ULaaDS
URBAN LOGISTICS AS AN ON-DEMAND SERVICE

360º OBSERVATORY

ULaaDS D2.1: Observatory of strategic developments on urban logistics – final version

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Project abstract

ULaaDS sets out to offer a new approach to system innovation in urban logistics. Its vision is to develop sustainable and liveable cities through re-localisation of logistics activities and re-configuration of freight flows at different scales. Specifically, ULaaDS will use a combination of innovative technology solutions (vehicles, equipment and infrastructure), new schemes for horizontal collaboration (driven by the sharing economy) and policy measures and interventions as catalysers of a systemic change in urban and peri-urban service infrastructure. This aims to support cities in the path of integrating sustainable and cooperative logistics systems into their sustainable urban mobility plans (SUMPs). ULaaDS will deliver a novel framework to support urban logistics planning aligning industry, market and government needs, following an intensive multi-stakeholder collaboration process. This will create favourable conditions for the private sector to adopt sustainable principles for urban logistics, while enhancing cities' adaptive capacity to respond to rapidly changing needs. The project findings will be translated into open decision support tools and guidelines.

A consortium led by three municipalities (pilot cities) committed to zero emissions city logistics (Bremen, Mechelen, Groningen) has joined forces with logistics stakeholders, both established and newcomers, as well as leading academic institutions in EU to accelerate the deployment of novel, feasible, shared and ZE solutions addressing major upcoming challenges generated by the rising on-demand economy in future urban logistics. Since large-scale replication and transferability of results is one of the cornerstones of the project, ULaaDS also involves four satellite cities (Rome, Edinburgh, Alba Iulia and Bergen) which will also apply the novel toolkit created in ULaaDS, as well as the overall project methodology to co-create additional ULaaDS solutions relevant to their cities as well as outlines for potential research trials. ULaaDS is a project part of ETP ALICE Liaison program.

Keywords

Urban logistics, sustainability, observatory, insights, best practices, challenge, trend.

Copyright statement

Executive summary

This report is a compilation of insights published in the ULaaDS 360° Observatory throughout the duration of the project (September 2020 – February 2024). The goal of the 360° Observatory is to fully recognise the challenges that are shaping and will shape urban freight transport through the on-demand economy in the future. Within the 360° Observatory, we find the insights produced in ULaaDS. The purpose of these insights was to provide additional information on relevant issues and innovations in urban logistics, as well as updates on the project and its results.

Various partners contributed to these insights, including Bax & Company and Miebach that contributed on topics like the on-demand economy, COVID-19's influence on urban logistics, and bicycle-based solutions. Eurocities provided insights on low emission zones, while Fraunhofer IML focused on data-driven tools. The University of Groningen offered perspectives on business and operating models, while IFZ on sustainable urban logistics initiatives. VIL contributed insights from ULaaDS pilots, and TØI provided expertise on parcel lockers, urban space, and the human dimension in urban logistics. Rupprecht Consult offered guidance on integrating urban logistics into strategic planning. In addition, a collaborative insight was provided by the satellite cities: Rome, Edinburgh, Alba Iulia and Bergen. The formatting and coordination of these insights was overseen by Bax & Company.

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1. Introduction

This deliverable collects all the insights published in the 360 Observatory during the course of the project. The 360° Observatory is a knowledge hub for cities and stakeholders that has gathered the latest insights form the ULaaDS partners, best practices and use cases of urban logistics, and research studies and events of interest. In total, 15 insights have been published from February 2021 to February 2024. These insights were written by different partners and coordinated and reviewed by Bax & Company.

Various methods were employed to produce these insights. Most of the topics were initiated by the partners and jointly discussed with Bax & Company to formulate them as insights; an interview was conducted with Domien Stubbe (VIL) to shed light on the coordination and preparation of trials; or a collaborative insight was written to present the vision of the satellite cities following the General Assembly held in Bremen in March 2023.

2. Insights

2.1 How is COVID-19 shaping Urban Logistics?

By Mari Carmen Jiménez (Miebach Consulting), Nacho Sarrió and Lorena Axinte (Bax & Company)

Publication date: 03-02-2021

The effects of the COVID-19 pandemic have impacted the economy at a global scale, regardless of sector. In the middle of the crisis, global logistics and transport have played a key role in the supply of essential goods, and the pandemic has highlighted the role of urban freight logistics as an essential public service.

At the beginning of the pandemic, the lockdown put strong pressure on supply chains as goodshad to continue circulating, while most people stayed at home and started to work remotely. As a result, shopping shifted online unexpectedly fast and the transfer of flows from B2B to B2C,along with the new safety rules, impacted urban logistics dramatically.

During this period, we have witnessed every area of the economy react to the current challenges with innovation, and urban logistics is no exception. COVID-19 has deeply influenced consumer behaviour, marking a turning point in logistics trends such as digitalization, omnichannel and the rise of the on-demand economy. Accordingly the Alliance for Logistics Innovation through Collaboration in Europe (ALICE) shared a relevant document during 2020 where some of the learnings from the pandemic situation where shared.

Restaurants, small and medium retailers, and all kinds of producers rushed to open e-commerce channels or to set up delivery services. This was an attempt to deal with restrictions and adapt to customer behaviour changes, helping some businesses to remain competitive and others to simply survive.

Urban freight deliveries were notably affected, both positively and negatively. On the negative side, e-commerce firms struggled to cope with the rise of orders, generating delays and service disruptions. Logistics and service providers had to deal with challenges due to the lack of resources, such as staff and capacity. New safety rules complicated face-to-face delivery (that would ideally be “contactless”), and challenged service providers to adopt new digital processes for delivery transactions.

On the plus side, urban freight deliveries benefitted from an unusual lack of congestion and easier access to parking, which reduced transport time in-between deliveries. The lockdown led to improved delivery efficiency and delivery success rates.

However, with the return to “normality”, it is unclear how consumer behaviour and urban freight flows will evolve. Nonetheless, there is some level of consensus among key stakeholders that some of the changes occurring during the pandemic are here to stay and will re-shape urban logistics:

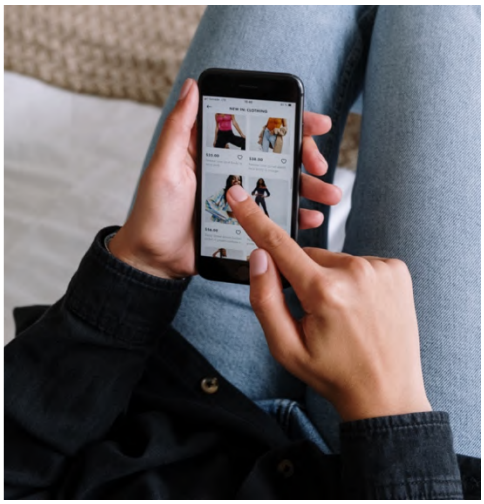


Figure 1: New consumer behaviour boosting e-commerce and on-demand services

The boom of e-commerce and on-demand services

New digital ways to interact with the brands and changes in customer behaviour regarding convenience, speed, and simplicity are now well established. Experts estimate that the pandemic has accelerated the shift to e-commerce by five years, prompting retailers to pivot to omnichannel fulfilment capabilities to keep driving traffic to their stores.

Figure 2: Working from home is the new reality

The rise of the home office

Recent surveys suggest that after lockdown, the general preference among workers is a combination of working from home and going to the office at flexible times. If this trend gets established, it will boost e-commerce even more and also reduce delivery failures.

Figure 3: The use of private and healthy means of transport is now much more common

Increase in private transport

Public transport and shared mobility services have struggled the most during the crisis and are far from recovering previous user shares. Social distancing measures have pushed away many regular users, as they instead opted for private transport modes such as cycling (private bikes) or walking for commuting. Unfortunately, many people have also opted for private vehicles (most of them combustion cars).

To support sustainable mobility patterns, many city authorities are taking actions and re-shaping urban space. (i.e. constructing wider sidewalks to guarantee physical distancing for pedestrians and enlarging the cycle lane network). Additionally, cities are also regulating stricter speed limits (20-30 km/h) in urban areas to give priority to cyclists and pedestrians.

As e-commerce keeps growing, deliveries and fragmentation of trips and loads will, too. This scenario, together with the increase of different modes of private transport competing for the use of urban space, is setting up the perfect storm to drive up urban congestion and pollution within the next few years. This scenario is threatening the sustainability goals set by the European authorities, particularly the potential to reach the net-zero emissions target by 2050.

In this context, both public and private actors will need to address the challenge of adapting to new customer trends and consumption, while complying with urban mobility regulations and sustainability goals. Innovation, collaboration between actors, and synergies between transport modes, supported by robust digital capabilities, will be key.

Among the most relevant solutions that are already in place or being tested within urban logistics are:

1. **Use of low and zero-carbon vehicles for last-mile (eVans, e-cargo-bikes)**
2. **Lockers located close to the final delivery point so that they can be conveniently accessed by customers**

3. **Urban consolidation centres and Microhubs (similar to urban consolidation centres but with a smaller footprint). These facilities allow for a mode shift in last-mile deliveries (i.e. zero-carbon vehicles)**
4. **Mixed multicarrier consolidation, sharing platforms (i.e. Microhubs) for delivery**
5. **Integration of urban freight mobility services and networks (i.e. use of park and ride facilities as drop-off/pick-up points with Microhubs or e-cargo bikes sharing space)**
6. **Using public transport for freight movements**

Furthermore, in the long term, we can already foresee other urban freight solutions such as the use of robotics, autonomous vehicles and drones.

ULaaDS connection

In this context, it is fitting to mention the ULaaDS project as an example of collaboration between public and private actors; including urban planners, city leaders, academic institutions and both established and newcomer logistics stakeholders. The aim is to develop solutions for future urban logistics, with ULaaDS developing and testing them through multi-stakeholder research trials in different cities across Europe.

ULaaDS is focusing on two aspects that cover some of the solutions listed above:

1. **Collaborative delivery models to enhance logistics efficiency & multimodal mobility in cities (Microhubs, cargo-bike sharing platforms)**
2. **Effective integration of passenger and urban freight mobility and network (cargo hitching)**

There is a wide range of potential solutions to address future freight delivery challenges. However, there is no one-size-fits-all and the future will not see a single solution winning, but rather different combinations which will vary from city to city depending on the local context. The ULaaDS project will hopefully shed light in this direction.

Finally, it is key to remember that these changes cannot be entirely left to the initiatives of citizens or private companies. They must be supported, or rather initiated by public authorities in consultation with local communities, in order for them to be accepted and sustainable in the long term.

2.2 The on-demand economy and its role in Urban Logistics

By Nacho Sarrió and Lorena Axinte (Bax & Company), and Mari Carmen Jiménez (Miebach Consulting)

Publication date: 30-04-2021

Anyone who has ever used their smartphone to request a vehicle, order food from a restaurant or even to buy groceries and have them delivered soon after has contributed to the on-demand economy.

In a nutshell, the on-demand economy refers to all economic activities that are **technology-enabled** and offer the consumer access to a product or a service shortly after they request it. The **immediacy** of the service and the fact that this is done exactly when the user wants or needs it, is what gives the concept its name. It is based on **instant gratification** - the satisfaction a user experiences when they can instantly request a good or service, pay for it, and even follow the route or status of their order all the way to its fulfilment. The on-demand economy has some clear and distinctive characteristics which can, in fact, be very similar or relatable to those of the **sharing** and the **crowdsourced** economy.

The **sharing economy**, on the one hand, allows for better **distribution** and use of (otherwise) idle resources. For instance, individuals can allow others to use their home, garage, bike, car or any other asset, for profit or not. Research from Cardiff University shows that the benefits of sharing lie mainly in reduced carbon footprint and resource use, increased access to previously unaffordable or insufficient goods and services, as well as reduced social isolation - all through the increased usage of the shared products or infrastructure. The sharing economy takes place between peers, rather than between businesses and consumers, and can be technology-enabled and/or on-demand, although not necessarily both.

On the other hand, the **crowdsourcing economy** refers to the engagement of individuals or organisations who **contribute** with tangible goods, services, ideas and/or skills to provide a service or deliver a product. It is also sometimes referred to as the *gig economy* and, overall, it relies on a large number of workers with unfixed and flexible schedules in temporary positions who often operate in an on-demand fashion (although not always).

The driver behind the on-demand economy: e-commerce

Pushed by the increasing digitisation and socioeconomic trends, and further enhanced by the COVID-19 pandemic, this particular side of the economy is currently seeing dramatic growth. Particularly, e-commerce is the faster growing driver behind the growth of the on-demand economy. In the EU, e-commerce revenue is expected to show a compound annual growth rate (CAGR) of 6.3% between 2019-23 (Statista).

Online purchases have now become possible for almost any product or service, offering customers fast and convenient options to fulfil their needs and desires from almost anywhere. Consumers and suppliers are connected through digital platforms, such as a website or an app, which play a crucial

role in today's digitalised economy. These platforms generally facilitate and enable the entire process: from marketplace display, to order placement, payment and transactions, communication, parcel and status tracking and even feedback collection. Both a result and cause, consumer behaviour is constantly changing and shifting towards prioritising fast, simple and efficient experiences – a behavioural trend that has been growing globally since the emergence of the Internet in the late 1990s.

Figure 4: We can access just about any product or service through digital platforms

On-demand economy: benefits and challenges

The benefits generated by the on-demand economy include customers' unlimited access to a wide range of products and services, which reduces their need to travel, and their time invested in shopping. For suppliers, addressing potential customers becomes easier through digital means, and the absence of a physical store can reduce rent-related costs. The job market becomes bigger and more flexible, making it possible for workers to find flexible jobs, work desirable hours and gain autonomy. However, the on-demand economy also poses significant challenges, including increasing and unsustainable consumption and waste levels, and precarious working conditions for workers. In many cases workers are contracted and not fully employed, so they lack social protection and benefits.

The different benefits provided by the platforms (accessibility, simplicity, privacy), plus the convenience and speed of home deliveries, are contributing to the steady growth of the on-demand economy as a whole. The consumer behaviour transition towards immediate access to "everything" has certainly contributed to this growth, and such turn is determined by a general perception of "lack of time". Studies show that, effectively, the growth experienced by the on-demand economy is mainly due to the consumers' growing appetite for greater convenience, speed and simplicity. On top of that, the actual increase in smartphone-connected consumers and technology-based

solutions for simple and secure on-line payments, as well as location and tracking services, are also innovations shaping our day-to-day and contributing to such enormous growth of the on-demand economy.

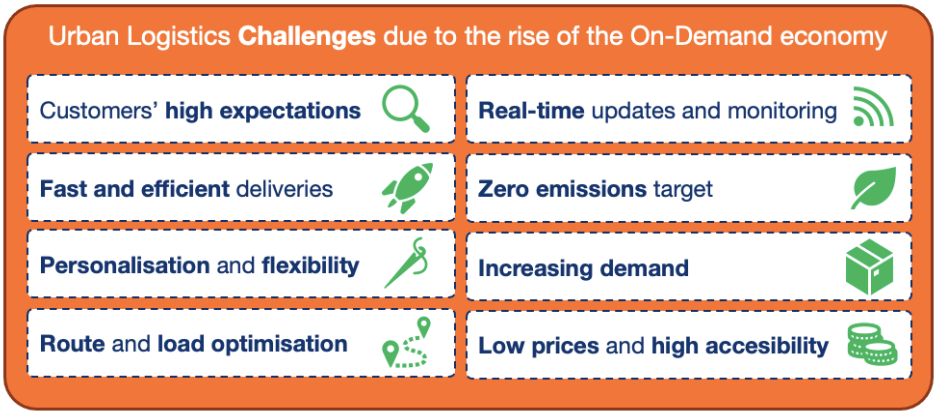


Figure 5: UL challenges due to the rise of the On-Demand economy

The on-demand economy in urban logistics

As a result, the growth of the on-demand economy is disrupting many sectors, from the most traditional ride-sharing and food delivery, to others such as groceries, music and video, learning and education, healthcare, and of course, logistics. According to the On-demand Logistics Market research Report, the on-demand logistics market revenue is expected to rise from $9,1 billion in 2019 to $75,0 billion by 2030, at a 21,1% CAGR, and this growth may be observed even earlier due to pandemic side-effects.

Figure 6: Ride hailing is one of the most common on-demand solutions

This unprecedented shift in consumption, where now a consumer is able to buy anything at any time with a single tap, is enabling and demanding existing services to re-invent themselves. As a matter of fact, most new successful on-demand services have made their way by correctly leveraging the aforementioned technology innovations while utilising existing infrastructure, or by being able to implement them on top of a well-functioning, more traditional, service or product. As a result, and after several iterations and improvements, such business models have appeared to outdate the pre-existing ones and satisfy the high-demanding and ever-changing needs of customers, in a cost-effective way that is also efficient and scalable.

More specifically, urban logistics, also commonly referred to as last-mile logistics, are undoubtedly experiencing an increase in size, relevance and presence following the on-demand economy trend. This growth is fueled by consumers getting used to 'right now right here' delivery. The consumer's immediate access to products is granted by the correct functioning of the urban logistics system as a whole. However, there are also negative impacts associated: an increase in the number and dispersion of delivery points, which combined with a tendency towards smaller shipment sizes results in a growth of the number of freight trips (1.35B deliveries in the UK by online orders in 2018, 28.8% increase from 2013 - Barclays), is ultimately leading to traffic congestion and CO2 emissions in urban centres.

ULaaDS connection: Piloting innovative solutions for sustainable future on-demand Urban Logistics

Without a doubt, urban and peri-urban areas are experiencing a steadily growing demand for new, sustainable and connected logistics solutions to integrate the requirements of the on-demand economy, ensuring healthy cities for their inhabitants. The ULaaDS project brings together established logistics stakeholders and newcomers to discuss rising challenges with the local authorities, jointly assessing and co-creating such novel solutions for a sustainable future: vehicle

and infrastructure capacity sharing for people and freight, implementation of consolidation centres and micro hubs, the use of cargo bikes, and even containerised micro-depots

2.3 Low Emission Zones and Urban Logistics: How can we make it work?

By Fraser Moore and Arianna Americo (Eurocities), and Nacho Sarrió and Lorena Axinte (Bax & Company).

Publication date: 20-07-2021

Cities are increasingly limiting the type of vehicles or the time that vehicles can enter urban cores for many reasons, including air pollution reduction and increased safety for all road users. This has left the door open for urban logistics solutions such as electric vehicle fleets, last-mile delivery via cargo bike or urban consolidation centres, amongst others.

A consensus among major cities in Europe has formed over the past ten years that polluting vehicles should be reduced in city centres, giving more space for pedestrians or cyclists, mainly aimed at increasing the cities' liveability and safety. There are many ways to reach this goal, and most cities try a combination of methods such as increasing cycling infrastructure, promoting public transport use, or increasing electric vehicle charging points.

But another key tool at cities' disposal is Urban Vehicle Access Regulation Schemes, better known as Low Emissions Zones (LEZs), Zero Emissions Zones (ZEZs) or congestion charging zones. Most major European capitals and large cities have some kind of scheme in operation that attempts to limit polluting vehicles' access to the city centre. According to Transport & Environment, there were more than 250 LEZs in Europe in 2019, and the number is expected to increase.

Generally, these schemes are effective at reducing air pollution and traffic congestion. A recent example from the city of Brussels shows that one year after the LEZ was set up, the city experienced an 11% reduction in NOx and a reduction of 11.5% of Particulate Matter (PM2.5). However, some stakeholders such as city centre businesses may rely on heavy-duty vehicles entering the urban core to provide their stock. What's more, the EU's report on the Treatment of logistics activities in Urban Vehicle Access Regulation Schemes from 2017 points out that LEZs could push polluting vehicles to drive around the restricted zones, causing an increase in air pollution elsewhere.

