

Available online at www.sciencedirect.com**ScienceDirect**

Transportation Research Procedia 12 (2016) 950 – 958

**Transportation
Research
Procedia**

www.elsevier.com/locate/procedia

The 9th International Conference on City Logistics, Tenerife, Canary Islands (Spain), 17-19 June
2015

CycleLogistics – moving Europe forward!

Susanne Wrighton* and Karl Reiter

Forschungsgesellschaft Mobilität- Austrian Mobility Research, Schönaugasse 8a, 8010 Graz, Austria

Abstract

The transport of goods, particularly in urban areas, contributes to a problem that most of today's cities share: they are overcrowded by motorised traffic. City administrations are aware of the fact that solutions have to be found. The Cyclelogistics (2011-2014) and Cyclelogistics Ahead (2014-2017) projects (www.cyclelogistics.eu) offer a possible solution. They demonstrate the great potential for the reduction in energy consumption and pollutants caused by urban goods transport by shifting intra-urban final delivery of goods from the car to the bicycle.

© 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of the organising committee of the 9th International Conference on City Logistics

Keywords: Cyclelogistics; urban freight transport; zero emission; sustainable city logistics; private logistics;

1. Introduction

The baseline study [1], carried out at the beginning of the first Cyclelogistics project has analysed existing transport surveys of European cities. For the calculations of the potential in the baseline study logistics was simply defined as the transport of goods from A to B, independent of the vehicle type. This includes transport services of professional carriers, freight transport by producers or traders, transport of tools as part of performing a certain service as well as private trips associated with the transport of goods (shopping, leisure, commuting) – subsummed as private logistics trips. Based on these analysis and assumptions the study came to the following conclusions described within this article.

* Corresponding author. Tel.: +43 316 810 451-21; fax: +43 316 810 451-75+0-000-000-0000 .

E-mail address: wrighton@fgm.at

2. Shift potential

In urban areas on average 51% of all motorised trips - associated with the transport of goods - could be shifted from car to the bicycle or cargo bicycle. About 1/3 of these motorised trips that could be shifted can be attributed to commercial transport, whereas private logistics (e.g. shopping and/or leisure transport) accounts for 2/3.

	1,000,000	400,000	600,000	490,000
All trips		Bicycle, pedestrian, Public Transport	Motor vehicle trips	Motorised trips related to goods transport
		NUMBER OF TRIPS PER DAY	NUMBER OF TRIPS TO SHIFT TO BICYCLE & CARGOBIKE	RELATIVE % OF SHIFT WITHIN MOT. TRIPS RELA- TED TO GOODS
Motorised trips related to goods transport		490,000	250,000	51%
Delivery		100,000	25,000	25%
Service and business		110,000	55,000	50%
Shopping		130,000	100,000	77%
Leisure		90,000	40,000	44%
Commuter		60,000	30,000	50%

Fig. 1. How Cyclelogistics can change the traffic in an average city

By means of a virtual European city with an average of 240.000 inhabitants the Cyclelogistics study has calculated the shift potential from urban motorised transport trips to bicycles or cargo bikes. In such an average city there are about 1 million daily trips – 60% of them are motorised the rest is done by walking, cycling or PT. Taking all motorised trips as basis for the calculation (60% =100%) and only considering those motorised trips associated with the transport of goods we calculate that 51% could be potentially shifted to bicycle transport. Because these trips are related to light goods transport (more than a handbag but less than 200 kg) and the distance covered is short enough (less than 7 km) to be done by bike/cargo bike.

Of course the potential for a shift can vary quite considerably if you look at the different trip purposes. In the area of delivery the potential to shift is half of that for service and business trips, because in the area of delivery the weight, volume and even the distance are usually bigger than in the other areas. A particularly high potential exists for the area of private logistics. More than ¾ of all the shopping trips could be shifted to bike of cargo bike. The reason for this is the usually quite dense network of shops for daily supply in urban areas and the relatively light weight of the purchased goods. Leisure trips that are associated with the transport of goods we also classify as private logistics. This might e.g. include the transport of sport equipment or anything else that has to be carried along to a leisure activity. Although the trip to work or to educational institutions is considered as private logistics here.



