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Public procurement as driver for more sustainable urban freight transport

Hans Quak[a*], Nina Nesterova[a], Robert Kok[a]

[a]*TNO, Anna van Buerenplein 1, 2595 DA The Hague, the Netherlands*

Abstract

Authorities aim at making the urban freight system more sustainable. The most common instruments to do so are regulation or stimulation of good practices, by offering subsidies or initiating projects together with the private parties that are responsible for actually performing urban freight transport operations. This contribution examines the possibilities for (local) authorities to use their market role, i.e. being a big procurer of goods and services in a city that result in many urban freight transport trips, to stimulate more sustainable urban freight transportation. Procurement is usually not linked to transport and data from procured goods and services do not provide sufficient insights to estimates the impacts of deliveries and trips related to the procured goods and services. This contribution discusses two cases in which (local) authorities try to make the urban freight transport that results from their procurement activities visible, via different methods, such as delivery service plans, and spend analyses. The cases of Rotterdam (in the project BuyZET) and for the logistics hub in The Hague show the first results of how (local) authorities can act to improve urban freight transport once the trips caused by procured goods and services are clearly mapped.

Keywords: sustainable city logistics; public procurement; cases; carbon footprint

1. Introduction: procurement as an instrument for more sustainable urban freight transport

Urban freight transport demonstrations within European projects do not always continue after the financing is over. In many cases because there is not a clear ‘ownership’ of the solutions and it is not clear who will pay and

Corresponding author. Tel.: +31631792851
E-mail address: hans.quak@tno.nl

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manage these (Van Rooijen et al., 2018). The use of public procurement as a tool for driving demand and acting as a crucial launch customer for innovative products and services is well-established and recognised by policy makers at all levels of government within Europe, and globally. Public procurement typically represents 10-20% of GDP within EU member states, and the public sector is therefore a major market actor – not only as a regulator, but as a buyer (see e.g. EC, 2017).

There is growing recognition of this, and acceptance that procurement can be used as a strategic instrument for helping to meet specific policy goals of the organisation through its influence on supply chains, and not simply as an administrative function. Within the transport and mobility sector, these procurement approaches can be highly effective in helping to find and encourage the development of new solutions which help meet the main challenges the urban freight transport system faces: i.e. decarbonization of transport to meet the climate agreements, reduction of local pollutants that have negative health impacts on citizens, and improvement of urban livability and city accessibility (Quak et al., 2018). The impact which public transportation services, such as bus services, have on urban transportation flows and emissions is well-recognised and has also received significant attention in the procurement field. However, the influence of public procurement on urban freight transportation is felt well beyond this. Public administrations procure a huge range of products and services each year. Every product purchased by a public administration must be delivered, whether paper clips or streetlights. The majority of services purchased by public administration involve the movement of goods and personnel, whether cleaning services, road maintenance, or waste collection. In some cases these services are carried out by administration staff, in others by contracted service providers. The delivery of these goods and services generates a significant number of motorised vehicle trips for the movement of both goods and people (Buyzet, 2017a and 2017b). To achieve the aims of zero emission (urban) transportation systems in European cities, this is a key area where innovative solutions are required. New approaches could include the establishment of new business models or contractual arrangements, the implementation of new technical solutions, new forms of joint or coordinated procurement with other purchasing bodies, or entirely new procurement areas (see Topsector Logistiek, 2017).

1.1. Structure

This paper discusses the role and options of using public procurement as a strategic instrument to achieve sustainable urban freight transport objectives. This paper presents the methods used in these two project to identify the freight flows that result from public procurement activities in the city, as well as the effects of innovative ways to include sustainability in procurement in order to reorganize urban freight transport that is directly controlled (due to the procurement power) in a zero emission way. Two approaches are discussed in section 2. This contribution's section 3 highlights the first results of both cases. In section 4 the main strengths and weaknesses, and challenges for more sustainable procurement by public authorities are discussed.

