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Downscaling the consolidation of goods – state of the art and transferability of micro-consolidation initiatives

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Abstract

Consolidation schemes are a popular measure in city logistics. The most common of these consolidation schemes are Urban Consolidation Centres (UCCs). However, many innovative experiences have been performed in the cities across the globe, offering a large panel of alternative schemes. In particular, many experiences have focused on downscaling the consolidation effort by bundling the goods much closer to the reception point.

This paper aims in offering a closer view into different alternatives that exist regarding the physical micro-consolidation of goods and to provide guidelines on selecting the most appropriate solutions for a specific city area.

In order to do this, we will develop a transferability methodology, based on the study of case studies across the Europe. We will build on the current transferability methodologies developed under several EU projects and adjust them for the specific case of the micro-consolidation measures. This will lead us to the definition of the most important features for the transferability of the micro-consolidation measures. Based on this, we will establish for each feature a list of attributes for the transferability of the micro-consolidation devices, which will be prioritized according to their importance for the transferability success.

Keywords: urban freight transport, micro-consolidation, transferability of urban freight transport measures.

1. Introduction

One of the most popular urban logistics measures are measures that have a consolidation aspect, i.e. the bundling of goods in order to increase the load factors and therefore decrease the number of necessary journeys needed to perform the deliveries. Among the most popular urban logistics concepts is that of an Urban Consolidation Centre (UCC, Ville et al., 2012). In fact, the introduction of a UCC is an appealing policy aiming at changing the quantity and quality of deliveries (Danielis et al., 2010). Broadly speaking the key purpose of UCCs is the avoidance of the need for goods vehicles to deliver part loads into urban areas (Browne et al., 2007). Many cities, mainly in continental Europe (Germany, The Netherlands, France, and more recently, Italy) have conducted studies, trials and experimented specific schemes (Danielis et al., 2010). Allen et al. (2012) make an international comparison of 114 UCC

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schemes in 17 countries over the last 40 years and highlights the growing interest in the UCCs (42 schemes between 2006 and 2010).

However, despite their popularity, many authors have demonstrated the limits of the Urban Consolidation Centres, the difficulty to implement them in a competitive environment and their limited benefits. Muñuzuri et al. (2005) conclude that solutions related to public infrastructure usually require extensive allocation of resources, unless they are implemented as a way of reutilizing existing infrastructure and that these solutions generally involve a reduction in the efficiency of logistic systems. Zunder and Ibanez (2004) state that urban freight platforms are a top down solution, and thus they can only yield true benefits in a controlled supply chain with a single player able to set the agenda. (Ville et al., 2012) concludes that UCCs do have excellent local environmental performance, but affect a very minimal proportion of total goods flows in an urban area and that except in unusual circumstances, the objective of consolidating intra-urban delivery tours is not in itself sufficient to economically justify new infrastructure and changes to carriers' habitual organization. In fact, the cost of additional transhipping in the logistic chain is not covered by the financial gains associated with consolidation, especially when done in an urban terminal (Gonzalez-Feliu et al., 2009). Danielis et al. (2010) judge their results as disappointing so far since only in few cases the UCCs survived financially without public subsidies or strong political commitment. Browne et al. (2005), followed-up by (Allen et al., 2012) concludes that the success of the UCC is greatly dependant of its type and implementation conditions and that, for UCCs that serve part or all of an urban area, the financial considerations are often complicated to resolve with schemes requiring on-going public subsidy. Zunder and Marinov (2011) argue that planner-led UCC solutions are untenable in the modern liberal economy and that the top down imposition of a Urban Consolidation Centre (UCC) works only in clearly controlled domains. Van Duin (2009) analyses the factors that caused the success or failure of UCCs and supports the hypothesis that UCCs are successful only in specific conditions and most often with structural public subsidies.

Verlinde et al. (2012) supports the idea that the UCCs are often granted a short life because of their dependence on the government subsidies and investigates alternative ways of consolidating goods. Among those, same authors mention the possibility of downscaling the scope of the consolidation effort by using the Urban Logistics Spaces such as defined by (Boudouin, 2012).

The present paper builds on the idea that downscaling the consolidation effort can sometimes be more efficient than the classic UCC. In fact, many recent innovative experiences have focused on bundling the goods not outside the city boundaries, as this is typically the case with Urban Consolidation Centres, but much closer to the reception point.

For the purpose of this paper, we will refer to these measures as “micro-consolidation” measures - on one hand, the scale of the consolidation is smaller; on the other hand, as we will demonstrate further, the size and weight of transported goods is smaller. Several authors have already addressed the question of micro-consolidation schemes indirectly. (Browne et al., 2011) and (Conway et al., 2011) evaluates the use of a micro-consolidation centres. (Gonzalez-Feliu et al., 2012) and (Augereau & Dablanc, 2008) address the question of reception points. These solution are sometimes referred to as “last-mile” solutions, i.e. solutions used for the last leg of the delivery (e.g. (Conway et al., 2011)) but we will avoid using this term since its definition is sometimes restricted to B2C home deliveries (e.g. (Allen et al., 2007), (Gevaers et al., 2011)). We will therefore prefer using the term “micro-

consolidation" that was introduced by (Browne et al., 2011) to designate a small district consolidation centre in the City of London and that was further adopted by (Conway et al., 2011).

Micro-consolidation initiatives usually involve a particular form of urban freight, the urban light freight. In fact, bundling the goods near the reception point requires the setting-up of logistical facilities in the very heart of urban areas, making these initiatives unsuitable for heavy loads.

