Activity Deliverable

Shared micro depots for urban pickup and delivery (S.M.U.D.)

Compilation of different micro depot solutions

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Executive Summary

Last mile logistics is an emerging research area with growing interest. The rapid growth is mainly driven by increasing urbanization and population growth, e-commerce development, changing consumer behaviour, innovation, and growing attention to sustainability.

For logistical companies, there are several challenges connected to the supply of populated urban areas. On the one hand, the lack of space combined with the growing delivery volumes that leads to traffic jams, high levels of emissions as well inefficiencies along the delivery process. All this results in lower service quality, lower delivery reliability and higher delivery cost, while simultaneously lowering the quality of living in the city.

One of the solutions for these challenges is the usage of dedicated depots for pickup and delivery. This solution has been used in the past and it has shown that depots dedicated to a specific stakeholder, however, are inefficient both in space utilization and pollution prevention. Therefore, S.M.U.D. "Shared micro depots for urban pickup and delivery" is addressing this issue by providing publicly acceptable and sustainable solutions for last mile delivery that allow the sharing of the services between all stakeholders, thus optimizing the routes and space within the cities as well as leading to a reduction of local exhaust emissions and greenhouse gas emissions and traffic congestion.

This report studies the best practices related to shared micro depot solutions and provides considerable information to city administrations in deciding which is the best alternative when it comes to strategic planning where the investment budget is high and the decisions taken directly affect the socio-economic domain, the environment and the quality of life of thousands of people.

It contains a list of the most important projects as well a summary of the main characteristics that have been observed for each proposed measure or combination of measures.

The summarised measures are flexible and may be used in different kinds of city contexts and urban environments. For example, cargo bike solutions have been developed in high congestion areas of city centres, where the streets are narrow and / or pedestrian, with time windows for loading and unloading. Whereas, smart points are installed in different areas of the city in order to offer a solution to failed deliveries by avoiding traffic congestion but at the same time offering easy access to the users.

The advantage is that the measures provided by these projects have already been tested in real life applications in the context of pilots and case studies. Stakeholders are presented with an overview of the characteristics, advantages, challenges and recommendations for each of the possible solutions that have been taken into account.

The description of the measures provided can be further combined with the specific characteristics of each city or area which will allow for an informed decision on which is the most appropriate measure to be applied.

1. Introduction

Last mile logistics is an emerging research area with growing interest. The rapid growth is mainly driven by increasing urbanization and population growth, e-commerce development, changing consumer behaviour, innovation, and growing attention to sustainability.

The last mile is considered as one of the most expensive, inefficient, and polluting parts of the supply chain. Some studies estimate that the last mile accounts for 13 up to 75% of total supply chain cost, depending on various factors. [1] Efficiency depends on multiple factors, such as consumer density and time windows, congestion, fragmentation of deliveries, and shipment size and homogeneity. Last mile logistics cause various externalities, especially greenhouse gas emissions, air pollution, noise, and congestion. Therefore, a better understanding of the last mile is required as well as working on solutions.to enhance its economic, environmental, and social sustainability.

City authorities and logistics companies are turning to a range of different solutions while trying to boost sustainability and cut CO2 emissions in order to reach the sustainability targets and comply with the European Green Deal[2].

For logistical companies, there are several challenges connected to the supply of populated urban areas. On the one hand, access to inner cities is constrained, as delivery vehicles compete with passenger cars for the same space leading to traffic jams, accidents and emissions. As a result, the cities face growing delivery volumes, smaller single deliveries, more just-in-time deliveries as well as inefficiencies along the delivery process. On the other hand, cities grow not only on population, but also in surface leading to longer transportation times. All this results in lower service quality, lower delivery reliability and higher delivery cost, while simultaneously lowering the quality of living in the city.

One of the solutions for these challenges is the usage of dedicated depots for pickup and delivery. This solution has been used in the past and it has shown that depots dedicated to a specific stakeholder, however, are inefficient both in space utilization and pollution prevention. Therefore, S.M.U.D. is addressing this issue by providing a publicly acceptable solution to last mile delivery (see Figure 1).