2. Introduction to approaches to use public procurement to increase urban freight transport sustainability

This contribution discusses two different approaches to use public procurement to increase urban freight transport sustainability: i.e. the European Horizon 2020 project BuyZET (and the city of Rotterdam in particular), and the Logistics Hub in The Hague (for the Dutch national authorities). These two projects are introduced shortly in this section.

2.1. BuyZET: mapping methodology and Rotterdam's procurement footprint and more sustainable tenders

BuyZET has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 724101 (see BuyZET, 2018).

BuyZET aims at using public procurement to stimulate zero emission urban freight transport. (Local) authorities procure transport on three levels: 1) their own fleets, 2) direct procured transport services and 3) indirect procured transport services that result from ordering goods or services. BuyZET aims at providing insight in the emission footprint (carbon as well as local polluters) of especially the third category, as there is already quite some knowledge available for other categories. Different methods are used to provide this insight, such as using data from invoices and making delivery and service plans at local authorities' buildings. The insights are to be used to provide positive incentives for suppliers to provide more sustainable transport in (new) procurement tenders for goods and services. The first step in BuyZET it to get an as accurate as possible insight in the transport footprint of the local authorities' procurement behaviour. The core city partners in this project are Copenhagen, Oslo and Rotterdam. The developed in BuyZET footprint mapping methodology needs to be flexible enough to deal with different data; as various data and data-quality is available from different cities. Data should be sufficiently accurate to enable intended users to make decisions with reasonable assurance that the reported information is credible; at the same time, from the industry perspective absolute accuracy is less important than ensuring the aspects of comparability (for decision making) and ease of use, whilst respecting an acceptable level of accuracy (GLEC, 2016). It is important to have a simple and understandable approach enabling municipalities to map the footprint with certain regularity, comparing results internally over time as well as externally with the reporting outcomes of other organisations. Transparency is necessary, for transferability of the method and knowledge exchange with other cities. It is also necessary because if public organization structure changes over time, that should be clear how to compare emissions over the years (GLEC, 2016).

For these reasons, the BuyZET mapping methodology is based on a two-phase approach:

- the main objective of Phase I is to get an overall big picture of what are the most emission intensive purchased categories and, where possible, emission intensive procurement clusters. Accuracy is important as much as it can be achieved with the data available, as collecting data directly (at this stage) from suppliers is time consuming and cost intensive.
- in Phase II a deeper investigation on the emission intensive procurement clusters from Phase I is performed, resulting in more accurate and precise emission footprint for the emission intensive categories. For that reason Phase II includes a more comprehensive data collection process in order to understand all the specifics in the procurement category / cluster that emits the most. This is necessary in order to be able to identify the most appropriate strategies to lower emissions from these clusters. Phase II per selected procurement cluster is looking deeper in such indicators as, e.g., the frequency of trips, transport modes that trips are performed and other parameters that will help to assess the impact of zero emission decisions on disruptiveness of trips, congestion and other important for city characteristics.

The BuyZET footprint-mapping methodology is founded on the traditional footprint calculation methods: fuel based, distance based and spend based methods. Depending on the data available these methods are used to map a footprint from different transport service categories. The choice of calculation method depends on several factors, such as: availability of relevant data and its quality, the goals of footprint calculation and accuracy requirements, the scope and boundary conditions established for the footprint calculation, the cost and effort required to apply each method. For the footprint estimation in phase I the fuel based method is the most accurate because fuel consumption is directly related to (carbon dioxide) emissions. When fuel data is not available, which is usually the case for transport categories 2 and 3, it is possible to make estimates based on assumptions on the distance travelled per each category of vehicles deployed or based on the amount of money spent on fuels. If there is no data available to estimate the fuel consumption, which is often the case for category 3 procured goods and services, it is possible to apply distance and spend based methods. These are less accurate, but still provide an indication of the actual footprint. The spent-based method is effective for screening purposes, however it has the highest levels of uncertainty compared to other two methods. The advantage of the spent-based method is that data on how much money spend on goods or service categories. The BuyZET mapping methodology is based on the principle that for each transport service category (category 1,2 and 3) the best possible data calculation method is to be selected based on the data available.