The concept of light freight is described by (Tsolakis & Naudé, 2008) in opposition to the heavy urban freight. Heavy freight consists of industry supplies, wholesale and retail supplies, waste removal and recycling, infrastructure construction materials and residential building materials and household removals (Tsolakis & Naudé, 2008). Light freight, the majority of which is carried over metropolitan networks, can be defined to include a myriad of trips of smaller loads such as smaller scale retail deliveries, household waste removal, offices and residential maintenance, packages (e.g. courier services), mail, office supplies, or service delivery trips (e.g. plumbing and electrical services. (Tsolakis & Naudé, 2008)

The light freight shares some characteristics: (1) use of LCVs (Light Commercial Vehicles) - although a small portion of these trips are still made using smaller rigid trucks, the bulk is performed by LCVs (Tsolakis & Naudé, 2008); (2) the time sensitivity of urban light freight is higher due to the nature of the goods transported and the time pressure of the urban business environment; (3) the amounts of to be transported at once are smaller;

Urban light freight accounts for a large part of urban freight in terms of vehicles-trips and number of deliveries. (Debauche, 2008) studies the delivery patterns in the city centre of Liège (Belgium) and concludes that 75% of deliveries are made in parcels against only 9% in pallets and that 79% of deliveries are made by light commercial vehicles against 21% by heavy goods vehicles.

Finally, the light freight is not only important but also growing. In fact, as evidence from French cities show, although the total tonnage of urban freight generated by person has remained stable, the number of shipments has doubled between 1988 and 2004, resulting in more numerous, smaller deliveries (Zunder T. , 2011). Moreover, parcel, courier and express transport services are one of the fastest growing transport businesses in cities (MDS Transmodal Limited, 2012).

This tendency can be explained through some general logistics trends. (Sirikijpanichkul & Ferreira, 2006) outlines the main factors that contribute to the growing needs of time sensitive freights – some of which that contribute to the expansion of the light freight in general. Some of the most important trends are: (1) globalization and international trade; (2) trend towards outsourcing non-core activities including logistics; (3) trend towards smaller more frequent shipment (time sensitive supply), just-in-time inventory and direct-to customer business; (4) dynamic factors including the pace and risk of obsolescence; speed-to-market and consistent; satisfactory customer experiences; (5) information technology e.g. bar-coding; electronic data interchange (EDI), web based ordering and tracking capabilities, automatic data capture, routing management and inventory track-and-trace visibility etc.

For this reason, we expect that these micro-consolidation measures focusing on the light freight are going to gain additional importance in the coming years.

This paper aims in offering a closer view into different alternatives that exist regarding the micro-consolidation of goods and to provide guidelines on selecting the most appropriate solutions for a specific city area. This paper has two parts: the first chapter provides a definition and a state of micro-consolidation schemes, and establishes common typologies; the second chapter studies their transferability and presents a common transferability framework that was developed for these initiatives.

2. Downscaling the consolidation of goods: state of the art and typology of micro-consolidation measures

In order to establish this state of the art and the typology of micro-consolidation measures, authors have performed an analysis of 38 micro-consolidation measures in Europe, and a literature review on the classification of these micro-consolidation initiatives.

Regarding the case studies, The first typology is the vehicle reception point, which consists in setting-up of a zone where carriers can load and unload the goods destined to the neighbouring receivers. This type of devices have been successfully implemented in several French cities, such as Bordeaux, Rouen, Lyon, Clermont Ferrand and Montpellier under a common denomination Espace de Livraison de Proximité (ELP). In addition to its major goal, which is to reduce parking problems and better accommodate trucks, the setting-up of this type of devices also reduces the vehicles-trips to be performed in the delivery area.
Figure 2 shows the functioning of this type of devices used the point (1).

The second typology, goods reception point consists in setting-up of a new urban service where carriers can deliver their goods to a communal delivery point. This type of device can be used by private customers (e.g. KIALA relays in France that use convenience stores as pick-up points for internet shoppers) or by business customers (e.g. drop zones in Aalborg where goods are delivered to neighbouring shops with longer opening hours). In addition to providing a new service and allowing off-hours deliveries, these devices also aim in reducing the total vehicles-trips to be performed in the delivery area by bundling goods at the reception point.
Figure 2 shows the functioning of this type of devices used the point (2).

The third type of urban logistics spaces, the urban logistics boxes follow a similar principle: bundling the goods at reception and enabling the deliveries in the absence of the receivers by setting-up of automated locker-boxes where goods are delivered. This typology is again valid for both business and private customers: in Paris, in the framework of Consignity project, lift manufacturers use these type of devices for picking-up spare parts; in Germany, DHL uses Packstations for the delivery of letters and parcels in absence of receivers.
Figure 2 shows the functioning of this type of devices used the point (3).

In addition to these classical Urban Logistics Spaces that have been previously defined and described in the literature, we have been able to identify three other innovative typologies that have been implemented in a series of recent initiatives across Europe.

A first typology are the micro-consolidation centres: they adopt a similar scheme as one of the classical urban consolidation centre - bundling the goods, combined with a fleet of none

polluting vehicles making rationalized rounds. However, in opposition to classical urban consolidation centres, micro-consolidation centres are set-up much closer to the delivery area and have a more limited spatial range that is conditioned by the range of vehicles used for the last leg of the delivery (generally clean vehicles such as such as cargo-cycles or electrically-assisted trolleys). Furthermore, the bundling of goods usually takes place in a suburban depot from where a consolidated transport is performed towards the micro-consolidation centre. This is for example the case of La Petite Reine in Paris or the Office-Depot micro-consolidation centre in London.

Figure 2 shows the functioning of this type of devices used the point (4).

Another innovative typology consists of bundling the goods in a suburban depot and performing consolidated transport to the city centre where a transhipment point (i.e. a vehicle reception point) is used for transferring goods to lighter and more adapted vehicles. This is for example the case of Cargohopper in Utrecht and the Freight Bus in Lyon.

Figure 2 shows the functioning of this type of devices used the point (5).

Another typology consists of using a suburban depot in a combination with a mobile logistical facility that is used to perform the consolidated transport of goods towards the urban area and that contains all the necessary equipment and vehicles for the last phase of the delivery. This is for example the case of TNT Express Mobile Depot in Brussels or Vert Chez Vous in Paris.

Figure 2 shows the functioning of this type of devices used the point (6).

Table 1 provides a list of micro-consolidation initiatives that have been analysed for the purpose of this paper. These experience all focus on bundling the goods much closer to the reception point, in the very heart of the urban areas by setting-up logistic facilities closer to the urban centre delivery area. The experiences range from the deliveries by soft mode of transportation (on foot or using the cargocycles) from logistical devices serving specific districts (e.g. a micro-consolidation centre or a vehicle accommodation area) to the communal delivery points (e.g. goods reception points). The micro-consolidation initiatives often involve two macro-echelons, as described in a paper by (Gonzalez-Feliu & Morana, 2011). This paper presents a case of French press distribution, which contains the inbound distribution (from the publishers' printing platforms to the press depots), and the outbound distribution (from the depots to the retailing activities selling the distributed products).

