOVELOG defined criteria for inter alia emissions, noise pollution or the level of service, safety and security as well as congestion and operating and maintenance cost.

At last, indices per measure and impact area are aggregated into a so-called Logistics Sustainability Index per measure that is used for the comparison of the sustainability performance between measures or for the evaluation of the same measure in different scenarios (Nathanail et al. 2016, p. 90 f.).

3.2.8. 2015 CITYLAB

The objective of the CITYLAB (City Logistics in Living Laboratories) project was "(...) to develop knowledge and solutions that result in roll-out, up-scaling and further implementation of cost effective strategies, measures and tools for emission free city logistics" (Verlinde et al. 2015, p. 4). In the cities of Amsterdam, Brussels, London, Oslo, Paris, Rome and Southampton the approach of "living laboratories" was implemented in which public and private freight transport measures were evaluated, adapted and improved. Because different living labs exchanged experiences (see Figure 8), a common framework for the implementation transfer between cities and between companies was elaborated. The aim was to improve the understanding of the impacts that freight and service trips have on urban areas.

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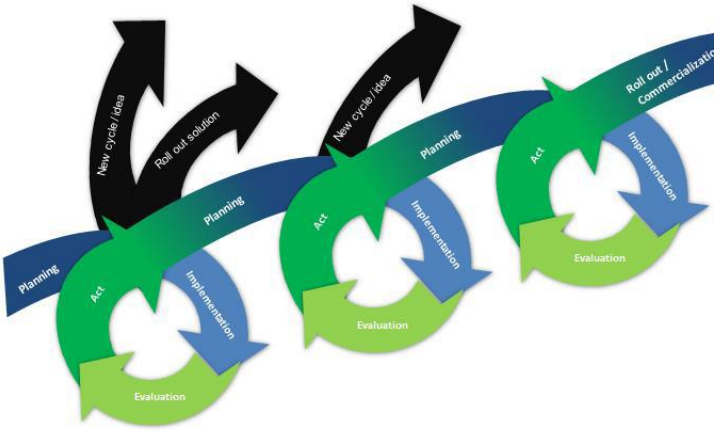

Figure 8: Schematic Overview of the Living Lab Environment (see Verlinde et al. (2015, p. 6 f.))

The indicators and before-after-evaluations applied in the project were structured into four fields of evaluation: (1) Adoption, (2) Process, (3) Context and (4) Impact. By applying these different fields of evaluation, as many aspects as possible should be covered. While “Adoption” and its indicators focused on the feasibility and willingness to pay for a specific solution, “Process” covers aspects and the evaluation of a (non-)successful implementation of certain measures (e. g. description of delays and lessons learned during the implementation phase). Third, “Context” highlights the local characterises which relate to a certain urban freight measure (e. g. city or industry related indicators). Last, “Impact” aimed at assessing and quantifying “(…) the changes that can be attributed to implementing the new urban freight transport solution” (Verlinde et al. 2015, p. 9). Indicators cover for example the average vehicle speed or the improvement of air quality.

3.2.9. 2012 STRAIGHTSOL

The STRAIGHTSOL (Strategies and measures for smarter urban freight solutions) project aimed to demonstrate solutions for smart and sustainable urban-interurban transhipment and last mile distribution. Furthermore, the demonstrators’ assessment should lead to policy recommendations, deployment strategies and real practice benchmarks. One of the main steps to achieve this goal was to “develop a new, generically applicable, impact assessment framework for measures applied to urban-interurban freight transport interfaces” (Balm and Quak 2012, p. 3).

Figure 9 illustrates the process that was followed in STRAIGHTSOL to define indicators, data needs and measurement methods. According to the authors, the process to define KPIs was based on the MAMCA approach to ensure that the indicators meet the different stakeholders’ perspectives. Therefore, the stakeholders’ opinion was the starting point in defining KPIs which also helped to allocate weights to different criteria.

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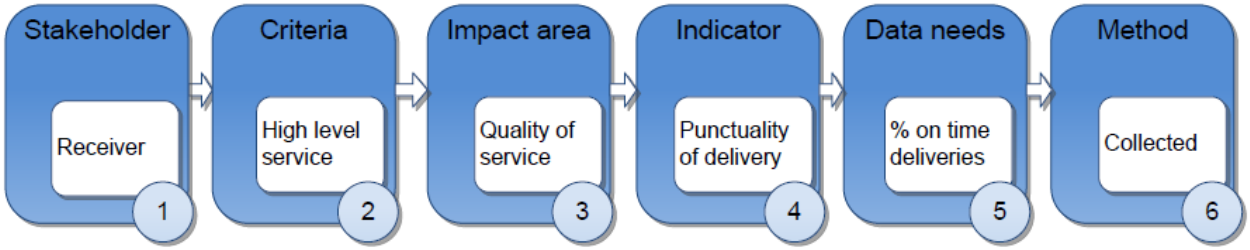

Figure 9: From Stakeholder to KPI Selection (see Balm and Quak (2012, p. 5 f.))

