

# **Alternative Locations to an Urban Distribution Center (UDC): Case Study of Lisbon's Downtown**

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## **ABSTRAT**

In recent years we verify that the population is gathered around big cities searching for better life conditions and work. In Europe the settlement of cities is around 80% which implies higher consumption thus increasing the need for distribution of goods in urban areas, leading to traffic congestion, pollution and noise. Lisbon is no exception, especially in the historical and touristic district of Baixa Pombalina, the downtown, which feels the pulse of the vibrant capital of the country, showing the same environmental impacts. It is therefore necessary to apply management measures to minimize the above-mentioned impacts, in particular environmental, achieving also more safety for pedestrians and visual clearance, as well to add value to the logistics operations in order to engage voluntarily those key players in the solution. It is well known that we cannot solve all problems with a single solution, I sought to reduce a significant amount of traffic and since the restoration (HORECA channel) represents about 25% of Baixa Chiado establishments, I chose to find solutions for the distribution of beverages. I sought to identify the relevant and fundamental factors to define alternative locations to an Urban Distribution Center (UDC), analyzing the similarities and differences in the perspectives of different stakeholders, as the public and the private sectors. I tried also to identify specific locations for the implementation of this UDC, given the constraints or availability in the area or at the adjacent areas.

**Keywords:** Urban Distribution Center, Location Factors, Beverages Distribution, HORECA Channel, Lisbon

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## **1 - INTRODUTION**

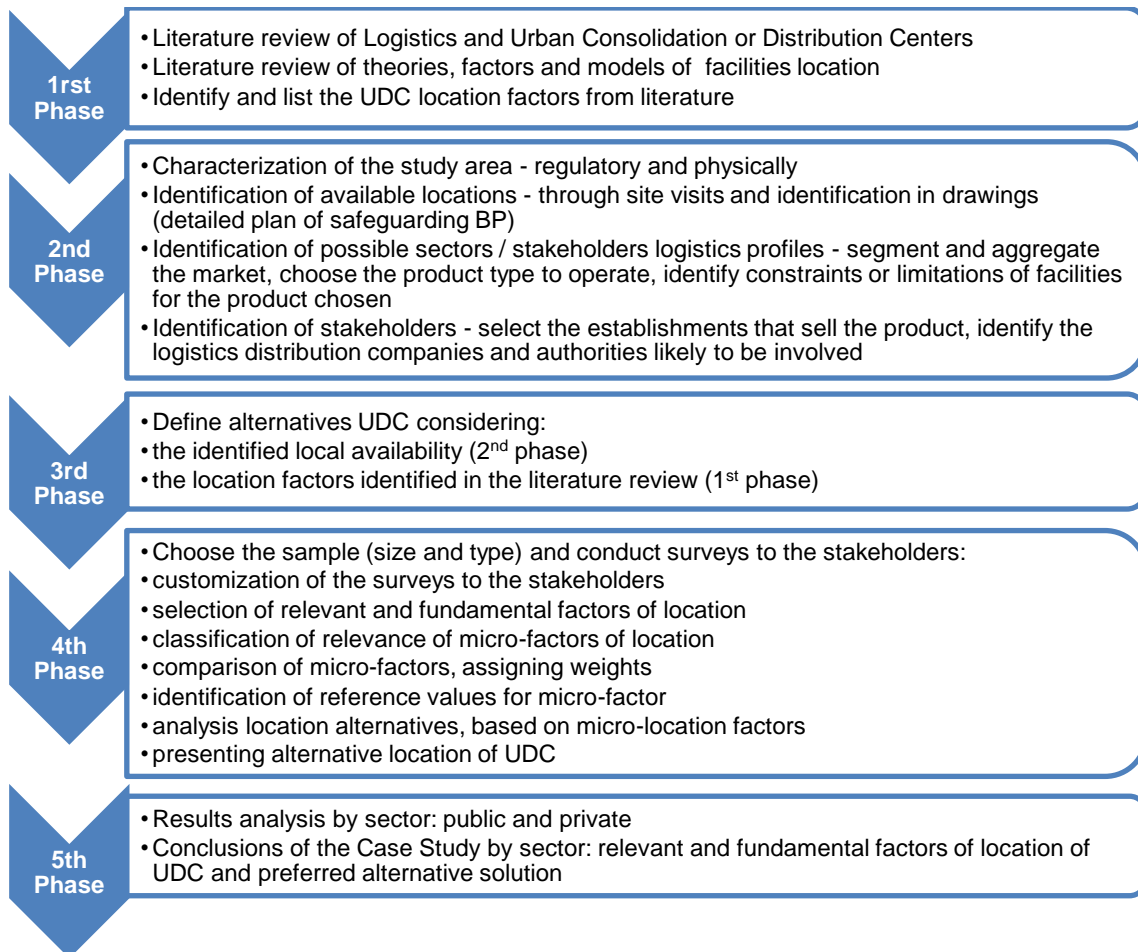
### **1.1 Context**

The growth in demand for goods and transport in urban areas, mainly by road, creates congestion and other negative impacts (pollution and noise) that are not compatible with current expectations of society (Taniguchi 2012) (Cherrett et al. 2012) (Macário & Reis 2009), particularly as regarding to sustainability. The urban freight transport of goods constitute, on several empirical studies, about 6 to 18% of all urban trips, and represents 19% of the energy consumed and 21% of CO<sub>2</sub> emissions (Russo & Comi 2012).

## 1.2 Objectives and Methodology

My purpose was to identify which were the relevant and fundamental criteria to locate an Urban Distribution Center (UDC), for beverages distribution in Lisbon's downtown, and that would reach the needs of various stakeholders.