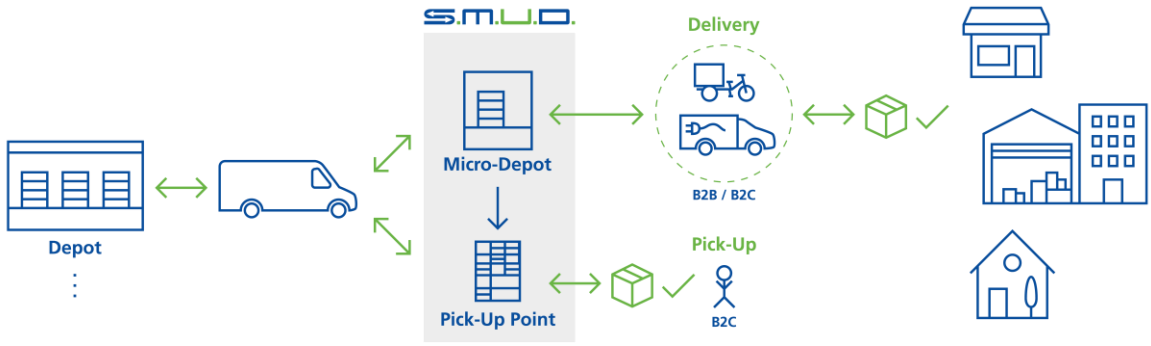

Figure 1: S.M.U.D. concept (source: S.M.U.D. consortium)

The S.M.U.D. implementation process will be evaluated within two living labs at shared micro depots in the cities of Helmond (NL) and Helsinki (FI). Additional support for future micro depots will be developed through

[1] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.676.5843&rep=rep1&type=pdf

[2] https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

the implementation of a roadmap and program as well as a toolbox with a wide range of solutions and best practices.

More specifically, the current deliverable aims to provide data and allow knowledge transfer of important lessons by identifying the most relevant experiences, key success factors, challenges and requirements. The tools used to carry out the tasks of the deliverable are:

- literature reviews;
- previous experiences on projects such as H2020, Smarter Together, and GrowSmarter.

Moreover, throughout this deliverable a validation of the learning lessons and provision of further information on critical success factors will be carried out. The main aspects of focus for each of the considered solutions will be: business model, sustainability, and logistics.

All of the above will allow a better understanding on how the living labs should be designed and form the base for further S.M.U.D. activities.

Finally, at the end of the project, interviews with the stakeholders will be carried out in order to validate the coherency of the results that will be produced.

2. Shared micro depot solutions

The suitability of different propulsion technologies for transport depends on the length of the transport route and the transport volume. Currently electric vehicles are suitable only for local transport. For longer routes, other propulsion technologies are better suited, e.g. electric engine with range extender or classical combustion engine. E-cargo bikes have a lower range and a significantly lower transport volume than delivery trucks. For this reason, shared micro depots are particularly suited for the use of e-bikes.

By combining the two mechanisms of consolidation and means of transport, the concept of micro depots is expected to simultaneously relieve urban infrastructure and reduce emissions. Electric bikes have no local emissions, neither greenhouse nor – more importantly for the air quality in cities – exhaust emissions such as NOx or PM. The only local emissions come from the truck to position the container. Furthermore, electric bikes generate less noise than trucks and do not block streets as much as delivery trucks do.

The concept of micro depots is particularly suitable for densely populated areas. However, for some urban areas a combination of different solutions is required, e.g. micro depots and e-cargo bikes for the inner city and electric vehicles for the outer city.

The main disadvantage of the concept is that some of the solutions involve the temporary storage of containers in the city. Containers take up valuable space that could be used for other activities, e.g. parking of passenger cars.

The following subchapters present a short description of the existing shared micro depot solutions.

2.1 Cargo bike

Cargo bikes aim to replace conventional freight distribution vehicles such as trucks or vans. The new urban logistics is defined by two processes (see Figure 2):

- Firstly, a conventional transport operator brings the good to a hub located in the city.
- Secondly, a cargo bike that is a more flexible vehicle, delivers the good from the previous hub to the customer.

Generally, cargo bikes have a greater potential in dense and congested cities with pollution problems. Moreover, they are more efficient in narrow streets and in zones where heavy vehicles could struggle.

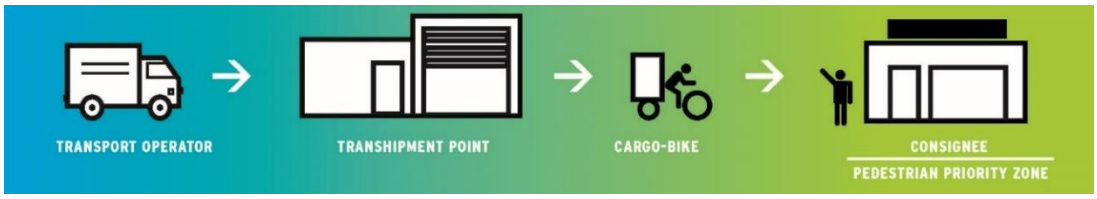

Figure 2: The urban logistics process (source: GrowSmarter project)

Nowadays, cycle logistics is establishing as a promising solution for last mile and inner urban deliveries and a realistic alternative to motorised transportation in urban areas, mainly because of factors such as the rising awareness on environmental issues and concerns related to urban freight transport.