The process resulted in a framework with 31 indicators based on the stakeholders' criteria. Additionally, these indicators were categorised to four impact areas of economy, environment, society, and transport to characterise the situation before and after the implementation of a demonstrator.

3.3. Implications for ASAP

After the brief examinations of various works in the field of urban logistics, this chapter focuses on the implications of each framework presented in the previous chapter.

The work of **Bengel & Mauch (2021)** does not provide a guideline to integrate the perspectives of different stakeholders. Nevertheless, it offers many indicators of different categories in assessing and evaluating urban logistics concepts.

The cycle of **SULP (2019)** is a systematic approach in designing the urban logistics context in a more sustainable way. The framework is divided into four phases of preparation and analysis (1), strategy development (2), measure planning (3) and implementation & monitoring (4) with 3 steps each. It is specifically designed for municipality representatives and follows a top-down approach. Nevertheless, it contains several steps in analysing urban logistics impacts at certain points as well as an extensive list of connected indicators and data collection methods, also valuable for ASAP.

The framework provided by **SLOCAT (2019)** is a methodological step-by-step approach for transport sector policymakers. Like the SULP cycle, it is a top-down-approach and also includes national policymaking. Even though the scope is not focused solely on urban areas, the eighth and last step of the framework also focuses on MRV. This step can be adapted by ASAP as it is necessary according to the SLOCAT framework to define standardised indicators to evaluate transportation measurements.

Based on the literature review and observations of data collection efforts and gaps of different European countries and cities conducted by **van den Bossche et al. (2017)** a list of indicators as well as common data collection methods to measure urban freight were derived. They underline that due to the differences of specific situations the frameworks presented in their publication can only be considered as advices as the most suitable collection methods depend on the (local) circumstances. Considering this fact, it is important to see this deliverable of ASAP as one step in

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understanding the impact of urban logistics concepts, while the interplay with other WPs is essential, too.

In **TRIANGULUM (2017)** a seven-stage methodology was adapted for developing indicators and calculating impacts, also to replicate the approach in the project's follower cities. The methodology was elaborated together with city stakeholders based on a bottom-up approach. The impact assessment framework and indicators are co-produced by different task groups in the project. To align the expectations within the consortium of ASAP as well as have a common understanding of the KPIs it is necessary to work collaboratively on the monitoring and evaluation plan during the project period.

The approach used in **SUCCESS (2016)** is built upon a pre-definition of a set of indicators based on the conducted literature review and a subsequent review with the integration of the project partners. By addressing basic questions of understandability, relevance, availability, and absence of indicators the integration of the different partners was ensured. This approach also led to a reduction of indicators. This procedure is valuable to address and include different stakeholders with a different depth of specific knowledge about urban logistics.

NOVELOG (2015) highlights the complexity of urban logistics. Its assessment framework has different layers of modules, impact areas and related indicators. For the identification and derivation of relevant impact areas and indicators NOVELOG provides valuable input for the ASAP monitoring and evaluation plan. NOVELOG's scope covered on the one hand the technical feasibility of urban logistics solutions while one the other hand also focusing on the societal and political impact and environment. This interplay will also be important when evaluating the testbeds in ASAP.

In **CITYLAB** different European cities participated with different measures and tools for emission free city logistics. This approach is similar to ASAP. Even though this deliverable of ASAP aims at being the foundation in quantizing the sustainability impacts of testbeds, it is clear that one cannot neglect the impact of the context and setting of implementing a certain testbed. CITYLAB offers a blueprint of indicators and insights for recording the local context besides analysing the testbeds quantitatively.

In the **STRAIGHTSOL** project KPIs were defined with the help of the MAMCA approach. This approach reflects the complexity of interactions between the many actors in urban logistics. ASAP strives to adapt the approach by including as many stakeholder opinions as possible in an open and iterative way. The data, provided by the testbeds, should be reflected with other stakeholders to foster the understanding of certain KPIs as well as their need to record them.

In conclusion, the monitoring and evaluation plan of ASAP is built upon the expertise of several European projects and publications and is inspired by their frameworks. Furthermore, since many publications already elaborated KPI lists, these indicators will be used to derive connections between urban logistics, its areas of impact and SDGs as a next step.

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4. Approach in ASAP

Subsequently to the literature review, this chapter focuses on the elaboration of the monitoring and evaluation plan of ASAP. To do so, first, derivations from the literature review will be made which also represent the guiding foundations for the plan in ASAP. In a second step, the deliverable draws conclusions of the interplay between urban logistics and SDGs based on previous work in this field as well as gaps in addressing urban logistics sufficiently. Third, the organisational approach of the monitoring and evaluation plan will be presented. The fourth and last step of the plan covers KPIs as well as areas of impact and shows connections to the SDG framework.