How can cities reconcile urban access policies for decarbonisation with the need of businesses and individuals to move goods around urban areas? To find out how this works in practice, three ULaaDS cities describe their experiences below. The city of Mechelen currently has a car-free city centre, while Bergen and Groningen are currently in the process of establishing their own schemes.

Bergen

Bergen has quite a unique geographic situation. What are some of the challenges and opportunities you are looking at when planning a Zero Emission Zone (ZEZ)?

Lars Petter Klem, Project manager at The Urban Environment Agency of Bergen:

"The City of Bergen has committed to making the whole city centre area a Zero Emission Zone by 2030, and started by piloting in smaller areas in the first half of the 2020. The city is located in a narrow valley and borders the sea. This geography makes it difficult to define pilot zones that are small enough to avoid blocking essential traffic in the centre, while also being important enough to reduce CO_2 emissions and give incentives for companies to replace their diesel vans with zero emission vehicles.

Of course, there's also a need for a legal framework to put the zones into action. This spring, our national government has pledged to start a dialogue with the cities that want to pilot ZEZs (for the time being, the City of Bergen and the City of Oslo) but have also demanded that such zones exclude roads that are part of the national road grid. In the case of Bergen, we do have an international E-road (E16) located in the very centre of our city, making it a bit difficult to reach our goal. Hopefully, our pilot zones will prove that this decision is not necessary, making it possible to turn our entire city centre into a zero-emission Zone by 2030.

Bergen's car sale records from March 2021 prove that ZEZs are not something that will make our city areas inaccessible for cars, with 71% of new passenger cars and 42% of new vans being electric. Major companies will be launching their electric trucks by this summer."

Figure 7: The City of Bergen has committed to making the whole city centre a zero-emission zone by 2030

Groningen

Groningen has drawn up a strategy to reduce freight and deliver traffic in the inner-city centre with the plan - 'Ruimte voor Zero Emissie Stadslogistiek' (Space for Zero Emissions City Logistics). How will this change the city in the next five years?

Sjouke van der Vlugt, Senior Policy Officer for Urban Development at the Municipality of Groningen: *"With the plan 'Space for Zero Emission City Logistics', we worked out our contribution*

to the national Climate Agreement of 2019, which states that approximately forty Dutch cities will set up a ZEZ by 2025 to jointly save one megaton of CO2 per year.

More space for you! In a clean and safe city centre. That is what the city of Groningen wants to achieve. However, we notice that the city centre is becoming increasingly crowded. This means that we must be smart with the use of available space. We're taking all kinds of measures for logistics traffic. Several are about reducing the number of trucks and delivery vans in the city centre and the logistics traffic that still runs in the city centre must be emission-free and operate safely. We do this with, among other things, stricter rules for deliveries for shops, companies, and the hospitality sector. Fewer trucks and delivery vans mean more space for pedestrians and cyclists in a beautiful, lively city centre."

Figure 8: The City of Groningen is one of several Dutch cities setting up a zero-emission zone by 2025 to collectively save one megaton of CO2 per year

Mechelen

Some business owners may hear "car free zones" and think "deliveries will be made more difficult". This is clearly not the case, but how do you get businesses in the city centre to agree to a car free zone? What arguments have you made in Mechelen to convince them?

Roos Lowette, Project Coordinator in the Mobility Team of the City of Mechelen: *"In the inner city of Mechelen, a few strategic streets are car free between 11 am and 6 pm. The city highly invests in and values participatory processes. When initially implementing and expanding car free zones, these processes turned out very valuable. Evidently, inhabitants and retailers were concerned about the changes that were about to take place and would affect their daily lives. But through participation, concerns evaporated, and the added value of the new reality was embraced.*

Give it time, don't rush these decisions, have all the stakeholders experience the new reality themselves and convince them through highlighting what's in it for them. Traffic safety, a higher quality of life and creating more space for people are arguments that work.

***Bruul, an important shopping street, has been a car-free zone since 2013**. It turns out that after initial concerns, retailers embraced the change and the difficulties that they anticipated turned out to be minor after all. For example, every retailer can obtain a permit for one vehicle to enter or exit the city during car-free hours. Retailers arranged their permits and coordinated with their couriers to respect the new time windows for deliveries. The retailers who replenish their supplies themselves either adapted to the new hours or used the permitted vehicle.*

By meeting retailers and inhabitants with benefits – the "carrot" – resistance of taking away a comfortable status quo – the "stick" – lowers. Experience teaches us that you need both the carrot and the stick to convince stakeholders."

Based on these cities' experiences, solutions to logistics in cities with LEZs or ZEZs can come in many forms. Although a certain level of traffic will need to enter the urban core, the harmful effects of pollution, congestion and poor road safety can be mitigated through mobility innovations, including but not limited to:

- **Light (electric) vehicles:** Cargo bikes can be used for last-mile deliveries of goods up to 250kg in weight, but with the possibility to increase this to around 500kg with trailers and electric assist. Some cargo bikes are even fitted with refrigeration units to allow for last-mile distribution of perishables.
- **Off-hour delivery:** This is a quick fix to adapt logistics to LEZs, ZEZs and congestion charging zones that involves offering businesses the option to receive deliveries outside of conventional working hours when there are fewer cars, pedestrians and cyclists in city centres.
- **Electrifying fleets:** Sales of electric vehicles more than doubled in the EU in 2020, and advances in battery range and charging infrastructure means that their popularity will only continue to grow.
- **Urban Consolidation Centres (UCCs):** Logistic facilities are located close to the area they serve and collect and distribute goods from different factories, warehouses, and other production sites to local businesses or even individuals.

ULaaDS connection

Many city dwellers may have become used to the impact of goods deliveries in city centres that are carried out by heavy-duty vehicles, often noisy, bulky, and polluting, and may accept it as normal. But cities are adopting more and more ambitious schemes to restrict entry to certain types of polluting vehicles. Rotterdam, for instance, will implement a far-ranging ZEZ from 2025, and is already transforming its logistics methods to suit this, including urban consolidation centres, cargo bikes, light electric vehicles and also heavy-duty electric vehicles for tasks such as garbage collection.

ULaaDS is a collaborative project between all stakeholders involved in the implementation of LEZs, ZEZs and congestion charging zones. With a goal to provide solutions for logistics, it is imperative they work for businesses, residents and local governments.

That's why, through the creation and deployment of a process that includes points of view, concerns and interests from all relevant stakeholders, ULaaDS is focusing on innovative solutions that are adapted to LEZs, ZEZs and congestion charge zones. Such solutions include:

- Collaborative and shared urban logistics models
- Integrated passenger and urban freight networks

ULaaDS' solutions are looking to bring about a change in the status quo by promoting business-friendly logistics solutions that improve citizens' quality of life, promote sustainability, achieve climate neutral cities by 2030 and provide long-term and profitable solutions for businesses. Eventually, such solutions will become the new normal.

2.4 Parcel Lockers- Greener, Cheaper, and more Convenient

By Howard Weir, Tale Ørving (Transportøkonomisk institutt), and Lorena Axinte & Nacho Sarrió (Bax & Company).

Publication date: 27-09-2021

Recent years have seen cities become a testbed for new and innovative solutions as logistics companies attempt to solve the infamous last mile problem. By far the most expensive, complicated, and polluting part of the logistics chain, the last mile has received a great deal of focus as new technologies and smarter tracking and information systems allow delivery solutions to be better tailored to specific situations.

Amongst the numerous solutions, one that stands out is that of automated parcel lockers. While delivery and collection points have a long history, advances in technology combined with the ubiquity of smartphones have allowed the process to be automated. Packages are delivered to a secure locker that alerts customers when their package has been delivered. The lockers are placed in safe, easily reachable locations, and packages can be picked up at the customer's convenience.

The range of services relying on this solution is also diversifying, with players such as laundry companies, restaurants, and supermarkets also looking into parcel lockers to deliver products and services. Some cities are even looking into peer-to-peer applications, which allow citizens to exchange goods without an intermediary company.

Figure 9: Australia Post's free 24/7 parcel lockers

Dropping door to door deliveries

From a logistic operator's perspective, one of the most significant advantages of parcel lockers is that they no longer need to visit each customer individually. They save time, reduce their emissions, and cause fewer traffic conflicts. Operators save costs and need fewer drivers, and subsequently vehicles, to deliver the same number of packages. Customers no longer have to wait at home for delivery windows that can stretch over several hours and can instead go to the nearest drop off point and pick up their package whenever it works best for them. Depending on the provider and the system used, customers might also have the flexibility to choose among several drop-off points in their neighbourhood/city.

Automated lockers can be more flexibly located than traditional pick-up points and can (and must) be distributed across a wider network because of their smaller footprint and lower capacity. This increases the ease of access for customers without significantly complicating a delivery driver's route. Parcel lockers can also be used to reach customers who would otherwise be too difficult, time consuming, or expensive to deliver to individually, such as in rural areas with long distances between homes.

A study of parcel lockers carried out by Polish carrier InPost suggests that using parcel lockers in dense urban areas has the potential (in the best case scenario) to halve the number of kilometres driven, increase the number of packages delivered per courier by a factor of 10, and reduce C02 emissions from 300g per package delivered to just 14g. Though this rosy picture makes parcel lockers sound like a silver bullet, their implementation is deceptively complicated and requires careful deployment to be an effective part of the delivery chain.

Location, Location, Location

Figure 10: Amazon has encountered issues with limited street and sidewalk space

Placement is by far the biggest deciding factor for determining how successful an individual locker will be. Lockers must be strategically located such that they are convenient, secure, and easy to reach. Their position should be considered within a wider context, both at city and neighbourhood levels, and ideally integrated into a network. Lockers must also comply with regulations and not be a hindrance to others.

Sharing limited street and sidewalk space is a contentious issue, something Amazon discovered first-hand when they mistakenly placed their boxes in a way that partially blocked the sidewalk in a Chicago park. Such missteps create pushback from local communities and can damage public perception of new solutions. In this case, Amazon was forced to put their plans on hold as local politicians decided to review current regulations and potentially revoke their approval to place parcel lockers in public parks.

Despite occasional missteps, parcel lockers are generally well received by customers, who like the flexibility and proximity that a network of well-placed parcel lockers brings. The challenge then is to strike the right balance between number of lockers, placement, and dwell time of packages. Given their limited storage space, lockers need to maintain a flow rate high enough that they are economically viable while also having a relatively low package dwell time so that they are continually emptied by customers. The complexity of getting this balance right underlines the difficulties in adding a new link in the supply chain. Parcel lockers require new systems and routines to integrate them into existing transport networks and the added complexity can act as a barrier to their adoption.

Double Edged Sword

The use of parcel lockers can have a synergistic effect with active transport, where parcel lockers located within 2km from consumers can encourage pickup by walking or biking, reducing traffic and creating positive health and environmental effects However, the flipside is also true. If lockers are poorly located, or spread too thinly throughout the city, they can become a source of unnecessary car trips, causing increased traffic and emissions. While a delivery company may still save costs in such a situation, it would essentially offload the extra trips and kilometres driven onto its customers, including the negative consequences of increased traffic.

Realising the benefits of parcel lockers for both logistic operators and consumers requires a multi-stakeholder approach. Careful planning on the side of logistics operators and city officials is needed to ensure that parcel lockers actually contribute to reducing the overall footprint, both environmentally and economically, of the last-mile.

ULaaDS connection

In Groningen, as part of the ULaaDS trials, smart parcel lockers will be deployed in a park&ride zone in Heemskerk, about 10km outside of the city centre. Mobility hubs are one of the most attractive locations for parcel lockers as people can easily incorporate a pickup into their daily commute. In this case, packages delivered during the day can be picked up by commuters returning home before they get in their cars to make the last leg of their journey, thus avoiding a detour to a separate location.

Solutions like the one from Groningen are part of a wider effort to determine exactly how to best implement parcel lockers into the rapidly changing and innovating area of last-mile logistics. The potential is there, but has yet to be fully realised.

2.5 How to kickstart sustainable Urban Logistics initiatives

By Günther Illek, Melanie Troppe (IFZ), and Lorena Axinte & Nacho Sarrió (Bax & Company).

Publication date: 29-01-2022

Logistics plays a key role in our daily lives. Rising urban populations, economic activities and new trends naturally lead to an increase in logistics activities. Although the word logistics tends to conjure up images of couriers and parcels, it spans many industries. This of course includes retail and food & beverage, but also waste management, construction, and many others. Now, especially with the rise of the On-Demand Economy, discussions on the potential environmental and socio-economic impacts of this trend have resurfaced.

- *How can conventional delivery methods using fuel driven vans and lorries be replaced by more sustainable alternatives?*
- *How can we improve efficiency and increase sustainability?*
- *Who should be responsible for taking the initiative for change?*

These are the questions we'll explore in this ULaaDS insight.

Who has a stake in urban logistics?

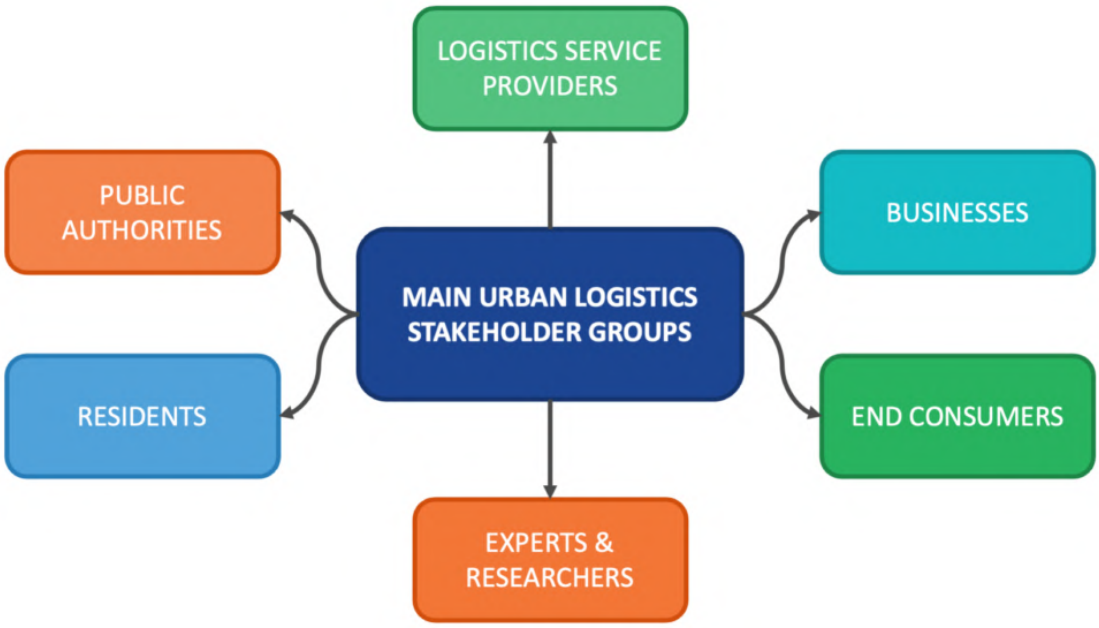


Figure 11: The main stakeholder groups in logistics

Logistics service providers are the key stakeholders here for obvious reasons, however, they are not alone.

Recipients, their expectations, needs and willingness to pay also play an essential role in the overall logistics ecosystem. A shift in their expectations could easily lead to changing solutions in the transport sector. Recipients can be further divided into businesses (leading to business-to-business models – B2B) and individual end-customers (in business to customer models – **B2C).**

With rising logistics activities in cities, **residents** are also starting to receive their deserved recognition as relevant stakeholders who should be included in the discussion for new solutions. The term "residents" normally describes people directly affected by these solutions (for instance when a new hub opens in their neighbourhood), and they can be vital in ensuring the successful implementation of such (e.g., in the case of determining the best locations for parcel lockers).

Last but not least, **public authorities** themselves – often the City administrations – are obvious players and are currently increasing their efforts to solve the raising challenges occurring in urban areas due to logistics activities.

In numbers, **experts and researchers** make the smallest group among the stakeholders. Their role is to bring in knowledge of appropriate and viable solutions, study patterns and analyse the impacts of project implementation.

Drivers of innovation

Sustainable urban logistics can be an effective element in contributing to environmental goals and a higher quality of life within a city. For this to happen, we need innovative solutions within the urban logistics network. These solutions can have different drivers, so let's have a look at the most common ones for those of you interested in supporting your city.

Company-driven initiatives

Company-driven initiatives are often based on economic decisions. In dense inner-city surroundings or within a pedestrian zone with limited time windows for delivery, a micro hub concept using cargo bikes for last-mile delivery can be much more cost-efficient than conventional approaches. Moreover, customer expectations may change, leaning towards sustainable deliveries and offering new economic potentials.

Similarly, many companies are already preparing for future access restrictions (such as **Low Emissions Zones**) by using smaller and low-carbon vehicles, outracing the competition on the way to sustainable last-mile logistics. Numerous new companies and start-ups are also entering the field, introducing **new solutions like parcel lockers**, shared platforms or vehicle sharing options. Last but not least, actions to *"green"* the internal logistic activities of course closely connect to a company's attitude towards sustainability and bring value in terms of marketing too.

Research-driven initiatives

Science plays an important role in the design of sustainable logistics solutions; developing technical vehicles, devices and IT solutions, as well as elaborating potential business and operating models for companies. Research solutions may sometimes be very optimistic, but pay limited attention to aspects of economic viability. In many cases, research-driven initiatives appear in combination with an actual funding scheme that acts as a kind of "business incubator".

Private and community-led initiatives

Certain solutions, like neighbourhood hubs, cargo bike rental schemes, peer-to-peer (P2P) solutions or neighbour pick-ups are based on private initiatives. Some of them can offer great value and upscale potential. **Private initiatives are normally based on contribution, social interaction and good neighbourship.**

City-driven initiatives

Initiatives from public authorities are normally city-driven initiatives, as the legal and infrastructural frameworks for sustainable solutions lie in the city's scope for action (e.g., planning and building permits). Cities benefit directly from successful results and hence have a direct interest in change. As other types of initiatives are normally implemented by just a handful of logistics service providers, **more and more cities are taking action to accelerate the shift to sustainable last-mile solutions.** Ways to do so can be regular networking activities, storytelling approaches about the future outline of the city, funding & support, the implementation of legal framework conditions based on strategies and concepts, and the introduction of sustainable solutions in public procurement.

The collaborative approach

As combined efforts often bring the best results, many initiatives are based on collaboration as a key path towards innovation. Such projects include stakeholders from all sides, with researchers, logistics service providers and cities working hand in hand to implement and test novel solutions and concepts for last-mile deliveries. Recent trends focus especially on the implementation of different kinds of **micro hubs with cargo bike deliveries, IT solutions (digital consolidation, dynamic routing etc.), and on the installation of parcel lockers** to minimise the number of delivery attempts – examples of solutions that strongly benefit from the collaborative approach.

The value of multi-stakeholder approaches

As we've seen, logistics solutions do affect different stakeholders in many ways. As a result, the introduction of new, more sustainable solutions should be developed in a collaborative way to achieve the best outcome for all the parties concerned. Multi-stakeholder approaches can take many different forms, varying in size, stakeholder mix and meeting frequency. The right solution depends on what is planned and the expected outcomes, but be sure to give the process enough time to get the best results.