As some authors suggest, the largest obstacle to the diffusion of deliveries by cargo bikes is the general lack of acknowledgement of their advantages amongst users, customers and policy makers.

The main stakeholders that might be involved with this innovation in urban logistics are:[3]

- Senders, that can be private or public;
- Receivers, private or public;
- Logistics service providers, that can be large companies diversifying their offer, start ups or a
- combination of them;
- Drivers, employees of a company or self-employed;
- Society, that plays a role especially with regard to the balance between the need of as cheap and quick as possible deliveries and the request for safe and "green" deliveries.

Public authorities, that should balance interests between different needs and requests and can introduce push-and-pull measures.

- Banks and insurance companies, financing or insuring innovative solutions and startups in this field.

Besides the unquestioned environmental advantages of cycle logistics, there are other success factors for cargo bikes that can be related to the following aspects:[4]

- Economic efficiency: purchase and maintenance costs are lower than those of a commercial van, bikes have no fuel costs and also for e- cargo bikes energy consumption is very low.
- Flexibility: bikes can easily work around congestion and are unlikely to get stuck in traffic, having access to some dedicated lanes and to areas with restrictions due to environmental or congestion issues.
- Liveability of the urban environment: using cargo bikes also improves the quality and liveability of the urban environment, since it reduces noise emissions, it generates less soil consumption on the road and for parking vehicles, it decreases congestion.
- Bikes are generally viewed as less intimidating and safer than vans, pose fewer dangers to vulnerable road users and are generally well accepted among the population.
- Furthermore, delivering by bike do not requires a driving licence; therefore, it can provide employment opportunities for disadvantaged people.

It is necessary to clarify that this section does not consider projects that create new micro depots for freights distribution with the addition of cargo bikes. This situation will be studied in another group.

2.2 Micro Depots

A micro depot is an interim storage in the city, which can be either stationary or mobile[5]. Usually it is realized as a container temporarily positioned near the centre of gravity of the respective delivery area.

Technically, the micro depot divides the last mile of transport into two steps: a second-last mile and a very last mile (see Figure 3). On the second-last mile, the container filled with parcels is transported by truck from the depot of the CEP (Courier, express and parcel deliveries[6]) service provider to the location of the micro depot and – in case of a stationary depot – parked there for the duration of the delivery process.

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[3] TeMA Journal of Land Use Mobility and Environment 2 (2016)

[4] TeMA Journal of Land Use Mobility and Environment 2 (2016)

[5] https://www.researchgate.net/publication/334784178_Sustainable_Parcel_Delivery_in_Urban_Areas_with_Micro_Depots

[6] CEP is an acronym for the three services the CEP industry usually provides: namely courier, express and parcel deliveries. Courier deliveries are usually same-day deliveries, express deliveries are usually shipped over-night, and parcel deliveries have no binding delivery date, but the arrival of parcels can be usually predicted to a day.

On the very last mile, the individual parcels are taken from the micro depot and delivered to the final recipients e.g. by cargo bike. In case of a mobile micro depot, the container is moved after every loop to meet the cargo bike and refill it.

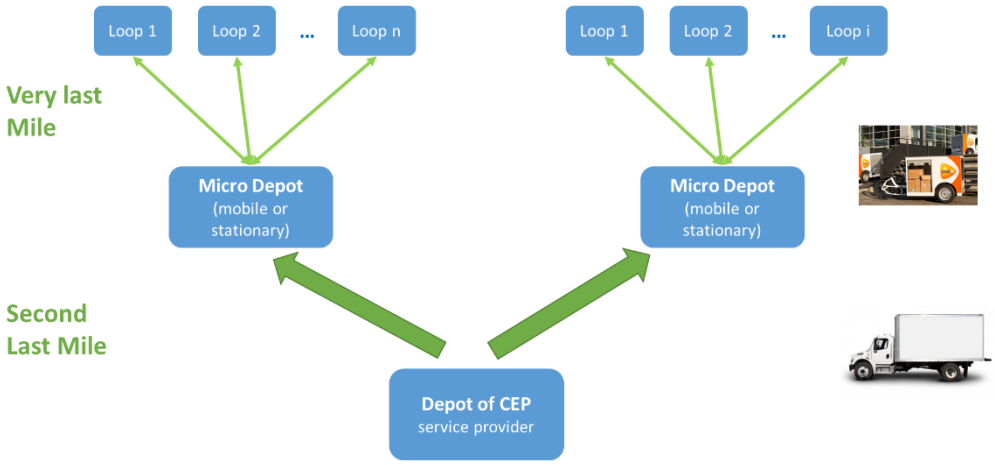

Figure 3: Concept of micro depots (source: CIMNE elaboration from paper "Sustainable Parcel Delivery in Urban Areas with Micro Depots")

From a logistical perspective, the micro depot is a combination of two mechanisms of city logistics: consolidation of transport volumes and use of environment-friendly means of transport. On the second-last mile, the volumes are bundled for a full truckload delivery to the micro depot. The delivery on the very last mile can be performed with the use of environment-friendly means of transport (small electric vans, cargo bikes, electric cargo bikes or walkers).