4.1. Derivations from Literature Review

Based on the conducted literature review, the elaboration of the monitoring and evaluation plan for ASAP will be derived in this chapter. To do so, certain preliminary requirements for the plan and KPIs are defined to foster the implications derived from the literature review:

- **Comparability:** By applying the monitoring and evaluation plan, it should be possible to compare the impacts before (baseline) and after the ASAP testbed implementation (ex-post) (Dziekan et al. 2013). Furthermore, it should be possible to compare testbeds in relation to other testbeds or concepts, at least to a certain extent.
- **Topical application:** As ASAP covers a range of testbeds including e. g. disposal transports as well as simulation of non-existent testbeds, it is necessary to initiate the definition of indicators as broad as possible in the course of an iterative process.
- **Multi-actor views:** Different points of view should be included as urban logistics represents a sector influencing and being influenced by various stakeholders. The methodology in ASAP adopts a bottom-up approach. The integration of testbed leaders' opinion, representing cities as well as practical partners, on KPIs is crucial. As proposed in SUCCESS, KPIs must be relevant for these stakeholders and data must be available within their means to shed light on sustainability from their perspectives.
- **Iterative process:** As this deliverable represents a first scientific draft in evaluating urban logistics concepts in the context of ASAP with respect to SDGs, there should be room for adapting the indicators in an iterative process. This means, that during as well as after the project period, the arrangement and inclusion of new parameters should be possible, also by integrating (new) stakeholders' perspectives as proposed in the TRIANGULUM framework.
- **SDG-relevance:** As SLOCAT concluded, it is essential that progress on sustainable transport needs to be tangible. The ASAP monitoring and evaluation plan aims at providing quantifiable indicators to measure the impact of different urban logistics concepts and to report transport co-benefits across different KPIs and SDGs.
- **Cross-country learnings:** Furthermore, by following the ASAP approach the third pillar of SLOCAT's suggestion is tackled, namely "identifying specific case studies to facilitate cross-country learning and exchange of knowledge" (SLOCAT 2019, p. 6).

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Additionally, the literature review revealed that especially when focusing on SDGs, two gaps to foster the evaluation of urban logistics are prevalent:

1. Most frameworks related to SDGs and transportation focus mainly on the movement of people and how to foster their sustainable development (e. g. SLOCAT framework).
2. The SDG framework provided by the UN is mainly characterised by a top-down approach. This means that the general goals are well defined while there is a lack of concrete definition and measurement tools how to achieve these goals. Even though the SDG framework offers 169 targets and even more indicators, these are often not suitable for evaluating the impact of urban logistics.

To overcome these gaps, this deliverable proposes a bottom-up approach to stress the importance of urban logistics for improving the SDG development as well as to map different indicators, chosen based on the literature review, which help to measure their relevance in fostering a sustainability evaluation and development of urban logistics and their connection to UN's SDGs (see Figure 10). Based on the identified derivations as well as defined requirements in this chapter, the ASAP project focuses on the operationalisation of the SDGs for urban logistics, which are presented in the following chapter.

Figure 10: UN and ASAP Approach Comparison

4.2. Elaboration of the monitoring and evaluation plan

The work towards the monitoring and evaluation plan consists of multiple steps and iterations which are inspired by the approach adapted in TRIANGULUM (see Figure 11). The monitoring and evaluation plan's scope is mainly to define areas of impact, indicators, units of measurement and their relationship with SDGs. Relevant indicators have been determined by reviewing (scientific) literature and consulting ASAP partners.

The following tasks have been carried out to this point in developing the first version of the ASAP monitoring and evaluation plan:

1. Reviewing literature and other (European) projects to gather information about impact assessment frameworks and KPIs with relevance to urban logistics.

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2. Pre-defining a list of KPIs and areas of impact as well as units of measurement of urban logistics based on the literature review.
3. First feedback regarding KPI list, areas of impact and scope of the monitoring and evaluation plan from other ASAP partners, especially testbed leaders.
4. Completed the first iteration of the monitoring and evaluation plan.