Regarding the literature review on micro-consolidation initiatives, several authors address the question. (Browne et al., 2011), (Gonzalez-Feliu et al., 2012) (Augereau & Dablanc, 2008), (Verlinde et al., 2012) and (Gonzalez-Feliu & Morana 2010), all address the question of micro-consolidation initiatives and provide examples of their implementation without providing a specific typology for these logistic devices. (Boudouin, 2006) introduces a concept of Urban Logistics Spaces, which are facilities that should smooth the progress of the deliveries in urban areas by setting-up specific physical infrastructures (NB: the terminology used in this paper English comes from the English version of this book "Urban logistics spaces – Methodological guide" published in 2012) and provides a typology of these devices according to the spatial dimension, as shown on

Figure 1. Three Urban Logistics Spaces focus on a very small area (i.e. a couple of streets or one neighbourhood) and can therefore be classified as micro-consolidation initiatives: vehicle reception point, goods reception point and urban logistics boxes. These Urban Logistics Spaces present several advantages: on one hand they reduce the vehicle-trips to be performed in urban areas (and particularly in most dense areas) by bundling the goods near

the reception point, and on the other hand, they reduce problems linked to the loading and unloading of the goods and in some cases allow unattended deliveries.

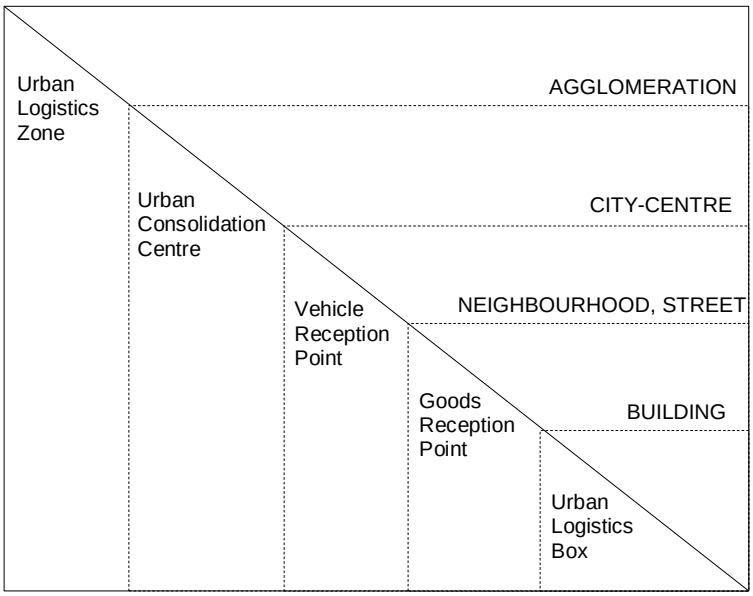

Figure 1: Urban Logistics Spaces
Source: (Boudouin, 2012).

For the definition of the typologies of micro-consolidation initiatives, we will therefore build on the typology proposed by (Boudouin, 2006) and complete it by three supplementary typologies that were highlighted in the analysis of case studies and that have not been formalized in the literature.

2.1 Suggested typology of micro-consolidation initiatives

The
Figure 2 illustrates the suggested typology of micro-consolidation initiatives.

The first typology is the vehicle reception point, which consists in setting-up of a zone where carriers can load and unload the goods destined to the neighbouring receivers. This type of devices have been successfully implemented in several French cities, such as Bordeaux, Rouen, Lyon, Clermont Ferrand and Montpellier under a common denomination Espace de Livraison de Proximité (ELP). In addition to its major goal, which is to reduce parking problems and better accommodate trucks, the setting-up of this type of devices also reduces the vehicles-trips to be performed in the delivery area.
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Table 1: List of analysed case studies

Case study	Short Description	In-depth analysis
BentoBox, Berlin	A prototype of a flexible collect-station for packages, little packets and smaller sachets, combined with the usage of cargobikes for the final leg of delivery.	NO
BentoBox, Lyon	A prototype of a flexible collect-station for packages, little packets and smaller sachets, combined with the usage of cargobikes for the final leg of delivery.	YES
Distributing goods by boat & bikes, Amsterdam	DHL started to deliver the mails per boat and bycycles to reduce the company's car use	NO

