The use of electric cargo bikes for the delivery of goods and services

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Lessons from two experiments in the food and field services sector in The Netherlands

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Introduction

The demand for city logistics is growing and changing (Taniguchi et. al, 2015). Underlying factors for the changing demand are the rising e-commerce market, the growth of inner city construction work, the increase of self-employed workers, and various trends in the food and hospitality industry. The average shipment size in city logistics is becoming smaller and deliveries are becoming more time-critical (Ploos van Amstel, 2015) leading to an increase in the number of delivery vans[1]. The London Assembly Transport Committee reported an increase of 11 percent in kilometres driven by delivery vans, while truck traffic remained the same (London Assembly Transport Committee, 2016).

The delivery of goods and services is required for the functioning of cities, but the delivery vehicles put increasing pressure on the city in terms of pollution, congestion, accessibility and loss of public space. One of the opportunities for improvement may be found in the use of light electric freight vehicles (LEFVs), such as electric assisted cargo bikes. Cargo bikes are smaller in size, can be manoeuvred easily and do not emit tailpipe pollutants. There is a growing interest among logistic service suppliers to use cargo bikes for city logistics (ECLF, 2016). A recent survey in The Netherlands shows that this interest is mainly driven by environmental consciousness and innovative ambitions, and less by financial considerations (Balm et al., 2017). The survey also revealed that LEFVs are already used for a variety of deliveries of which parcel, food and post are the most common.

LEFV-LOGIC Living Lab

Within the LEFV-LOGIC project, three Universities of Applied Sciences (Amsterdam, Rotterdam and Arnhem/Nijmegen) work together with 30 public and private organizations to explore how light electric freight vehicles can be a financially competitive alternative to conventional freight vehicles. The project runs from 2016 to 2018. The project defines light electric freight vehicles (LEFV) as electrically powered or electrically assisted vehicles that are in size smaller than a delivery van and have a maximum loading capacity of 750 kilograms. It includes electric cargo bikes and L-category vehicles.

Within the LEFV-LOGIC Living Lab, researchers and students monitor and evaluate five different experiments with LEFVs in Dutch cities. A Living Lab can be defined as a “test environment for cyclical development and evaluation of complex, innovative concepts and technology, as part of a real-world, operational system, in which multiple stakeholders with different background and interest work together towards a common goal, as part of medium to long-term study” (Lucassen et al, 2014). The aim is to gain insight in the opportunities and challenges of LEFVs in different sectors based on daily practice.

The results of the first two experiments are presented in this contribution for the LEV Summit 2017. In both experiments a new logistic concept with electrically assisted cargo bikes is tested. The first focuses on food delivery from a market hall and the second on field services (i.e. maintenance, installation and repair).

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[1] Commercial vehicle with gross vehicle weight below 3,5 metric ton

Experiment 1: CycleSpark - CargoBikeXL, food delivery in Amersfoort

Introduction
Greenolution has developed the CycleSpark CargoBikeXL which is tested by 2Wielkoeriers (local bike courier) for food distribution in Amersfoort (see Figure 1). Het Lokaal is a market hall for organic food, which values a sustainable distribution of its products. The large volume and weight payload of the CargobikeXL, which is comparable with a delivery van, makes it a unique solution for the heavy goods of Het Lokaal. Bike courier 2Wielkoeriers has tested the CargoBikeXL every Monday starting in April 2017.

