GREEN CITIES
GREEN LOGISTICS FOR GREENER CITIES
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DEMAND ANALYSIS FOR PICK-UP SITES AS AN ALTERNATIVE SOLUTION FOR HOME DELIVERY IN THE BRAZILIAN CONTEXT

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David José Ahouagi Vaz de Magalhães
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**Introduction**

*Pick-up sites* are physical facilities where consumers can retrieve products purchased over the internet or by telephone.

This solution allows the use of a distribution network with storage at a manufacturer or distributor, resulting in lower logistical costs. In addition, since the pickup of the product is carried out by the customer, part of the last mile distribution expenses is avoided for the carriers, whereas the consumers are also benefited because they would not have to wait for the delivery at home and could receive the purchase earlier.
Agenda

- Introduction
- Motivation and Reasons
- Objectives
- Pick-Up Sites
- Methodology
- Discrete Choice Model
- Results and Discussion
- Conclusions
- References
Motivation and Reasons

• E-commerce is booming.
Motivation and Reasons

- The continuous expansion of e-commerce drives the demand for home delivery and therefore the number of urban freight vehicles. In this context, the problems related to traffic and urban distribution are aggravated, directly affecting the efficiency of transport companies.
Motivation and Reasons

- Brazil has continental dimensions, with a very pulverized population and a transport infrastructure in non-ideal conditions. All of this raises freight costs, especially for in-home deliveries over the last mile.

- The cost to go through the last mile of these deliveries can represent from 13% to 75% of the total logistics cost, especially in regions where logistics sprawl occurs.
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Land use management

Access Conditions

Traffic Management

Information & Surveillance

Disruptive Solutions

Public Infrastructure

Transfer Points

Parking

Building Regulations

Spatial Restrictions

Time Restrictions

Delivery Routes

Information

IT

City terminals
Outskirts logistic centers
Use of public parking lots
Intermodal Terminals
Logistic improvement of terminals

Use of private parking lots
Parking space planning

Planning of Hub Areas
Load/unload interfaces

Access according to weight and volume
Closing the center to private traffic
Street blocking allowance
Road pricing

Night deliveries
Access time Windows
Adequate rotation in load zones

Optimized Route
Carrier classification
Pick-Up Points

Customer service support
Loading / unloading zone surveillance

Deliveries by Drones
Crowdshipping
Autonomous vehicles
Objectives

Considering the following purposes of urban logistics:

- Improve integrated planning for urban freight distribution;
- Attend the growing and settled trend for deliveries from purchases mainly through the internet (e-commerce);
- Low inventory levels and Just-in-Time deliveries;
- Minimize logistic cost;
- Minimize noise, pollution, energy expenditure and traffic conflicts.

The aim of this exploratory study is to use a binary discrete choice model to analyze how consumers’ willingness of using pick-up sites in Brazil would be influenced by some attributes such as: freight cost, delivery time, waiting time and accessibility to the pick-up sites.
**Pick-Up Sites**

- They have extended working hours and/or work 24 hours 7 days a week;
- They allow the customer to choose a pick-up site of their preference between the network of partners, and collect when desired;
- They are located in places of easy access and safe;
- They allow the tracking of the order and sends a message when the product is available;
- They allow electronic signature and the collection can be carried out by any person (upon presentation of the password provided in the purchase)
- It is designed for orders from small to medium volume (up to 1m width x 1m length x 1m height) and weight (up to 30kg).
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Data Collection: Stated Preference Technic

It was applied a stated preference survey that presented for each interviewee 6 situations out of the 18 that compose the sample plan, always formed by the combination of different levels of the 4 attributes studied (freight cost, delivery time, delivery waiting and accessibility up to the pick-up sites).

Then, from the chosen alternative was applied a method of discrete choice allowing to infer under what conditions the interviewee would be prone to use the solution by pick-up sites.