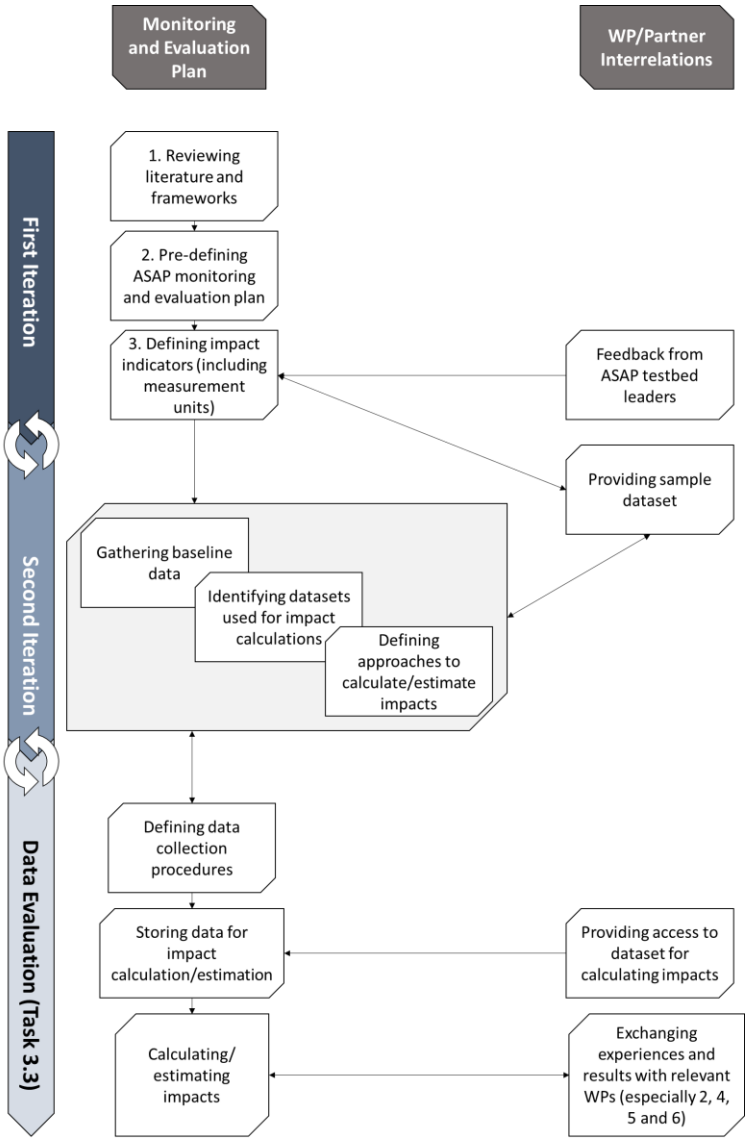

Figure 11: Elaboration Process of the Monitoring and Evaluation Plan

The monitoring and evaluation plan strives to integrate all partners in communication flows to make sure there is a clear and shared understanding among project partners regarding

(1) what is to be evaluated,

(2) what data is to be collected to perform the desired evaluation and

(3) how this data should be collected and in what format.

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To this point, the first iteration consisted of feedback given based on the preliminary KPI list (see Chapter 4.2.4) by the partners with existing testbeds in ASAP. Even though most of the partners have reported that most of the indicators are recorded, the availability of specific KPIs differs. Open questions also need to be clarified in some cases, e. g. regarding the unit of measurement or the expected frequency and degree of detail.

The next step, to initiate the second iteration, will be the **collection of real-life data**, starting with a sample dataset to evaluate the possibilities of ex-ante and ex-post impact assessments. The data originators (mainly testbed leaders) will be accompanied by the data processors bilaterally to clarify open points and respect their respective data sovereignty.

The last step will be the actual data collection carried out in the testbeds in the areas of impact described in Chapter 4.2.2.

4.2.1. Urban logistics and SDGs within ASAP

Regarding the SLOCAT framework, one can examine that mainly (public) transport is addressed. Even though some cross-related topics are covered (e. g. “amount of fossil-fuel”), other urban logistics aspects that can influence a more sustainable approach are excluded (e. g. loading factors of vehicles). To address these topics and with respect to the identified indicators in the literature, this deliverable proposes to focus on so-called primary SDGs while also showing up interrelations to secondary SDGs.

On the one hand, primary SDGs are defined as impact areas that can be measured within ASAP testbeds by using public, open, or private data and indicators (see Chapter 3.1.2). Their application allows a derivation of impacts for different SDGs. Secondary SDGs are on the other hand defined as SDGs that are related to urban logistics as well as the primary SDGs but cannot be measured directly within the testbeds’ scope. For example, the use of cargo bikes leads to a decrease of local emissions which can be directly derived from the substitution of the prior used (fossil-fuelled) vehicle (Primary SDG). Even though an improvement in cardiovascular health of the cargo bike driver is conceivable, this aspect cannot be measured directly within the project’s scope (Secondary SDG).

Based on the defined primary SDGs (No. 7, 8, 9, 11, 12, 13), the project team derived important indicators (54 pieces) from the literature which are related to the aspect of urban logistics (see Chapter 4.2.4). Primary SDGs for ASAP are:

No. 7: Affordable and Clean Energy

ASAP measures will help to increase energy efficiency due to improved processes and lower primary energy consumption due to promoting alternative vehicle concepts. Furthermore, ASAP fosters the use of more clean energy (or zero emission) options.