The implementation of micro depots allows using a more suitable vehicle for each situation: On the one hand, for long distances heavy vehicles as trucks are used. On the other hand, small and flexible vehicles such as electric small delivery vans, deliver goods from the micro depot to the customers, reaching destinations where heavy vehicles could struggle and optimizing the transport route. Figure 4 presents a generic micro depot model with the main flows carriage.

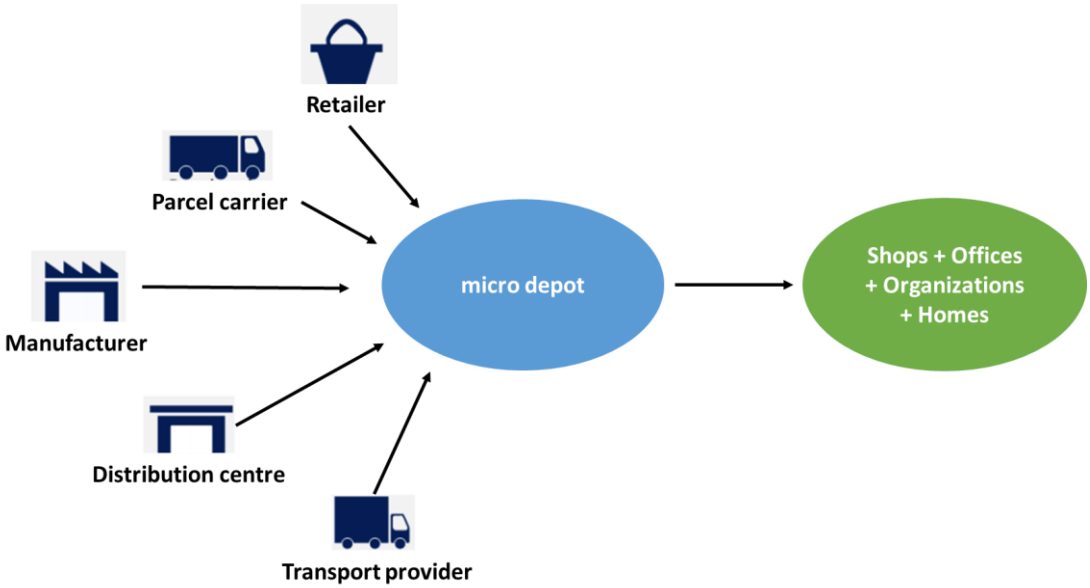

Figure 4: Micro depot framework (source: CIMNE elaboration)

A micro depot has multiple objectives, such as:

1. Reduction of urban traffic levels by reducing the total number of journeys by urban vehicles through consolidation or modal shift.
2. Change in the type of vehicle used in the urban distribution of goods (light or heavy vehicles).
3. Reduction of the environmental impacts associated with the activities of cargo vehicles, by reducing the number of trips and or use of environmentally friendly vehicles.
4. Improvement of the efficiency of urban freight transport, by increasing vehicle occupancy levels
5. Reduction of the inventory of products and logistic activities in the urban context, which can result in an increase in the volume of business due to the offer of services of greater added value by the micro depot as the leasing of storage spaces.

The efficiencies induced by the implementation of a micro depot on the overall logistical network are further improved by the use of environmental-friendly vehicles in the last-mile delivery/collection services.

2.3 Micro depot + Cargo bike

This type uses micro depot implementation where the vehicle used from the micro depot to the customer is a cargo bike. A distinction is made between a new micro depot with or without cargo bikes due to parameters such as the emissions, financial sustainability or efficiency of the system change.