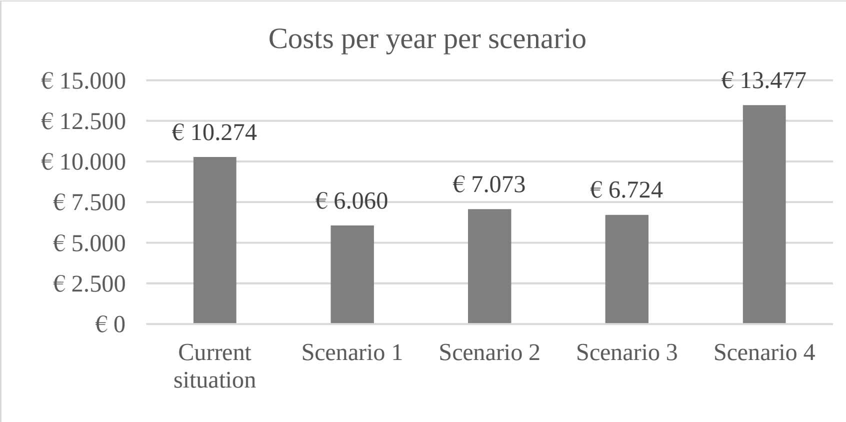
Figure 1 CycleSpark CargoBikeXL

Market and delivery characteristics
During the past few years there has been an extreme growth in the number of indoor food markets. It is expected that this trend will continue for the next few years (Van Spronsen & Partners, 2016). Het Lokaal is an indoor food market in which customers can shop or order at the café. Next, Het Lokaal sells and delivers their products to offices and restaurants in Amersfoort. Most of the products are locally or regionally produced foods. Bread, beer and coffee are produced inside the market. Het Lokaal transports the food in crates or paper shopping bags. The regular crates are 60x40x40cm, while milk crates are 40x30x40cm. The crates can be stacked easily, in contrast to the bags, which can only be stacked on top of the crates. The weight of the products differs a lot. The small crates containing milk are the heaviest, at 12 kilogram per crate.

Results
Input for the evaluation has been gathered by collecting and analyzing trip characteristics and by face-to-face interviews. After three months of experimenting, both Het Lokaal and 2Wielkoeiers aim to continue with the CargoBikeXL. The cargo bike is suitable for the heavy deliveries of Het Lokaal. Next, the success of the pilot is explained by the persistence of Het Lokaal to use emission free transport as much as possible and by the experience of 2Wielkoeiers as bike courier.

In theory, Het Lokaal can substitute its delivery van for a CargoBikeXL. This would reduce transport costs with 30-40% (see Figure 2). In practice there are several barriers. First, the van is also used for commuting trips. Next, the van is shared with another company (which is located inside Het Lokaal) and third, the van offers flexibility for early morning pickups just outside Amersfoort. Het Lokaal outsources the inner city deliveries to 2Wielkoeriers. On the long-term, when the CargoBikeXL can be fully utilized, Het Lokaal would prefer to purchase/lease the cargo bike themselves and hire personnel for the delivery.

2Wielkoeriers is satisfied with the vehicle as it can carry a lot of volume. This does make the reliability of the electric assistance crucial though. Main points for improvement are: water resistance (avoiding electric failures), the use of standard crates as this will improve the stability of the cargo bike, and professional cooling equipment including (sensor) temperature measurement.



Explanation scenario’s:

1: Het Lokaal using CargobikeXL

2: 2Wielkoeriers using CargobikeXL

3: Het Lokaal using CargobikeXL+ 2Wielkoeriers using Bullit

4: Het Lokaal using delivery van and 2Wielkoeriers using CargobikeXL

Figure 2 Comparison of costs in different scenarios

Experiment 2: CityServiceBike, field services in Utrecht

Introduction

CityServiceBike provides space in a parking garage in Utrecht where field service engineers from KPN, Douwe Egberts and CocaCola can park their delivery van and switch to an Urban Arrow cargo bike. In the current situation, field service engineers face a lot of challenges from traffic in dense cities, with long parking search time and high parking costs. The concept has been tested between May and July 2017. For the pilot, the municipality of Utrecht has offered space in a public parking garage Vaartsche Rijn, which is below a train station and well accessible by car (see Figure 3).