Fig.2. Shift potential for cyclelogistics

The concept to label shopping, leisure or commuter trips associated with the transport of goods as “logistics” has so far been a new and unusual concept for the logistics industry. However, if the shopping bags that are usually transported home in private cars would be delivered by a delivery company no one would question the terminology. Given the huge potential to shift such trips and the associated positive effects of such a shift, the results from the baseline survey could be used by decision makers to implement efficient policies for a shift from motorised to bicycle related goods transport. The findings could also help decision makers to set priorities.

The aim of the first Cyclelogistics project was therefore to create an impetus to exploit the entire shift potential (private and commercial) in European cities by implementing measures in the following areas:

- Commercial delivery to businesses and consumers
- Transport of goods associated with communal and business services
- Incitement of policy interventions across Europe
- Private goods transport with a focus on shopping traffic

2.1. Commercial delivery using cargo bikes

The increasing demand for delivery of goods increases the problem of congestion, air and noise pollution and decreases the quality of living in the inner cities of Europe. Urban areas of the future are likely to look very different from today's with conflicts over urban space putting increasing pressure on logistics companies to do things differently.

In European Cities traffic created by commercial delivery is responsible for about 30 percent of the transport CO₂ emissions, over 50% of the NO_x emissions and about 40% of the particulate matter emissions [2][3]. While large Delivery Lorries only have a small share of the trips they contribute disproportionately to noise levels.

Research undertaken by the CycleLogistics project has identified significant potential [1] to shift motorized trips related to goods transport to bicycles in European cities. Every fourth such commercial delivery trip could be shifted. This suggests that bicycles and in particular the cargo bike is a realistic alternative to motorised transportation and one that is increasingly being used by both individuals and commercial organizations across the EU member states. To encourage and assist individuals and companies with the set-up of more CycleLogistics businesses a Transferable Business Model was developed during the project by partner Outspoken Delivery.

But also big delivery companies like DHL have noticed that the trend calls for a change in the logistics industry towards more sustainability. According to a study [4] 60% of people see climate change as a serious current problem and are already considering “green” logistics solutions important. At the same time they are increasingly aware of their power to contribute to shaping the market by using their buying preferences as a means to steer market developments. This clearly demonstrates that the demand for green and climate-friendly logistics solutions is rising.

Certainly such green logistics solutions will include cargo bicycles and this will be supported by the fact that this type of logistics creates a considerable interest, both in the media and in the public.

Almost on every letter or package delivered these days and in the advertisement of large postal, delivery of logistics companies one can find a label that claims that this item was delivered CO₂-free, going green, emission-free, etc. This signals a rising awareness of environmental issues of the public that companies try to meet. Large express courier companies carry out surveys among customers only to find an increased demand for sustainability and climate protecting solutions that also extend into the logistics area.

However, the labels that signal and promise to the customer that this product is delivered CO₂ neutral or free are often misleading as they are only indirectly linked to CO₂ saving measures.

In this respect the proclaimed CO₂ neutral delivery of the Austrian Post is only partly a result of a direct reduction in green-house gas emissions through environmentally friendly technologies and more efficient use of resource. All emissions that cannot be avoided are compensated for by the support of national and international climate protection projects.

Within the second Cyclelogistics project a special label has been developed that signals the final customer that the package or goods have been delivered by bicycle rather than by motorised vehicle. This awareness raising tool enables the customer to choose a sustainable last mile logistics solution over delivery with motorised vehicles running on fossil fuels.

3. Establishment of the European Cyclelogistics Federation

Discussions with the cycle based delivery companies around Europe has highlighted that there is no one group or professional body which represents and supports their needs. As a result it was concluded that the European Cycle Logistics Federation (ECLF) should be established to give the sector a voice and demonstrate to relevant stakeholders the potential and relevance of the cargo bike.

The objectives of the ECLF are to develop the cycle as a tool for the distribution of goods and services, particularly in urban areas; to contribute to the decarbonisation of urban logistics and at the same time promote health, safety and wellbeing of all people employed in the cycle logistics sector; and to bring together cycle logistics companies and their supporters to achieve these objectives together.