No. 8: Decent Work and Economic Growth

ASAP testbeds should lead to new technologies and new job possibilities and might also provide the possibility of new start-ups. Additionally, ASAP employs inter alia the use of cargo bikes. They

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are a particularly low-level entry point for persons that cannot afford cars or have no driving licence. All this contributes to ensure jobs for all levels of society and can thus contribute to combat against poverty.

No. 9: Innovation and Infrastructure

ASAP measures strongly contribute to the development of innovative, reliable, sustainable, and resilient urban logistics solutions. The idea is among other things to upgrade or retrofit existing infrastructures. The testbeds of ASAP can spread across innovative start-ups, research institutions and other municipalities.

No. 11: Sustainable Cities and Communities

The ASAP idea is to activate, use and promote underused or inactive infrastructure and resources in cities for urban logistics purposes. The use of ecologically sustainable concepts lowers the exposure to noise and emissions caused by urban logistics. Furthermore, this will lead to an increased quality of life and more safety.

No. 12: Responsible Consumption and Production

ASAP will also foster the improvement of reverse logistics and waste management which aims to reduce waste and disposal operations. Furthermore, consolidating goods and using re-usable or no packaging can reduce the ecological footprint of urban logistics.

No. 13: Climate Action

Proposing the use of ecologically sustainable concepts can cause cities to adjust their climate protection measures in a positive way for the environment and the city's inhabitants. ASAP promotes the use of existing structures and infrastructure and the use of alternatively powered vehicles. This also reduces the human-made impacts on nature.

Secondary SDGs for ASAP are:

No. 3: Good health and well-being

No. 4: Quality education

No. 6: Clean water and sanitation

No. 14: Life below water

No. 15: Life on land.

4.2.2. Areas of Impact

The assessment of the ASAP testbeds will be based on the following areas of impact which are oriented by the components and processes carried out by LSPs in the urban area:

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- Vehicle related,
- Goods related,
- Facility/Cargo handling,
- Transport related,
- Recipient related,
- Business/Employee related and
- Urban Area.

The areas of impact are starting points in calculating/estimating the impacts of the different testbeds regarding inter alia logistics efficiency, traffic efficiency, land-use, and the environmental impact as well as their business-related sustainability. Deeper explanations of the areas of impact are compiled in Table 1.

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Area of impact	Description
Vehicle related	As ASAP covers a range of different transport modes as well as vehicles, knowledge about the type of vehicle used for urban logistics is key to understand its applicability in different urban surroundings. Furthermore, the type/dimensions of vehicle, its propulsion and its payload are indicators to derive inter alia its environmental impact as well as its potential to substitute fossil-fuelled vehicles.
Goods related	Goods related aspects cover the type of good that is transported and its specific requirements (inter alia packaging and load carrier). Based on this knowledge, it is possible to derive special requirements but also possibilities to adapt the processes to other goods. Furthermore, in combination with knowledge about the quantities transported, it should be possible to derive the vehicle load rates.
Facility/Cargo handling related	Public spaces are not just occupied by the vehicles but also by facilities (e. g. hubs, parcel lockers) and cargo handling equipment for (un-)loading. The execution can take place e. g. on streets, shared spaces, squares. Since some of ASAP testbeds represent temporary solutions, it is also important to assess how long certain measures use certain spaces. By gaining insights about these processes, it can be possible to derive (negative) impacts for third parties like other traffic users.
Transport related	As urban freight activities use mutually used infrastructures, they are one of the contributors to congested routes and lead to a reduced efficiency of traffic and good flows. Transport-related processes can be optimised with respect to what transport mode is used and how this process is performed. In most cases, rush hours occur twice every weekday: in the morning and in the afternoon or evening due to people commuting. Recording inter alia departure and arrival times, vehicle speeds as well as the mode of transport of the ASAP testbeds can be indicators whether transport-related processes are improved by implementing a certain measure. Furthermore, knowledge about the transport processes can help to calculate environmental impacts based on the used vehicles and their energy needs. Transport-related aspects cover on the one hand the movement but also on the other hand dwell and stationary time periods. By gaining insights about the stationary periods (e. g. where/when/how long), one can also estimate the effects on other traffic users.
Recipient related	Meeting recipient requirements is essential when executing logistics-related services. It might be that certain measures lead to a change of the recipients' behaviour which can be advantageous (e. g. marketing with green logistics) but also disadvantageous (e. g. less flexibility regarding delivery time windows). Therefore, knowledge about the user group (businesses or customers) can help to better understand their needs. Furthermore, in the context of urban logistics it is valuable to find geographical patterns within city or district borders which are advantageous for a certain measure. For example, cargo bikes have a more limited working radius than conventional vans why their placement (as well as their depot) is a crucial success factor.
Business/Employee related	Another important aspect is business-related sustainability. ASAP strives to investigate how testbeds affect the before-situation and whether the changes or new implementation represents a viable business model. Therefore, it is important to assess the different fixed and variable costs linked to a testbed. Besides business-related sustainability, ASAP also focuses on the role of the employee. Using the example of cargo bike drivers, one could assume that the cardiovascular health of the cargo