Often, when bringing many different stakeholders together, **it is important to use specific tools for consensus or decision making. Useful tools may be the collective target system, the analytical hierarchy process, MAMCA or even a conjoint analysis approach.**

SULPs – a clear commitment from the city

SULP stands for **Sustainable Urban Logistics Planning;** a method to explore the status quo, future visions, and necessary actions to reach these visions. **SULPs foster the exchange and collaboration between stakeholders and provide a solid foundation to kickstart sustainable urban logistics solutions.** The results of SULPs offer an overview of the current logistics ecosystem in a city, building the base for collaborative decision-making and the elaboration of clear sustainable long-term solutions. So, if you are a stakeholder from a city, a SULP process may be the solution for you to kickstart sustainable logistics initiatives in your hometown!

The SULP process consists of 4 phases: preparation & analysis, strategic development, measure planning, and finally implementation and monitoring. SULPs are based on the SUMP concept (Sustainable Urban Mobility Planning), which was already introduced in several EU projects almost a decade ago. A visual representation of the different phases in a SUMP/SULP process is presented below, and for further information on the topic, check out the European Platform on SUMPs guide on how a SULP can be implemented **here.**

Figure 12: An overview of the different phases and steps in a SUMP/SULP process

The ULaaDS connection: a combined approach

ULaaDS, as a clear example of a collaborative approach, puts a strong emphasis on **bringing all stakeholders on board** while implementing solutions that are adapted to local needs. Additionally, such solutions are intended to comply with economic and social factors too. Such a process can inspire and provide valuable ideas to kickstart sustainable logistics initiatives in all cities.

Besides numerous smaller scale conversations with different stakeholders, there is also a series of local fora for each trial in ULaaDS, where a wide array of stakeholders of all groups will be involved to initiate fruitful discussions. The plan for the first of these fora starts with the discussion of future visions for each city as a baseline. Then, the planned logistics solutions will be introduced, and details of the actual implementation discussed. Below is an overview of the ULaaDS multi-stakeholder approach.

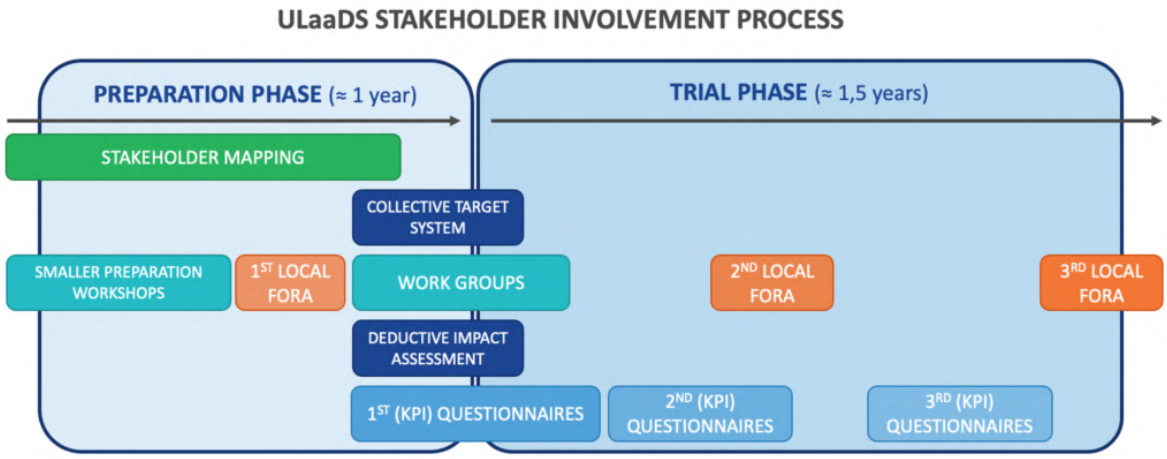


Figure 13: A generic overview of the multi-stakeholder approach used in ULaaDS

The outcomes of the local fora will be processed and combined with the outcomes of other activities from the preparation phase. The process aims to update and optimise the original plans for the ULaaDS trial phase.

Two further local fora in the mid and end of the trial phase will give the necessary room to discuss, adapt and improve the trials among the different stakeholders during and after the project. They will also provide best practices and outputs which will serve for future developments and SUMP/SULP adaptations and recommendations.

The ULaaDS multi-stakeholder approach is further supported by the application of the collective target system – a questionnaire about the visions and targets of the different stakeholder groups in terms of economic, ecological, and social aspects. Frequent meetings and working groups among the implementation partners and stakeholders are rounding up the whole process.

Over time the results of the project's multi-stakeholder approach will be revealed, so please follow us on social media and keep an eye on our website for updates! If you are interested in learning more about the ULaaDS multi-stakeholder approach, check out our new deliverable ***'Local ecosystem stakeholders' needs and requirements & prioritisation of use cases'*** on our **Resources page**.

2.6 Data-driven decision support tools for Urban Freight Transport (UFT) planning

By Philipp Müller, Daniela Kirsch, & Sandra Jankowski (Fraunhofer IML), and Nacho Sarrió & Lorena Axinte (Bax & Company).

Publication date: 05-04-2022

Urban areas are melting pots of a multitude of interests. If we look at Urban Freight Transport (UFT), it's clear that many different demands need to be fulfilled. Logistics service providers want to operate smoothly and efficiently without external restrictions, local companies require on-time deliveries to ensure complete assortment or functioning production processes, citizens expect to benefit from on-demand goods access while not being disturbed by UFT processes, and local authorities have to harmonise these requirements while handling negative externalities like congestion, air and noise pollution, or even safety. The key problem here is the limited space and time to satisfy the different needs of these stakeholders. However, **there is a way we can better understand, optimise and plan Urban Freight Transport processes, by using one of the key resources of our time: data.**

How to better fulfil the 7 Rights of logistics with data

UFT is fundamental for a functioning city and its importance continues to grow as cities across the EU attract more and more people from rural areas. European countries are already highly urbanized (2020: 74.9%) compared to the rest of the world, and the United Nations expect that 83.7% of the European population will live in cities in 2050 (United Nations 2018).

Logistics has always been about fulfilling its 7 Rights ***"(…) 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). These pillars may still be the foundation of logistics but, especially in urban areas, the circumstances have become increasingly more complex: entry restrictions like time windows for deliveries or low/zero-emissions zones are two examples that affect the business of companies dependent on logistics services. On top of regulating UFT, city authorities must also take close care to ensure the supply of goods into, within, and out of the city while also harmonising the coexistence between all (non-)road users.

Data-driven decision making can be a key pillar to optimise UFT and its planning regarding societal, environmental and/or economic aspects. Furthermore, this can be done from the point of view of

different stakeholders, which is also useful in enabling a more flexible and accurate analysis that considers all possible players. Over the past decades, especially with the rise of the public internet by the early 1990s, technologies - *besides traditional methods like surveys* - have gradually emerged (and have become more affordable) which fosters the collection of (real-time) data like:

- GPS
- Sensors (for emissions, weight, acceleration, speed etc.)
- Smart devices (like handhelds, tablets, smartphones etc.)
- Image processing devices

Additionally, **a wide range of static and real-time data sources exist nowadays. These can be used to quantify UFT more precisely than ever before to best understand reality, including the flow of goods and all possible interactions.** But as the involved stakeholders differ, so do the intentions in making data-driven decisions. This leads to different purposes for analysing data such as:

- Tracking and tracing
- Understanding traffic impacts (like emissions, noise etc.)
- Optimising traffic flow and routing in advance or on the fly
- Increasing freight utilisation
- *and more*

Different kinds of data sources, may they be static or real-time data, can be valuable for these undertakings as they lead to a better understanding of the triggers and impacts of UFT. **Depending on the level of data detail, these aspects can be broken down from a city-wide perspective to as focused as single streets.** Besides the presented purposes, one can apply additional advanced data analytics techniques to incorporate predictions. Examinations can be enriched for example with other data sources like weather forecasts, time, or weekday related factors (e. g. traffic density, school opening and closing times) to better estimate future scenarios and shape UFT decisions more accurately, e. g. avoiding traffic peaks by postponing or re-routing transport flows.

Data, may it be public or private, often possesses fundamental importance and value for its owner. Therefore, it seems clear that different challenges can occur, and certain boundaries must be kept in mind when gathering data. On the same line, sharing data is widely regarded as a sensitive topic and often connected with privacy concerns for most private companies and even public entities. Many fear weakening their market position by exposing too many insights into their own processes. That's why some technologies enabling these collections are forbidden in certain European countries or can only be used by following strict restrictions. Therefore, **to diminish reservations against privacy concerns, data processors should respect the sovereignty of data owners and ensure that they follow the EU's General Data Protection Regulation.**

However, to create meaningful results, a certain degree of transparency and expression of data is necessary. This implies that data reported from third parties to others, like local authorities, should be accurate and it must be clear which application created them. Furthermore, expertise in data requirements and processing is necessary to evaluate what kind of data is needed for a specific purpose. Lastly, it should be clear in which format, where, and to what kind of degree data should be made accessible to which interested groups.

This data and derived insights foster knowledge of UFT and change in serving sustainability objectives set by a city. The process model of Sustainable Urban Logistics Planning (SULP) provides target-oriented guidance for local authorities in reaching these objectives. In this respect, performance indicators and parameters support the analysis of the current UFT situation and its impacts on the city, especially against the background of the increasing importance of UFT through e-commerce. In the SULP process *"(…) key components [are] a thorough assessment of the current situation and future trends, a widely supported common vision with strategic objectives [and an] implementation [of measurements which] should be accompanied by reliable monitoring and evaluation."* (Aifandopoulou & Xenou, 2019) For local authorities, ex-ante and ex-post assessments of the UFT measurements are crucial in understanding whether the desired outcome is achieved.

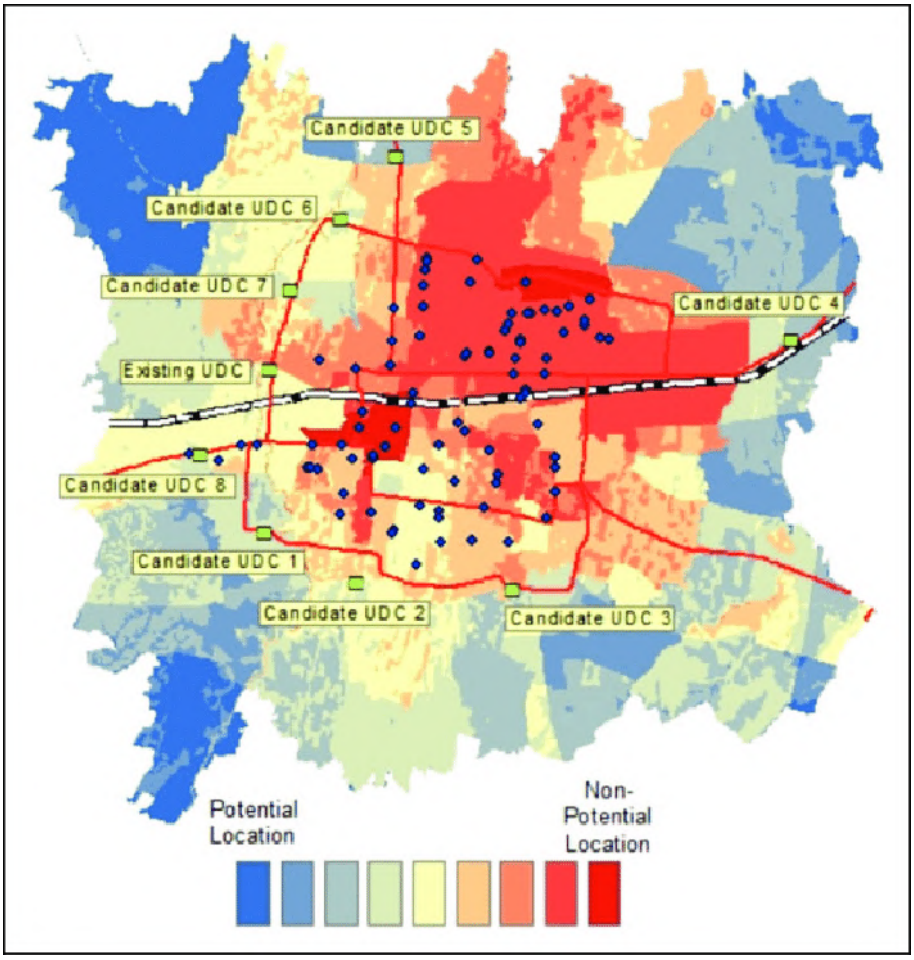


Figure 14: Urban distribution center location: Combination of spatial analysis and multi-objective mixed-integer linear programming – Scientific Figure on ResearchGate

Data collection, processing and updating can be a time and cost-consuming undertaking for cities and other interested parties. To understand the value and expression of data, one must always keep in mind that data analysis should be seen as a multi-stakeholder approach; one's advantage might be the other's disadvantage. Nevertheless, even though many aspects can be quantified by using data, **soft factors (like the acceptance of certain technologies or concepts) remain fundamentally important for the understanding of UFT.**

In conclusion, it is important to stress that closer cooperation between private and public stakeholders can lead to benefits for them all. In the case of traffic flow management, it can reduce congestion and emissions while private companies can increase their process efficiency. Finding commonly supported solutions based on data is widely viewed as both likely and preferable.

How data will change the logistics market

The importance of data-driven UFT planning will continue to grow as technological possibilities do. Data is widely regarded as "the new oil" of this century (Szczepański 2020). This leads, in a way, to the entrance of new players into the UFT market. **Accordingly, it is expected that large tech companies and innovative start-ups will continue to establish themselves in the upcoming years and offer further diversified services tackling aspects of this market.** This trend shows that knowledge gained by companies already owning a lot of (customer) data can help them lower the entry barriers to the urban logistics sector and collect even more data whilst taking care of the supply chain.

Most technologies will continue to evolve further and become more affordable too. This fact will foster the collection of data from many sources, plus emphasises the inclusion of processing and analysing processes to implement new or optimise existing UFT business models in economic, societal and environmental terms.

It can be concluded that using **data-driven decision support tools can be, on the one hand, advantageous for private actors, and on the other, a pillar for local authorities in becoming a smarter and more sustainable city regarding UFT and SULPs.**

The ULaaDS Connection

The ULaaDS project is an example of collaboration between public and private actors and how data can be used in understanding and shaping UFT. One of the project goals is to develop concepts and test solutions for future-oriented, on-demand, urban logistics in different cities across Europe. Such research trials cover the use of cargo bikes, containerised micro-depots, as well as consolidation centres, among others. Throughout the project, urban planners, city leaders, logistics operators and researchers come together to share insights and exchange data regarding these ULaaDS concepts with the intention to better understand existing and new solutions.

One pillar represents increasing the data-based understanding and decision making of these concepts to enable the best deployment and development of such models. To compare the different research trials, an impact assessment framework is built on existing knowledge in the field of UFT obtained through literature review, studying documentation from other EU projects, and leveraging the ULaaDS partners' expertise. The areas of impact that will be covered by gathering data are environmental and economic impacts as well as land use, traffic conditions and logistics impacts, among others. Furthermore, soft factors like user experience, acceptance and awareness shall round off the picture.

2.7 Business and Operating Models for Sustainable Urban Freight Transport

By Paul Buijs (University of Groningen), and Lorena Axinte & Nacho Sarrió (Bax & Company).

Publication date: 09-09-2022

Research and development in urban freight transport is generating vast amounts of new on-demand and sustainable solutions. These include new types of urban freight facilities, vehicle technology, and ICT. Without sound operating and business models, however, such innovations are short-lived in the hyper-competitive urban freight transport market.

Figure 15: The first autonomous shuttle on Flanders public roads

As part of ULaaDS, we have developed an overview of recent practices in urban freight transport that purposefully contribute to the transition towards carbon-neutral cities. Generally, such practices either focus on introducing sustainable vehicle technology and/or on utilising existing transport resources more efficiently. Sustainable vehicles can replace polluting transport resources, thereby reducing greenhouse gas emissions. Given the sheer number of urban freight vehicles and current production rates, replacing every polluting vehicle with a sustainable one seems impossible in the short to medium term. Therefore, using existing transport resources more efficiently deserves attention too. Doing so would curb the need for more vehicles as urban freight flows increase. Indeed, improved resource utilisation can help justify investments in sustainable vehicle technology—developments in sustainable vehicle technology and improved resource utilisation are inextricably linked.

Innovations in Sustainable Vehicle Technology

Slowly but steadily, polluting urban freight transport vehicles give way to more sustainable variants. Nevertheless, not all current vehicle types have a direct sustainable alternative—or at least not one with a similar operating profile or cost of ownership. Technology advances quickly, however, for some vehicles, the total cost of ownership of an electric variant will break even with its polluting counterpart shortly, if it hasn't already. This does not hold true for all vehicle types though. Further technological improvements are especially needed for larger vehicles. A shift to smaller vehicles for use in urban freight transport seems logical—both for economic reasons and because smaller vehicles better fit the urban space, especially in European cities with historic city centres with narrow and busy streets. Enter the cargo bike. Cargo bikes appear in many shapes and sizes, from regular bicycles to cargo bikes and/or trailers with a capacity of 2 m^3 and over 200 kg loading capacity. Larger ones are often equipped with electric assistance too. Additionally, light commercial freight vehicles are increasingly electric too.

Innovations in Logistics Facilities and Networks

Urban freight transport networks are changing, both in response to the operating restrictions of sustainable vehicle technology and because of ambitions for more efficient use of existing vehicle capacity. For the better part of the 20th century, logistics facilities in urban areas have increased in size and moved away from the city centres to suburban or peri-urban areas, a concept known as logistics sprawl. This enabled increased efficiency due to economies of scale for material handling and made land available for residential areas and commercial activities closer to the city centres. The resulting logistics network structure is rather unsuitable for the use of sustainable vehicles—considering their operating restrictions—and urban consolidation schemes that are often highly localised. Hence, we observe a trend where companies search for logistics facilities closer to the city centre again. The available space is scarce, however, and often also heavily used by other stakeholders. Innovative solutions include smaller facilities, automatic lockers, and crowd-sourced neighbourhood hubs. To curtail material handling costs, urban freight facilities are often combined with the introduction of standardised and modular load carriers that enable a seamless handover of freight at the facility (i.e., containerisation).

Innovation in Information Technology

The last type of innovation identified as part of the ULaaDS project can be categorised as information and communication technology (ICT). Partly, this involves novel hardware and algorithms needed to enable autonomous vehicles. In the domain of freight transport, there are developments in indoor applications (e.g., drones for counting stock or moving parts), aerial carriers (e.g., drones for transporting blood between hospitals), and autonomous road-based vehicles. The latter are especially interesting from the perspective of urban freight transport, as they could potentially enable the removal or reduction of an expensive element in last-mile transport: labour cost for couriers. Equally interesting are developments in digital platforms. Some platform developments are pushed by local authorities, for example with the aim to collect, bundle, and/or publish data on all sorts of processes in the city. But most platforms are commercially driven—often by start-ups aiming to create a platform economy for various aspects of the logistics sector. Such platforms hold

the promise of more efficient use of transport resources, and they too are often deployed in an attempt to curb labour costs.

2.8 Low and zero-carbon vehicles for urban last-mile deliveries

By Melanie Troppe & Günther Illek (IFZ), and Lorena Axinte & Nacho Sarrió (Bax & Company).

Publication date: 01-10-2022

Low and zero-carbon vehicles are a key element of most sustainable urban last-mile logistics solutions today and are gaining more and more presence and relevance. In this ULaaDS insight, we take a look at the three main types of vehicles for use in an urban context: cargo bikes, Light Electric Vehicles (LEVs), and e-Vans. We've also included an analysis of their pros and cons according to the needs of the logistics framework in which they should be implemented.