Vert chez Vous, Paris	A distribution service using a combination of a barge and of electric cargocycles for deliveries in Paris	YES
Cargohopper, Utrecht	Cargohopper is a multi trailer, narrow, solar powered road train used for the final leg of deliveries in Utrecht	YES
Chronocity, Strasbourg	ChronoCity is a parcel-delivery service in Strasbourg that uses electric-powered handcarts for the routes through the inner-city, combining a consolidation hub with "clean" vehicle use	YES
Freight Bus, Lyon	An innovative conceptwhere the carrier distributes its packages in 3 independent modules from each other. In the warehouse of the carrier, these modules are loaded on a truck and are then routed to a space in the immediate vicinity of delivery area. Each module is then transferred on a light vehicle adapted to the city, taking the relay for last-mile delivery.	NO
Dropzones,Aalborg	One shop functions as a drop zone for the neighbourig shops that open late, preventing unnecessary trips	YES
Pick up Points for B2C, French cities	Using convenience stores as pick-up points as an alternative for home deliveries	YES
Collectpoints in convenience stores, Winchester	A company Collectpoint that offers an alternative to home delivery (mainly to internet shoppers) by providing collection points in convenience stores	NO
Alternative delivery points, Germany	Using fuel stations as alternative delivery and pick-up points	NO
Chronopost, Concorde	An ULS situated in an underground parking facility in Concorde and small electric vans and electric wheeled containers	YES
Micro-consolidation centre, London	A micro-consolidation centre in central London is used as a starting point for delivery of stationnary equipment by cargocycles	YES
La Petite Reine, Bordeaux	A Urban Distribution Centre outside Bordeax city and electrical vans and cargocycle	NO
Ecopostale,Brussels	Use of electric cargobikes and electric minivans (bigger parcels) for last mile deliveries in Brussels	NO
Natoora, Paris	Natoora.fr is an Internet site where private customers can order organic fresh products online. The company has set up a Urban logistics space of 220 m2 on the first floor of the car park of the Porte d'Orléans for delivering in Paris, using electric motorbikes	NO
La Petite Reine, Paris	La Petite Reine Delivery company uses a combination of underground logistics spaces and of cargocycles for the deliveries of parcels in central Paris	YES
Petite Reine, Toulouse	A combinatiion of a Urban Consolidation Centre and cargocycles for the final leg of delivery	NO
Petite Reine, Lyon	A combinatiion of a Urban Consolidation Centre and cargocycles for the final leg of delivery	NO
Cargo bikes, Cambridge	In Cambridge, an innovative emission-free cycle business has been operating since 2005 and is now the largest cycle courier business of its kind in the UK	NO
UCC in Donostia, San Sebastián	Introduction of special electric cargo bikes that operate from a city distribution centre	NO
Emission-free pizza delivery, Germany	Pizza delivering companies are using bycicles for deliveries	NO
The Green Link, France	Founded in 2009, The Green Link's principal activity is the delivery and collection of packages and parcels on short journeys by electric tricycles	NO
Hajtas Pajtas,Hungary	A Courrier Company that uses byclicles for the deliveries	NO
CargoCruiser, Germany	Cargo-Cruiser is a tree wheeler with a width of approximately 1.2 meters, that operates as a heavy good transporter. It can transport 250kg but is considered legally as a byclicle, avoiding traffic jams. It was tested by a messanger company in Germany	NO
Mobile Depot, Brussels	Mobile depot is a truck/trailer which is equipped with all depot facilities (i.e. loading docks, labelling, data entry etc.) and contains the electric tricycles which will be delivering the last mile	YES
Distriopolis	Consolidation centre, a transhippement platform in the city, clean vehicles (trucks + vans + tricycles)	NO

Consignity, Paris	A new type of delivery service based on a network of automated lockers for goods pick-ups and deliveries, used for the deliveries of spare parts for technicians of lift manufactureres	YES
E BOX, Paris	Automatic locker boxes for postal deliveries in Paris	NO
Packstations, German Cities	A service by Deutsche Post: urban locker boxes offering businesses and individuals the possibility of collecting and returning their parcels 24/7	YES
Packstations, Szczecin	Automatic locker boxes for postal deliveries	NO
Cityssimo, Paris	A system of dedicated locker banks which constitutes an alternative to home deliveries for parcels delivered by Colissimo	NO
Community delivery points, Bristol	Locker boxes for the delivery for internet shoppers	NO
ELP, Bordeaux	Community delivery areas with an innovative design and management	YES
ELP, Rouen	Community delivery areas with an innovative design and management	NO
ELP, Lyon	Community delivery areas with an innovative design and management	NO
ELP, Clermont Ferrand	Community delivery areas with an innovative design and management	NO
ELP, Montpellier	Community delivery areas with an innovative design and management	NO

