Toward cost-efficient and sustainable e-commerce deliveries: The collection and delivery points network in Belgium

2017 METRANS International Urban Freight Conference

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The challenge of e-commerce

Fragmented
Failed Deliveries
Reverse Flows


Increase of demand for goods movements in residential areas

City Logistics

Suistanability

Efficiency
Sustainability: Delivery Options

EFFICIENCY

PILOTS

SUSTAINABILITY
Agenda

• Current situation in Belgium
• The Belgian e-commerce deliveries market
• Pick-up points networks in Belgium
• Conclusions and further research
E- Shoppers in Belgium
Percentage of E-shoppers in Belgium

Major roads

Percentage online shoppers per sector
- <45% (1964)
- 45-50% (5891)
- 50-55% (8473)
- >55% (3066)
Players in the parcel delivery market

NPO
- PostNL
- Deutsche Post
- Royal Mail
- Bpost
- USPS

Integrators
- DHL
- TNT
- Fedex
- UPS

Parcel Carriers
- Hermes
- DPD
- GLS
- DHL Parcel

Last Mile Specialists
- Doddle
- Bring
- Kiala
- BubblePost
- PackStation
- Parcel Home
Operational costs

\[
\frac{\text{Last Mile Internal Costs}}{\text{Stop}} = \frac{\text{Time Costs} + \text{Distance Costs} + \text{Fixed Costs}}{\text{Number of successful stops}}
\]

\[
\frac{\text{B2C Last Mile internal costs}}{\text{Stop}} = \frac{2D_{lh}\left(d + \frac{t}{\bar{sp}_{lh}}\right) + D_d d + T_d t + f c_v}{S(1-f)}
\]

Where:
- \(S\) is the number of daily stops
- \(d\) is the vehicle costs distance coefficient in monetary units per kilometre.
- \(t\) is the labour costs time coefficient in monetary units per hour
- \(D_{lh}\) is the one way distance between arrival terminal and the starting point of the route in kilometres
- \(\bar{sp}_{lh}\) is the average speed of the line-haul leg in kilometres per hour
- \(T_d\) is the average time spent delivering the goods from the first to the last stop in hours
- \(D_d\) is the delivery tour total distance from the first to the last stop in kilometres
- \(f c_v\) is the vehicle usage fixed costs per day in monetary units
- \(f\) is the failed delivery rate

Country

3.8 euro/parcel

1.8 euro/parcel

Cities
Operational costs per parcel

[Map showing operational costs per parcel across different regions, with legend for €/stop ranging from 1-1.5 to >9.]
External costs per zip code

- Provincial capital

€/zip code:
- <1
- 1-2
- 2-3
- >3
External costs per parcel
Even without an incentive, DP deliveries have a relevant share on the delivery options.

DP options are dominated by clothing, electronics, fitness and books products.
## Delivery points networks in Belgium

<table>
<thead>
<tr>
<th>Carrier</th>
<th>Number of DP</th>
</tr>
</thead>
<tbody>
<tr>
<td>bpost</td>
<td>1300</td>
</tr>
<tr>
<td>PARCELSHOP</td>
<td>1250</td>
</tr>
<tr>
<td>Kiala</td>
<td>907</td>
</tr>
<tr>
<td>Karibool</td>
<td>750</td>
</tr>
<tr>
<td>ParcelShop</td>
<td>600</td>
</tr>
</tbody>
</table>
Delivery points networks in Antwerp
Delivery points network carrier 1

<table>
<thead>
<tr>
<th>Distance to customers</th>
<th>Number of Customers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;500</td>
<td>30239</td>
<td>15%</td>
</tr>
<tr>
<td>500-1000</td>
<td>38941</td>
<td>19%</td>
</tr>
<tr>
<td>1000-2000</td>
<td>77894</td>
<td>39%</td>
</tr>
<tr>
<td>Total</td>
<td>147075</td>
<td>73%</td>
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</tbody>
</table>
### Delivery points network carrier 2

<table>
<thead>
<tr>
<th>Distance to customers</th>
<th>Number of Customers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;500</td>
<td>45550</td>
<td>23%</td>
</tr>
<tr>
<td>500-1000</td>
<td>64970</td>
<td>32%</td>
</tr>
<tr>
<td>1000-2000</td>
<td>78782</td>
<td>39%</td>
</tr>
<tr>
<td>Total</td>
<td>189303</td>
<td>94%</td>
</tr>
</tbody>
</table>
**Delivery points network carrier 3**

<table>
<thead>
<tr>
<th>Distance to customers</th>
<th>Number of Customers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;500</td>
<td>91777</td>
<td>46%</td>
</tr>
<tr>
<td>500-1000</td>
<td>87563</td>
<td>43%</td>
</tr>
<tr>
<td>1000-2000</td>
<td>21626</td>
<td>11%</td>
</tr>
<tr>
<td>Total</td>
<td>200966</td>
<td>100%</td>
</tr>
</tbody>
</table>
Stakeholders’ interests regarding the DP network

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receivers</td>
<td>Shipping costs</td>
</tr>
<tr>
<td></td>
<td>Accessibility</td>
</tr>
<tr>
<td></td>
<td>Availability</td>
</tr>
<tr>
<td>Logistics Providers</td>
<td>Delivery costs</td>
</tr>
<tr>
<td></td>
<td>Failed deliveries</td>
</tr>
<tr>
<td>Public Sector</td>
<td>External costs of LGVs</td>
</tr>
<tr>
<td></td>
<td>External costs of motorized collecting trips</td>
</tr>
<tr>
<td></td>
<td>Competitiveness and accessibility</td>
</tr>
</tbody>
</table>

Diagram:
- Receivers
- Logistics Providers
- Public Sector
- Shipping costs
- Accessibility
- Availability
- Delivery costs
- Failed deliveries
- External costs of LGVs
- Competitiveness and accessibility
case study: costs analysis
(assuming 100% usage)

Acceptable utility interval (30-45 DP)
Pending multi-objective analysis
Conclusions

DP are a solution that potentially can provide saving to the different stakeholders in the B2C e-commerce last mile. However, under which conditions and in what extent these benefits will appear?

Having access to modal choice preference of customers the model can be optimized to achieve the less total costs. What would be the optimal design for the delivery points network?

In practice, only 20% of the customers uses DP, web shops have the capability to increase this ratio by offering price incentives. However, if the prices of home deliveries vs delivery points are different which percentage of customer will use the delivery point network based on their willingness to pay for a home delivery service?

Different carriers networks overlap in the city, hampering the design of a optimal network, public authorities involvement may facilitate the deployment of optimal DP networks. In this sense, how public stakeholders may participate in the design and optimization of delivery points networks?
Thank you for your attention!

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