LEV, e-Van, eLCV – a short excursion into nomenclature

Commonly interchanged, here is some clarification:

- **LEV**: *light electric vehicles; small vehicles with less than 100 kg weight that use electricity to run*
- **e-Van**: *are regular-sized vans that instead of using petrol and a combustion engine they run on electricity*
- **eLCV**: **:** *electric light commercial vehicle; vehicles used for commercial purposes with a gross vehicle weight of no more than 3,5 metric tonnes, which the EU defines as N1 vehicles**

Conclusion: eLCV englobes both e-Vans and LEVs

** N1 vehicles are further subdivided into three classes: Small (N1-I, gross weight: ≤ 1305 kg), Medium (N1-II, gross weight: 1305-1760 kg), Large (N1-III, gross weight: 1760-3500 kg)*

What vehicles are available?

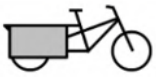
Cargo bikes: affordable or inefficient solution?

In recent years, more focus has been put on the rediscovery of cargo bikes for sustainable urban logistics solutions, in line with early suggestions made by Wright and Reiter in 2016. They stated that up to 25% of motorised logistics pickup and delivery trips can be replaced by cargo bike use. This number has not yet been reached but there is strong momentum towards cargo bike use for first and last-mile delivery. In short: cargo bikes have a long history but have been given a push in the last decade.

The ideal bike model will depend on the required load and type of products that must be carried. The heavier the load that needs to be carried, the more wheels needed to better distribute the weight. Additionally, electric cargo bikes are also commonly used to cope with heavier loads, as well as to navigate hilly areas. Compared to regular cargo bikes, where the endurance of the cyclist determines the possible distance, the range of e-cargo bikes mainly depends on the capacity of the battery. This range oscillates between 20-100km.

Figure 16: Rytle cargo bike

See below our overview of cargo bike types according to their shape, load distribution, and number of wheels, which all influence driving behaviour and possibilities. Three and four-wheelers have the advantage that they are more stable in adverse weather conditions, but other than that, they are usually more prone to overturning around bends/corners at high speeds, compared to two-wheelers. Furthermore, transverse forces come into play here, as the wheels of three and four-wheelers stay upright when turning. Spoked wheels are often not built for these forces and therefore can increase maintenance costs. To avoid abrasion, ULaaDS partner Bpost uses a notable alternative; postal delivery bikes with trailers. Another way to reduce this wear would be to fit the wheels with plastic rims. This increases the weight but leads to a higher load capacity for the wheels.

Type	Image	Maximum Load	Wheels
Postal delivery bikes		50 – 75 kg	2
Longtail		50 – 100 kg	2
Frontloader | Long John		150 – 200 kg	2-3
Backloader		500 kg	3-4

Cargo bikes vs trailers

Trailers are a great option to further increase the loading capacities of regular bikes and cargo bikes. Depending on the trailer model, up to 150 kg of weight can be loaded onto this add-on. With the extra load, it is essential that the bike is robust, with a well-functioning braking system. Additionally, the trailer has the advantage that it can be handled manually for shorter trips at the destination, making it much more flexible than regular cargo bikes with fixed cargo areas.

Figure 17: Bpost bike trailer

LEVs: Small and flexible choice

Light Electric Vehicle is a term for a variety of small electric vehicles with a weight of less than 100 kg, most often built for very specific purposes. They are widely recognised due to their use by postal services, for instance. One of the main advantages is their size, allowing for greater flexibility and the possibility of using city cycling infrastructure – if the national legal framework allows its use. One of the size disadvantages is that more trips are needed to deliver many parcels, which could be transported by one van load. Therefore, additional infrastructure, such as hubs will be needed for efficient urban logistics.

E-vans: Traditional solutions reinvented

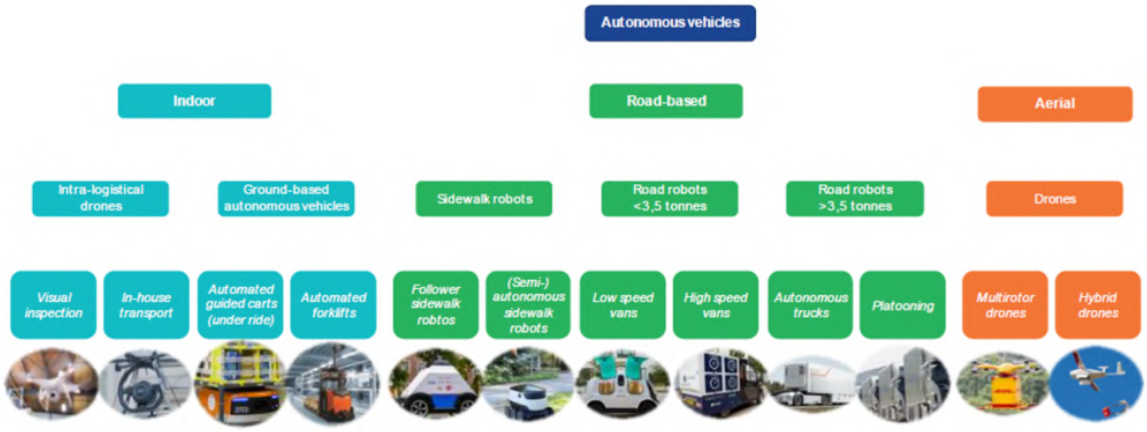
From a logistics service provider point of view, it makes sense to start a transition to more sustainable logistics with e-vans. By replacing the engine, conventional and established van models – for which most cities are prepared for – become a carbon emission-free solution suitable for use in urban and suburban areas.

At first glance, this may seem like a great solution. However, e-vans are more expensive and have a lower range. Furthermore, charging stations will need to be installed, which increases investment costs and doesn't help cities to free up space in urban centres or reduce congestion.

Figure 18: Mercedes-Benz eSprinter

Autonomous vehicles: future reality or fantasy?

Recently, a lot of research effort has been invested into Autonomous Vehicle (AV) applications, focusing on mobility as a whole and logistics, both urban and long-haul. The following chapter provides an overview of innovations with logistic relevance and is based on ULaaDS Deliverable 3.1. So far, only a few of the applications are beyond the pilot phase and for most, the chances of adoption in the sector in the coming years are still highly uncertain.



Of the many options, aerial AVs (drones) are being investigated as unmanned aerial vehicles for last-mile delivery, which, due to their limited volume, weight capacity and range, their inclusion in the urban freight transport network is not trivial. They could operate for last-mile delivery using a mobile depot for deliveries to customers. Regulatory and social concerns will be the main challenges for fast adoption, especially in Europe.

Road-based AVs range from small sidewalk robots to automated light commercial vehicles or even self-driving long-haul trucks. Some solutions are already being trialled, however fast adoption is still a substantial challenge, mainly due to regulatory and social concerns.

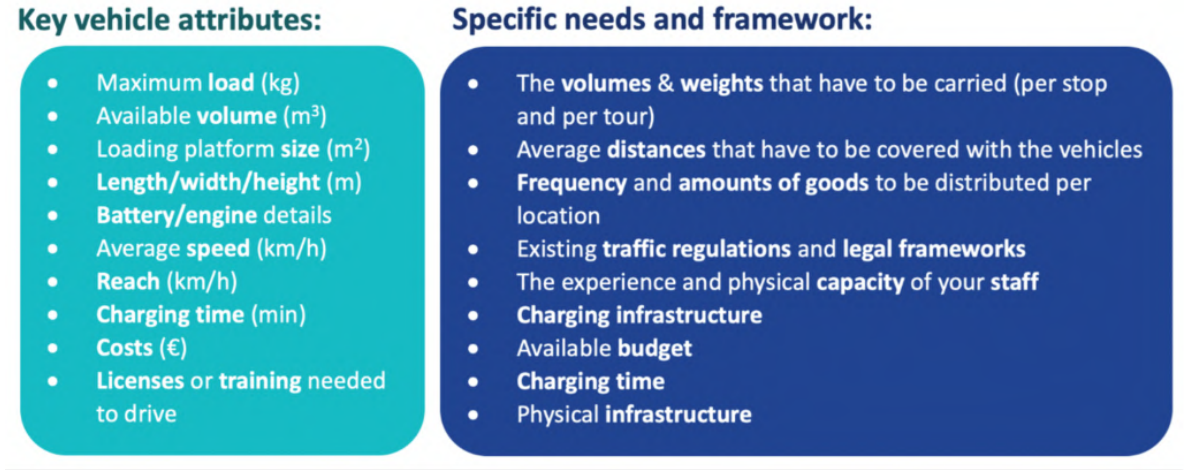
In the ULaaDS project, a solution based on the use of an autonomous vehicle provided by Easymile and operated by Ush has been successfully implemented. The goal of this trial was to test the possibilities of cargo-hitching with an autonomous vehicle used to transport both people and parcels; with an onboard parcel locker. The parcel locker was serviced by Bpost and passengers on the testing site were able to pick up parcels during the ride.

Figure 19: How to choose the right vehicle(s) for your fleet

When deciding to purchase sustainable vehicles for logistics services, two main aspects must be considered:

- Do the key attributes of the vehicle **already** fit my basic needs and requirements?
- What is the framework of the local logistics environment, how will it develop and how can precautionary measures be taken?

We will have to determine the best option among many key attributes by considering our current and future needs in order to ensure the vehicle's lifetime is as long and useful as possible. Many topics come into play when making this decision, some of which are presented in the table below. Key attributes of the vehicles, which can contribute to the best decision to match the vehicle and needs perfectly, are also considered. For further information on what to consider for the diversification of a logistics fleet, check out **this publication** from the Urbanized project.



Building on these parameters, it will often already be possible to answer the question of which is the right vehicle for a logistics service and/or define what the best vehicle composition of a fleet is. For interested readers seeking more information about vehicle technologies, their pros and cons, or applications, ULaaDS offers a deeper insight in deliverable 3.1: Benchmarking & state-of-the-art.

Mode	E-Vans	LEVs	Cargo bikes	Trailers	Autonomous Vehicles
Pros	• Few changes to logistic framework needed (range and charging infrastructure) • Heavy/voluminous loads possible • Carbon free emissions • Slight increase in liveability in cities	• Free from local carbon emissions • Small size - reduced space needed • More flexibility and considerable reach • Lightweight • Often no driving licence needed • Positive impact on liveability and traffic safety	• Affordable • Small size – reduced space needed • Carbon free emissions • Light weighted and flexible • Positive impact on liveability, environmental requirements and traffic safety • Wide range of vehicle models and flexibility • No need for specific licenses for drivers	• Can be handled manually for shorter distances • Flexibility and complementarity • Attached and used when needed only	• Little to no personnel resources needed
Cons	• Taking up quite some space • No gains in terms of manoeuvrability and flexibility • No traffic safety increase	• Less capacity than (e-)vans • More trips needed for same amount of goods • Less protection from adverse weather conditions	• Reduced reach • Reduced loading capacities • Easily influenced by heavy loads and externalities (abrasion, overturn…)	• Need for robust and prepared bike	• Legal difficulties in implementation • Further research needed • High costs

The ULaaDS Connection

As discussed, ULaaDS deliverable D3.1 goes into detail about several existing logistics operating models and vehicles, further analysed in ULaaDS trials. Accordingly, ULaaDS explores a variety of zero-emission vehicle solutions across some of its trials and use cases.

On a company site in Mechelen, an autonomous vehicle is picking up and delivering parcels and people for combined passenger and cargo transport, testing out cargo-hitching principles, as previously outlined.

In Bremen, Rytle cargo bikes and microhubs are used for the last-mile delivery of cargo. The bikes can transport pallets and large weight which is loaded onto the cargo bikes at different hub locations. The standardised pallet-size measurements of the cargo bike optimise the handling of goods in transport. Furthermore, cargo bikes will be added to the fleet offered by the free rental platform for private logistics, organised by ADFC.

2.9 Bike-based solutions in urban logistics

By Rosa van Gestel, Lorena Axinte (Bax & Company)

Publication date: 29-11-2022

Cycle logistics offer promising solutions in urban environments, as a sustainable response to the rising on-demand economy and its impact on last mile deliveries. A variety of smaller, light vehicles and mobility hubs (more info here) enables a zero-emission cycle-based transport alternative for different types of markets. Aside from minimising the impact on the environment, bikes offer numerous benefits for companies (e.g., lower purchase and maintenance costs, health benefits for drivers) and cities (e.g., increased road safety, reduced noise, better use of public space). However, ensuring that bike-based solutions realise their full potential requires a careful examination of all aspects that may influence their uptake.

The team at ULaaDS partner Bax & Company interviewed four companies that have successfully integrated cycle-based deliveries in their operations in order to learn more about their business and operational models. Helped by the growing academic literature on cycle logistics, we examine the factors which support the uptake of cargo bikes and similar vehicles in urban logistics.

Examples of integrated cycle logistics

bpost (BE)

Cycle logistics have been part of bpost's operations since it first started with mail deliveries. Now that bpost – the largest player in Belgium's post and parcel market – is transitioning towards a zero-emissions fleet by 2030, bikes are increasingly being used for delivering not just post, but also parcels of different sizes.

Gregory Perez (Urban Logistics Project Manager at bpost) points out that the choice of vehicles in their fleet is mainly determined by the physical volume of mail and parcels. When implementing cycle logistics, bpost initially struggled with the bikes' lower load capacities as compared to regular vans. In order to integrate bikes into their fleet in an economically feasible way, bpost needs to **operate in areas with high drop densities and sufficient micro-hubs to replenish**, so that as many packages can be delivered in a tight timeframe. However, to achieve this, appropriate infrastructure is needed, and urban policies can be helpful to accelerate the mobility transition.

Considering external factors that influence the uptake of cycle logistics, Perez emphasizes that restrictive measures for car or van use could play an important role in the success of cycle logistics. For instance, multiple cities in Belgium (e.g., Mechelen, Gent), have introduced regulations that limit access for motorised vehicles in several streets. This is supported by research finding that these deteriorating conditions for conventional vehicles are among the most influential factors for businesses' decision to purchase cargo bikes.

Adequate legislation can accelerate the transition to zero-emission deliveries and help to implement greener logistics.

Apart from establishing appropriate legislative and infrastructural measures, bikes must be prepared for cycle logistics as well. bpost started with the use of cargo bikes. However, after several years of testing various types and manufacturers, they concluded that the cargo bikes are not durable enough for the volumes they need to transport on a daily basis. The combination of carrying cargo with a vehicle of limited strength, the frequency and the street surface (e.g., cobble stone pavement, potholes), results in bended axles. Therefore, bpost has shifted towards the use of regular bikes with trailers, which have shown to be much sturdier. In addition, trailers can be uncoupled and walked within pedestrian areas, representing a better fit for their cycle-based operations.

Figure 20: bpost regular bike with attached trailer

Employees who tried bikes for their operations found that they could work more efficiently and convinced other mailmen to swap their vans for bikes with trailers.

For drivers, transitioning from using vans or cars to bikes is not always easy. Perez highlights the importance of changing mindsets instead of enforcing new ways of working. Giving employees the opportunity to test out bikes and sharing their experience can be helpful in guiding the transition towards cycle logistics. In Mechelen, for instance, several employees who tried the bikes found that they could win time and work more efficiently. Their positive attitude convinced other employees to swap their vans for cargo bikes. Although changing mindsets and behaviours takes time, Perez acknowledges that change management is key to successful implementation of cycle logistics.

PostNL (NL)

As The Netherlands' largest mail and parcel deliverer, PostNL aims to provide zero-emission last-mile deliveries in city centres by 2025, and to have an entirely emission-free fleet for last-mile deliveries by 2030. The use of sustainable alternatives for vans is part of their vision for sustainable city logistics, building on the foundation of the organisation's origins – the delivery of letters carried out on foot and by bicycle for many years.

Although PostNL has recognised the potential of cargo bikes for urban logistics for almost ten years, there is still room to expand in this direction. Similar to bpost's experience, PostNL found that although drivers are often enthusiastic after trying cargo bikes, the durability of the bike itself is often insufficient for their heavy operations. However, the ongoing research and development phase should enable PostNL to integrate cargo bikes in their fleet in the near future. Jorick Dam (Program Manager Sustainability at PostNL) mentioned they could use cargo bikes similarly to their light electric freight vehicles (LEFVs): in urban areas with high drop densities. PostNL aims to use the cargo bikes and LEFVs for the inner cities with narrow streets and canals, and the larger electric vehicles in less dense areas or for larger parcels.

When drivers change from conventional vehicles to LEFVs or cargo bikes, they feel like ambassadors of the city, and are very proud.

According to Dam, one issue that PostNL encountered when rearranging the logistics chains to include the use of LEFVs and cargo bikes, is the communication at City Hubs during the transhipment process. Traditionally, vans were loaded and driven by the same person, transporting the parcels from the sorting depot to the end receiver in one go. However, with LEFVs and cargo bikes, an additional hub is required to load parcels onto the smaller vehicles for the last miles in city centres. Besides the additional costs associated with the micro-hub, this means that a smooth process is required to load the parcels into the cargo bodies in the correct order. PostNL has developed a so-called Tetris-tool, which examines the pile of parcels and makes a plan for the compartments of a truck's roller cages, that are later used to load the smaller vehicles with. The **algorithm, developed by PostNL helps employees to load the smaller vehicles in the most efficient way, both in terms of space and the order for delivery routes** (more info on their digitalisation strategy here). This enables PostNL to fit parcels of different shapes and sizes in the vehicle, that would otherwise have been delivered by conventional vans. These types of innovations are promising, but also highlight the effort needed to rearrange logistics operations to accommodate more sustainable vehicles for last-mile delivery.

Figure 21: PostNL employee with different vehicles

Pedal Me (UK)

Unlike bpost and PostNL, two large logistics service providers that are exploring cycle-logistics for their operations along with other types of vehicles, Pedal Me is a smaller, London-based company which focuses solely on delivery by bike. Pedal Me carries anything that conventional delivery vans can – from coffee to furniture, and from beer barrels to humans. Their mission is to remove vans from the streets, shifting from a motor vehicle culture to a biking culture.

While being carried in one of their bikes, Christopher Dixon (Co-founder and Head of Training at Pedal Me) explained in our online interview the Pedal Me approach to integrating bike-based solutions in urban logistics. As Pedal Me tries to replace the work done by van-based logistics service providers, the company is competitive across the entire logistics market. However, competing with larger logistics service providers is not always easy. Often, people assume that trips made by bikes are much cheaper than trips made by conventional vehicles. In a way, this is true: **depending on the right infrastructure and skills of the rider, bikes can be very quick and win time.** However, other costs (e.g., wages, electricity bills for charging bikes, or hub rentals) may not allow small companies like Pedal Me to reduce the prices significantly. Still, customers move to Pedal Me because they perceive them to be an environmentally friendly and cheaper alternative, especially in times where fuel prices are increasing.

Pedal Me's ability to carry heavy weights and high volumes is mainly thanks to their bike design. Dixon emphasizes that they do not use regular cargo bikes, but the specific Pedal Me bike produced by Urban Arrow, with which use is not restricted by volume. Like bpost and PostNL, Pedal Me has experienced some issues regarding the durability of delivery bikes. However, as the main aim of the

business is to remove vans from the street and replace them with bikes, Pedal Me is motivated to find solutions for these issues as quickly as possible. Their collaboration with Urban Arrow allows them to improve the quality of their bikes continuously.

Cycle logistics come with issues. As entrepreneurs on a mission to remove vans from the streets, we are committed to fixing these issues.