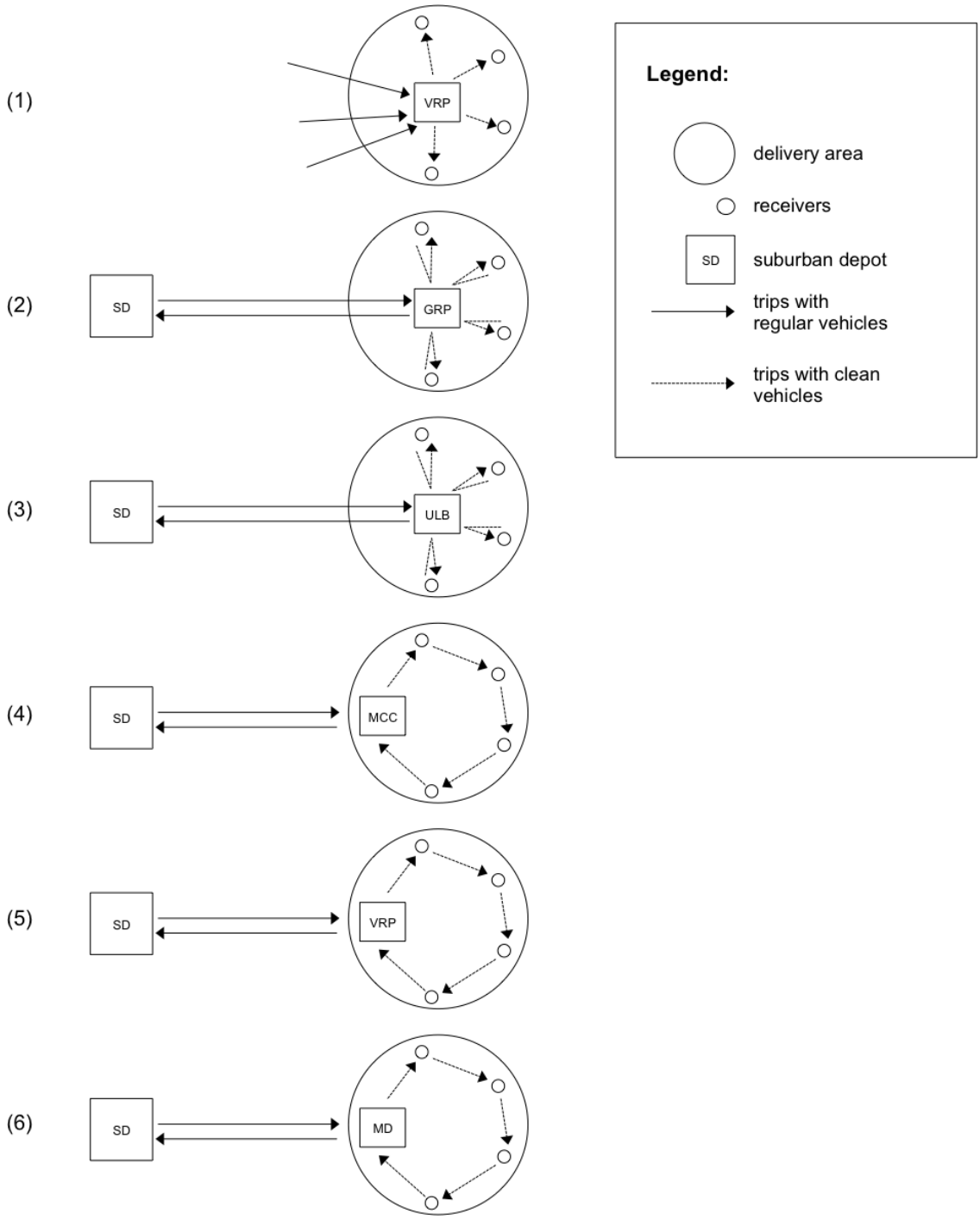

Figure 2: Typology of micro-consolidation schemes

3 Transferability of micro-consolidation initiatives

Transferability of successful urban freight measures has been a major issue in the EU-funded research in recent years. The rationale is simple: replicating successful experience from one city to another allows leveraging knowledge and efforts developed in the original environment. However, successful replication of experiences requires a transferability analysis, i.e. highlighting which are the key success factors of the initiative in the original environment and assuring the same conditions in the new environment.

Since each urban freight solution is distinctive, each measure will have different transferability issues: however, in case of micro-consolidation initiatives, we have been able to highlight some common issues and indicators. There are several reasons for that: first of all, all of these measures involve a setting-up of some type of physical infrastructure in the very heart of the urban areas; many case studies involve the use of light clean vehicles with a limited range or even soft transportation modes like walking and cycling for the last leg of the delivery; finally, all of these measures involve the light freight. In light of these similarities, we have constructed a common transferability framework for all of these initiatives.

For the construction of this transferability framework, we have used a combined approach: on one hand a top-down approach by looking at general transferability frameworks in the literature and analysing how they apply to the micro-consolidation initiatives; on other hand, analysing the transferability issues based on the analysis of case studies and combining the results.

Regarding the case study analysis, we have selected 14 case studies out of 38 micro-consolidation measures by applying two basic criteria: the necessity of constructing a representative sample of the case studies (i.e. including case studies belonging to all the typologies) and the availability of data for each particular case study.

Regarding the literature review, a general transferability methodology has been developed within the CIVITAS program: it suggests a list of steps to follow for successful transfer of experiences: (1) Diagnostic of the problems; (2) Characterisation of the city; (3) Analysis of the city context and implications of problems identified; (4) Look around for similar contexts; (5) Selecting examples of source urban contexts; (6) Identify measures with potential for transferring; (7) Packaging & Dimensioning the measures for transferring; (8) Ex-ante assessment of measures to transfer; (9) Identify need for adjustment; (10) Implement measures and steer results (Barrera, 2012).

TURBLOG project pushes further the transferability analysis by focusing more on the characteristic of the area in which the solutions were implemented and by considering transferability as a match between the characteristics of the urban freight measures and the environment in which it is implemented. For this, the project uses the concept of logistic profiles, which was formalized by (Macario & Marques, 2008) who supported the hypothesis that, within a city, it is possible to identify areas with homogenous groups in terms of logistical needs, based on three key variables: the urban characteristics of the area, the requirements of the logistic agents, and the characteristics of the products they transact / type of delivery (TURBLOG, 2011). In order to define these logistic profiles, the report suggests a series of attributes and indicators. The objective of the identification and characterisation of the logistic profiles is to clearly identify similarities between characteristics that are common to various locations, product types and deliveries profile in order to be able to identify examples of measures that can be transferred and replicated elsewhere (TURBLOG, 2011).

The transferability framework developed within this paper builds on the idea of logistic profiles, i.e. the analysis the interactions that exist between a certain logistic solution and the environment in which it will be implemented. Logistic profiles are defined through a series of attributes and indicators - the analysis of the case studies has led us to highlight those that are most relevant to the case of micro-consolidation initiatives and to add some that were not included by this analysis.

3.1 Transferability Framework for micro-consolidation initiatives

When considering a specific city area, it is important to be able to choose the right solution or the right set of solutions, i.e. solutions that are most relevant and most suitable. In order to do so, we suggest a transferability framework that aims in finding the best fit between the possible solutions and the specificities of the area. Figure 3 presents this framework. In order to test the transferability of a certain initiative into a new environment, we suggest to study the micro-consolidation initiative and its original environment as well as the target city area, and to compare them on two dimensions: the first dimension assesses the relevance of the micro-consolidation initiative for a specific city area; the second dimension suitability of the micro-consolidation initiative.

The relevance is assessed by comparing the market segments targeted by the initiative and the market segments at the target city area (e.g. if the initiative targets exclusively the delivery of office supplies, it will be relevant to city areas that have a strong concentration of these specific goods flows, e.g. business districts).

The suitability is assessed by comparing the characteristics of the original environment in which the initiative was implemented and the characteristics of the target environment (e.g. if the initiative is successful because there are strong access restrictions in the original area, it is likely that these conditions should be replicated in the target city environment).

In the following section, we will describe these dimensions in detail.