3.1. ECLF Membership and services

To date there are over 165 signed-up members from all over Europe. So far two ECLF conferences have been held. A survey among members [5] demonstrated that cyclelogistics businesses aim to develop into a well-recognized logistics branch, globally associated with and used by big express logistics companies. Most important for them is the sharing of knowledge and experience (31%), the establishment of lobby groups to influence relevant stakeholders (27%), the support of cyclelogistics operators and new businesses (20%) and the highlighting of best practice (15%).

The survey among members has also helped to define better the services offered to members of the federation according to their specified wishes. These range from various trainings on Start-up, business development, marketing and promotion to branding issues. Also, accreditation and/or benchmarking schemes will be provided as a service, just like advocating and provision of information regarding group insurance schemes, goods in transit solutions, employer and public liability. Certainly it will be an important issue to carry out collective negotiations with big delivery companies and lobbying on a European level.

When it comes to acceptance and willingness to use cargo bikes or electric cargo bikes as a delivery vehicle, as well as to their perception as a possible vehicle option, bicycle couriers are much more willing to perform the switch in vehicle. In fact, the natural progression here seems to be: bicycle courier >> bicycle logistics company >> integration of electric vans into the fleet. Traditional logistics companies or car messengers are much less willing and likely to integrate cargo bikes into their fleets (personal communication and [6]). A possible reason might be that prevailing prejudice against the capabilities of cargo bikes still exists and a lot of awareness raising is still necessary when it comes to the potential and capacity of such cargo bikes.

Since its inception the Federation has been invited to a number of events and exhibitions. In addition the Federation was asked to contribute to a white paper on Carbon Free Urban Logistics for DG Move (The Directorate-General for Mobility and Transport who are in charge of developing transport policies for the European Union). The Federation members were asked for their views and subsequently the European Cyclists' Federation used the responses and prepared a position paper.

The Federation has so far given 7 start-up trainings for cycle logistics companies within 2 years of the first and second cyclelogistics projects with 142 participants. In addition 92 organisations have received telephone consultancy and due to the workshops and trainings well over 50 new bicycle delivery companies have formed across Europe as a direct consequence. This indicates the high level of interest throughout Europe for this form of innovative city logistics. Alone in the area of “Commercial Delivery” there is a record of over 150 additional cargo bikes within the partner cities of the Cyclelogistics project. If other areas, like service and delivery of food and own products of companies, would be considered here too, the number of new cargo bikes in the Cyclelogistics partner cities would exceed 500 and the number of new companies that use cargo bikes exceeds 200 (only associated with the Cyclelogistics partners and ECLF).

Within the second Cyclelogistics project that has started in May 2014 members from the ECLF and the consortium are trained as trainers to deliver Cyclelogistics start-up trainings all over Europe with the aim to roll out this measure on a large scale. The first workshop with 20 future trainers took place in Milan.

Certainly, more education, information and awareness raising work still has to be undertaken to convince about the profitability and usability of cargo bikes in fleet numbers. The ECLF has also collected facts about the economic advantages of this medium.

A cost modelling and simulation of last-mile characteristics presented at the 8th conference on City Logistics [7] has demonstrated that the cost for last mile cargo bike delivery in densely populated areas is €1.60 per unit, while the standard delivery within a city, with motorized vehicles is € 2.91. These results indicate a possible cost reduction of up to 45% in urban areas if cargo bikes are used for deliveries. These saving on delivery costs, combined with much lower purchasing price and running costs of cargo bikes compared to motorized vehicles [8] indicate that cargo bikes are by far the most cost-saving vehicle for urban delivery.

In the New Member State countries the ECLF is preparing the ground by informing decision makers and city officials about the advantages of cycle-based delivery options with so-called empowerment workshops.

4. Municipalities and small businesses

European cities could cut logistics trips by over 50%, by shifting them from motor vehicles to bicycles. Doing so reduces congestion, energy use, air & noise pollution, enhances quality of life, sustainability and many other benefits. Therefore, it should be in the interest of most Cities to do so. The following list of advantages of cargo bikes should help to convince municipalities and businesses:

Results from the Focus Group meetings for small business operators like plumbers, window cleaners, chimney sweeps, etc. proved the theoretical potential for cargo bike use in this area, taking into account weight of tools and distances. However, the main barrier turned out to be the perceived lack of image for cargo bike use. Owners of (existing) small businesses were afraid that a shift from car to bike would be considered as a sign for a lack of commercial success of the concerned company. This seems to be especially the case when this switch in vehicles is suggested to already existing businesses. New start-up companies have less such concerns.