Phase I provides the basis for prioritization and determines which are the most relevant procurement clusters from each category to be included in the Phase 2 inventory. BuyZET's phase I estimates what the public procurement effects of different categories are on (city) emissions:

- A clear overview of what kind of transport activities are carried out by the municipality's own fleet (category 1), on behalf of the municipality (category 2) and for the municipality (category 3) by the third party providers fleet;
- An emission estimation for each of these categories (based on the best available data per category for the best possible accuracy);
- An indication of the most emission intensive procurement clusters within the categories.

In Phase II a more accurate footprint calculation is performed for the selected intensive procurement clusters. In BuyZET the focus is on two selected intensive clusters per city. For this analysis, a detailed data collection and understanding of the processes behind the numbers needs to take place. It is necessary to have more accurate data and to achieve more precise emission calculation that the one performed for this cluster in Phase I.

This contribution discusses the first results of the City of Rotterdam from phase I in BuyZET. Rotterdam is the second largest city in the Netherlands and the largest port in Europe. The Rotterdam Sustainability Programme sets the ambition to become a clean, green and healthy city. The action plan encourages sustainable procurement practices to assist the transition to a more resource-efficient city and to shift markets onto a sustainable paths. Rotterdam has an annual procurement budget of around Euro 1,3 billion. Procurement and purchasing within the city of Rotterdam has been centralised to a very large extend. One or more contract managers are responsible for specific contracts and services. A list of upcoming contract renewals is updated regularly, specifying both the procurement officer and the project manager of the procuring division. Hence the organizational scope coincides with the full organization, as far as its financial administration is centralised. The City of Rotterdam aims at incentivizing zero emission transport by using its role as big procurer of goods and services in the region. By adding favourable conditions for zero emission (or promises to become zero emission) for the transport of goods and / or services, the city aims at increasing the amount of zero-emission vehicles operating in the region of Rotterdam.

2.2. The logistics hub in The Hague: how to organize last mile deliveries more sustainable

The Dutch national authorities have offices located at several places in the city of The Hague. These different locations often have their own procurement organisations, and are supplied independently. In the project logistics hub The Hague, the authorities have investigated and are planning to implement the possibilities to change their procurement strategies – together with the city authorities of the Hague - so that the suitable flows will be consolidated in a logistics hub and from there transported using zero emission vehicles to the different (office) buildings. The objectives for the Dutch national authorities are various: reducing its transport footprint (as a direct consequence of signing the COP21 Paris climate agreement), improving the liveability in the city of The Hague. The logistical hub The Hague project carries out research and plans a pilot project to organize the logistics within the government more efficiently and sustainably. It is planned to be a trial - in collaboration with the municipality of The Hague - where government buildings in The Hague are supplied with their materials from a central distribution centre. The goal is to reduce CO_2 emissions, a better accessible city centre and a cost saving by organizing the logistics processes more efficiently. A logistics hub in the Hague region offers many opportunities, partly because of the high concentration of government buildings, category management within the government and the purchasing power of the government. For this project the following steps were undertaken:

- Selecting a specific procurement category / city logistics segment (e.g. facility logistics);
- In depth analysis of demand (e.g. size and locations of buildings, demand per unit) and supply (e.g. selection of products, size and weight of goods, suppliers, locations, routes and distances, vehicle types) for these facility logistics goods.

The approach for evaluating the potential for making use of procurement of facility products (including typical office supplies such as paper, coffee cups, and toiletries) a strategic instrument to improve local urban freight transport is sketched in Fig. 1.

3. Linking public procurement with transport: insights from footprinting

One of the first lessons we learned in both cities is that procurement and logistics are often not linked. It is a serious task to find what the actual transport impact and footprint is of the public procurement behaviour. Normally, no data are collected on the deliveries and services and the required transport activities. For the BuyZET category 3, in which the facility logistics goods on which is focused in the logistics hub The Hague also categorize, the procurement contracts most often do not contain data on transport, vehicle type, or even transport frequency. Transport and the footprint are usually no part of procurement contracts; where more emphasis is on price and availability of the goods (or services).