Figure 22: Fully loaded Pedal Me delivery bike

Still, making deliveries with bikes also requires drivers who know how to use them. Besides the different handling skills required as opposed to using regular bikes, the integration of Pedal Me bikes into the traffic network is also important to consider. In contrast to driving vans, **cyclists have much more social interaction**, using eye contact and gestures to move through traffic. To prepare riders to deliver goods and passengers quickly and safely, Pedal Me offers training. For their own employees, these trainings are mandatory, ensuring a layer of risk mitigation.

A motor vehicle culture is not the same as a bike culture. Cycling is about communicating in space, with people who are as vulnerable as you are. There is a lot of social interaction through eye contact and gestures.

The local public authority recognizes Pedal Me's work. As the trainings benefit society through behavioural change and eventually decarbonisation, transport planning department's cycling budgets can be allocated to Pedal Me, supporting their work. Dixon points out that governments can help the shift towards cycle logistics by providing these types of support. However, **this requires awareness, knowledge and motivation throughout all levels** of the public authorities' framework, as well as guidance by the higher governmental levels.

Urbike (BE)

The Brussels-based company Urbike started in 2018 as an applied research project, where the initiators collaborated with larger companies such as bpost and Delhaize to show the potential of

cycle logistics in urban areas. Today, the project has evolved into a company with 45 employees, offering not only bike-based delivery services, but also material, training, and advice on business model transformations towards cycle logistics.

Urbike's largest customer is a parcel deliverer, who employs Urbikes' last-mile services to make their own operations more environmentally friendly and efficient. Although the regularity and volume of the small parcel (under 30 kg) flow makes it highly suitable to be transported by bikes, Renaud Sarrazin (Co-founder and Expert Urban Logistics at Urbike) points out that competition in this logistics flow is high. Therefore, Urbike additionally focuses on small volumes such as fresh and dry food, pharmaceutical goods, flows that stay within the city (e.g., local B2C delivery of books and flowers), or even small orders for construction sites. Pick-ups and first miles can also be covered by Urbike, providing a reversed logistics service while simultaneously making their operations more efficient by avoiding cycling with empty cargo. Urbike tries to consolidate orders where possible. I**t is therefore crucial that delivery box sizes are standardized** (e.g., by Euro container dimensions) and used by the variety of logistics stakeholders, to ensure smooth transhipment and consolidation.

To keep track of all (reversed) logistics, each parcel or product has a digital twin. An automated system communicates with customers to continuously inform them about the status of the order, preventing situations where no one is present to receive the product. Similar to the other interviewed companies, Urbike has experienced issues with the durability of bikes. While previously they did not teach their couriers how to fix small breakdowns, Urbike's trainings now include equipping their drivers with skills to repair the most common technical issues. Additionally, two mechanics joined the company and are responsible for maintenance, prevention, and reparation of half of Urbike's vehicles. The other half is leased from DOCKR, a delivery bike company who offer subscriptions including a maintenance service.

Figure 23: Urban cycle-based logistics

Next to the technical expertise and automated system, Sarrazin highlights **the importance of the human workforce** at Urbike. The company ensures high quality, long-term job contracts with fair wages. Employees are trained and supported by a mentor teaching them how to drive the bikes, handle niche flows with special requirements (e.g., pharmaceutical products, flowers), and solve issues when they occur (e.g., absence of a receiver, small breakdowns of the bike). The company's care for this human workforce results in fair prices for their customers. Although these prices may not be the lowest in the logistics sector, they do convey an educational message to the customer, **showcasing the environmental, social, and economic sustainability** of their bike-based deliveries.

What we need from the government is recognition. Only if they see cycle logistics as a separate sector, can they support its uptake effectively.

While bike-based solutions have the potential to cover 30% of urban last-mile deliveries, they currently only encompass less than 1%. To increase its use and impact, Sarrazin highlights the importance of governments' recognition of cycle logistics as a separate sector. This way, public authorities can provide fiscal and financial incentives, as well as change land use plans to allow more city- and micro-hubs. Additionally, they can provide expertise on developing educational programmes focused on cycle logistics, such as licences for deliverers on bikes. These **supportive regulations can be combined with restrictive measures**; however, the latter must be handled carefully according to Sarrazin. Such "smart constraints" would enable governments to discourage conventional van-use, without making the necessary high-volume deliveries (e.g., to supply supermarkets and city hubs) by vans and trucks impossible.

Factors supporting the integration of bike-based solutions in urban logistics

Infrastructure

Total costs of conventional vehicles should be perceived higher than the costs associated with the use of bikes in order for bikes to be a more appealing fleet choice for logistics providers. This also includes the efficiency of the vehicle: if bikes win time, they save money. In a more car- or van-oriented city layout, bikes may not be faster than conventional vehicles, and thus may not offer significant economic benefits. Ensuring safe roads with lower speeds, appropriate parking facilities, and charging points for electric bikes would allow cycle-based solutions to make use of their advantages.

Active role of government

The interviewed companies recognise the effectiveness of both restricting and supportive regulations. Restrictive measures include for example ensuring parking fees for double parking, or imposing urban vehicle access regulations (UVARs), such as the implementation of low or zero emission zones. Enforcing these regulations is crucial to deter logistics service providers from using conventional vehicles. It also requires governments to differentiate between types of vehicle, to avoid having the same rules for vehicles of varying sizes and speeds. This differentiation is important for bikes and other small zero-emission vehicles to make use of their advantages over conventional vans. Surely, these restrictive measures go hand-in-hand with supportive regulations, giving cyclists priority and privileges in traffic.

Additionally, public authorities could support companies that focus on or shift towards cycle logistics by providing funding or subsidy schemes. However, it is important to be aware of the long-term

impact of those financial incentives; often when funding opportunities end, companies struggle to find alternative financing. Additionally, they may lead to a lower motivation of manufacturers to cut down the prices of delivery vehicles, thus, a careful execution is necessary. Combining financial incentives with supportive regulations such as educational programmes or making space for more city- and micro-hubs may be beneficial.

Involvement in projects and trials that promote cycle logistics, as well as using bikes for their own logistics operations (directly or via procured services), are additional actions that governments can take.

Change management

Change management is crucial, especially for larger logistics providers that want to shift to cycle logistics as part of their operations. Employees who are used to driving cars and vans may be reluctant to switch to bikes. Still, all interviewees indicate that after employees try bikes, they are enthusiastic about using them for their deliveries. Therefore, giving employees the opportunity to test bikes, providing training, listening to their needs, sharing positive experiences, and increasing environmental awareness within the company would help manage the change towards cycle logistics.

Smooth transhipment at hubs

When bikes are used for last-mile deliveries, extra hubs in the city are needed to ensure bikeable distances and refills. This also requires an extra step in the logistics process: transferring goods from the larger vehicles into the cargo bodies or trailers of the bikes. Multiple people are involved in this process, which means that good communication is needed to have a smooth transhipment and ensure that the parcels are loaded in the vehicles in the correct order. Digitalisation of data, such as that seen in PostNL and Urbike, can smoothen this process, as well as the use of standardized delivery box dimensions by all logistics stakeholders.

Solution-thinking

The commitment illustrated by Pedal Me has shown to be effective in addressing the durability issues with the bikes. Since their business is built upon a motivation to remove vans from the road and replace them by bikes, they are determined to solve any issues associated with the vehicle. A similar vision is present at Urbike, who are committed to providing their drivers with the best training and material possible. This solution-thinking found at these smaller companies focused on bike-based solutions is crucial and may be useful for the larger logistics service providers to adopt cycle logistics more effectively as well.

ULaaDS connection

Being zero-emission transport vehicles, bikes play an essential role in future urban logistics, and accordingly, in the ULaaDS project. The European Commission recognizes the potential and importance of cycle logistics, as mentioned for instance in the New EU Urban Mobility Framework. EU projects like ULaaDS allow cities and relevant stakeholders to explore the possibilities of cargo

bikes and similar vehicles together, contributing to a better and wider uptake of these zero-emission logistics solutions.

2.10 Two Urban Logistics solutions for the last-mile delivery problem

By Anna Keim (Miebach Consulting), and Nacho Sarrió & Víctor Ferran (Bax & Company).

Publication date: 21-03-2023

The rapid growth of e-commerce, the on-demand economy, and the associated surge in shipments, are escalating traffic and environmental pollution in cities. This reinforces the need for new and effective urban logistics concepts, not to mention ever-increasing customer demands, service improvements required to satisfy these demands, the desire for flexibility, and the growing importance of sustainability for companies and their value creation.

ULaaDS partner Miebach Consulting, alongside JLL and the Research Lab Urban Transport (ReLUT) of Frankfurt University of Applied Sciences, conducted a study at the beginning of 2023 with the aim to identify and examine new trends in the field of urban logistics.

Two concepts were considered in the study: Urban Consolidation Centres and Micro Hubs.

As investigated in project deliverable 3.1 'Benchmarking business/operating models and best practices', an Urban Consolidation Centre (UCC) refers to a logistics facility for the consolidation of urban freight flows, if necessary, across companies, to reduce freight traffic. A Micro Hub, on the other hand, is a logistics facility where goods are clustered within the city, in denser zones, to serve a limited geographic area and enable a shift to low-emission vehicles or innovative modes for last-mile delivery.

The focus of the conducted study was on the needs of the various players in urban logistics like manufacturers, retailers, and logistics service providers concerning the two aforementioned solutions.

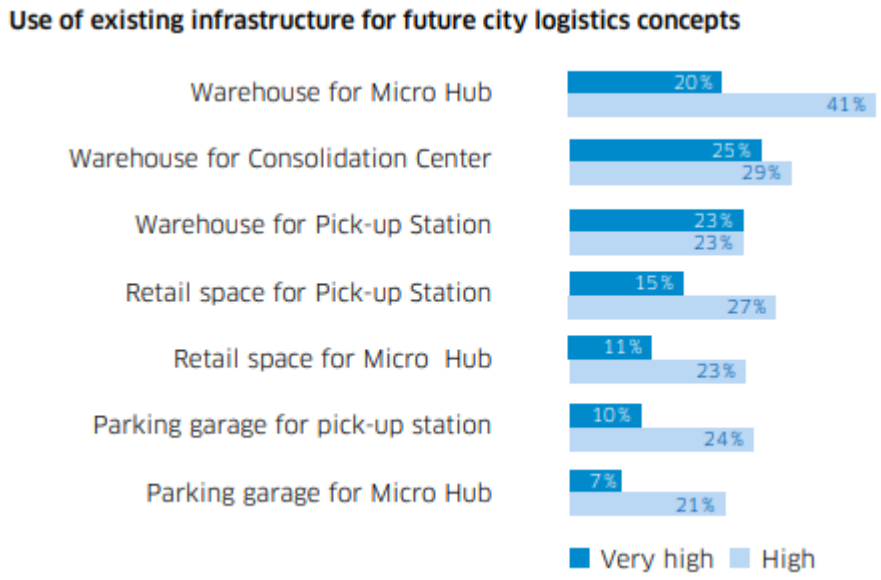
As part of an empirical expert survey, managing directors, production and logistics managers from the above-mentioned groups were asked the following questions (among others):

Q: What significance do you see in the near future (the next 3 years) for the following "Urban Logistics" concepts?
Q: What use could you imagine for future city logistics concepts with the infrastructure you already have today?
Q: In your opinion, what are the reasons for urban logistics concepts?
Q: In your opinion, what are the risks for urban logistics concepts?
Q: What challenges do you see in implementing urban logistics strategies and why?

The survey received 284 responses from manufacturers, retailers, and logistics service providers **and two key messages were taken from the survey.**

1: Urban logistics concepts are on-trend

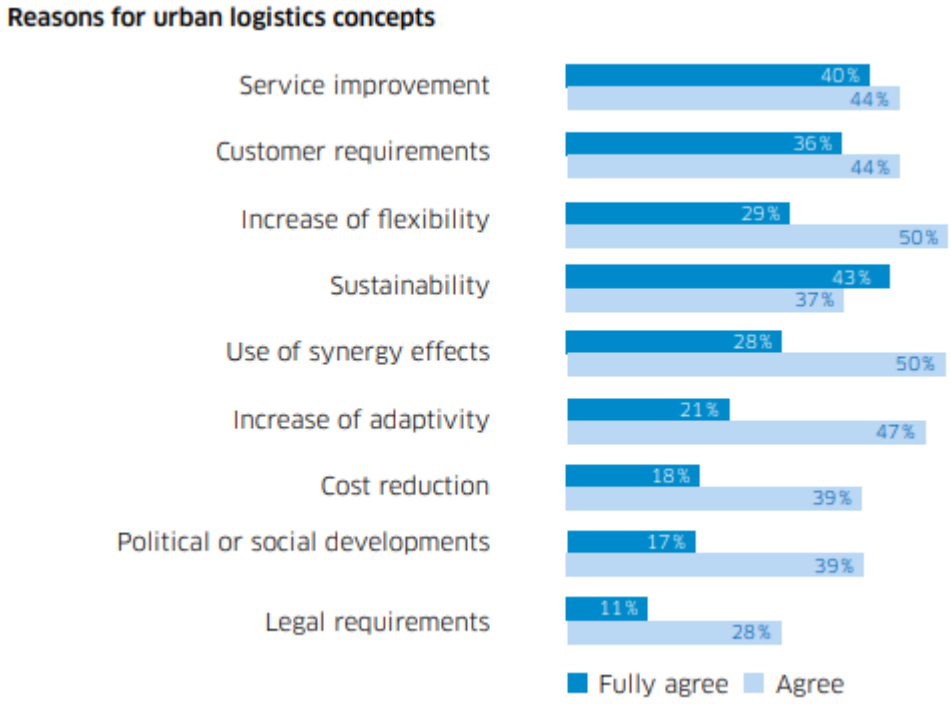
A large proportion (approximately 70%) of the companies participating in the survey can see themselves using urban logistics concepts like UCCs and Micro Hubs in the near future. Other concepts such as pick-up stations are seen as a future trend.



2: Urban logistics concepts provide a competitive advantage

A growing number of people live in metropolitan areas: 76% of the world's population lives in urban areas, and one in eight people live in a city with over a million inhabitants (according to the European Commission's Joint Research Centre's (JRC's) new Atlas of the Human Planet 2019). In the wake of the e-commerce boom and with increasing delivery traffic, not only is the burden on the city intensifying, but citizens are facing the burden of increased health risks. As a result, the pressure on rethinking urban logistics is building. Municipalities are mainly reacting to increasing delivery traffic and concerns about air quality with driving bans and access restrictions. Accordingly, new concepts should not only be free of conflict with these regulations, but should coexist with and reinforce them.

The results of the study conducted by Miebach show that in order to be successful, new concepts should be applied to meet ever-changing cities and their related challenges. The competitiveness of companies will benefit if the supply chain is improved in terms of sustainability and meeting increasing customer demands to deal with the current trend in urban populations in a meaningful way.



Urban Consolidation Centres (UCCs):

Urban Consolidation Centre (UCC) is the name given to a logistics facility for the consolidation of urban freight flows, possibly across companies, with the aim of reducing freight traffic. UCCs are thus transhipment points near (usually major) cities. Freight destined for the city is delivered, bundled according to the local delivery destination and characteristics, and then transported further into the city (as CO2-neutral as possible) for delivery. Therefore, UCCs are a suitable solution for reducing traffic congestion in cities, mostly due to large delivery vehicles and derived traffic issues. Depending on the location of the UCC, the large vehicles transporting larger volumes of freight can be removed completely from the city centre, as the final miles can be completed by smaller vehicles like LEVs, Vans or even bikes. As a result, the carbon footprint is decreased by reducing the distance of freight travel through route optimisation, as well as the use of e-mobility, LEVs and white label deliveries. **Almost 72% of the companies that participated in this study anticipate using a UCC within the next 3 years.**

Micro Hubs:

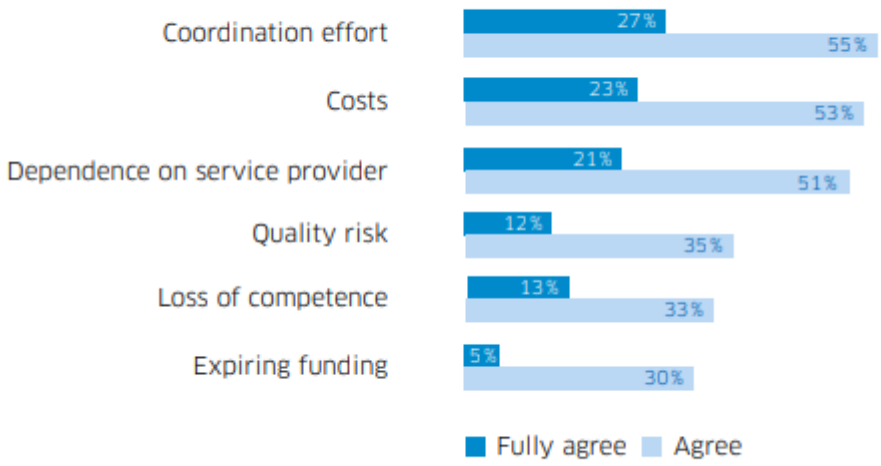
A Micro Hub is a logistics facility where goods are clustered within city limits to serve a limited geographic area around it and allow a smooth shift to low-emission vehicles and/or cycle and walking-based solutions for last-mile deliveries. Almost **70% of the companies surveyed can imagine using a micro hub soon**. The concept, which is intended to ensure low-emission inner-city logistics, is thus well received, but does not have only supporters due to the diversity of the companies' needs.

Risks and challenges:

One of the major barriers to urban logistics concepts is the coordination effort. Any solution always implicit a huge variety of stakeholders involved, even sometimes with clashing objectives. Another risk for the successful implementation of these concepts is cost. A lack of standardisation and a high amount of manual handling tasks raise the costs per freight unit.

Other risks include the possible rapid change in consumers' purchasing behaviour. In general, e-commerce is growing but there are also new trends like shopping locally, etc. There are also socio-political risks, as even more jobs will be created in the low-wage sector. Here, the support of government policy is questionable, and social conflicts could be the result. In general, the concepts have risks due to a possible lack of synergy across service providers as well as uncertainty about which player bears which costs. This is because, overall, the willingness to pay for higher costs is low among all stakeholders, including end customers.

Risks for urban logistics concepts



Despite increasing shipment volumes and customers located in urban areas, as well as some innovative techniques and concepts, the economic viability for urban logistics concepts is not always a given. Cooperation between logistics players often remains wishful thinking and the legal framework is not so helpful.

The challenges of new urban logistics concepts are mainly related to legal aspects, profitability, cooperation between different stakeholders, and the availability of infrastructure and resources.

Challenges of new urban logistics concepts

- **Legal framework**
  - Official restrictions
  - Government regulations (too inflexible & not very innovative)
- **Profitability**
  - There is uncertainty among companies as to whether the strategies will be (financially) worthwhile
  - High investments necessary
- **Cooperation between partners**

- Mostly seen as an expense and not as a benefit
- Customer acceptance uncertain

- **Infrastructure & resources**
  - Availability of spaces and buildings & labour
  - External conditions sometimes do not allow for technical solutions

The UlaaDS Connection:

The aim of ULaaDS deliverables 5.4 'Economic impacts, user experience acceptance and awareness' and 5.5 'Impacts on logistics and traffic efficiency, land use and the environment' is to evaluate and detail the influence of different trials in the cities of Bremen, Groningen and Mechelen, by analysing the effects on logistics and traffic efficiency, land-use and the environment, as well as their economic impact. This last one will be especially important to mitigate the risk and challenges currently faced by urban logistics players.