In addition, a socioeconomic form was used to know the interviewee's profile and behavior regarding online purchases.
**Stated Preference Survey Layout:**

<table>
<thead>
<tr>
<th>CHARACTERS</th>
<th>Home Delivery</th>
<th>Delivery at Pick-Up Site</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Freight Cost</strong></td>
<td>Default cost</td>
<td>Same freight cost between home delivery</td>
</tr>
<tr>
<td><strong>Delivery Time</strong></td>
<td>Default delivery time</td>
<td>48 hours shorter than the home delivery period</td>
</tr>
<tr>
<td><strong>Need to Wait</strong></td>
<td>Yes, throughout a whole day</td>
<td>No</td>
</tr>
<tr>
<td><strong>Extra Detour</strong></td>
<td>No</td>
<td>No, pick-up site is located along the daily route</td>
</tr>
</tbody>
</table>

After analyzing the situation, the interviewee should choose a delivery alternative (conventional home delivery or at pick-up site).
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The utility is modeled as a random variable to reflect the subjectivity of each respondent. The systematic component $V_{ij}$ of the utility function associating alternative $j$ with individual $i$ in the set of options is given by:

$$V_{ij} = \beta_0 + \beta_1 X_{1j} + \beta_2 X_{2j} + ... + \beta_m X_{mj}$$

The discrete choice model most used to estimate utility function parameters in transport research is Logit (Ben-Akiva & Lerman, 1985). The following probability function represents its functional form for the multinomial case:

$$P_{ij} = \frac{e^{V_{ij}}}{\sum_{k=1}^{n} e^{V_{ik}}}$$
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The stated preference survey was conducted entirely online in Brazil during the months of November and December of 2017 and January of 2018. Altogether, 458 individuals responded to the survey. Of this total, 451 respondents answered the survey completely (totaling 2,700 observations). Another 7 people did not fully complete the survey.
Interviewee Profile - Results

• Only 33 (7.3%) had never bought through the internet.
• Most people 130 (31%) usually buy through the internet every 2-4 months.
• Most respondents indicated an average ticket of R $ 100,00 to R $ 500,00 (52%) while 29% reported that they spend on average R $ 50,00 to R $ 100,00, in other words, 81% usually spend between R $ 50,00 to R $ 500,00 per purchase.
• The most purchased products were Fashion and Accessories, Electronics, Telephony and Mobile items.
The probabilities of using the pick-up site solution were calculated using the software Biosim (Bierlaire, 2016). The results, obtained from the general model, are illustrated in Table above, compiling the choice probability information according to different possible attribute and level scenarios and the results of the stated preference survey.

<table>
<thead>
<tr>
<th>#</th>
<th>Scenarios Analyzed</th>
<th>Choice Probability</th>
<th>% Survey Home Delivery</th>
<th>% Survey Pick-Up Site Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>- Freight cost is 50% cheaper than freight for home delivery</td>
<td>92.03%</td>
<td>4.00%</td>
<td>96.00%</td>
</tr>
<tr>
<td></td>
<td>- Delivery time to the pick-up site is 48 hours shorter than the home delivery period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pick-up site is located along the daily route (between home, work, school, shopping, public transportation stations etc) and no detour is required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>- Freight cost is 50% cheaper than freight for home delivery</td>
<td>86.53%</td>
<td>8.00%</td>
<td>92.00%</td>
</tr>
<tr>
<td></td>
<td>- Delivery time to the pick-up site is 24 hours shorter than the home delivery period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pick-up site is located along the daily route (between home, work, school, shopping, public transportation stations etc) and no detour is required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>- Freight cost is 25% cheaper than freight for home delivery</td>
<td>83.37%</td>
<td>7.30%</td>
<td>92.70%</td>
</tr>
<tr>
<td></td>
<td>- Delivery time to the pick-up site is 48 hours shorter than the home delivery period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pick-up site is located along the daily route (between home, work, school, shopping, public transportation stations etc) and no detour is required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>- Freight cost is the same between home delivery or delivery to the pick-up site</td>
<td>50.00%</td>
<td>50.70%</td>
<td>49.30%</td>
</tr>
<tr>
<td></td>
<td>- Delivery time to the pick-up site is 48 hours shorter than the home delivery period</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Access to the most convenient pick-up site is within a radius of 2.0 to 5.0 kilometers, it means, requires a detour between 2.0 to 5.0 kilometers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>- Freight cost is the same between home delivery or delivery to the pick-up site</td>
<td>50.00%</td>
<td>50.00%</td>
<td>50.00%</td>
</tr>
<tr>
<td></td>
<td>- Delivery time is the same between home delivery or delivery to the pick-up site</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pick-up site is located along the daily route (between home, work, school, shopping, public transportation stations etc) and no detour is required</td>
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</tr>
</tbody>
</table>
Stated Preference Survey - Discussion