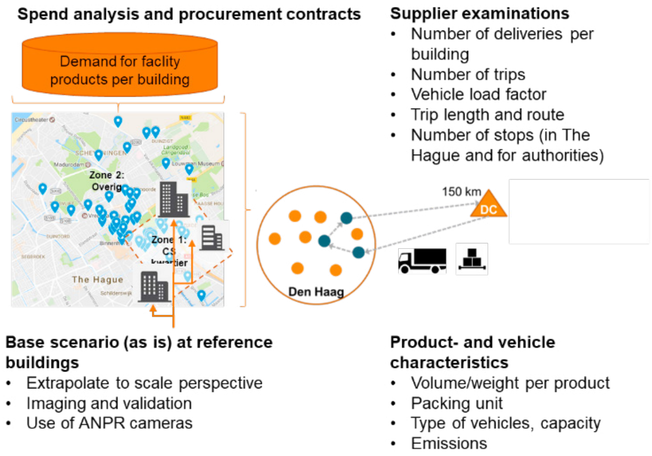

Fig. 1. Analysis of feasibility and available volume to support logistics hub.

Therefore the first mapping exercise that makes the actual footprint of the procurement transparent has high value for the following reasons:

- it provides a link between the policy objectives (reduction of emission, improvement of city accessibility) and the procurement behaviour;
- it enables transport policy officers to contact and to link with their procurement colleagues at public organizations (normally these departments are not automatically cooperating);
- it provides the first insights in the procurement categories and their resulting transport impact on the city;
- it provides insights that can result in more sustainable requirements (e.g. for some products the delivery frequency could be reduced, without resulting in too low inventory levels)
- it is the first step for authorities to provide an example function (i.e. practice what you preach: in case local authorities use their regulative role to force transport activities to become more sustainable or cause less nuisance) as well as to become a launching customer of a more sustainable urban freight solution (such as a hub).

Therefore, by showing the environmental impact of procurement decisions can already be helpful to start organizing city logistics more sustainable. If projects, like BuyZET, can provide these insights, it can be helpful for both public and private companies that want to contribute to more sustainable cities.

3.1. First insights from BuyZET mapping methodology in Rotterdam

The overview of municipality invoice orders and delivery receipts was taken as a starting point for category 3 mapping. Based on this information and making a set of assumptions, the municipality has focused on the identification of the number of kms required to deliver the goods and services to the municipality buildings by third party providers and the distribution of these kms over different vehicle categories. To estimate the procurement footprint on the basis of the invoice and receipts information, the following steps were taken:

1. *Categorisation of invoice orders.* The database of invoice orders for one year contained 457 categories. First, these orders were categorised in 5 categories, from the perspective of logistics point of view: transportation, immaterial and intellectual, product, energy and service. Next round of classification was performed for four categories, excluding immaterial products and intellectual property, and took in consideration homogeneity of goods and services in terms of unit and unit price and the spend-based volume of each group. This resulted in 59 types of products and 30 types of service groups for which the footprint was estimated. Finally, invoices were also classified on suppliers, assuming that most supplies deliver only one type of services or goods. This also allowed to connect invoices with delivery receipts.
2. *For goods, quantification of the distance driven* by delivery vehicles within city boundaries was performed based on the following calculation model (see formulas 1-3, and Table 1). These calculations were done for each invoice.

$$(1)\ M = \frac{p}{u} \qquad (2)\ D = \frac{M}{c*f} * d \qquad (3) E = D * e$$

Table 1. Calculation model for the delivery of goods (Source: BuyZET 2017a).