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	bike driver could improve. While this aspect cannot be measured directly within the project's scope, asking for employees' satisfaction is a possible option to gain insights about their well-being.
Urban Area	To assess urban logistics concepts adequately, it is necessary to include unforeseen events that can affect the processes carried out. Possible events are e. g. construction works, road deviations due to accidents, but also public events like demonstrations or festivals. The knowledge about the urban area is amongst others important to detect data outliers. This field covers all areas mentioned above.

Table 1: Areas of Impact of the Monitoring and Evaluation Plan

4.2.3. Key Performance Indicators

To measure the sustainability impact in different facets, ASAP uses KPIs based on the literature review (see Chapter 3.2). In ASAP KPIs are defined as mostly quantifiable positions to measure (…) "the success, the performance or the degree of utilisation" (…) (Wirtschaftslexikon 2022) reached in the ASAP testbeds. Their application helps to compare the situation before and after implementing a certain testbed and allows to monitor the progress. Since ASAP testbeds differ in their design, a broad range of KPIs were proposed to the partners involved. The KPIs defined and described in Chapter 4.2.4 are preliminary and will be further discussed with the testbed leaders in the second iteration of the monitoring and evaluation plan which focuses on real-life data collection (see Chapter 4.2).

For the KPIs used in ASAP, the deliverable uses the premises defined in the SUCCESS project:

- **Understandable:** As urban logistics is a melting pot of different stakeholders, it is important that they should perceive the KPIs as easy to grasp. Relevant stakeholders are for example other cities (administration and politicians) and companies (LSPs etc.).
- **Relevant:** Based on literature review, a first selection of indicators to assess urban logistics processes was compiled. As ASAP covers a range of different existing and intended testbeds, not all KPIs are foreseen to be equally relevant in each case.
- **Available:** It must be possible to collect necessary data of adequate quality and it must be possible to do so within the resources available in the project.
- **Comparable:** The collection of KPIs should be executed in the same way for all the ASAP testbeds. The KPIs will be used for monitoring and evaluating the testbeds and deriving sustainability impacts. To be able to compare results across the testbeds it is necessary to use the same KPIs as well as take care of external factors (like e. g. seasonal changes, events affecting urban logistics processes etc.)
- **Quantifiable:** It should be mainly possible to express each KPI in a numerical measure, e. g. a pure number, an index, ratio, or percentage.

In an iterative process, feedback from the ASAP testbed leaders will be used to validate and prioritise the preliminary set of KPIs. This also covers the aspect of indicators that appear to be missing for different stakeholders. During this process the preliminary set of KPIs can also be reduced which

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could foster the focus and make data handling more manageable. The KPI list is presented in the following chapter.

4.2.4. Areas of Impact and KPI Table

Table 2 below sums up the defined areas of impact as well as the KPIs. Furthermore, the expected units of measurements were pre-defined based on the conducted literature reviews as well as further information were given to foster the understanding if e. g. no unit of measurement was defined. It must be stressed that this table is a preliminary and extensive list that must be mirrored in an iterative way with the respective testbed leaders which indicators are measured, or if deviations in evaluating the testbeds must be found.

Even though not every KPI has a quantitative nature, it is important to integrate certain qualitative aspects. By doing so, the understanding of the logistics processes should be improved for external parties which are not directly involved in the ASAP testbeds. Because the ASAP project strives to elaborate a platform solution for sustainable urban logistics for different interested parties, this aspect should be considered when evaluating different urban logistics concepts. Furthermore, including qualitative aspects can help conducting interviews with testbed leaders and derive use patterns or opportunities to change processes by applying a different approach (e. g. how the change of packaging, vehicle or load carrier is affecting the different impact areas).