Table 1. Advantages of Cargo bicycles [9].

Cargo bikes are unlikely to get stuck in traffic	Cargo bikes can use both, bicycle infrastructure/bus lanes and regular road space
Cargo bicycles are not restricted to delivery windows in pedestrian zones	Cargo bike logistics is not associated with emissions or noise
Cargo bicycles require less space than vans which is a big advantage in inner city areas	Cargo bikes are cost efficient
Cargo bikes are easy on road surfaces	Cargo bikes pose less danger to vulnerable road users
Cargo bikes riders don't need a driver's license	Cargo bikes are well accepted among the population

4.1. Policy interventions

So, how can cities and regions assist in developing policy and practices that favor delivery of goods and services by cycle? It has been demonstrated within the Cyclelogistics project [10] that there is a range of regulative measures that can promote low emission city logistics by cargo bike. These range from restrictive measures for motorized transport (access restrictions that are based on time, emission factors, weight, etc.) as an indirect means of promotion. But even the introduction of a 20 km/h zone, as established in Ferrara (IT) can indirectly promote Incentives and funding for cyclelogistics businesses are the direct means. Particularly in Graz (AT) it could be demonstrated that the funding scheme of the city had a big impact on the number of new cargo bicycles. In Plovdiv (BG) and Alba Iulia (RO) the creation of cycling infrastructure is an incentive for more cycle-based businesses; in Leicester (UK) the municipality integrated an intermodal delivery service (train/bike) in their policies. In total there are now almost 200 new cargo bikes (small business applications) in use in the partner cities. But municipalities can also promote cargo bike use by using them for their municipal services like for street cleaning, park maintenance, inter-departmental transport, etc. Also, favoring cargo bicycle logistics options when it comes to municipal procurement procedures sets a positive example.

5. Private Logistics

The area of private logistics, including shopping, leisure and commuter trips, has the biggest shift potential. Within the Cyclelogistics project it was demonstrated that it is possible to promote the shift from car to bicycle or cargo bicycle by creating favourable framework conditions. As the evaluation shows 85% [11] of all shopping trips relate to daily supplies. In cities these can easily be undertaken by bike. Another study [12] has demonstrated that in 8 out of 10 cases shopping goods could be transported home on a bike and if you use a bicycle trailer this raises to 9 out of 10 cases.

To address private logistics Bike&Buy campaigns were carried out in over 15 European locations to raise awareness and to determine areas of improvement at supermarkets. Evaluation results of implementations of these Bike&Buy campaigns in Graz and Vienna [13] have already lead to insights on what would make citizens use their bikes more for shopping. 65% of respondents wish that city administrations would improve cycling infrastructure. Results also show that car users, who try cycling, usually like it. In 91% their positive expectations about cycling where met and even exceeded. This opens up an incredible potential: if it would be possible to exploit the potential by shifting the possible shopping trips in European cities from the car to the bicycle this would lead to massive CO₂ savings of 18-20 million tons a year!

As established during the Cyclelogistics Focus Group meetings the transport policies and the economic policies of cities play a major role in the realisation of potential shifts within the fields of private logistics. In application areas where Cyclelogistics partners were involved in implementations it was demonstrated that e.g. in Copenhagen 68% of all trips to the supermarket are done by bike or public transport. Also in cities like Ferrara and Houten the majority of these trips are done by bike.

6. E-Commerce and Services

Both, rising deliveries associated with E-commerce and delivery services have to be considered as a factor that contributes to the problem posed by urban freight. These problems might not be associated with congestion in all cities but they are always connected with a decrease in liveability of the inner city areas due to space being taken up by large delivery vehicles or the ensuing air pollution and noise disturbance.

6.1. E-Commerce

With the rise in E-commerce [14][15] it is becoming clear that new sustainable delivery methods are needed. In Germany every year 750 million packages are delivered and a third is sent back. Not only are numbers constantly increasing, the type of goods delivered is also increasing.