It is clear, even without a complex statistical analysis, that in situations where the cost of delivery was lower, the adhesion of new customers to the pick-up sites increased considerably.

We highlight the first situation where 96% of the interviewees preferred delivery through pick-up points. In this situation we all have attributes favorable to the use of pick-up point delivery.

Analyzing the opposite situations, with greater rejection to the pick-up sites, we have in common that all situations present a scenario of equality in the freight costs and need of extra displacement by the consumer until a pick-up sites.
Comparison of Distribution Costs

Considering the hypothetical scenario where fixed costs and rates for variable costs per kilometer rotated would not be changed and taking the pick-up site solution and its optimized route into account, the numbers above show that a reduction of the daily distance covered results in an average total cost of **12.8% lower** than the conventional home delivery cost.

<table>
<thead>
<tr>
<th>Custos/Veículos</th>
<th>Fiorino Furgão - 1.3 Flex</th>
<th>Kombi Furgão - 1.4 Total Flex 8V</th>
<th>Fiat Ducato Maxi Cargo Furgão</th>
<th>Daily 45 S17 Gran Furgone</th>
<th>Daily Van GNV</th>
<th>Sprinter Furgão 311 CDI Street</th>
<th>Hyundai HR</th>
<th>Kia Bongo</th>
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<tbody>
<tr>
<td>Quilometragem Mensal</td>
<td>678</td>
<td>678</td>
<td>678</td>
<td>678</td>
<td>678</td>
<td>678</td>
<td>678</td>
<td>678</td>
</tr>
<tr>
<td>Quilometragem Mensal (acréscimo de 10%)</td>
<td>745,8</td>
<td>745,8</td>
<td>745,8</td>
<td>745,8</td>
<td>745,8</td>
<td>745,8</td>
<td>745,8</td>
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</tr>
<tr>
<td>Custos Fixos Mensais</td>
<td>5134,5</td>
<td>5345,2</td>
<td>6394,9</td>
<td>6270,0</td>
<td>6683,6</td>
<td>6588,6</td>
<td>10636,4</td>
<td>10756,3</td>
</tr>
<tr>
<td>Custos Variáveis por KM</td>
<td>0,494</td>
<td>0,586</td>
<td>0,817</td>
<td>0,869</td>
<td>0,819</td>
<td>0,872</td>
<td>0,738</td>
<td>0,749</td>
</tr>
<tr>
<td>Custo Total (Pontos de Coleta)</td>
<td>5469,5</td>
<td>5742,5</td>
<td>6948,9</td>
<td>6859,2</td>
<td>7191,9</td>
<td>7179,7</td>
<td>11136,9</td>
<td>11264,2</td>
</tr>
<tr>
<td>Custo Total (Entrega Convencional)</td>
<td>6194,7</td>
<td>6602,5</td>
<td>8148,4</td>
<td>8135,1</td>
<td>8394,3</td>
<td>8459,5</td>
<td>12220,5</td>
<td>12363,9</td>
</tr>
<tr>
<td>Custo por KM rodado (Pontos de Coleta)</td>
<td>8,067</td>
<td>8,470</td>
<td>10,249</td>
<td>10,117</td>
<td>10,608</td>
<td>10,590</td>
<td>16,426</td>
<td>16,614</td>
</tr>
<tr>
<td>Custo por KM rodado (Entrega Convencional)</td>
<td>2,880</td>
<td>3,070</td>
<td>3,790</td>
<td>3,790</td>
<td>3,910</td>
<td>3,940</td>
<td>5,690</td>
<td>5,760</td>
</tr>
<tr>
<td>Custo por Kg (Pontos de Coleta)</td>
<td>0,257</td>
<td>0,270</td>
<td>0,326</td>
<td>0,322</td>
<td>0,338</td>
<td>0,337</td>
<td>0,523</td>
<td>0,529</td>
</tr>
<tr>
<td>Custo por Kg (Entrega Convencional)</td>
<td>0,294</td>
<td>0,314</td>
<td>0,387</td>
<td>0,387</td>
<td>0,396</td>
<td>0,402</td>
<td>0,581</td>
<td>0,588</td>
</tr>
</tbody>
</table>
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Conclusions

