The carriers' carrier consolidation approach in sustainable urban logistics: Trials, benefits and future growth

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Hypotheses and Lead Questions

• Following hypothesis and questions build the starting point of this study:
  
  ➢ How to scale-up the use of electric vehicles instead of diesel vans to reduce air pollutants and carbon emissions?
  
  ➢ Is the carriers’ carrier approach to parcel deliveries business reducing the total freight distance for retail and e-commerce clients, by changing from outer London depots to centrally located logistics distribution centres in London?
  
  ➢ Is there a difference in consolidating deliveries of carriers and retail clients into one single van delivery trip to reduce the number of vehicle movements, associated congestion and air pollution?
Hypothesis, questions & objectives

• Initial **hypothesis**: The aim of this study was to demonstrate the benefits for public sector and private business, which are occurring when using a carriers’ carrier approach to grow consolidation and electric vehicles in city centers.

• The study assessed the potential for:
  - re-timing of e-commerce B2C activity, away from peak hours
  - re-routing of journeys away from the most congested roads and pollution hot spots
  - improving the logistics efficiency (time and distance per parcel)
  - reduction in emissions (CO$_2$, diesel particulates, NO$_x$)

• **Objective** of this study is to verify/falsify this hypothesis and answer the **question**: what are the benefits for public sector and private business, which are occurring when using a carriers’ carrier approach to grow consolidation and electric vehicles in city centers.
Approach and Methods

Freight efficiency optimisation
Climate Change mitigation
Internalise external costs
Improve business model
Minimise risks
Customer oriented

Conceptual and mathematical framework

Before-after Tests & trials

Calculations & validation

Impact assessment, data monitoring and reporting

Legacy (scale-up) & future scenario

With one Carrier
with Carriers
with Retailers

Conceptual and mathematical models for testing consolidated urban freight deliveries
Selection of businesses

- The London parcels delivery business **Gnewt Cargo** tested electric vehicles and logistics consolidation in Central London during the one-year trials from 1st July 2015 to 30 June 2016.
- The customers were carriers and retailers, paying the same price per parcel than for other subcontractors.

- **Carriers:**
  - Hermes
  - TNT UK
  - DX

- **Retailers:**
  - Farmdrop (Food e-commerce)
  - Emakers (e-commerce delivery business)
  - Spicers (leading uk wholesale office suppliers)
Central London Delivery Area

Location of Gnewt Cargo urban distribution centers used in 2015-2016

Typical geolocation of 100% electric delivery fleet on an average day
Trial: parcels delivery business
Gnewt Cargo in Central London

A last-mile logistic provider using a 100% ELECTRIC fleet and centrally located urban logistics consolidation centers.
Over 100 electric vehicles fleet

Delivered over 2,634,000 items 2016 zero emission
## Business Performance & Citylogistics Indicators


<table>
<thead>
<tr>
<th>KPI</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total parcels delivered</td>
<td>2,005,728</td>
</tr>
<tr>
<td>Average parcels delivered per week</td>
<td>38,572</td>
</tr>
<tr>
<td>Average parcels per van per day</td>
<td>151</td>
</tr>
<tr>
<td>Maximum parcels/van/day</td>
<td>668</td>
</tr>
<tr>
<td>Minimum parcels/van/day</td>
<td>1</td>
</tr>
<tr>
<td>Total miles driven</td>
<td>148,545</td>
</tr>
<tr>
<td>Average miles per van per day</td>
<td>11</td>
</tr>
<tr>
<td>Average metres per parcel</td>
<td>119</td>
</tr>
<tr>
<td>Average completion</td>
<td>87%</td>
</tr>
<tr>
<td>Total driver working time in minutes per parcel</td>
<td>6</td>
</tr>
</tbody>
</table>
Results: Main benefits

- **the carrier’s carrier approach**, by which the operator carries parcels for different carrier customers; this makes a difference in terms of logistics efficiency, high load factor, much shorter distance per parcel, much better performance in time and costs per parcel, when compared to a distribution system for a single client.

- **the use of the city centre depot as base for a fleet of electric vehicles**; this lowers emissions because it replaces polluting diesel trucks and vans with zero emission vehicles for all trips to the final recipients of the parcels, located in the most polluted areas of the city centre.

- **the use of diesel trucks at night** to bring the parcels to Central London during a low traffic, low emission time; this solution completely avoids the usual peak traffic time in the mornings on the congested arterial roads towards city centre.
Logistics distribution model, case 1

BEFORE starting using Gnewtcargo

AFTER starting using Gnewtcargo

Key:
- Diesel van round, peak
- Electric van round, peak
- Truck trip off-peak
## Logistics distribution model, case 1