Symbol	Unit	Variable	Linked to / derived from
p	€	Amount paid	Invoice data
u	€/m^3 ; €/t	Unit price	Product group
M	m^3 ; t	Mass or volume transported	= p/u
d	km	Distance from by-pass to delivery address	Address data of supplier (O) and Delivery address data (D) (from receipts database when available, otherwise assumed city hall)
V		Vehicle type	Product group
c	m^3 ; t	Maximum vehicle capacity	Vehicle type
f	%	Load factor	Vehicle type
D	km	Distance driven	= M / (c*f)*d
e	X/km	Emission factor	Vehicle type
E	X	Emissions	= D * e

A set of assumptions was done in order to perform the calculations:

- Amount paid: the basis of calculation is invoiced amount;
- Origin and destination: it was assumed that supplier address from invoice is the trip origin;
- Distance driven within city boundaries: per invoice, the distance is estimated based on measuring the distance from (the entry point of) the by-pass to the destination within the city;
- Unit and unit price: for each product group a fixed unit price is assumed, derived from the combination of bottom up approach (by taking the (weighted) average of unit prices of goods delivered from receipts) and top down approach (unit price is calculated from trade statistics);
- Vehicle type: each product group is assumed to be delivered by the single type of vehicle;
- Load factor and utilization factor: to include the effects of partial loading and empty drives, both are combined in a single value, the utilization factor;
- Emission factors: emission factors per vehicle type are derived from STREAM.

3. *For services, quantification of the distance driven* by delivery vehicles within city boundaries was performed based on the following calculation model (formulas 4-7 and Table 2). These calculations were done for each invoice.

(4) $T = \frac{p}{w}$ (5) $x = 2d + b * (\frac{8}{t} - 1)$ (6) $D = (1 - h) * \frac{T}{8} * x$ (7) E = D*e

Table 2 Calculation model for the delivery of services (Source: BuyZET 2017a).

Symbol	Unit	Variable	Linked to / derived from
p	€	Amount paid	Invoice data
w	€/h	Hourly wage	Professional discipline
T	h	Hours worked	= p/w
h	%	Fraction teleworking	Professional discipline
d	km	Distance from home to work	Professional discipline
b	km	Distance between locations	Professional discipline
T	h	Time working at one location	Professional discipline
V		Vehicle type or modal split	Professional discipline
x	km	Distance covered per day	= 2d + b * (8/t – 1)
D	km	Distance driven	= (1 – h) * T/8 * x
e	X/km	(Averaged) emission factor	Vehicle type
E	X	Emissions	= D * e

Assumptions performed in order to map the footprint from the services delivered to municipalities are the following:

- Professional discipline: the categories of professions were identified per invoice;
- Wages: assumption, combining the results of three approaches: based on the sector average; using unit price from delivery database; looking for hourly rates in invoice description;
- Distance covered per day
- Teleworking: the fraction of service provided by teleworking is estimated for each profession;
- Emission factors: derived from STREAM, for car, bicycle, public transport and delivery van.
- *Purchaser and supplier inquires:* for some types of goods, the contact with suppliers was established. That allowed to verify some key assumptions.

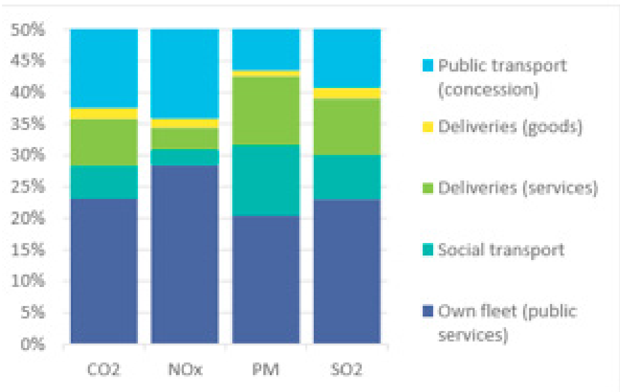

Fig. 2. Shares of different categories in the emissions of Rotterdam (BuyZET, 2017a).

Using these calculation steps, emissions were mapped from the category 3 of transport services. Overall, Rotterdam have mapped emissions from all three transport categories. The result of this mapping exercise is presented in Table 3. It clearly shows that public services delivered by own fleet, only diesel fuelled (category 1) and public transport (category 2) are responsible for more than half of the local emissions for all investigated air pollutants.