One of the trials in Bremen demonstrates the scheme of containerised last-mile delivery, which is operated by the introduction of the micro hub concept. Three micro hubs in different locations receive parcels during the morning to be then further delivered during the day via electric cargo bike. The success of this solution is measured by the reduction from two trucks to one truck.

2.11 Learning from the Implementation of Urban Logistics Pilots in European Cities: Insights from Domien Stubbe of VIL

An interview with Domien Stubbe – Vlaams Instituut Voor de Logistick VZW (VIL)

Publication date: 16-04-2023

Domien Stubbe, a Project Leader at VIL, shares his insights on the implementation of urban logistics pilots in the ULaaDS Lighthouse cities. He details how the pilots in Mechelen, Bremen, and Groningen were planned, and where they currently stand. He also discusses the challenges of defining the pilots, such as difficulties in planning, discussing with partners, and navigating policy contexts.

VIL is Flanders' sole innovation spearhead cluster for logistics, with over 600 members. VIL is involved in various aspects of the ULaaDS project, in particular as the leader of WP4, which includes the ULaaDS research trials. VIL's expertise in applied research in the field of urban freight is crucial for supporting and achieving the objectives of this work package. VIL's involvement includes the implementation of various trials in the lighthouse cities, data collection during the trials, and detailed reporting of the trial results for the validation and final definition of the ULaaDS models for horizontal collaboration and impact assessment. VIL will also play a key role in up-scaling and multiplying activities with satellite cities. VIL has a proven track record in bringing together different stakeholders in the challenging environment of urban freight, as has been demonstrated in numerous regionally funded projects.

- **How were the ULaaDS pilots in Mechelen, Bremen, and Groningen were planned, and what is their current status?**

The initial planning of the trials took place during the proposal phase of the project, and all three cities took a different approach.

In Mechelen, three commercial parties were identified and invited to join the project, with a focus on cargobike logistics, but the trial was not defined in detail. During the project, the partners came together to define the trial, focusing on collaboration for pickups at local shops. However, it turned out to be very difficult to define a framework for collaboration. Due to commercial concurrency, the use of subcontractors, and in the end, not enough buy-in at the director's board, sadly this trial never reached a real testing phase. It was a very educational process, though it does feel like failing in the end.

The second trial was about cargo-hitching with an autonomous vehicle. During the project, the opportunity arose to join forces with another European project (ART-Forum) to enlarge the impact. This helped to effectively test an autonomous vehicle transporting people and packages at a business park during the summer of 2022, and investigate the possibilities for future business models concerning the topics. With a lot of meaningful insights as a result, but also with the knowledge that autonomous vehicles are maybe not yet ready for full implementation in daily use for city logistics, certainly not in a cargo-hitching scheme.

Bremen took a different approach: it chose two promising existing trials from local projects, and through ULaaDs it scaled up its activities. The first trial is about standardised microhubs and cargo-bikes, delivering goods inside the city (infrastructure and bikes delivered by Rytle). The second trial focuses on private logistics: citizens can book a cargobike for a day and save a car trip this way. The trials are running as we speak and have quite promising results. It also shows that, for positive results, too much new and combined innovation in a trial can be a blocking factor.

Groningen had the bad luck that during the Covid-crisis, their main trial partner went bankrupt. Therefore, they had to search for a new partner, with a completely different background. They showed a lot of flexibility and creativity to completely redefine the trial setup, together with their stakeholders. This ended up in a very successful trial where local shopkeepers are sharing (through a rental scheme) sustainable logistics vehicles for their transportation needs. In a second trial, Groningen is placing public parcel lockers at a mobility hub (park & ride zone) outside the city. For very practical reasons, this is turning out to be a very difficult trial. First of all, it was a nightmare to get electricity at the necessary space, and secondly – when everything seemed ready to start – the internal land use planning department came with very useful concerns towards the safety implications: the lockers would block the view of safety cameras, and therefore solutions needed to be found. It shows that, even if you think you have reached all the necessary stakeholders, there are always more implications than expected in the definition of trials. Hopefully, we can start this trial now very soon, as we are already in the last year of the project – so only little time is left to gather meaningful results.

Overall, the process of setting up trials is turning out to be an incredibly difficult, but also educational process.

- **Why were these pilots chosen for these specific cities?**

The cities were in the lead for defining the trials. They did have to take into account the basic principles of the project: to create sustainable business models for collaborative and shared city logistics solutions, or the integration of passenger and urban freight transport. Where Bremen opted for realistic, yet less innovative solutions, Mechelen chose radically to innovate and learn. Groningen is, in my opinion, somewhere in between. It all depends a bit on the local needs and possibilities, in line with the city governments' willingness to participate.

- **What were the main challenges in defining pilots in ULaaDS?**

Defining pilots in a European project is a challenging process. To create a proposal, you need to define the pilots a year before the project starts, without knowing if the proposal will be accepted. Effective trialling doesn't usually start in the first year of the project. Therefore, you have to convince stakeholders to become project partners two years in advance to join and define a trial. In those two years, a lot can and will change, especially within the participating businesses, and new technologies and policies may also be introduced, making it challenging to stick to the original plan. Therefore, it is good to leave room for further definition but finding the right balance can be tricky. Too many unknown factors can make partners less committed to the project's end goal. If you have a strong and positive connection with all stakeholders, the process can be easier. However, if you have to create a new collaboration, it can be a challenging and exhausting process.

- **What have been the strengths and weaknesses of running the pilots and collecting data from the three cities?**

In the project timeline, the idea was to first define which KPI's (and therefore linked data) to ask the trial partners, to ensure these data sources were available. This turned in to an exhaustive longlist, a 'wishlist' of data sources. But the partners were not willing to give away any of the data without being sure it was all in line with their role in the project. Therefore, we changed the strategy and worked with each individual partner to gather meaningful data. This was (and is) a very intense process, where the responsible partners (Fraunhofer from Germany and Transport Economic Institute from Norway) are doing a tremendous job in gathering data-driven results. Additionally, there are stakeholder fora, organised by the cities but with help from the Austria-based knowledge institute IFZ. They also had to throw away the theoretical idea from the start and play with the possibilities and opportunities that came up within the cities and stakeholder groups. In the end, I believe all participants in the project are showing tremendous flexibility and willingness to bring this project to a successful end. However, the initial plans described in the proposal had to do a 180°.

- **Do you think the lighthouse cities will transform the pilots into fully-fledged initiatives that continue past the project's lifetime? What is needed to continue their implementation?**

The likelihood of transforming the pilots into fully-fledged initiatives that continue past the project lifetime depends on each trial. As mentioned before, Mechelen took a leap of faith in testing very innovative and difficult setups, and the trials are not yet ready for real implementation. In Bremen though, as the trials existed already, I believe there are good chances of continuation and even adoption by other cities. As for Groningen, the trial on sharing logistic vehicles, has a strong chance

of continuing, but it might be more difficult once the financial support stops. It will be very important to clearly define the business model in a practical sense, together with stakeholders to ensure an embedded adoption.

- **What are the key lessons learned to replicate the pilots in other cities, particularly in the ULaaDS satellite cities?**

There are so many lessons, and if we had to do it all over again, it would have been a different project, with other difficulties and mistakes, of course. However, my learnings can be summarised into the following:

- The importance of a strong stakeholder participation forum for sustainable innovation implementation (not just within a project, but for city logistics in general)
- The need for clear and specific expectations, and to have them in writing
- The importance of defining clear expectations on data-sharing, domains of collaboration, expectations on joining meetings, and dedicated working time up front
- The difficulty in maintaining promises in agreements made several years ago, particularly if there are changes in priorities or circumstances
- The need to minimise the time span between agreements made on trialling and the start of the actual work to be done
- The understanding that if circumstances change, the rules of the game will change as well

- **Based on your experience in ULaaDS, how do you see the future of urban logistics?**

Throughout the course of this project, I have observed a significant transformation taking place in many cities. Logistics, which was once considered just a small part of mobility or economics, has now emerged as a spearhead domain in its own right. Cities are now recognizing the urgent need to create a clear vision for sustainable and safe logistics that is seen as a necessary component of city life, rather than a burden.

I have seen that a lot of cities have gained knowledge and experience in this area and have recruited dedicated professionals to help shape their future plans. They are creating Sustainable Urban Logistics Plans (SULPs) that are integrated into their mobility plans, and they are doing this in strong partnership with stakeholders from the quadruple helix: local shopkeepers, citizens, logistics companies, and experts. This collaborative approach represents a significant evolution in my opinion. Cities are no longer just experimenting with ideas, but are actively seeking the best proposals and solutions that align with their unique needs.

Policy will be a strong trigger in levering the shift towards sustainable city logistics, something cities all acknowledge today as well. It will require significant political courage to implement these regulations, as they may not make all stakeholders equally happy. However, strong and effective stakeholder management will be the key to successful implementation.

I am optimistic that a real shift towards sustainable logistics will be created in the next few years, perhaps by 2030.

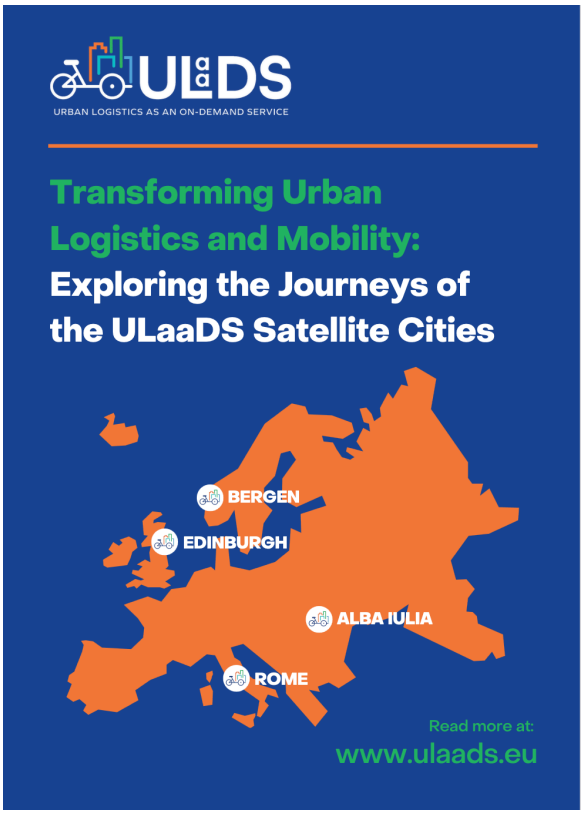
2.12 Transforming Urban Logistics and Mobility: Exploring the Journeys of the ULaaDS Satellite Cities

Produced by: Amy McCready (Bax & Company), Víctor Ferran (Bax & Company)

Contributors: Marco Surace (Agenzia Roma servizi per la Mobilita' Srl), Lars Petter Klem (Bergen Kommune), George Lowder (Transport for Edinburgh), Liviu Stanciu (Alba Iulia Smart City)

Publication date: 26-07-2023

In this new collaborative insight report, the four ULaaDS satellite cities – Rome, Edinburgh, Bergen, and Alba Iulia – present their current projects and challenges in urban logistics and mobility, their experiences and lessons learned during the last few years in the project, as well as the future steps they will take in their cities.



Annex 1

2.13 Redefining urban space: the hidden impact of logistics in cities

By Delphine Pernot and Howard Weir (TØI)

URBAN LOGISTICS AS AN ON-DEMAND SERVICE
Publication date: 16-01-2024

ULaaDS members Delphine Pernot and Howard Weir (TØI), delve into the complex interplay between urban logistics and city space utilisation. They examine the challenges and conflicts arising from the use of urban space for logistics activities, such as parking and traffic congestion, and their impact on city liveability. The insight also explores innovative approaches and research, like in ULaaDS, in measuring and improving space use efficiency in urban logistics, highlighting the need for a balance between operational efficiency and sustainable urban living.

Space use for logistics activities: more than a parking problem

Figure 24: Logistics activities in a pedestrian street (picture from Tale Ørving)

In dense urban cores, space is a scarce resource for both businesses and residents. The diverse needs for **space usage** often lead to conflicts between private and public interests, as well as among various users such as pedestrians, cyclists, car drivers, and logistics operators. The competition for space is particularly evident in the allocation of parking areas. Urban freight parking vies with spaces for private cars, cycle lanes, sidewalks, and pedestrian zones. But providing less parking space for trucks also means more trucks parked haphazardly, exacerbating traffic congestion. In Seattle, a significant 28% of the total trip time for commercial vehicles is spent searching for a parking space, adding more congestion to the city. When implementing a pedestrian area, cities want to improve liveability by making areas more attractive for residents, shoppers, and tourists, while also trying to cut down local pollution. However, the impact of such urban planning

on logistics activities, and vice versa, is not sufficiently taken into consideration in pedestrianisation plans, even though it can worsen congestion by concentrating vehicles on surrounding roads and/or during delivery windows (deliveries are usually authorised in the morning in pedestrian areas).

It is important for cities to give more thought to how logistics activities are occupying space and the subsequent impact on urban liveability. The issue of space usage for logistics extends beyond parking and traffic concerns; it encompasses the broader organisation of logistics activities and its implications for urban planning, environment, and social dynamics. In addition to the space used by vehicles, there is also a need for available areas to install logistics facilities. Due to the lack of available space and high prices, many of them have moved from the inner city to the fringes of metropolitan areas, where land is cheaper and suitable for large warehouses. This phenomenon known as logistics sprawl is often driven by pedestrianisation and the associated increase in the rental value of commercial floors. However, relocating logistics facilities to the outskirts can also create many **negative externalities**, such as air pollution, noise, and congestion. This is because trucks and vans have to drive further to enter city centres, where there is a high concentration of people and businesses awaiting deliveries. The areas to which logistics facilities are moved are also often low- and medium-income neighbourhoods, meaning that these population groups are more exposed to the negative consequences of logistics activities. It shows that the organisation of urban logistics also raises concerns regarding class and environmental justice.

Logistics activities, typically managed by private entities, are organised to **maximise efficiency and minimise costs**, often overlooking the planning and liveability aspects of urban spaces. To help cities in influencing the choice of logistics vehicles and the organisation of space usage, it is crucial for research to explore ways to comprehensively assess the nuisances caused by vehicles, not just in terms of efficiency but also considering sustainability and liveability. For instance, developing tools to compare the real impact of different types of vehicles could be a significant step forward.

Making the invisible visible

Space use is usually measured by the surface area occupied by vehicles. But this way of measuring the impact of logistics vehicles on cities does not take into consideration other kinds of nuisances, not fully representing the effects on city liveability. Due to a lack of measurements, other nuisances remain largely invisible. For example, when comparing a cargo bike and a van, many different impacts could be taken into consideration: pollution, noise, congestion, as well as safety and how vehicles interact with pedestrians and other vulnerable traffic users. This raises several pertinent questions: Do people avoid pedestrian areas during delivery hours due to these externalities? Does the presence of a large vehicle parked in front of a shop negatively affect its sales? Can blocked sight lines caused by large vehicles lead to psychological distress or safety hazards? Are parents more concerned about their children's safety when logistics vehicles are operating nearby?

A recent study by Just Economics (2022) has shed light on the **hidden environmental and social costs** associated with different types of logistics vehicles. The cost of e-cargo bikes is estimated to be 8.58 times lower than the cost of diesel vans and 7.00 times less than electric vans. This calculation takes into account the environmental costs (climate change, air pollution, noise and water pollution) and the social costs (accidents, infrastructure costs, congestion and health

implications for riders versus drivers). The study also highlights that pricing does not fully capture the economic cost of deliveries made by vans, since drivers are covering parts of the costs themselves, including vehicle purchase or fuel. In contrast, cargo bike riders are usually employed on a payroll, with these costs covered by their employer.

So, **how can we make these issues more visible when making decisions at the city level?** It would be impractical to measure all these negative impacts city-wide. A more feasible approach is to use the area-time (m2.t), which measures the space used over time by a vehicle remaining in the same location. It considers the vehicle's footprint, as well as the period of time the vehicle occupies the area. It is an effective tool for comparing the impact of a large vehicle that occupies a street for a short period versus a smaller vehicle that remains for a longer duration. The Elskedeby ("Beloved City") project that took place in Oslo takes this indicator one step further by improving the calculation of the area occupied by a vehicle, acknowledging that the actual space occupied extends beyond the vehicle's physical dimensions. For example, when a vehicle is parked, it creates a surrounding zone where it is impossible to walk, cycle, or drive, with larger vehicles necessitating wider zones. Additionally, when vehicles are loading and unloading, they require space not only for the open doors and lift gate but also for the driver. While smaller vehicles such as cargo bikes close their door when delivering the goods, trucks usually leave their lift gates down. The Elskedeby method also considers this by assigning varied weights to the space used during loading/unloading, depending on the vehicle type.

Although this is an improvement, this indicator does not fully capture the externalities created by different vehicles. We suggest that nuisances may increase exponentially with the vehicle volume, meaning that volume could be a proxy to compare the extent of nuisance caused. More research is needed to evaluate this hypothesis, and the ULaaDS project has tried to contribute to this area of study.

The ULaaDS connection

The ULaaDS project aimed to develop an indicator for space use efficiency based on the volume occupied by different vehicles and facilities. This is particularly relevant in densely populated areas, where the visual obstruction caused by a vehicle can have impacts on the delivery zone. The space use efficiency indicator essentially reports the amount of cargo delivered over time in relation to the vehicle's size.

All ULaaDS trials have been evaluated through the lens of space use efficiency, but a prime example of this in action is the Rytle trial in Bremen, which effectively illustrates the potential of cargo bikes to revolutionise space use in inner-city areas for general cargo transport. In this trial, consolidated goods are delivered by a 7.5-ton truck to micro hubs near the city centre, from where they are transloaded to cargo bikes. These purpose-built cargo bikes are capable of carrying either a swappable container or a Euro pallet, which allows them to replace truck movements in the most crowded areas of Bremen. During the trial, the average weight of individual deliveries was nearly 70 kg, challenging the traditional narrative that cargo bikes are only suitable for delivering small packages.

Figure 25: Rytle cargo bike at the micro hub for loading

The diagram below represents the space use efficiency indicator for the different vehicles and facilities from the Rytle trial, assuming they occupy space for one hour to deliver a single unit of cargo, such as a Euro-pallet. As expected, it shows that the cargo bike is significantly more efficient than a truck. However, it's important to consider the logistical footprint of the micro hub from which the bike operates. If we also consider the volume occupied by the micro hub (a 10-foot container), in addition to the cargo bike, efficiency is reduced, but the combination of the two is still more efficient than the truck. In other words, if a truck takes 12 minutes to deliver a Euro-pallet, the cargo bike can take up to 33 minutes to deliver the same pallet while still maintaining greater space use efficiency in combination with the micro hub This highlights that focusing solely on logistics efficiency might overlook the broader benefits of reduced space usage in urban centres. A more comprehensive consideration of space use efficiency across different vehicles can bring to light some of the less tangible impacts of logistics activities, thereby encouraging the adoption of smaller, more space-efficient vehicles.