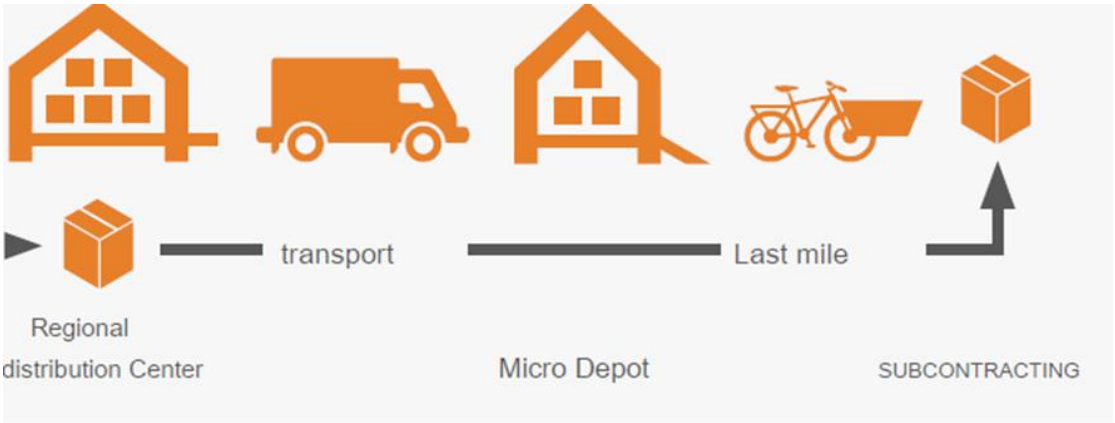

Figure 5: Micro depot with cargo bikes (source: HANDBUCH: Mikro-Depots im interkommunalen Verbund)

2.4 Smart point

Smart point (pick-up point) centres include the installation of lockers in the streets, residential zones or office building to create new many-to-many hubs between the company and the customers. During the first phase, the company transports the goods to the lockers, usually through a semi-flexible vehicle as a van. Subsequently, as lockers are located close to the customers, they can pick up their order from the locker on their own.

Commonly, pick-up points are deployed by private companies. When the order has arrived to the locker, the customers usually have between 2 and 7 days to collect their orders.

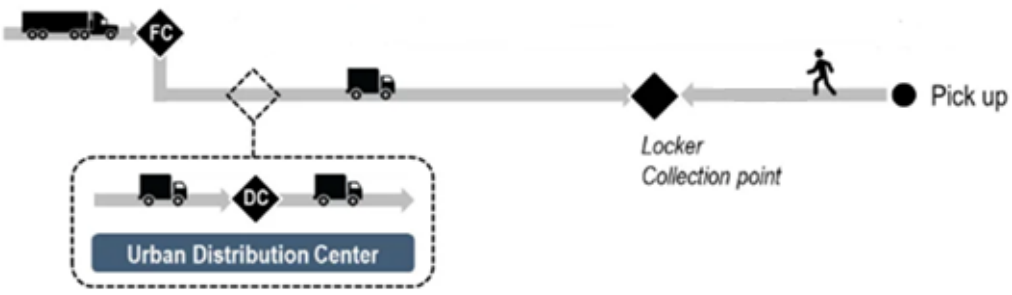

Figure 6: Smart point functioning (source: https://globalcitylogistics.org/)

Smart points offer a solution to failed deliveries (avoiding the necessity of having to do two or more trips for the distribution of the same package) while also increasing the density of deliveries. When the number of parcels to the pick-up point is high enough, benefits for both logistics carriers and the society are achieved. This is due to the reductions in the overall number of vehicle kilometres travelled (VKT). Results show that reductions-can be obtained with a limited number of smart points.

2.5 Micro depot + Smart Point

This type of measure consists in a combination of micro depots and smart points. This measure can be used by different distribution companies at the same time.

One of the first examples in Europe is he CityHUB located in Turku, Finland. The station is located in the downtown area of the city.

The purpose of the local distribution station is to reduce the number of delivery vehicles in the city centre and to support carbon neutral logistics.

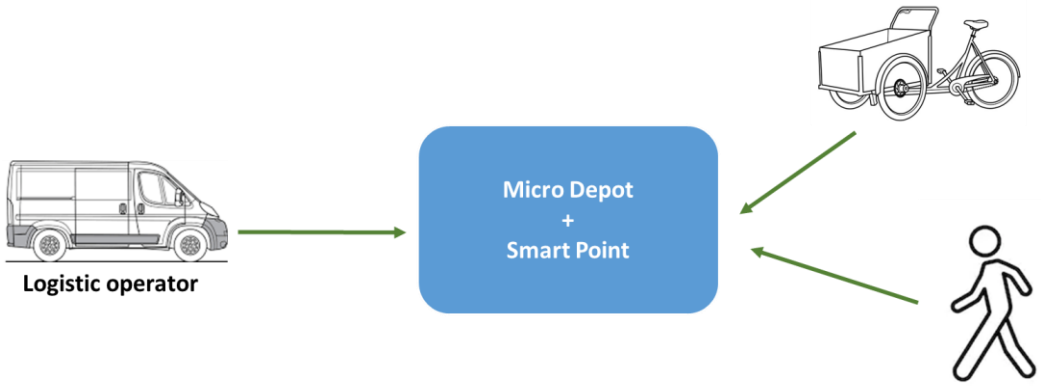

Figure 7: Micro depot + Smart Point (source: CIMNE elaboration)

The logistic operators can bring packages during the day by car at the micro depot and subsequently bike couriers distribute the parcels to the city area. In the evening, the operators can fetch new shipments to be distributed at the micro depot. Thus, distribution vehicles do not visit the station more than a couple of times during the day.