Table 3 Summary of emissions in Rotterdam (BuyZET, 2017a)

Emissions	Tonnes CO_2	kg NO_x	kg PM	kg SO_2
Category 1 – Own fleet	6,633	48,190	1,163	39.9
Category 2 – Transport service	19,420	112,984	3,833	114.6
Category 3 – Delivery of goods and services	2,632	8,321	676	18.6
Total for Rotterdam	28,685	169,494	5,672	173.1

Table 3 illustrates, that category 3 represent only 9% of municipality CO2 footprint. The dataset for invoices in 2016 contained 181389 entries for 6039 suppliers. Categorization of the invoices resulted in 59 groups of products assessed and 30 groups of services. Examples of goods and services included in assessment: construction materials, office supplies (toner, paper, computers); tools for gardening and cleaning; Equipment for sports and children's farms; street furniture (lamp posts, benches, garbage containers); cleaning, consulting, catering – as examples of services. Even though this category represents only 9% of the total footprint, this is an important category to address within decarbonization effort. Acting on its own fleet is in direct influence of municipality: city of Rotterdam have clear plans on making its fleet zero emission by 2020. Category 2 is also already following decarbonization path: The current provider of public transport services in Rotterdam is RET, with a concession that runs until 2019. However, Rotterdam has decided to prolong the concession period with another 7 years if RET proves before the expiration date that it will have made the transition to emission free services buy 2025, in line with the national ambition.

Despite the lowest direct footprint contribution, addressing category 3 can have a very large multiplier effect: each supplier that delivers goods and services to municipality will have zero emission fleet/approach in delivering to municipality, the rest of the days in a week that they deliver to other than municipality clients, they can also use zero emission technologies, thus, contributing much more in the overall city logistics fleet decarbonization.

The results of mapping allow to identify the most CO_2 emission intensive product groups and services. For Rotterdam, delivery of sand is by the good that produce the most kilometers driven within a city (almost 70% of all transported goods, see Fig. 3). Sand and other construction material is brought by heavy duty vehicles.

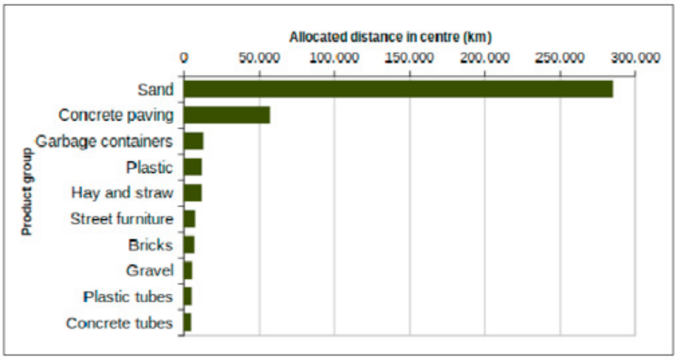

Fig. 3. Kms delivered per product group (Source: BuyZET, 2017a).

Fig. 4 illustrates, that for services, employees that use a company van to travel show a higher emissions per kilometer than people with other travel modes. Procurement service category that emits the most is therefore construction works as well as so-called maintenance workers, using predominantly delivery service vans as means of transport.

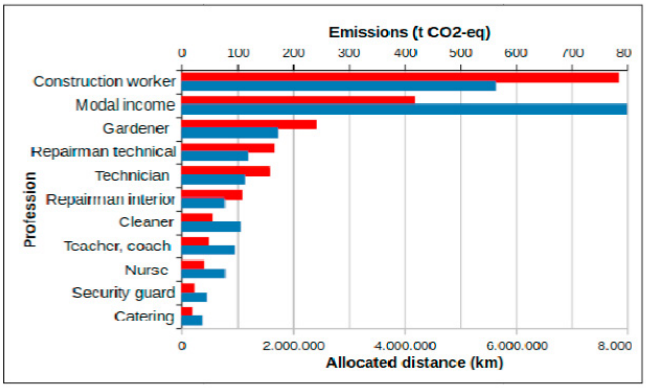

Fig. 4. Distance driven within city boundaries (in blue) and emission of CO2 (in red), for the most important professional disciplines.