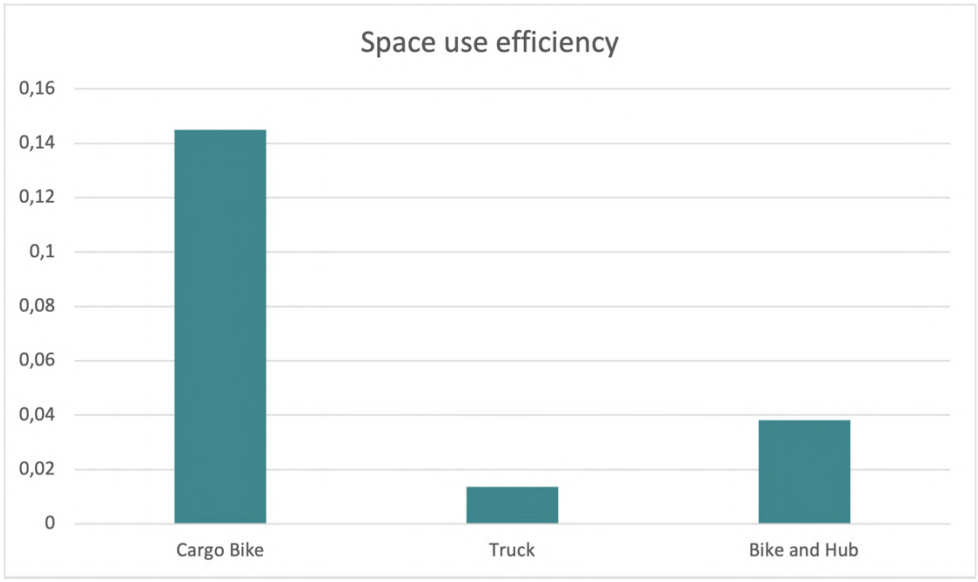


Figure 26: Space use efficiency for different vehicles and logistics facilities (1 unit of cargo (1 pallet) in 1 hour)

The trial also raises questions about the value of occupied space. The location of occupied space and the time of day or week it occupies space also has an impact on the perceived nuisances. For instance, a micro hub situated in a parking area just outside a pedestrian zone is less intrusive than one positioned directly on a pedestrian street. Moreover, the impact of the hub's presence is less pronounced during off-peak hours, such as at night, compared to periods of high traffic.

ULaaDS has started to address this gap, but there is a need for further research to establish a robust link between space use and other nuisances. The work conducted has highlighted the importance of developing an indicator that not only quantifies space use but also highlights the benefits of implementing space-saving solutions. Future research should explore users' perceptions of logistics activities to refine this indicator. Such a tool would be relevant for cities interested in making their streets more liveable, guiding them in forming policies in favour of more sustainable logistics practices.

2.14 Navigating Urban Logistics: The importance of adopting a Human-Centric Approach

By Mina Saghafian and Howard Weir (TØI)

Publication date: 31-01-2024

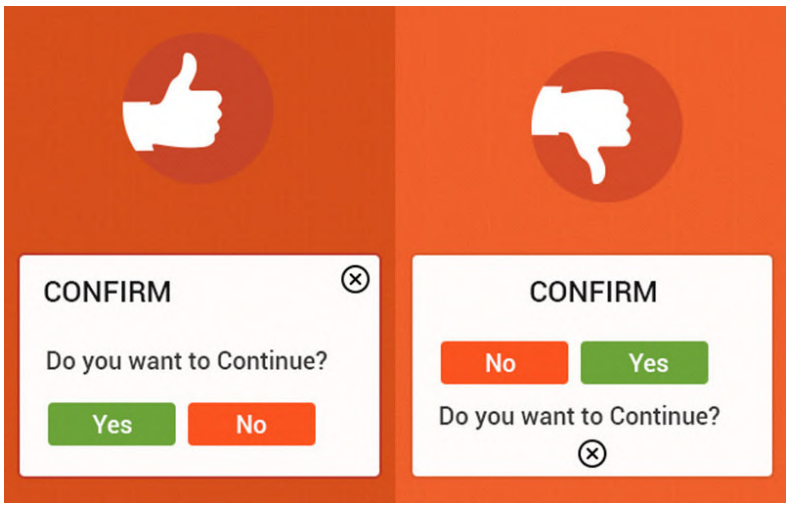
In the ever-evolving landscape of logistics, the seamless flow of goods and services is not solely dependent on technical systems but is deeply intertwined with human interactions and social dynamics. In this insight, ULaaDS members Mina Saghafian and Howard Weir explore the intricate

relationship between the technical and social elements within logistics systems, highlighting the importance of a holistic approach that prioritises user-friendly interfaces, ergonomic designs, and collaboration among stakeholders.

Logistics systems are complex organisms encompassing both **social** and **technical** elements. The way in which these different aspects interact can often lead to wide-ranging and unexpected outcomes. It is important to not focus solely on the technical elements, as undervaluing the significance of social dynamics and **human interactions** within these expansive systems can lead to problems that must then be solved once damage has already been done.

For instance, the acquisition of a new fleet of vehicles without a comprehensive understanding of driver roles and workflows can embed inefficiencies into the system for an extended period, spanning the entire lifetime of the vehicle fleet. Therefore, it is imperative to consider how new solutions can enhance task performance, ensuring effectiveness and satisfaction in the long term.

An essential aspect of a logistics system is supporting users through intuitive interfaces that are user-friendly and easy to navigate. In today's digital landscape, where many interfaces and apps are integral to daily operations, supporting users in their tasks while minimising the potential for mistakes is necessary for optimal system performance.



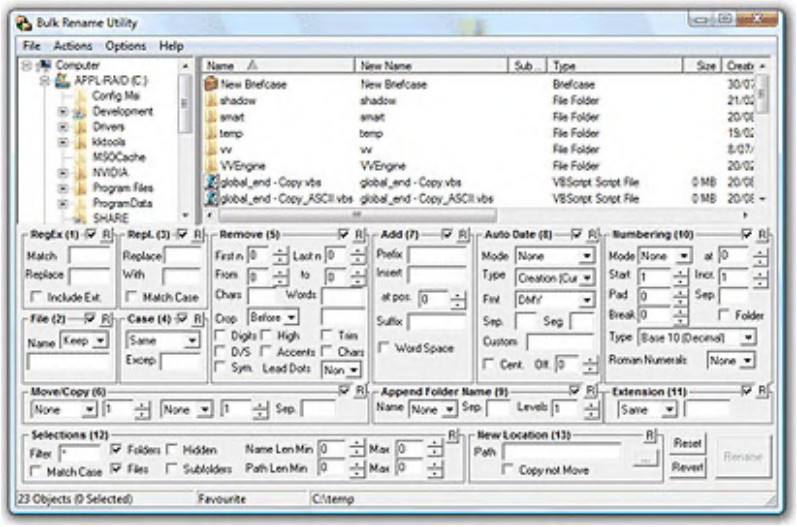


Figure 27: Examples of interfaces that are difficult to navigate and encourage mistakes due to awkward design features

However, designing new solutions is not limited to digital interfaces. The tools used to navigate these physical spaces, such as delivery vans or cargo bikes, should also be designed to support the tasks of drivers. This may involve improvements in ergonomics or loading compartments to streamline their workflow.

There will always be people involved who use technology to deliver the best service possible to suppliers and receivers. This further implies that the coordination and regulation of these activities requires considerations from an organisational perspective. Logistics actors, municipalities, and other regulatory bodies involved should have a common vision, exercise supervision, and foster collaboration to align and achieve their common goals. To ensure that the entire system functions optimally for both people and technologies, the systems approach must be taken. One effective strategy in ensuring that a system is well-coordinated is to consider the entire chain of events, thus enabling the smooth flow of products or services in their journey.

From terminal to customer – the parcel's journey

Examining a single logistics operator can be a good starting point to collect data and gain insights into the social aspects of logistics systems. Let's look at parcels entering the city through logistic operators like postal companies, focusing on the significant role of the human element in this journey. In this example, we will consider parcels departing from the main terminal by truck and are moving towards the city, where they will be transferred to smaller vehicles operating out of a micro hub.

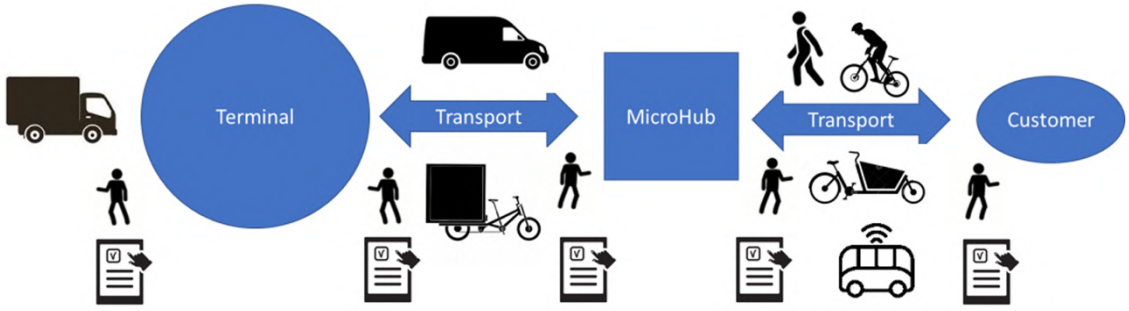


Figure 28: The flow of goods from a terminal through a microhub and the role of people and tools in the process

At this point, the parcels have already undergone numerous interactions with people as they are sorted within the terminal. This stage of the process requires knowledge, communication, organization, and the right equipment. Once the truck transporting goods for the city leaves the terminal, we can look at the **driver's perspective**. Drivers must sit comfortably, be mentally vigilant, ensure their own safety and that of others outside the vehicle, adhere to road signs, and adapt their driving behaviour to the flow of traffic, all in pursuit of arriving at their destination safely and efficiently. Additionally, they rely on digital devices and interfaces for navigation, communication with logistics centres, and tracking tasks. Identifying elements that hinder these tasks is crucial, such as dispatch systems reliant on text-based information, which may encourage drivers to check their phones. The need for multitasking and processing multiple pieces of information simultaneously can introduce potential errors. This exemplifies a system flaw, which can be addressed through user-friendly interfaces that offer essential information clearly, reducing the need for multitasking and minimising errors.

Once at the micro hub, drivers must park safely and assist in transferring goods from the vehicle. The infrastructure can determine how quickly, safely and easily this is managed. These goods will now be transferred to two lightweight electric freight vehicles, often cargo bikes. The goods must be placed into the right vehicle, with some goods potentially remaining at the hub for later refill. This requires careful packing of the bikes, often with the support of software. The loading process can impact the efficiency of the driver's route. Questions arise regarding the organisation of packages and whether drivers have the necessary information to load their bikes swiftly and effectively.

En route, the cyclists need to take similar considerations to those of the truck driver in order to **navigate a complex traffic environment safely and efficiently**. Effective communication with dispatch is essential to adapt to changing circumstances, and interactions with customers are crucial to ensure successful package deliveries. Each stop offers opportunities for improvement, such as optimising vehicle parking, facilitating access to storage compartments, locating packages efficiently, and easily locating customers.

In summary, following the journey of a single parcel sheds light on the multitude of people involved, the frequency of interactions, and the need for user-friendly interfaces. This approach helps unravel system flaws and explore potential improvements. People are integral at every stage of this process, and each handling of a parcel, whether transferring it between vehicles or any other task, carries the potential for introducing errors. Simultaneously, individuals actively engaged in the

parcel's journey serve as valuable resources, capable of resolving unexpected challenges, thereby contributing to the seamless progression of the parcel's journey.

The ULaaDS connection

ULaaDS conducted several pilot projects in different cities, offering two key advantages. Firstly, these projects helped unveil flaws in existing systems and facilitated the improvement of designed solutions. Secondly, they served as a means to introduce the public to new possibilities and alternative approaches. In essence, these pilot projects acted as catalysts for change, encouraging the adoption of more sustainable solutions for liveable cities.

The insights gained from ULaaDS through conducting these pilots highlighted the importance of taking a **user-centric approach for sustainable solutions**. Prioritising user satisfaction and long-term engagement emerged as key factors. Furthermore, it is vital to consider the entire journey chain, rather than individual components or terminals. This holistic perspective ensures that the needs of all users, user interfaces, tools, and infrastructure, are accounted for.

Supporting people through thoughtful design- considering new vehicles from a human perspective

ULaaDS tested innovative new vehicle types in several cities, including heavy cargo bikes in Bremen, 3-wheeled electric freight vehicles in Groningen, and an autonomous shuttle in Mechelen. These vehicles have the potential to either replace larger vehicles or reduce overall vehicle kilometres. Taking the example of the heavy cargo bikes in Bremen, the **safety and comfort of drivers and cyclists** was paramount. This was guided by ergonomic considerations and thoughtful design, through assessing their interaction with other vehicles, bikes, and pedestrians, as well as their manoeuvrability on city roads.

Figure 29: Locals get the chance to test out cargo bikes at a street festival hosted as part of the CIVITAS ULaaDS project in Bremen. Photo: Michael Glotz Richter

The size of the bikes, the number of wheels they have, the type of suspension used, and the frame materials, are just a few areas that must be considered. Equally central was the ease and speed of loading, unloading, and securing cargo loads, which impacted the driver's workday. During the project, notable improvements were observed, such as Rytle's enhanced loading system for swift pallet lifting, saving time and effort for couriers.

To make these vehicles applicable across different cities, factors like topography and the need for electric bike power to handle varying loads and slopes have to be assessed. For larger bikes, careful deliberation will determine whether they would primarily operate on regular roads shared with cars or on dedicated bicycle infrastructure. The size of these cargo bikes could potentially hinder the comfort of other cyclists, potentially necessitating adjustments like riding further into car lanes or pedestrian areas to pass them. These adaptations might introduce new safety challenges. Therefore, the design of these cargo vehicles must not only prioritise the comfort and safety of their riders but also ensure harmonious coexistence with other road users and pedestrians. Embracing a broader range of perspectives within the system can foster social acceptance and facilitate successful implementation.

Social acceptance: considering a wide range of stakeholders

ULaaDS expanded its objectives to consider social factors and acceptance beyond its immediate scope. In ULaaDS, the role of design factors in shaping interactions with the city and how they are perceived by city residents was taken into account, and acceptance factors were identified. The project demonstrated that acceptance is greatly facilitated through familiarity. For instance, the study investigated user attitudes towards parcel lockers on autonomous vehicles. Users quickly adapted to and embraced the concept of an autonomous vehicle after their first-hand experience. However, people preferred static parcel lockers over the onboard locker due to their familiarity, lack

of waiting times, predictability, greater capacity, and the convenience of not needing multiple apps. In contrast, the dynamic locker had limited capacity, experienced availability issues, and demanded more from users through its interface. The trial aimed to address the challenge of transporting people and parcels simultaneously, but balancing freight capacity and passenger comfort remains crucial.

When it comes to using the space in pedestrian zones, businesses relying on goods deliveries can be negatively impacted when service or logistics vehicles obstruct their shop windows and entrances, or make the area less appealing to visitors. ULaaDS highlighted the significance of businesses in the neighbourhood affected by cargo vehicles' parking, especially those with outdoor seating, which contributes a significant portion of their annual revenue. Balancing the needs of these businesses with those of goods delivery vehicles emerged as a crucial aspect of urban logistics planning.

UlaaDS has shed light on critical aspects of sustainable logistics solutions, emphasising the importance of considering people when designing solutions – both primary users and those that may be passively affected by these solutions. By considering people early on and designing solutions that address their needs, the likelihood of acceptance and the long-term use of these solutions is greatly enhanced.

2.15 Revolutionising Urban Logistics Planning within ULaaDS through SUMPs and SULPs

By: Hassan Hussin, Dr. Susanne Boehler-Baedeker, Katy Huaylla, and Goekce Demiral (Rupprecht Consult)

Publication date: 26-02-2024

Through a comprehensive exploration of the ULaaDS project's guidelines, methods, and policy recommendations, the Rupprecht Consult team illuminates the path towards a more sustainable, efficient, and inclusive urban logistics system. They underline the critical roles of stakeholder engagement, technological innovation, data-driven approaches, and strategic planning in developing Sustainable Urban Mobility Plans (SUMPs) and Sustainable Urban Logistics Plans (SULPS)

In an era where decarbonising the transport sector is paramount, faced with the challenges of global population growth, urban expansion, and the e-commerce surge, urban logistics stands at a crossroads. Responsible for 40% of transport-related CO2 emissions and contributing to noise pollution affecting 100 million Europeans, the sector is ripe for transformative solutions. Notably, about 30% of urban freight distances are covered by empty vehicles, highlighting a significant inefficiency in freight operations.

Enter the ULaaDS project, a pioneering effort to redefine urban logistics management. Drawing on a pivotal statistic from the Bremen trial, which underscores ULaaDS' response to the global challenges outlined earlier, the cargo-bike sharing trial has emerged as a promising solution: 55% of

cargo-bike trips during the project's duration replaced what would have been car journeys, representing a substantial stride towards fostering more sustainable urban logistics practices.

ULaaDS recommendations for integrated SUMPs & SULPs implementation

Published in November 2023, the ULaaDS project's Deliverable 6.2, titled 'Guidelines, Methods & Policy Recommendations for Integrating ULaaDS into SUMP and SULP Processes,' represents a thorough endeavour to **seamlessly integrate eco-friendly logistics planning into SUMPs and SULPs**. This guideline aligns with the global movement towards advancing SUMPs and SULPs in cities and regions, emphasising enhancements in public transport, the promotion of sustainable mobility modes, and the optimisation of urban freight to enhance urban living and achieve sustainability objectives.

Figure 30: SUMP cycle highlighting specific urban logistic planning actions, (Sustainable Urban Logistics Planning Topic Guide), Novelog, 2019

The planning of SULPs follows four phases:

- In the first phase, the **Inception phase**, policymakers deliberately make a choice to develop a SULP within a defined urban region. The foundation of this phase includes an in-depth analysis of the current mobility situation, assessing financial and institutional capabilities, and identifying mobility issues. This involves establishing a functional management structure and initiating a capacity-building initiative.
- Transitioning to the **Vision and Strategy Development phase**, the guidelines emphasise shaping the future urban mobility landscape based on analysis findings. This includes crafting a clear vision and strategy in collaboration with stakeholders. Various scenarios are evaluated, aligning with the SULP vision, and the selected scenario is refined for short and long-term implementation.
- Moving on to the **Operational Planning phase**, the guidelines highlight the translation of the chosen scenario into actionable measures with detailed monitoring mechanisms. Financial aspects are crucial, involving the devising of a financial mechanism, identifying

funding sources, and defining financial flows for the entire SULP. This phase prepares the SULP for submission to the relevant political body for approval.

- In the final **Implementation and Monitoring stage**, the focus is on executing the approved SULP measures and establishing a system of continuous monitoring, evaluation, and communication. The plan is handed over to sectoral planning departments for implementation according to local and national regulations. The guidelines emphasise the importance of a monitoring system for successful execution and adaptive management of the SULP.

Within the D6.2 guidelines, we adopted an analytical approach to explore strategic methodologies within SUMPs and SULPs, recognising them as essential tools for green urban logistics planning. Our focus extended to governance structures, regulatory support for integrating SUMPs and SULPs, and strategic engagement with diverse logistics stakeholders, laying the foundation to translate early-phase analyses into actionable urban logistics strategies.

These strategies, based on international experiences and **insights from the ULaaDS trials, have identified key facilitators and barriers.** Thus, they established the groundwork for the development of policy guidelines aimed at improving urban logistics through SULPs.

The joint efforts of Rupprecht Consult with Bax & Company and the Bremen team, coupled with enriching dialogues with Mechelen and Groningen representatives, played a pivotal role in developing the recommendations and guidelines. This deliverable underscores the project's dedication to fostering sustainable urban environments through strategic collaboration and innovative policy formulation.

Setting the scene for urban logistics implementation through SULPs

Within this section, we will delve into the **summary of guideline recommendations** to further explore actionable steps that will advance the integration of ULaaDS into SUMPs and SULPs.