The centre also runs a pick-up point and delivery service where the Commerce Cash Service operates on a self-service basis. The smart point works with smart locks, the key of which is the smartphone. The lock is powered by the cell phone battery and does not require cabling.

The service is aimed at residents and commuters. The location of this hub should be strategic, in order to make it easy for public transport users and pedestrians to grab a pre-ordered shopping bag from the hub.

3. Status-quo compilation

This chapter aims to establish a knowledge base and scope of micro depots, analysing existing projects, studies and lessons learned from existing living labs throughout Europe. It identifies possible solutions offered by and requirements of shared micro depots.

Table 1 shows the types of shared micro depot solutions that have been implemented in the European cities:

1. Cargo bikes
2. Micro depots
3. Smart point centres

For each of these types, a short description of the micro depot is provided, jointly with the project that implemented the measure, the country and city where it was implemented, the year of implementation and status of the project. The information was gathered with the objective to identify the most relevant experiences in terms of solutions for the last mile and gain insight.

As indicated inTable 1, previous projects with a focus on last mile delivery solutions are: ECCENTRIC (civitas), TiMMi, GrowSmarter, FREVUE, Trendsetter (civitas), Straightsol, LaMiLo (Last Mile Logistics), Citylogistik, Vivaldi (civitas), Cyclelogistics (civitas), SMILE, Quartiersbox and Mayordomo.

The table shows the information put together by type of solution, by identifying the projects that have implemented those solutions, the cities where they were implemented as well as period frame of the projects and their status.

Moreover, further information each project and city (where available) is facilitated by providing links of the pages.

It is important to state that both successful and unsuccessful cases are reviewed to gain a comprehensive understanding of micro depots.

Table 1: Status-quo analysis (source: S.M.U.D. consortium)

Shared micro depot solutions		*Description*	*Project*	*Country*	*City*	*Year*	*Status*
Cargo bikes		Replacing conventional vehicles for freights distribution by cargo bikes. This section does not consider projects that create new micro depot for freights distribution.	TiMMi	Germany	Hannover	2018	Finalised
				Germany	Dresden	2018	Finalised
				Germany	Essen	2018	Finalised
				Germany	Koln	2018	Finalised
				Germany	Hamburg	2018	Finalised
				Germany	Leipzig	2018	Finalised
				Germany	Karlsruhe	2018	Finalised
			GrowSmarter	Spain	Barcelona	2017-2019	Finalised
Micro depots	Micro depot + cargo bike	Micro depot creation, including cargo bikes as the main freight distribution vehicle.	Cyclelogistics (civitas)	Spain (among other countries)	San Sebastian	2014-2017	Finalised
			ECCENTRIC (civitas)	Germany	Munich	2018-2020	In progress
			SMILE	Spain	Barcelona	2014	Finalised
			KoMoDo	Germany	Berlin	2018-2019	Finalised
			Nürnberger micro depot-concept	Germany	Nuremberg	2016-2017	Finalised
			Park_up Stuttgart	Germany	Stuttgart	2017-2019	Finalised
			GLS ParcelShop Düsseldorf	Germany	Düsseldorf	2016	In progress
			City2Share	Germany	Munich	2016-2020	In progress
			DHL City-Hub Frankfurt am Main	Germany	Frankfurt am Main	2018	In progress
			Part of Hermes "Urban Blue"	Germany	Hamburg	2019	Finalised
			DPD-micro depot-concept	Germany	Constance	2019	In progress
Smart point centre		Installation of lockers in office buildings, residential zones or in the streets to create a new many-to-many hub.	Quartiersbox	Germany	Munich	2018-Today	In progress
			Mayordomo	Spain	Barcelona, Madrid, La Coruña and Palma de Mallorca	2016-Today	In progress (start up)
			GrowSmarter	Sweden	Stockholm	2015-2019	Finalised
			Hamburg Box (pilot project)	Germany	Hamburg	2020-2021	
			Pakket	Netherlands			In progress