• This survey has shown that the pick-up site delivery solution is feasible, as long as it shows additional benefits to consumers, when compared to conventional home delivery solution.
• It can be concluded that there is an audience interested in alternative delivery solutions.
• The main benefit to carriers would result from a more efficient allocation of vehicles in terms of cargo transported due to the greater concentration of deliveries to a smaller number of points (with the pick-up sites), that is, more consolidated loads. Therefore, it would be possible to use fewer vehicles to carry out the same amount of deliveries made than in the traditional door-to-door service.
• The location of the pick-up sites is crucial to the success of this delivery solution. The presence of pick-up points in places of high agglomeration, such as supermarkets, subway and bus stations, shopping malls and large stores is recommended. The pick-up sites can also act as a catalyzer, increasing the sales in the location, since when collecting a product the consumer may end up buying in the store.
• Therefore, the commercial partnership with these establishments is fundamental and can be beneficial for both sides.
Thank You
Dziękuję
Obrigado!

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<th>Tópicos ou Contribuições</th>
<th>Principais Referências</th>
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<tbody>
<tr>
<td><strong>Distribuição Urbana de Mercadorias</strong></td>
<td>Conceito</td>
<td>Dablanc (2007)</td>
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<td></td>
<td>Fluxo de Mercadorias</td>
<td>Portal (2003)</td>
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<td>Logística Urbana</td>
<td>Taniguchi (2001)</td>
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<td>Infraestrutura de Armazenamento</td>
<td>Lacerda (2000)</td>
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<td>Agentes na Distribuição Urbana</td>
<td>Dutra (2004)</td>
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<td>Provedores Logísticos</td>
<td>Fleury (1999)</td>
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<td>Interações Logísticas</td>
<td>Visser &amp; Nemoto (2001)</td>
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<td><strong>Modalidades de Entrega</strong></td>
<td>Entregas à Domicílio</td>
<td>Browne (2001)</td>
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<td>Soluções Alternativas</td>
<td>Allen (2017)</td>
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<td>Oportunidades (City Logistics)</td>
<td>Jaller (2015)</td>
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<td>Last Mile Cost</td>
<td>Gevaers (2011)</td>
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<td>Problemas nas Entregas Convencionais</td>
<td>Verdict Research (2001)</td>
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<td><strong>Pontos de Coleta (Pick-Up Points)</strong></td>
<td>Conceito</td>
<td>Augereau &amp; Dablanc (2008)</td>
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<td>Estações de Coleta Automática (Lockers)</td>
<td>Oliveira (2015)</td>
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<td>Pontos de Coleta (Click and Collect)</td>
<td>Holguin-Veras (2015)</td>
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<td>Comparativo entre Modalidades de Entrega</td>
<td>Morganti (2014)</td>
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<td>Panorama da utilização dos Pick-Up Points</td>
<td>Verdict Research (2016)</td>
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<tr>
<td><strong>Metodologia Científica</strong></td>
<td>Modelo de Mapeamento das Motivações</td>
<td>Junjie (2013)</td>
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<td></td>
<td>Tipologia da Pesquisa</td>
<td>Gil (2002)</td>
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<td></td>
<td>Pesquisa de Preferência Declaráda</td>
<td>Kroes &amp; Sheldon (1988)</td>
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<td><strong>Análise Estatística</strong></td>
<td>Testes Estatísticos</td>
<td>Neder (2010)</td>
</tr>
<tr>
<td></td>
<td>Modelo de Escolha Discreta</td>
<td>Ben-Akiva &amp; Lerman (1985)</td>
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