A survey of the Umweltbundesamt in Germany from 2012 [16] demonstrated that tonne-kilometres per year associated with the freight traffic have increased by 55% in Germany between 1995 and 2010. Estimates forecast a further growth until 2030 of about 39%. Particularly the area of KEP-Services has increased rapidly due to the enormous rise in E-commerce. In Germany the number of KEP deliveries due to E-commerce has doubled between 2000 and 2013.

Due to a change in lifestyle the number of home delivery services, particularly of fresh, organic food, is on the rise as well and adds to the number of deliveries. Most of these deliveries are still carried out with motorised vehicles a fact that is in stark contrast with the ambitious targets of the European Commission. The Transport White book [17] prescribes a basically CO₂-free city logistics in major urban centres until 2030 and a complete phasing out of conventionally fuelled vehicles until 2050.

Certainly cargo bikes are one possible solution to achieve the above defined goals. The calculation of the potential for cyclelogistics has predicted that about a quarter of all motorised trips in the area of deliveries and more than half of all motorised private and commercial trips associated with the transport of goods can be shifted to cargo bikes.

The City Log project [18] where the so-called “bento box” was used as an inner city consolidation centre has demonstrated that 20% of the process costs and more than 80% of motorised courier trips could be replaced by cargo bikes. The other German National research project “Ich ersetze ein Auto” [6] has confirmed that especially e-cargo bikes, with the advantage of the electric supports that makes them more powerful and faster than regular cargo bikes, they are well suited to shift delivery trips from cars to bikes. Particularly in the area of point-to-point deliveries carried out by courier companies, because unlike the express or parcel delivery sector the courier sector is characterised by a high share of short-distance trips. Within the 21-month project lifetime 41 electric cargo bikes were tested in 8 large German cities and used to replace motorised delivery vans. Taking into account the parameters of trip distance, weight/volume and time a shift potential has been calculated. Assuming a trip distance of 10km and the maximum vehicle load capacity a shift potential of 42% was determined. By moving the threshold to 20km trip distance the potential increases to 68%.

After books, shoes and clothes, more and more food is now ordered via the internet. Particularly in the UK, Denmark and the Netherlands studies show [19] that already almost two thirds to three quarters of the goods are not picked up in shops any more, but ordered online and delivered by express courier services or mail. Certainly this not only increases last mile urban delivery but also the problem of failed deliveries. Cyclelogistics Ahead will implement different measures that can help to reduce the bad effects of motorised logistics in this area. These measures will range from public locker systems – based on the DHL example of the “Packstation” that might be stationed at supermarkets or mobile & autonomous. Other options are home delivery services and order platforms that enable the end user to receive on-line goods, food, etc. with a near zero emission delivery option – by cargo bike.

6.2. Services

Within the Cyclelogistics project – and as a world-wide trend – we are observing a very dynamic development of food/home delivery services that seems to go hand-in-hand with the development of the movement and delivery of healthy/organic/vegetarian food.

One of the recent very successful and award-winning projects in Austria the delivery service “Rita bringt’s” that delivers freshly prepared, organic and vegetarian food exclusively with 3 cargo bikes. Up to 200 meals a day are delivered sustainably every day (after just a few months of service) and if the 3 cargo bikes are not sufficient help is enlisted through cargo bikes of a local bicycle courier service.

Also, intermodal combinations between cargo bikes and trains or even boats are getting to more and more popular. In such intermodal combinations like the new “foodlogica” service in Amsterdam local food is linked with customers and businesses through a transport system utilising the combination of bikes and boats. This helps the city to reduce emissions, congestion and pollution.

In Graz, Austria a feasibility study is currently underway to determine how to make the delivery chain from the producer (farmer) to the consumer (restaurants, organic food stores and private customers) as eco-friendly and sustainable as possible. It is investigated how goods can be transported by public transport (passenger trains, regional buses) into city centres where they would be distributed for the last mile by cargo bikes. First evaluation results have shown a great potential for such a delivery system because currently the delivery vehicles of the producers (59% private cars) are operated half empty. A first survey has also shown that most of the goods are delivered within a 20-40km radius which is an optimal distance for an intermodal combination of sustainable transport vehicles.

In the UK a similar distribution that utilises trains and cargo bikes for the delivery of fresh vegetables from the farm to certain restaurants. In Austria however, it seems that there is more potential for the delivery of these local foods to private individuals and organic food stores rather than restaurants.