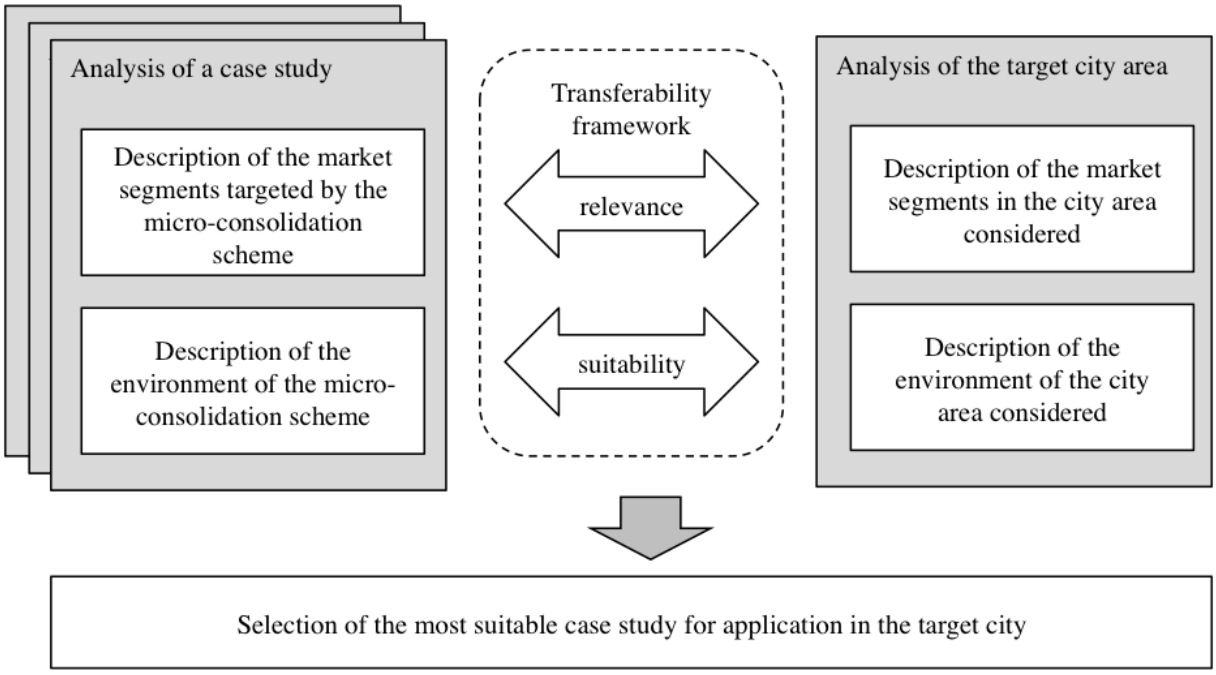

Figure 3: Framework for the transferability of micro-consolidation measures to a target city

3.1.1 Relevance of the initiative to the new environment

Regarding the relevance of the micro-consolidation initiative, we will assess how useful is it to implement such initiative in the target city, given the urban freight transport market segments targeted by the initiative and the urban freight transport market segments present in the target city area. The market segments are defined by the characteristics of the products that transact and the type of delivery. For micro-consolidation initiatives, we will consider the market segments relevant to light freight: (1) Office supply & equipment; (2) Machinery; (3) Small scale retail (food); (4) Small scale retail (non food); (5) Motor vehicles spares; (6) Electrical & telecommunications equipment; (7) Courier services; (8) Express services; (9) Post services; (10) Medical; (11) Residence & business maintenance; (12) Service delivery trips; (13) Home deliveries.

This will allow us to select the most relevant initiatives for a specific city area. For example, for a business district where the majority of goods flows are office supplies, the most relevant initiative would be the micro-consolidation centre such as demonstrated in the City of London, precisely because it targets these type of goods flows. For a residential area with a strong concentration of postal deliveries, the most relevant initiatives would be the ones targeting this urban freight market segment (e.g. Packstation).

The Table 2 shows the relevant market segments for each one of the 14 cases studies that have been analysed. Most of the micro-consolidation initiatives target the four following segments: small-scale retail, courier services, express services and home deliveries. This is directly linked to the initiators of these new logistical schemes, who are most often express and courier transportation companies active in these segments.

Table 2: Analysis of market segments relevant to the case studies

	Machinery	Small scale retail (food)	Small scale retail (non food)	Motor vehicles spares	Electrical & telecommunications equipment	Courier services	Express services	Post services	Medical	Residence & business maintenance	Service delivery trips	Home deliveries
BentoBox (Lyon)			***			***	***					***
Vert chez Vous, Paris						***	***					***
Cargohopper, Utrecht			***									
Chronocity, Strasbourg						***	***					***
Dropzones in Aalborg			***									
Pick up Points for B2C in French cities												***
Chronopost, Concorde						***	***					***
Micro-consolidation centre, London												
La Petite Reine, Paris		***	***		***	***	***					***
Mobile Depot, Brussels						***	***					***
Consignity, Paris											***	
Packstations DHL, Germany								***				***
ELP, Bordeaux			***			***	***	***				***

(***=relevant and has been demonstrated in the case study)

3.1.2 Suitability of the initiative for the new environment

Regarding the suitability of the micro-consolidation initiative, we will assess how likely is its implementation to succeed if the initiative is replicated in a target city area. For this, we will study interactions between the case study characteristics and the characteristics of the environment in which it was implemented in order to highlight its key success factors – and consequently the key transferability attributes.

We will structure the analysis of the case study characteristics around three axes: the characteristics of the urban logistics space used, the vehicles and the operating mode of the case study. These characteristics will then be combined with the attributes of the target city environment. Figure 4 shows the attributes that are used in each category.