### Energy use analysis of the Client B demonstration with and without Gnewt Cargo

<table>
<thead>
<tr>
<th></th>
<th>Without Gnewt: Diesel van</th>
<th>With Gnewt: Diesel truck</th>
<th>With Gnewt: Nissan eNV200</th>
<th>With Gnewt: Total</th>
<th>Without-with reduction %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distance km</strong></td>
<td>16436</td>
<td>595</td>
<td>14054</td>
<td>14649</td>
<td>11</td>
</tr>
<tr>
<td><strong>Electric energy used kWh</strong></td>
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<tr>
<td><strong>Conversion factor goe/kWh</strong></td>
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<td></td>
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<tr>
<td><strong>Total period litres</strong></td>
<td>1479</td>
<td>112</td>
<td></td>
<td>112</td>
<td>92</td>
</tr>
<tr>
<td><strong>Conversion factor goe/litre</strong></td>
<td></td>
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<tr>
<td><strong>Total energy use kgoe</strong></td>
<td>1250</td>
<td>95</td>
<td>213</td>
<td>307</td>
<td>75</td>
</tr>
<tr>
<td><strong>Results energy per km goe/km</strong></td>
<td></td>
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<tr>
<td></td>
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<tr>
<td><strong>Results energy per parcel goe/parcel</strong></td>
<td></td>
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</tbody>
</table>
Logistics distribution model, case 2

BEFORE starting using Gnewtcargo

AFTER starting using Gnewtcargo

Carrier logistics: single-carrier deliveries

Key
- Diesel van round, peak
- Electric van round, peak
- Truck trip off-peak

<table>
<thead>
<tr>
<th>Distances</th>
<th>Miles</th>
<th>Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average TNT delivery round per day before</td>
<td>73</td>
<td>117</td>
</tr>
<tr>
<td>Average Gnewt Cargo delivery round per day after</td>
<td>16</td>
<td>26</td>
</tr>
</tbody>
</table>
### Logistics distribution model, case 2

**Distance analysis**

<table>
<thead>
<tr>
<th>April 2016</th>
<th>Parcel units</th>
<th>Miles</th>
<th>Km</th>
<th>Km/parcel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gnewt Cargo (TNT international) delivery journeys</td>
<td>21,211</td>
<td>3,519</td>
<td>5,663</td>
<td></td>
</tr>
<tr>
<td>Average Gnewt (TNT international) delivery distance</td>
<td></td>
<td></td>
<td></td>
<td>0.267</td>
</tr>
<tr>
<td>Total TNT domestic deliveries</td>
<td>30,089</td>
<td>15,315</td>
<td>24,647</td>
<td></td>
</tr>
<tr>
<td>Average TNT domestic distance</td>
<td></td>
<td></td>
<td></td>
<td>0.820</td>
</tr>
<tr>
<td>Difference in %</td>
<td></td>
<td>77</td>
<td>77</td>
<td>67</td>
</tr>
</tbody>
</table>
Logistics distribution model, case 2
Overall analysis of efficiency & benefits

- Reduction in the number of vehicle trips
- Reduction in total kilometres travelled
- Reduction in NOx (in g NOx/parcel)
- Reduction in PM (in g PM10/parcel)
- Reduction in CO2 emissions (in CO2e/parcel)
- Reduction in total transport energy use
- Reduction in empty vehicle distance

% reduction

- Achieved Q1
- Target (final) Q1 (financial year 2016/2017)
Business & Citylogistics Efficiency
KPI: Metres per parcel delivered

1st July 2015 – 30 June 2016 (n = 13,358)
one point = average distance in metres per parcel for one delivery round = one driver, one van, one full working day, 7 days/week, full day distance, only paid (successful deliveries and collections) units counted

Potential for future efficiency improvements
100% = average distance in metres per parcel for one delivery round = one driver, one van, one full working day, 7 days/week, full day distance, only paid (successful deliveries and collections) units counted.
Business & Citylogistics Efficiency
KPI: Working time per parcel

1st July 2015 – 30 June 2016 (n = 13,358)
one point = average distance in metres per parcel for one delivery round =
one driver, one van, one full working day, 7 days/week, full day distance,
only paid (successful deliveries and collections) units counted

Time per parcel

Average 6 min. / parcel
Discussion

• Hypotheses verified?
• Questions answered?
• How other papers compare?
Final re-considering of initial project hypothesis, questions & objectives

• **Initial hypothesis**: Is it possible to scale-up the carriers’ carrier business model to obtain a better efficiency of urban distribution? *In theory yes*

• **Objective** of this study was to verify/falsify this hypothesis and answer the question:
  - what could be the future upscaling of urban distribution centers and electric vehicle use?
  - Using one specialist carrier and a fully market oriented business approach
Résumé:

• **Trials:** different business models were tested, corresponding to the different types of potential future clients

• **Results:** On most cases tested the distance driven are shorter, the emissions reduced, the daytime traffic decreased, the overall time spent per parcel decrease

• **Limitations:**
  – In one example, it was possible to reduce tailpipe emissions to zero. Only the lifecycle emissions of electric vans production and road surface dust &PM emissions remain.
  – It remains a very difficult business environment for an independent subcontractor, and to increase the market share
How other papers compare?

• Overview, review & prospective papers were essential otherwise the trials would have been meaningless

• No literature on testing different clients and business models benefiting citylogistics efficiency with an approach of real business trial data?

• Findings of this research obtain a distance reduction between 11% and 67%

• Decision makers and modelling authors working with assumptions (such as Rizet et al 2014) find an increase in total distance and costs due to smaller capacity vehicles and additional loading/unloading activities
Approaches required in future

• Work together with research, industry and public authorities to:
  - Find suitable, central consolidation centre locations at prices lower than the real estate market
  - Further test different business models with different clients, different cities
  - Introduce bigger electric vans and trucks
  - Obtain good quality before-after data