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Impact Area of Urban Freight transport	Indicator	Expected Unit of Measurement	Further Information
Vehicle related	Type of vehicle	[…]	using European classification for vehicle category, based in UNECE standards
	Number of vehicles per type	#	
	Vehicle size (height x width x length)	m	
	Propulsion	[…]	e. g. petrol, fuel, electricity etc.
	Vehicle payload	kg and m^3	
	Vehicle net weight	kg	
Goods related	Type of good transported	[…]	using the European standard goods classification for transport statistics
	Load carrier	[…]	e. g. pallets, containers
	Packaging	[…]	e. g. carton
	Delivery weight & volume	kg and m^3	
	Quantity of deliveries/goods transported	#	trips per day
	Special goods requirements	[…]	e. g. cooling food, hazardous waste
Facility/Cargo handling related	Crew size	#	necessary for cargo handling
	Storage size	#	trips per day
	Loading/Unloading equipment	[…]	e. g. crane
	Load/Unload location	[…] and Lat/Lon	e. g. (stationary/temporary) street, bike lane, pavement etc.
	Time taken to load/unload	hh:mm:ss	
	Area occupied by facilities	m^2	Hubs, Micro Depots, Parcel Lockers etc.
	Area occupied by vehicle	m^2	While parking/(un-)loading
	Time of area occupation per day	hh:mm:ss	e. g. in case of mobile solution (like mobile micro depots)
Transport related	Day & Time (Departure & Arrival)	dd.mm.yyyy hh:mm:ss	
	Driving & Dwell Time	hh:mm:ss	
	Vehicle speed	km/h	if possible, GPS-tracked
	Type of vehicle round	[…]	Single destination, Multi-drop, Milk Run etc.
	Mode of transport	[…]	e. g. street, bike lane, waterways, rail
	Energy consumption	l or kWh	Should be aligned by a conversion factor => Joule
	Emissions	kg	CO2, PM, Nox
	Vehicle Load Factor	%	
	Freight Flow Intensity	tkm	
	Distances (to next stops)	m	which allows to derive total tour length in the end
	No. of Stops/Tour	#	
	No. of Tours/Day	#	
	Parking location before/during/after vehicle use	[…]	e. g. street, bike lane, pavement, depot etc.
	Number of negative interactions between ASAP concept and other user groups	#	e. g. illegal parking, accidents, fatalities

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Recipient related	B2B, B2C, C2B, C2C	[…]	
	Sector	[…]	e. g. retail, automotive, construction, waste management
	Place/Type of establishment	Lat/Lon and […]	Shop floor, stock room etc.
	Drop Factor	#	e. g. parcels/stop
	Share of successful delivery attempts	%	Problems e. g. absence of recipient
	Distance between (un-)loading point and recipient	m	e. g. parcel locker <-> home
	Number of users	#	e. g. daily, weekly, monthly
	Requirement of recipient's interaction	y/n	e. g. check, signature
	Recipient satisfaction level	[…]	e. g. by conducting qualitative surveys
Business/ Employee related	Type of operator	[…]	e. g. own account, logistics company, parcel carrier etc.
	Investment costs/Depreciation costs of investment	€	
	Personnel costs	€	differentiated in function of staff (e. g. delivery person, overhead)
	Vehicle costs	€	TCO
	Operating costs	€	
	Maintenances costs	€	
	IT costs	€	based on IT functionalities
	Working hours/day	hh:mm:ss	
	Employee satisfaction level	[…]	e. g. by conducting qualitative surveys
	Amount of money spent by local authority to support concept	€	
Urban Area	Events (which can influence logistics execution)	[…] dd.mm.yyyy / Lat/Lon	e. g. Delivery Time Window, Entry Restrictions, Events, Roadworks etc.

Legend	
[…]	Qualitative Statement
#	Numeric Value
y/n	Boolean
Lat/Lon	Georeferenced

Table 2: Areas of Impact and KPIs

Following, three examples aim to show the relationship between indicators and SDGs. As the extensive lists covers to this point more than 50 indicators, the approach can only be done exemplary.

Vehicle related: Vehicle type and propulsion

The use of non-fossil-fuelled vehicles relates to every primary SDG. Since local emissions and noise can be reduced (SDG 7: Affordable and Clean Energy and SDG 8: Decent Work and Economic Growth), the change of the propulsion is a step towards a more sustainable urban logistics. Furthermore, less local emissions foster actions to mitigate the climate impact (SDG 13). If also existing infrastructure is used by the vehicles, the vehicle is target-oriented and resource-efficiently designed, it also tackles SDGs 9 (Innovation and Infrastructure) and 12 (Responsible Consumption and Production) which leads in conclusion to a more sustainable city (SDG 11)

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Goods related: Goods properties and packaging

The properties of the transported goods, like weight, dimensions, and packaging, mainly address SDGs 8 (Decent Work and Economic Growth) and 12 (Responsible Consumption and Production). Regarding SDG 8, one must also examine the possibilities for the delivery person to use (un-)loading equipment. SDG 12 is mainly addressed by investigating which materials are used to transport the goods and whether they can be reintroduced into the circular economy.

Transport related: Driving and Dwell Time

Whether the transportation is mainly characterised by driving or dwell times can provide information about its efficiency. All primary SDGs relate to this indicator as resources for vehicle propulsion can be used adequately when not wasted on congested streets. Besides having positive impacts on the local environment, it also affects the company's economic performance as energy costs can be reduced.