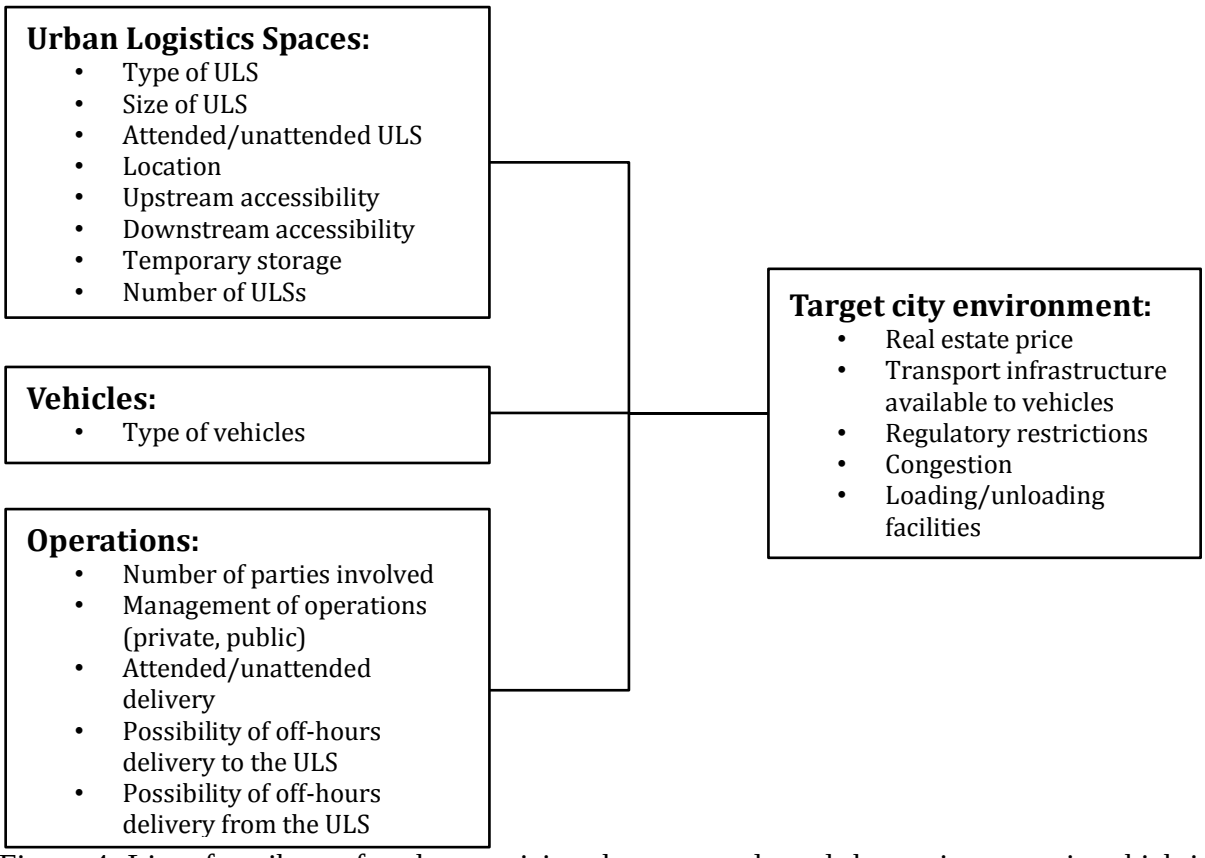

Figure 4: List of attributes for characterizing the case study and the environment in which it was developed
Source: own elaboration

Table 3 and Table 4 show these characteristics of each case study that was analysed.

This analysis has led us to defining some key transferability attributes for micro-consolidation initiatives, which will be presented in the following section of the document. In order to derive these attributes according to each separate case study, we have rated the importance of each attribute for each case study, as shown in the Table 5.

In the following section of the document, we will present the transferability attributes, and discuss how their importance varies according to the characteristics of the case studies that have been identified:

(1) Availability of public land/real-estate for setting-up of the ULS: many micro-consolidation initiatives require setting-up of logistical infrastructure in the city – experiences show that since the land is so scarce in these areas, it is often necessary to have public land available for the setting-up of these facilities; the importance of this attribute is directly linked to the type and size of the ULS that is used in the micro-consolidation initiative – in fact, for experiences using a vehicle reception point (e.g. ELP in Bordeaux and Mobile Depot in Brussels) or the experiences using micro-consolidation centres (e.g. La Petite Reine in Paris or Chronopost in Concorde), the availability of land will be more relevant than for those using the existing infrastructure (e.g. Drop-zones in Aalborg) or smaller ULSs (e.g. Urban Logistics Boxes)

(2) Necessity for public support for financing of ULS: since the price of the real-estate in central urban areas is so high, public authorities will often need to provide their support by renting logistical facilities in central areas for a lower price, for example; the importance of this attribute varies again according to the type of ULS used; considering that micro-consolidation centres are the largest and the most complete types of ULS and will generally require public intervention, although exceptions exist, like in the case of micro-consolidation centre in London where the bottom-up pressure of the end-users has allowed to propose a self-sustaining initiative.

(3) Necessity of a central location: the necessity of having a central location in the city centre is crucial for a large number of initiatives and will again depend on the type of the ULS used; the only type of ULSs that are less dependant on the central location are the Urban Logistics Boxes – they require however a large network of ULSs.

(4) Necessity for security system at the location: ensuring the security of the goods at the ULS is crucial and may require a specific security system; this attribute will be extremely important for the ULSs that are not attended and that provide temporary storage (e.g. Urban Logistics Boxes).

(5) Necessity for a location with high upstream and downstream accessibility: the upstream accessibility is linked to the proximity of the large transportation axis and the downstream accessibility is linked to the proximity to final customers; this attribute has been judged as important for all the case studies, regardless the type of ULS used.

(6) Necessity for a large network of ULSs: some case studies require not a single ULS but a network of ULSs over a certain territory in order to ensure the proximity to end users; the importance of this attribute will be directly linked to the type of the ULS used, the Urban Logistics Boxes requiring the largest network;

(7) Necessity for a regulatory framework providing advantages to the concept: in many cases, the access restrictions and regulations in the city area support the business case of the case study by providing a relative advantage to the vehicles used in the latter; the importance of this attribute will be directly linked to the types of vehicles used by the micro-consolidation initiative – for example, micro-consolidation initiatives using the soft modes of transportation (e.g. on foot or by cargocycles) for the last leg of the delivery will be most advantaged by strict access restrictions for regular delivery vehicles.

(8) Necessity for a dedicated transport network providing relative advantage to vehicles: in many case studies, a dedicated infrastructure for vehicles in use (e.g. bicycle lanes for cargocycles) is crucial for providing them an advantage over other vehicles; again, the importance of this factor will be directly linked to the types of vehicles used by the micro-consolidation initiative.

(9) Necessity of having a private firm managing operations: all of the case studies are operated by a single transportation company – when transferring the experiences to the other cities, it is crucial to ensure the existence of such an actor;
(10) Necessity to set a regulatory framework for the chain of liability: some case studies involve the breaking of the liability chain (e.g. KIALA pick-up points in French cities) requiring a framework governing the liability; the importance of this attribute will be linked to the number of actors that are involved in the completion of deliveries.