Fostering flexibility and resilience in dynamic urban logistics

Flexibility and resilience in urban logistics are crucial, given the ever-evolving nature of the field and its deep connection with technological advances. It emphasises the ability to adapt swiftly to challenges and evolving demands. Furthermore, embracing SULPs as vital and evolving strategies is essential for adaptability to the changing landscape. SULPs should serve as living documents, empowering cities to navigate changes effectively and ensuring the agility of the logistics system. For instance, learning from the vulnerabilities exposed by the COVID-19 pandemic underscores the need for resilience in urban logistics. In this manner, considering SULPs as framework documents that facilitate rapid adjustments to crises and community demands, is fundamental to ensuring adaptability in the face of unforeseen challenges.

Inclusive stakeholder engagement

Effective stakeholder engagement is crucial for sustainable urban logistics planning, a sentiment underscored by the predominant response from the ULaaDS partners, as shown in the figure below. The use of strategies like local stakeholder forums, collaborative target-setting mechanisms, and

online surveys, fosters collective decision-making and information sharing. This inclusive engagement serves several crucial purposes: fine-tuning logistics projects based on on-ground feedback, ensuring sustainability, and building trust among stakeholders. Collaboration with businesses further tailors SULPs to meet economically diverse logistical needs, enhancing overall effectiveness and viability.

Figure 31: Perspectives on the main aspects to be included in a SULP (Survey Results from ULaaDS partners at the Final Event in Barcelona, November 2023)

Encouraging technological innovation and data driven approaches

Encouraging innovation, technological and data-driven approaches in urban logistics involves embracing ongoing advances, such as small electric vehicles, automated vehicles, and exploring the feasibility of air mobility through drones. SULPs should promote agile and prepared urban logistics operations, evolving with technological changes. According to a survey shared among the ULaaDS partners at the project's final event, respondents were asked to identify the innovations expected to have the greatest impact on urban logistics in the next decade. The main responses included **AI**, **automation**, **robots**, **data**, and **logistics hubs**, highlighting the strategic importance of these advances in shaping the future of urban logistics.

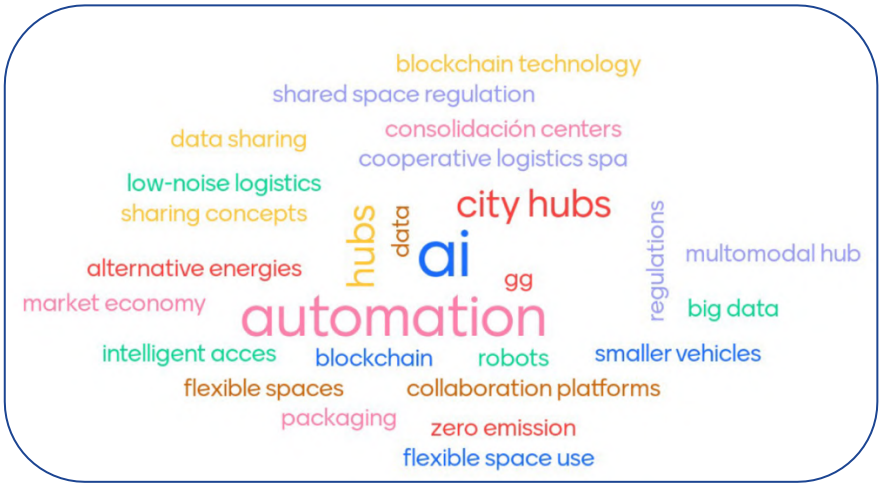


Figure 32: Anticipating the future of urban logistics in the upcoming decade. (Survey results from the ULaaDS partners at the project's final event in Barcelona, November 2023)

Optimised space allocation and regulation

Figure 33: Delivery Van Blocking a Cycle Lane.

The interplay between space allocation and regulations is pivotal for ensuring efficient and unintrusive urban logistics operations. Establishing a fair regulatory framework that cultivates trust and collaboration within the industry is a fundamental aspect of this process. Effective management of urban logistics operations with a sensible use of or urban areas such as logistics hubs, storage facilities, and designated loading zones requires the essential enforcement of regulations. This includes thorough monitoring and timely evaluations to ensure optimal management. This approach aims to reduce congestion, optimise urban space, and streamline logistical processes. Careful monitoring and substantial fines restrict unauthorised zone use, promoting compliance and safeguarding the integrity of the logistics network, as well as the overall liveability of urban areas.

Ensuring fair competition in logistics

Given the competitive and profitable aspect in logistics business and operations, it is essential to establish a **balanced regulatory framework**. This involves preventing the concentration of privileges in the hands of a single operator, as unchecked dominance can stifle innovation and impede new entrants into the market. The strategy involves creating a level playing field where both SMEs and established industry players can compete on equal terms. Effective regulation coupled with thorough monitoring and timely evaluations, are deemed crucial in maintaining a fair and competitive marketplace that benefits both **industry players** and **consumers**. Striking a delicate

balance between preventing anti-competitive practices and fostering innovation is essential for the sustainable growth and development of the logistics industry.

Learning processes: Trial-first approach

Figure 34: Cargo Bikes Trial in Bremen

The "trial-first" approach has proven successful throughout the ULaaDS project, drawing on lessons from both successful and challenging trials. This methodology encourages cities to embrace experimentation with innovative logistics concepts, prioritising practical trials as a foundation before long-term fixed projects launching. Through real-world trials, cities acquire invaluable insights into the effectiveness, challenges, and potential benefits of diverse logistics models. The data gleaned from these trials becomes a cornerstone in shaping SULPs, ensuring that **policies are not abstract** constructs but finely adjusted to the unique needs and dynamics of each urban environment.

To further delve into the comprehensive guidelines and recommendations crafted by Rupprecht Consult to seamlessly integrate eco-friendly logistics planning into SUMPs and SULPs, we invite you to explore 'Deliverable 6.2: Guidelines, methods & policy recommendations to integrate ULaaDS in SUMP and SULP processes'.

3. Conclusions

Throughout its tenure, the 360 Observatory has served as a platform for partners to showcase and valorise their work through the publication of insights. It has also proven instrumental in providing updates on project results and featuring other innovative reports or stories pertinent to the field, which have been incorporated into the best practice radar.

The 15 insights presented herein are indicative of the project's ethos of innovation and sustainability in urban logistics. This guiding principle has not only shaped the project's endeavours but has also resonated with the interests and aspirations of the participating cities and stakeholders.

Acronyms

Acronym	Meaning
AI	Artificial Intelligence
AV	Autonomous Vehicles
D	Deliverable
EC	European Commission
GA	Grant Agreement
ICT	Information and Communication Technology
LF	Load Factor
LSP	Logistics Service Provider
O	Objective
ODD	On-demand Delivery
P	Product
PPP	Public Private Partnership
PM	Person Month
SUMP	Sustainable Urban Mobility Plan
SULP	Sustainable Urban Logistics Plan
T	Task
UC	Use Case
UCC	Urban Consolidation centre
UFT	Urban Freight Transport
ULaaDS	Urban Logistics as an on-Demand Service
WBS	Work Breakdown Structure
WP	Work Package
VUR	Vehicle Utilisation Rate
ZEV	Zero Emission Vehicle

Annex 1:

Transforming Urban Logistics and Mobility: Exploring the Journeys of the ULaaDS Satellite Cities

ULaaDS

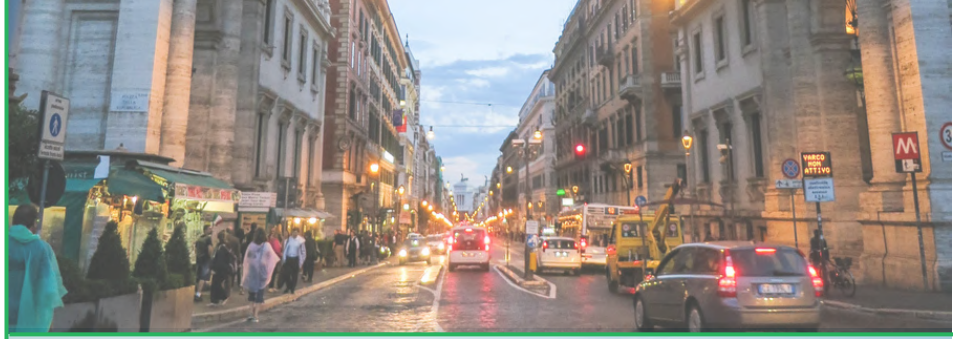
URBAN LOGISTICS AS AN ON-DEMAND SERVICE

Transforming Urban Logistics and Mobility: Exploring the Journeys of the ULaaDS Satellite Cities

Read more at:

www.ulaads.eu

In this insight from the ULaaDS project, the four ULaaDS satellite cities – **Rome, Bergen, Edinburgh, and Alba Iulia** – present their current projects and challenges in urban logistics and mobility, their experiences and lessons learned during the last few years in the project, as well as the future steps they will take in their cities.



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Rome

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Projects and challenges

Since the late 1980s, and the inception of Demand Management Policies in Rome, the city has faced the challenge of safeguarding citizens' health and preserving its cultural heritage from traffic pollution. To address this, the city has gradually implemented measures like Limited Traffic Zones and incentives to reduce private vehicle traffic in the historic centre and promote public transport usage. Now, awaiting approval from the Rome administration, the **Sustainable Urban Logistics Plan (SULP)** aims to achieve sustainable freight distribution through various measures.

PRIORITY	MEASURES
Measure 1	Rationalisation and reinforcement of loading/unloading bays in the LTZ
Measure 2	Review of LTZ Access Rules
Measure 3	Incentives for the purchase of low environmental impact vehicles
Measure 4	Pick up and Delivery Points (PuDo)
Measure 5	Cycle-Logistic Incentivation (Cargo-Bikes)
Measure 6	Collaborative Logistics
Measure 7	Consultation&Dialogue with the Local Authority
Measure 8	Monitoring of worksites
Measure 9	Mini Hubs (proximity logistics areas)
Measure 10	Urban Distribution Centres (UDC)

The SULP addresses three key challenges, which are directly comparable to the trials conducted in ULaaDS:

- Measure 4: Deployment of PuDo services.
- Measure 7: Involvement of different stakeholders (shop owners, carriers, logistic operators, citizens), each with their own distinct requirements.
- Measures 9 and 10: Identification of suitable areas for logistics operations and development of a business model for the management of mini-hubs and distribution centres.

Additional challenges addressed in the Sustainable Urban Mobility Plan (SUMP) include gaining stakeholder acceptance of new access rules, managing fragmentation and increased deliveries resulting from e-commerce, and addressing the lack of data through surveys.

ULaaDS learnings

Rome has gained valuable insights from the lighthouse cities' trials, aligning with its SULP provisions. These insights include consolidation centres, micro-hubs, containerised last-mile deliveries, and parcel lockers at mobility hubs, as well as the ULaaDS Stakeholders Fora methodology. During SULP implementation, technicians will consider and share strengths and risks identified in each trial, such as managing public space, navigating bureaucracy for parcel locker permits, and engaging stakeholders through campaigns. The proposed business and operating models from the trials will support the implementation of these measures.

Next steps

Drawing from experiences gained through the trials, Rome is implementing strategies to optimise parcel delivery and mobility. The city is **deploying lockers near public transport** hubs to consolidate parcels, and establishing **24 bike box stations** at metro stations to encourage combined bike and locker usage. Rome is also promoting cycle logistics for urban parcel distribution and exploring storage options near residential areas with input from operators and stakeholders.

To enhance multimodal mobility for commuters, Rome is creating its **first mobility hub at Flavio Biondo square, close to Trastevere railway station.** The redevelopment includes public transport areas, connections to stops, green spaces, pedestrian zones, bike and car-sharing spots, EV charging stations, loading zones for goods, and a designated kiss & ride area. Parcel lockers will also be installed. Facilitated by the Logistic Living Lab, Rome is also actively engaging various stakeholders to support its SULP.

Bergen

Contributor:
Lars Petter Klem, Bergen Kommune

Projects and challenges

The City of Bergen is on track to achieve its goal of zero emissions from road transport by 2030, currently boasting the highest share of electric cars in the world as of 2023 (38% for passenger cars). In April 2023, electric commercial vehicles surpassed diesel sales for the first time ever. The city's **low emission zone**, which includes a rush hour fee, plays a crucial role in achieving this milestone. However, despite the advantages of electric vehicles in reducing pollution, there are still challenges related to space and congestion.

Finding and establishing new solutions for sustainable urban logistics also requires addressing and understanding how it fits into the logistics ecosystem – from shipment and consolidation at distribution facilities to last-mile transport. In Bergen, many of the largest goods distribution facilities have historically been placed in, or nearby, the city centre and its railroad terminal. This has given way to short last-mile delivery, including the use of cargo bikes.

However, new transformation processes of former industrial areas, along with the **modernisation of the current railway terminal** located in the city centre, have forced several major logistics companies to relocate their facilities to the outskirts of the city. While this creates space for citizens and enhances the liveability of public areas, it also creates longer distances between distribution facilities and the recipients. For the city, this could be seen as an obstacle to achieving a more sustainable last-mile delivery system, but it also lays the foundation for completely new ways of approaching urban logistics.

Parcel lockers have proven to be such a valuable tool and have been popping up around the city over the past two years. Bergen has so far prohibited their placement on municipal grounds, and it seems that the logistics companies have managed to find suitable locations on private grounds. The types of parcel lockers currently being used outdoors are flexible and battery-driven, which makes adjusting their location fast and flexible. This flexibility has proved valuable in facilitating communication between the parcel locker operators and the city.

ULaaDS learnings

Participation in ULaaDS has been truly insightful for The City of Bergen. Not only did they have the opportunity to join the study trips and see how the trial solutions are contributing to more sustainable logistics, but they also had the chance to meet colleagues from across Europe and discuss how we together can develop policies that lead us towards a sustainable urban future.

Next steps

In the forthcoming year, the City of Bergen will focus on the development and testing of parcel locker policies across Europe, including initiatives by project partners Mechelen and Groningen, as well as the municipalities of Bærum and Oslo in Norway. A regional tender is being planned to establish parcel lockers on public land. Furthermore, the city aims to actively pursue Zero Emission Zones, with the hope that the national government will give it due consideration. Bergen is also exploring solutions for addressing everyday logistics in their extensive urban transformation projects, such as the implementation of permanent microhubs in local neighbourhoods.

Edinburgh

Contributor:
George Lowder, Transport for Edinburgh

Projects and challenges

Edinburgh aims to achieve carbon net zero by 2030 through various strategies like Climate Strategy 2030, City Mobility Plan 2030, the Active Travel Action Plan, and more. One aspiration of the transformed City Centre is to reduce deliveries by large vehicles and establish a series of logistics hubs around the city centre where last-mile deliveries and collections will be enabled by more sustainable methods. The detailed implementation plans continue to be refined and are being informed by public consultation, pilot projects and interim schemes. Some ongoing projects include parcel lockers by InPost and e-cargo bikes by DHL.

During the **Edinburgh Trams line extension construction to Newhaven**, measures were implemented to support affected businesses, including last-mile deliveries using cargo bikes and trolleys, and collaborating with various organisations to establish Logistics Hubs. One observation was that using trolleys for deliveries, instead of cargo bikes, was preferred due to limited road space and potential congestion. The dedicated Logistics team established effective relationships with delivery agents and businesses, enhancing the success of last-mile deliveries.

The **Cargo Bike Movement**, initiated during COVID-19 lockdown, provided cargo bikes on loans, training, and awareness events. In 2022, the project engaged with a total of 6825 people. It completed 22 direct long-term loans to businesses and community groups and 167 direct and 201 partnership generated short term loans to individuals and families. By December 2022, it saved 91 tonnes of CO_2e (compared to the fuel consumption of a car) and redistributed 11.5 tonnes of food, which would have otherwise been thrown away.

SEStran and Edinburgh Napier University are collaborating with ZEDIFY Logistics on sustainable logistics research. They are **piloting a logistics hub in central Edinburgh's Haymarket area** to explore various commercial approaches to logistics in a crowded urban setting. The partners are re-modeling deliveries, moving away from diesel vans and trucks and instead consolidating them for greater efficiency. The pilot aims to gain insights into sustainable city logistics by examining bottom-up commercial operations, the significance of partnerships (public-private and private-private), the importance of raising public awareness, and validating the concept of the last sustainable mile to boost commercial confidence.

ULaaDS Learnings

It is clear the ULaaDS Lighthouse, Satellite, and Follower cities face common challenges in achieving carbon reduction through sustainable urban logistics. While key components of their solutions are similar, each city's unique geography, demography, topography, and weather require tailored approaches. Funding and business models also differ, necessitating local adaptations. By recognising similarities and sharing best practices, cities can compare experiences, avoid pitfalls, and facilitate the adoption of future schemes by Satellite and Follower cities.

Next steps

Final reports for the Tram to Newhaven, Support for Business Logistic Hubs, and the Haymarket Logistic Hub, are expected in summer 2023. Other schemes will continue to be evaluated for their duration. All of this will contribute to Edinburgh's efforts to develop urban logistics and help meet its carbon net zero target by 2030.

Alba Iulia

Contributor:
Liviu Stanciu, Alba Iulia Smart City

Projects and challenges

Last-mile delivery in Alba Iulia faces challenges due to roadworks, hindering implementation. The municipality lacks the authority to coordinate the flow of delivery services since none of them have parcel lockers in public areas.

Currently, private companies like eMag (11 easy boxes), GLS (3 parcel lockers), and DPD (1 automat pickup) manage last-mile delivery services. As a result, there are no municipal-level policies for last-mile logistics. The outdated Sustainable Urban Mobility Plan (SUMP) adds to the challenges, as more parcels are delivered on private premises rather than public ones.

To address this, **dedicated public spaces for parcel lockers are necessary.** The municipality, though behind other cities, can benefit from regulating placement, design, and aesthetics from ground zero.

Alba Iulia is currently implementing various mobility projects, including:

- Cycle Logistics, ENCLOSE, SUITS, TInnGO, SUMP PLUS, CityChangerCargoBike, and EU-funded energy efficiency projects.
- Two large mobility infrastructure projects funded through the Regional Operational Programme 2014-2020, featuring 18 km of new bus lanes, 95 traffic cameras, a smart lighting management centre, and a bike-sharing centre with 300 bikes.
- Other mobility projects funded by Romania's National Recovery and Resilience Plan, like the development of an eco-friendly public transport system in collaboration with Ciugud.

Between 2021 to 2027, Alba Iulia's main steps will revolve around the implementation of operational programmes and the National Recovery and Resilience Plan. Specifically, the city willl focus on the development of the South and North ring roads.

ULaaDS learnings

As a satellite city, Alba Iulia closely followed Groningen and Bremen in terms of freight, parcel locker policies, and last-mile delivery. The meeting in Groningen was a great opportunity for Alba Iulia to learn about micro-logistics and smart delivery. The entire Dutch way of rethinking the Inner City and sustainability and smart mobility is inspiring for Alba Iulia, but this strategy takes some time to replicate.

From Bremen, they learned that an efficient delivery system depends on municipal policies, and micro hubs need to fit well into public spaces without affecting aesthetics. The cargo-bike sharing scheme is also worth replicating.

Implementing efficient solutions in Alba Iulia depends on delivery companies and the local community. **Alba Iulia is a 15-minute city, but its rapid expansion poses challenges for infrastructure.** The 'slipper distance,' a new concept in delivery policies, depends on citizens' comfort zones and road quality to the nearest parcel area.

Next steps

Alba Iulia should implement delivery-related traffic policies and update its SULP with digital parcel locker maps. Increased citizen awareness of parcel areas will lead to greater adoption of new last-mile delivery policies. This is an opportunity for Alba Iulia to learn from the ULaaDS project's solutions and replicate them on a larger scale with improvements.