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4.2.5. Data Collection and Processing

The ASAP research testbeds represent one of the essential sources for data as they are ”sleeping assets” and can be building blocks for a more sustainable urban logistics. To this point, first feedback was given based on the preliminary KPI list (see Chapter 4.2.4) by the partners with existing testbeds in ASAP. Even though most partners have reported that the majority of the indicators are recorded, the availability of specific KPIs differs. Also, in some cases open questions have to be clarified, e. g. regarding the unit of measurement or the expected frequency and degree of detail.

Therefore, as a next step it is planned to record a first sample dataset. This helps to mirror this mainly theoretical framework with real-life data, to define approaches to calculate impacts and to uncover potential data gaps (see Chapter 4.2). It is intended that this process will be done bilaterally between data originators and data processors to respect their data sovereignty and the DMP of ASAP (Müller & Dragon 2022). In addition, the collection and revision of data will be done in an iterative approach to adjust data (collection methods) and to enable an exchange between the partners to discuss derived insights as well as clarify open questions (e. g. data outliers).

Even though this deliverable focuses mainly on (private) partner data, other data sources are also important since it can be necessary to circumvent data gaps. Other sources of data for the indicators are presented in Chapter 3.1.2. Theoretical premises represent for example one data source to assess the impact without the need of partner data (e. g. using frameworks for calculating CO_2 equivalencies).

The relatively small scale of the individual testbeds also has to be stressed which leads to small sustainability impacts on a (larger) city scale. To calculate potential larger benefits this deliverable refers to other urban areas where the testbeds could be viable and by using extrapolation.

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5. Conclusion and Next Steps

To this point, the monitoring and evaluation plan has been defined. Furthermore, the associated preliminary list of KPIs was communicated within the consortium in a first iteration to gather initial feedback. As D3.1 is one of the key foundations for Task 3.3 “Data Collection and Evaluation”, it is foreseen that this document must be regarded as a living document, especially concerning feedback related to data, collection methods as well as formats. Following steps are intended to take place in the next iteration(s):

- **Finalising KPI selection:** To this point, the testbed leaders mainly shared feedback to the theoretical KPI list without sharing real-life data. It will be crucial to align the possibilities of data collection, the willingness to share data as well as the level of detail to evaluate to which degree sustainability impacts can be derived. Based on the following iterations, the final definition, selection, and description of the KPIs to be used to evaluate the testbeds will take place. This includes validating and prioritising the preliminary KPIs presented in this deliverable, in a systematic and open approach based on feedback from the ASAP testbed leaders to foster consensus of the sustainability evaluation.
- **Initiation of and aligning with data collection activity:** In Task 3.3 procedures to collect, sanitise, process, store, and finally provide data to the respective project-internal stakeholders will be initiated. Regular contact with testbed operators (existing in WP 3 and intended in WP 5) and local project partners should ensure a smooth and continuous flow of data. The foundation for the upcoming processes is provided with this deliverable as a guiding document.
- **Defining evaluation methods:** Methods to be used in evaluating the impacts have to be defined from a theoretical point of view but also with respect to the testbed leaders’ perspectives. Dialogues about the level of granularity will be necessary to take care of data sovereignty. Furthermore, the sustainability impact of the testbeds in the urban areas of Paris, Stockholm, Versailles and Vienna are expected to be of a rather small scale. The methods will have to consider the use of extrapolation.
- **Connecting with other WPs**: This deliverable provides the monitoring and evaluation plan including mainly measurable indicators. To understand and evaluate the ASAP testbeds in depth, it will be necessary to include qualitative aspects, also including work from WP 2 as well as WP 5.

As ASAP covers existing as well as intended testbed, specific next steps for each case are explained more detailed below.

As a subsequent step, the large number of indicators presented in this deliverable will be reflected in a second iteration and as initiation of the task “Data Collection and Evaluation” with the existing testbeds. This allows to evaluate, whether a further reduction of the indicators is necessary by evaluating the benefits of each indicator and the effort of data collection for it. Fraunhofer IML will contact each testbed leader in an iterative approach. This represents an extension to conceive an overall monitoring and evaluation plan incl. description of indicators (linked to SDGs) and how to

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measure them (D 3.1) that specifies how to proceed in general to efficiently collect the data from the field, and how to ensure sufficient quality. Moreover, the plan already showed the use of interrelationships between indicators and the integration of external data sources to circumvent data gaps or low-quality data. Finally, this plan outlined the procedure for the data-based testbed evaluation for task 3.3.

For the intended testbeds, it will be necessary to reflect with the partners involved in WP 5 whether it is possible to integrate the presented indicators and areas of impact into or extract from the simulations. As the simulations cover a range of testbeds, this process will also be done bilaterally. The aim is to gain specific insights and derive valuable results to connect simulations and SDGs as they represent planning tools for non-existent and future-oriented solutions to foster sustainability of urban logistics processes.

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