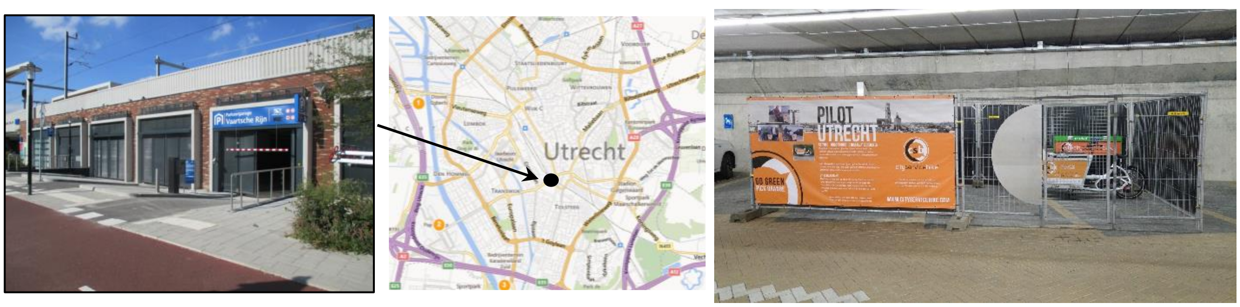


Figure 3 Hub location CityServiceBike in Utrecht

Market and delivery characteristics

While field service vehicles represent considerable share of delivery vans in cities, service logistics as part of city logistics has been underexposed and frequently overlooked (Ellison, et al, 2017). Service logistics differs from freight delivery in various ways. Service workers spend more time delivering the service and therefore require a proper (and legal) parking space. They have a highly unpredictable driving pattern that often changes during the day. On average, the field service engineers that participated in the CityServiceBike experiment visit 4 to 5 customers per day. The weight of supplies and material is maximum 22 kilogram, which makes it suitable for cargo bikes.

Figure 4 Field service engineers on electric cargo bikes

Results

Input for the evaluation has been gathered through an online survey, telephone interview and during a face-to-face group evaluation. The three companies have similar but also different experiences in the experiment. They all agreed that the electric cargo bike, the innovative locks (which is locked/opened with a mobile phone application instead of a key) and the parking garage were convenient and well-functioning. Though, there was a great difference in number of hours cycled, ranging from 3 to 106 hours in 10 weeks. Main reason is that stops are planned differently and have different levels of priorities. For some engineers, stops are automatically assigned and can be spread across the region. But other service engineers can select orders themselves, which allows them to cluster stops in the centre.

For one of the participants, it was calculated that the use of CityServiceBike could save 18 percent of the time needed per day, which allows him to visit more customers per day. A perquisite is that the service engineer can visit multiple customers successively in the city centre, at short distance. When there is only one stop in the centre of Utrecht, it becomes difficult to compensate for the time needed to switch from delivery van to cargo bike. It was also mentioned that multiple hub locations or hubs closer to the centrum could make CityServiceBike suitable for more trips. The service men also noted that they have to decide more carefully which materials they need when they switch to the cargo bike. A lot of material (inventory) is stored in the delivery van, which is often not needed, but it offers convenience and flexibility.

During the pilot, the service man were formally allowed to enter pedestrian zones with the cargo bike. However, manoeuvring between pedestrians was experienced as frustrating and could harm the image of the company.

Conclusions

We draw the following conclusions:

1. At this moment, the interest in LEFV is mainly driven by environmental consciousness, innovative ambitions and marketing benefits, and less by financial considerations. For a larger uptake of LEFV in city logistics, the operational efficiency, technical feasibility and financial benefits should become more evident.
2. LEFVs are faster and cheaper than a delivery van in fine-mazed networks. Fine-mazed means that there are many stops in a route and the distance between stops is short. When distances are too long (>15 km), the personnel costs for LEFV increase too much in comparison with a delivery van.
3. Logistics hubs can be a good solution to reduce the negative effects of urban freight transport. For efficient use of LEFVs, the hubs need to be located (also) within the city and not only at the city border. Next, a facilitative role of the local government is needed.
4. The willingness of the driver to change his behavior and change to LEFV is very important in the level of success. A new recruitment and training procedure of personnel is advised for companies that want to implement LEFV.
5. The increase of LEFV causes uncertainty among other road users and traffic policy makers. Mobility policy lacks behind which hampers the development of this innovative and sustainable type of vehicle.

The outcomes of the experiments are of value for practice, education and further research in the second year of the LEVV-LOGIC project.

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