Shared micro depot solutions	*Description*	*Project*	*Country*	*City*	*Year*	*Status*
		Citypaq	Spain			In progress
		Coolomat	Poland	Warsaw		In progress
		Nærboks (pilot project)	Denmark	Kolding	since 2019	In progress
		Omniva	Estonia			In progress
		DPD	Estonia			In progress
		SmartPOST	Estonia, Finland			In progress
		Cubee	Belgium			In progress
		BoxIt	Israel			In progress
		Yellow	Israel			In progress
		iPostal Station	Hong Kong	Hong Kong		In progress
		CliqueRetire	Brazil	São Paulo, Rio de Janeiro	since 2019	In progress
		POPStation	Singapore	Singapore		In progress
		PopBox	Indonesia			In progress
		Australia Post	Australia			In progress
		Parcel24	Cyprus			
		Gegebox	China			In progress
		Cainiao Network	China			In progress
		Nearby Locker	Finland			In progress
		China Post	China			In progress
		FedEx	Hong Kong	Hong Kong		In progress
		Blu	Singapore	Singapore		In progress
		Pos Malaysia	Malaysia			In progress
		eLocker	China			In progress
		Pickup	France			In progress
		My Post 24	Switzerland			In progress
		InPost	UK			In progress
		Ozon	Russia			In progress
		LOCKER	South Africa			In progress
		Gmarket	South Korea			In progress
		Canada Post	Canada			In progress
		Austrian Post	Austria			In progress
		Parcel Motel	Ireland			In progress

Shared micro depot solutions	*Description*	*Project*	*Country*	*City*	*Year*	*Status*
		Park N Parcel	Singapore	Singapore		In progress
		Washbox	Latvia			In progress
		Box24	Thailand			In progress
		Box24	Singapore			In progress
		EziPod	Malaysia			In progress
Micro depot + Smart Point	It is a micro depot with an installed pick-up service point where the parcels are delivered by using cargo bikes or users grab them directly by using their smartphones.	New Solutions for City Logistics - CityHUB	Finland	Turku	2019-2020	In progress

4. Agenda for shared micro depots

The chapter aims to identify trends and drivers of shared micro depots, with respect to technology, logistics, and regulation on city traffic. The information showed in the previous chapter will be integrated to more detailed information with regards to the characteristics of the areas where the implementation will be carried out.

Moreover, advantages, challenges, lesson learned, problems and recommendations are taken into account for the analysis.

The information gathered during this phase will serve as input for the development of the tool which helps identifying the most appropriate measure for the area taken into consideration.

The information gathered by the partners is summarised in a table (see appendix Task 2002-2).

With regards to this task, the data collected, in addition to the data collected during the previous task, is related to:

- Solution for the measure (B2B, B2C OR C2C)
- Area of the city where the measure has been implemented
- Characteristics of the area (narrow streets, pedestrian zone, urban toll…)
- Type of vehicle
- Specifications of potential services
- Requirements
- Emission reduction
- Administrative regulation
- Marketing
- Advantages
- Challenges before the implementation
- Lessons learned
- Problems during the project
- Recommendations

From the different measures applied in many cities of the Europe and World, a summary of the main characteristics observed per type of solution was made.

1. Cargo bikes

Characteristics:

- The operating model is of permanent use, with multi users.
- The technical implementation consists on the installation of monitoring sensors on the bikes to be used for the last mile delivery.
- The main solutions used for the measure are B2B and B2C.

- From the data recovered, all projects have implemented the measure in the city centre where access for cargo bikes is facilitated.
- The measure results in reduction of CO2 emissions, energy (kwh) use and noise (dB).
- The regulation taken into account by the cities is their SUMP (where available).
- The most important advantage of this measure is the reduction of the time delivery window.
- The main challenges encountered before the implementation are related to finding suitable public locations, discussing the administrative way to manage the service, solutions to make it financially sustainable and also the rapid changes that the Urban logistics sector is facing.
- The lesson learned for this measure is that in a future scenario, no public intervention should be required.
- The main issues encountered during the implementation of the different projects were competition from other companies, the lack of need for these services if logistic companies find financially sustainable to develop their own sustainable delivery system and the distortion in market competition that could be created when pubic space is ceased to one company instead of another.
- The recommendations for this type of measure are to ensure enough density of small shipments in the area, create a stakeholder platform to discuss freight delivery issues in the city, plan a clear way of contracting the services. The aim is not creating conflict, monitor the service to ensure that public resources are being correctly used and engage logistic stakeholders to use the micro platform.

Problems:

- Acceptance of cargo bikes and small vehicles in public spaces: cargo bikes and small vehicles participate in public road traffic and can impair processes on roads, cycle paths or sidewalks.

2. Micro depot + Cargo bike

Characteristics:

- The operating model can be with multi users or single users, it is of temporary use or permanent use.
- The technical implementation can be mobile or immobile, with flexible storage systems.
- The main solutions used for the measure are B2B and B2C.
- The measure can be applied in city districts, historical city areas, inner city areas, city centres.
- The vehicles used are cargo bikes.
- The final results of this measure are similar to the first one (cargo bikes).
- The reduction in CO2 emissions, energy, noise and congestion is achieved through this measure.
- The regulation used can be the Sustainable Urban Mobility Plan of the city, the Planning Policy Frameworks, Municipal Plans etc.
- Marketing measures include incentives for stores' participation, as free advertising in the local media or stickers showing environmental and social responsibility, explaining to the customers how the extra cost of using the City logistic service can add value to the shop, offering customers trial periods of the service.