Overall, the large majority of all emissions are a result of personal transport. Table 4 specifies the distribution, as derived from the analysis of the financial administration system. More than 95% of the transport movements are carried out with light to medium duty vehicles, servicing personnel and third party employees trips. The remainder is carried out by heavy duty vehicles, providing mainly building materials.

Table 4. Distance driven in the center, per vehicle type (Source:BuyZET, 2014a)

Transport footprint modality breakdown	Vehicle type	Distance driven in centre (km)
Services / 3rd party employees	Company (service) van	10.6 million
	Other personnel	(12.8 million)
Goods	Heavy duty vehicles (heavy goods)	388000
	Medium / light duty vehicles (light goods)	5365

3.2. First insights from BuyZET mapping methodology in Rotterdam

The first step for the authorities was to check if volume-wise a logistics hub for procurement of facility goods would be feasible. To examine this the following examination was undertaken:

- *Selection of goods flows*: a number of selection and exclusion criteria were used to select promising products and goods flows that are (relatively easily) suitable for delivery via a hub on the outskirts of the city. The excluded goods flows are 'more difficult' flows but not necessarily unsuitable for delivery via a hub. The following aspects have been taken into account to exclude the 'more difficult' flows:
  - Time-critical deliveries would place high demands on the level of service on the hub and has more cross-dock functionality than stock capability on the hub.
  - Safety requirements and procedures, such as the waste stream, the destruction of confidential documents and the transport of confidential documents.
  - Special vehicles / handling units, such as dirty waste streams and separated waste.
  - Conditioned deliveries, such as frozen food, dairy. This places special demands on the vehicle, increases energy consumption and makes the possible use of electric vehicles more complex.

  - Risk of double journeys, such as mail and parcels. Mail and courier companies already have a close-knit network with urban loop runs for daily and time-critical deliveries.
  - Small inner city supplies, such as the baker and the florist. This is insufficiently clear if a logistics hub can solve the problem of small inefficient inner city deliveries. In addition, the large flows are more interesting to create sufficient critical mass to get a logistic hub off economically profitable.

  This means that the most promising flows of goods concerns the large volumes from outside The Hague. Therefore, the following facility flows are included in the calculation of the effects of a logistics hub: blank paper, envelopes, stationery, communication printing, sanitation (toilet paper / paper towels), cleaning articles, coffee / drinks vending machines, office supplies, office furniture, ICT hardware and supplies and the waste streams of normal paper / cardboard and coffee cups.
- *Selection of office locations:* the next step was to examine the amount of offices and the resulting flow of facility goods that could be steered differently via the procurement process. In total it concerns 36 government buildings and 17 municipal buildings (including 8 district offices). The size of the building is determined on the basis of data on gross floor area, number of workplaces, number of employees and number of FTEs per building. Over 27% of the buildings are large (> 1000 workplaces), 31% medium-sized (from 251 to 1000 workplaces) and 42% small (up to 250 workplaces). The average building size is 730 workplaces. The large buildings will therefore provide a large part of the demand for facility products, but nonetheless the smaller buildings will cause many vehicle-trips.
- *Supplies per building and delivery / collection frequency:* the next step was to determine the average demand for facility products per FTE. In the base scenario a delivery profile was made for some selected office buildings. Based on these delivery profiles (for small, medium and large office buildings), in which the actual number of deliveries was counted for a period of a week, and these data were combined with procurement data, the total number of supplies per office building were estimated.

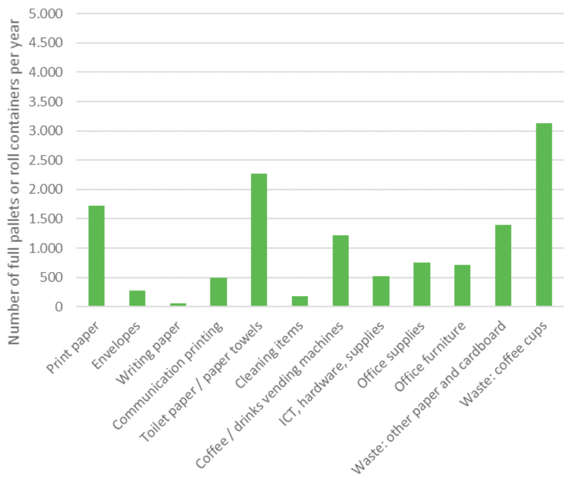

Fig. 5. Public procured facility goods volume per year feasible for procuring via logistics hub The Hague.