7. Conclusions

Urban freight transport and particularly the last mile are characterized by a strong growth. In Germany for instance the number of courier, express and parcel services has more than doubled between 2000 and 2013 [20] with a similar growth forecast for the next ten to 15 years. In addition, parcel, courier and express services are one of the fastest growing business types in urban areas [21]. This leads to problems at several levels because it results in greater numbers of smaller deliveries.

In the present paper the authors have analysed the potential for the use of cargo bicycles for the first/last mile. Given the huge shift potential of 51% of motorised private and commercial transport trips, cargo bikes are indeed a serious alternative to motorised delivery vehicles in urban areas. Cities like London and Paris that suffer a lot from the detrimental effects of transport and freight traffic have already recognised cargo bikes as one possible solution to combat congestion, emission and pollution. However, many other cities still need to be convinced. It is especially important for cities to recognise that there are many regulative measures that can promote the use of cargo bicycles by the logistics industry. These regulative measures range from restrictions for motorised vehicles to parking regulations to funding of cargo bicycles for companies and the favoring of zero emission logistics vehicles in municipal procurement procedures or use of such vehicles in the municipal fleets. Within the current Cyclelogistics project such measures are tested in 7 European cities and recommendations for cities will be developed.

Furthermore, it is important that municipalities recognise that the greatest shift potential from car to bicycle lies in the area of private logistics - due to the short trip distances and the light weight of the transported goods. The development of effective strategies to achieve such a shift in this area would have an enormous effect on the liveability of cities.

References

- [1] Reiter K. and Wrighton S., 2014. Potential to shift goods transport from cars to bicycles in European Cities. www.cyclelogistics.eu
- [2] Deutsche Bundesregierung; 2008. Masterplan Güterverkehr und Logistik, Berlin

- [3] Gebhart-Graf, C., et al., 2012. Luftschadstoff-Emissionskataster Baden Württemberg 2010
- [4] Deutsch Post AG; 2010. Delivering Tomorrow – Zukunftstrend Nachhaltige Logistik,
- [5] Survey results European Cyclelogistics Federation; Survey results 2014
- [6] Gruber J., 2015. Ich ersetze ein Auto – Schlussbericht, DLR
- [7] Gevars R., Van de Voorde E., Vandelslander T.; 2014. Cost Modelling and Simulation of Last-mile Characteristics in an Innovative B2C Supply Chain Environment with Implications on Urban Areas and Cities; *Procedia – Social and Behavioural Sciences* 125, pp 398.
- [8] Wrighton S., 2014. Final Public Report. Cyclelogistics Project www.cyclelogistics.eu
- [9] Leonardi J., Brown M., Allen J., 2012. Before-after assessment of a logistics trial with clean urban freight vehicles: A case study in London. *Procedia – Social and Behavioural Sciences* 39, pp 146.
- [10] Wrighton S., 2014. Monitoring and Evaluation Report Cyclelogistics Project 2011-2014
- [11] Hoffmann M., 2006. Regionales Verkehrskonzept Weiz
- [12] ARGUS, 2009. Arbeitsgemeinschaft umweltfreundlicher Stadtverkehr
- [13] Wrighton S., 2012. Evaluation Report Shop-by-bike campaigns in Austria. www.cyclelogistics.eu
- [14] Cushman & Wakefield (2013) Global perspective on retail: online retailing. London: Cushman and Wakefield
- [15] BESTUFS., 2001. Best Practice Handbook Year 2. E-commerce and urban freight distribution (home shopping). Germany: PTV
- [16] German Umweltbundesamt., 2012. Daten zum Verkehr. Edition 2012
- [17] European Commission, 2011. White Paper: Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system
- [18] LNG LogisticNetwork Consultants GmbH., 2012. BentoBox – Eine Lösung für die letzte Meile: www.benobox-berlin.de
- [19] Francke F., Visser J., 2013. Internet shopping, an assessment of impacts on Mobility, ETC 2013 Frankfurt
- [20] Esser K., Kurte J., 2013: Die Kurier-, Express-, und Paketbranche in Deutschland – KEP-Studie 2013. Köln
- [21] MDS Transmodal Limited., 2012. DG MOVE European Commission: Study on Urban Freight Transport, Final Report. MDS Transmodal Ltd. Chester, UK.