Problems:

- Business model: Typically, urban areas have high rents and a conflict of use with other businesses exists. Furthermore, a tradeoff exists between urban environmental objectives and urban subsidies for micro depots to ensure the supply of the population.

- **Legal and administrative:** Requirements may differ from cities or municipalities so there is no common legal basis for scaling the business model.
- **Acceptance of cargo bikes and small vehicles in public spaces:** cargo bikes and small vehicles participate in public road traffic and can impair processes on roads, cycle paths or sidewalks.

Recommendations:

- **Several decentralized locations instead of one central micro depot:** A holistic logistics concept is needed for the entire city, which includes several micro depots following a honeycomb pattern.
- **Qualified planning personnel with local detailed knowledge:** Logistics companies need a qualified contact person on site who supports them in setting up operating and development structures and contributes detailed local knowledge.

3. Smart point centers

Characteristics:

- The operating model is of permanent use with multi users.
- The technical implementation consists in locating lockers close to the customers.
- The main solutions used for the measure are B2B and B2C.
- The lockers are generally located near streets, offices, residential buildings, train stations, petrol station, supermarkets, post offices, universities, subway station.

Problems:

- **Infrastructure costs** high acquisition and maintenance costs.
- **Business model:** business model only works in high-density areas.
- **Local retailer/ businesses involvement:** acceptance, sponsoring and system integration.

Recommendations:

- **Open system:** high land utilization through cooperative use.
- **Security:** protection against vandalism and environmental influences (e.g. weather).

4. Micro depot + Smart Point

Characteristics:

- The operating model is of permanent use and it has multi users.
- The technical implementation consist on the storage unit as well as lockers.
- The main solutions used for the measure are B2B and B2C.
- The location for the implementation is strategic, near public transportation services in order to allow easy access to every user.
- It consists in using cargo bikes for the distribution and smartphones for the pick-up.
- The reduction in CO2 emissions, energy, noise and congestion is achieved through this measure.
- The regulation used can be the Sustainable Urban Mobility Plan of the city, the Planning Policy Frameworks, Municipal Plans etc.

Problems:

- **Business model:** Typically, urban areas have high rents and a conflict of use with other businesses exists. Furthermore, a tradeoff exists between urban environmental objectives and urban subsidies for micro depots to ensure the supply of the population.

- **Legal and administrative:** Requirements may differ from cities or municipalities so there is no common legal basis for scaling the business model.
- **Acceptance of cargo bikes and small vehicles in public spaces:** cargo bikes and small vehicles participate in public road traffic and can impair processes on roads, cycle paths or sidewalks.
- **Infrastructure costs** high acquisition and maintenance costs.
- **Business model:** business model only works in high-density areas.
- **Local retailer/ businesses involvement:** acceptance, sponsoring and system integration.

Recommendations:

- **Several decentralized locations instead of one central micro depot:** A holistic logistics concept is needed for the entire city, which includes several micro depots following a honeycomb pattern.
- **Qualified planning personnel with local detailed knowledge:** Logistics companies need a qualified contact person on site who supports them in setting up operating and development structures and contributes detailed local knowledge.
- **Open system:** high land utilization through cooperative use.
- **Security:** protection against vandalism and environmental influences (e.g. weather).

5. Concluding remarks

The S.M.U.D. project is addressing the issues of inefficient space utilization and pollution prevention approaches by providing acceptable and sustainable solutions to last mile delivery.

The focus of the project is on shared micro depots as a viable sustainable solution for the parcel delivery in urban areas leading to a reduction of local exhaust emissions and greenhouse gas emissions as well as a relief of the local traffic situation.

The best practices studied in this report provide considerable information to city administrations in deciding which is the best alternative when it comes to strategic planning where the investment budget is high and the decisions taken directly affect the socio-economic domain, the environment and the quality of life of thousands of people.

The summarised measures are flexible and may be used in different kinds of city contexts and urban environments. For example, cargo bike solutions have been developed in high congestion areas of city centres, where the streets are narrow and / or pedestrian, with time windows for loading and unloading. On the other hand, smart points are installed in different areas of the city to offer a solution to failed deliveries by avoiding traffic congestion.

It is important to remind the shared use of these solutions by all operators, thus optimizing the routes and space within the cities.

The advantage is that the examples provided by these projects have already been tested in real life applications in the context of pilots and case studies. Stakeholders are presented with an overview of the characteristics, advantages, challenges and recommendations for each of the possible solutions that have been taken into account.

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