Eventually, this analysis – combining both local delivery data and procurement data, including feasible goods categories and procured quantities per year – provided an overview of the total public procured volume (see Fig. 5) that can be used in The Hague for achieving policy objectives; i.e. fewer truck kilometers and less emissions. In total this is about 12,000 roll container (or pallet equivalents). The next steps is finding how exactly these categories should be procured via a logistics hub, and how financially a split should be made (in the procurement agreements) between the last-mile deliveries in The Hague (via the hub operator) and the line-haul transport to the logistics hub, so that the exploitation of the logistics hub can be financially feasible. One issue here is that many of the facility goods procured do not make transport costs explicit yet in the purchase price. The total transport costs (so line-haul and last-mile delivery combined) is only a limited part of the total purchase price. And it is not too easy to determine a distinctive price for procuring these facility goods without the last-mile delivery yet. Per category, when the new procurement contracts require so, the right prices – including a distinction for last-mile transport – will be determined in the future, so that a logistics hub operator (and last-mile logistics service provider) can earn enough to actually run the The Hague logistics hub.

4. Conclusion

These two cases showed how difficult it is to determine the exact trips that result from public procurement behavior. First of all, procurement is often only used as an administrative activity and not used to achieve policy objectives. In most procurement activities and systems, the resulting footprint, nor the resulting transport activities are asked, let alone recorded. Procurement officers do have other incentives than to minimize the transport trips or the footprint, and therefore this is often not one of the select suppliers for goods or services. Both cases, Rotterdam via the BuyZET project, as well as the logistics hub project in The Hague, made attempts to make the actual footprint of the procured goods and services visible, in order to act on that.

During this exercise, we found that the existing procurement systems show internal inaccuracies. It appeared that the assignment of categories to purchase orders, and subsequently to the corresponding invoice(s) is not always as accurately as was thought initially. This is either because the purchase could not be classified as one of the available categories to choose from, or because the purchaser did not succeed in finding the appropriate category. This inaccurate categorization provided a major challenge for doing accurate calculations (see e.g. BuyZET, 2017a). Besides, sometimes small items or categories are procured per building or even department in a building and these items are not easily found in the central systems.

In general, the municipal purchasing database system is not geared towards the assessment of physical quantities, such as the mass or the distance driven. This is understandable, as the system is intended as a financial accounting tool. What is somewhat disappointing in this respect is the fact that labelling of several expenses was inappropriate. This was a complicating factor in the analysis, and also provides a major opportunity for future improvement. Not only the assessment of transport footprint, accounting efforts will be facilitated by correctly classified invoices and receipts (BuyZET, 2017a).

It proved to be challenging to link the datasets on invoices and receipts. What is more, not all delivery addresses were available from the database. This has to do with the way the user input is handled. Improvement of the data handling software will lead on improvement on this point and allow for more accurate calculation of distances. In addition, this would help to identify opportunities for combined transport.

Although, the actual visualizing of the footprint and trips resulting from procurement decisions was not too easy, both cases showed that once this exercise was done and procurement and transport was linked, it provides opportunities to use procurement strategically to achieve policy objectives:

- For the city of Rotterdam some categories were procured in a zero emission way (in the coming years);
- Rotterdam started to find other procurers with similar suppliers in order to bundle (some of their) deliveries;
- In The Hague it showed that there is enough volume to continue in planning the deliveries via a logistics hub.

A next step could be to make it easier for other (local) authorities to link their procurement decisions with the resulting impacts on urban freight transport. Obviously, a similar approach as was taken in Rotterdam or The Hague could be chosen. However, for future research we intent to find delivery indictors that can more easily be used to roughly estimate the expected urban freight trips from the procurement decisions in order to use the most considerable categories to strategically act on for sustainable urban freight transport objectives.

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