Table 3: Characteristics of Urban Logistics Spaces used in the case studies

	Urban Logistics Space							
	Type of the ULS	Size of the ULS	Location of the ULS	Attended/ unattended ULS	Temporary storage at the ULS	Number of ULSs	Upstream accessibility of the ULS	Downstream accessibility of the ULS
BentoBox, Lyon	Urban Logistics Box	Small	In the Part-Dieu commercial centre	unattended	yes	One	high	high
Vert chez Vous, Paris	Mobile ULS (barge on river Seine)	Medium	Mobile (Paris city centre, on river Seine)	attended	yes	One	high	high
Cargohopper, Utrecht	Vehicle reception point	Medium	City centre (about 300 m away from downtown)	unattended	no	One	high	high
Chronocity, Strasbourg	Goods reception point	Small	Strasbourg city centre	unattended	no	Several	high	high
Dropzones in Aalborg	Based on existing infrastructure	n/a	City centre of Aalborg	attended	yes	Several	high	high
KIALA pick up points in French cities	Based on existing infrastructure	n/a	In convenience stores all over the country	attended	yes	Network of 5000 in the country	high	high
Chronopost, Concorde	Micro-consolidation centre	large	In an underground parking facility in Concorde	attended	yes	One	high	high
Micro-consolidation centre, London	Micro-consolidation centre	large	In central London, near to the Tower of London	attended	yes	One	high	high
La Petite Reine, Paris	Micro-consolidation centre	large	In underground parking facilities in city centre	attended	yes	Two	high	high
Mobile Depot, Brussels	Mobile ULS (mobile depot)	Medium	Brussels city centre	attended	yes	One	high	high
Consignity, Paris	Urban Logistics Box	small	In the entire Paris Region	unattended	yes	Network of 10-20 in the city	high	high
Packstations DHL in German Cities	Urban Logistics Box	Small	All over urban areas	unattended	yes	Network of 2500 in the country	high	high
ELP, Bordeaux	Vehicle reception point	Medium	In the city centre	attended	no	Two	high	high

Table 4: Characteristics of Urban Logistics Spaces used in the case studies

	Vehicles		Management of operations			
	Type of vehicles	**Attended/ unattended delivery**	**Management of operations**	**Number of parties involved**	**Possibility of off-hours delivery to the ULS**	**Possibility of off-hours delivery from the ULS**
BentoBox, Lyon	none	unattended	private	one	yes	no
Vert chez Vous, Paris	cargocycles	attended	private	one	yes	no
Cargohopper, Utrecht	cargohopper	attended	private	one	yes	no
Chronocity, Strasbourg	electric trolleys	attended	private	one	yes	no
Dropzones in Aalborg	none	attended	private	several	yes	yes
KIALA pick up points in French cities	none	attended	private	several	no	no
Chronopost, Concorde	cargocycles	attended	private	one	yes	no
Micro-consolidation centre, London	electric trolleys	attended	private	one	yes	no
La Petite Reine, Paris	cargocycles	attended	private	one	yes	no
Mobile Depot, Brussels	cargocycles	attended	private	one	no	no
Consignity, Paris	none	unattended	private	one	yes	yes
Packstations DHL in German Cities	none	unattended	private	one	yes	yes
ELP, Bordeaux	various (inc. electric trolleys)	attended	PPP - private	one (+assistance from ELP workers)	no	no

Table 5: Importance of transferability attributes for each case study

	Availability of public land for setting-up of the ULS	Necessity for public support for financing of ULS	Necessity of a central location	Necessity for security system at the location	Necessity for a location with high upstream and downstream accessibility	Necessity for a large network of ULSs	Necessity for a regulatory framework providing advantages to the concept	Necessity for a dedicated transport network providing relative advantage to vehicles	Necessity of having a private firm managing operations	Necessity to set a regulatory framework for the chain of liability
BentoBox, Lyon	*	*	**	***	***	**	*	n/a	***	*
Vert chez Vous, Paris	*	*	***	*	***	*	**	***	***	*
Cargohopper, Utrecht	**	*	***	*	***	*	**	**	***	*
Chronocity, Strasbourg	**	*	***	*	***	**	**	**	***	*
Dropzones in Aalborg	*	*	**	*	***	**	**	*	***	***
KIALA pick up points in French cities	*	*	*	*	***	***	*	*	***	***
Chronopost, Concorde	**	***	***	*	***	*	**	***	***	*
Micro-consolidation centre, London	**	*	***	*	***	*	**	***	***	*
La Petite Reine, Paris	**	***	***	*	***	*	**	***	***	*
Mobile Depot, Brussels	**	*	***	*	***	*	**	***	***	*
Consignity, Paris	*	*	**	***	***	***	*	*	***	*
Packstations DHL in German Cities	*	*	*	***	***	***	*	*	***	*
ELP, Bordeaux	***	**	***	*	***	**	**	*	**	**

(*=not very important; **=rather important; ***=very important)

4 Conclusion

The light freight and the micro-consolidation initiatives are gaining importance in the urban freight transportation segment, as many recent experiences in European cities have demonstrated. This paper provides a closer view into different micro-consolidation initiatives by establishing a state of the art and defining six common typologies.

Beyond the simple inventory of micro-consolidation initiatives, authors suggest a theoretical framework for transferability of case studies. In fact, learning from these foreign experiences and replicating them in local conditions remains one of the major challenges for both private and institutional actors, making the transferability a key issue in the urban freight transport research. The transferability framework consists of two dimensions: the first dimension assesses the relevance of the micro-consolidation initiative for a specific city area; the second dimension suitability of the micro-consolidation initiative.

Authors have applied this framework to test the transferability potential of the Espace de Livraison de Proximité in Brussels and to select the optimal pilot site for its possible implementation out of 26 possible locations in Brussels. Regarding the relevance, the 26 locations were assessed according to the market segments present and 10 locations with highest concentration of retail flows were selected. A suitability analysis was then performed on these 10 locations, and an optimal pilot site was chosen. The application of this framework has led us to highlight the critical attributes for the selection of the pilot site, which are the availability of the public land, the central location and the upstream and downstream accessibility of the location. However, the translation of these attributes into quantitative indicators was quite challenging, especially given the unavailability of the data with regards to them, both in the original and the target city areas. A further step in the research of the transferability of micro-consolidation initiatives would be to define precisely these indicators and to quantify them for the analysed case studies.

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