The methodology followed the next 5 stages, represented on the scheme (Scheme 1):



**Scheme 1 – Problem analysis methodology**

## 2 – STATE OF ART

### 2.1 Urban Distributions Centers

UDC has different meanings, sometimes vague and ambiguous, so BESTUFS considers appropriate to describe UDC as: "a logistics device located relatively close to the geographical area you want to serve, in which various logistics companies deliver goods destined for this area, from which consolidated deliveries are made and added value" (BESTUFS 2006, p.5).

For twenty years the use of UDC was considered a popular measure of urban logistics (Verlinde et al. 2012). Although many of the projects have not progressed and many of the UDC in operation were closed for various reasons such as reduced demand for services; dissatisfaction concerning service levels; nonexistent autonomy of financing of operations; unrealistic

calculation of the UDC benefits (van Duin et al. 2010) and also: unwillingness to cooperation between stakeholders or to share relevant information, fear of loss customers to the competition (BESTUFS 2003). Huschebek & Allen (2005), in (BESTUFS 2003), identified as major advantages: better planning of logistics operations; better inventory control, product availability and customer service (flexibility and reliability of deliveries); switch easily between push and pull logistics. And the main disadvantages: the possibility of high installation costs (especially the real estate (land)) or of the operations; operational complexity and difficulty in handling different goods, due to the specific requirements of products (as dangerous goods, frozen products). The benefits to the public sector are: lower emissions and more efficient urban deliveries, resulting from the reduction of the number of trips; reducing traffic associated to supply vehicles. For the private sector the benefits: economic gains for additional services; participation in cooperation; attract new customers (BESTUFS 2003).

## **2.2 Facilities Location**

### **2.2.1 Theories and Interests**

Until 1960, the theories of location have been dominated by economists, geographers or regional development researchers as: Richard Cantillon (1755), Von Thünen (1826), Albert Weber (1909), Walter Christaller (1933), August Lösch (1940), François Perroux (1955), Albert Hirschman (1958). Their models tend to be either geometric or extensive computational methods to locate facilities in the two-dimensional plane (ReVelle & Eiselt 2005). The 60 and 70 decades of the twentieth century, were fertile in theoretical and operational contributions to land intraurban, namely land use organization, the importance of social elements that affect the decision-making stakeholders, and their identification of a suitable location rather than optimal. Stand out William Alonso (1964), Harry Richardson (1978) (Mafra & Silva 2004) (Santos & Ribeiro 2009), S. Hakimi (1964, 1965) and Ronald Ballou (1968). There are two stages in the evolutionary process of location theories (Ferreira 2011): 1.the period of descriptive theories with two distinct schools of thought: 1.a) the classical theories of location (models from Von Thünen (1826) to Lösch (1940)); 1.b) theories aimed at the development (as Perroux (1955) and Hirschman (1958)); 2.the new era that comes after Dantzig (1963), supported by developments in information technology and based on mathematical models.

Despite all stakeholders share one common goal "freight goods in urban areas", their individual interests often collide. The private sector seeks to: minimize transport costs in order to be optimized the supply chain management costs, one segment that can be affected by policy measures taken by the administrators (Anand et al. 2012); safety, celerity and benefits of incentives (Mazzarol & Choo (2003) in (Morgado 2005)). The public sector, by contrast, has the overall interest of reducing the total social cost, including six specific objectives: 1) Economic; 2) Efficiency; 3) Road Safety; 4) Environment; 5) Infrastructure Management; 6) Urban Structures (for more detail see Ogden (1992)). Differences in perspectives produce intrinsically different criteria selections as well as different weights of criteria (Anand et al. 2012).

According to van Druin et al. (2007), in (Anand et al. 2012), to understand the traffic problems is inevitable required to understand the logistics processes with a multi-level approach, multi-dimensional and multi-disciplinary.

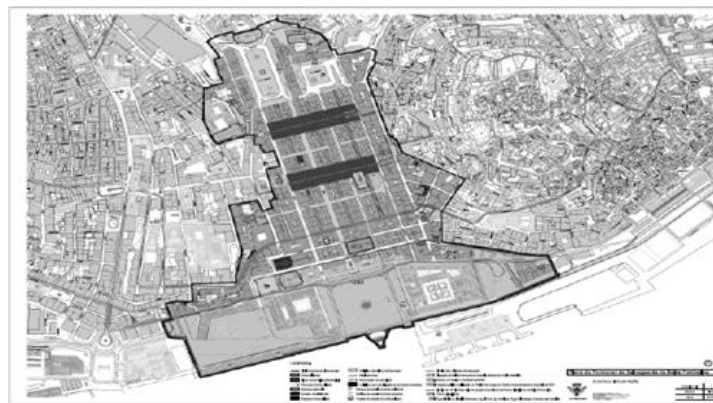
### 2.2.2 Location Factors

**Transport costs** and **transport distances** are some of the **most mentioned factors in literature** when dealing with the facilities location. From the several factors found in literature (Taniguchi 2001 in (Cândido 2010)) (Morgado 2005), (Freese 1994 in (Morgado 2005)), (Reis 1999 in (Morgado 2005)), (Fontanillas 2008), (van Duin et al. 2010), (Prologis 2013) I chose to analyze this **22 location factors**: Environmental impacts; Access roads; Demand; Accessibility conditions; Labor; Time; Socioeconomic impacts; Quality of institutional relations; Quantity of institutional relationships; Support services to the Community; Distribution conditions; Reliability and service requirement; Governance; Access distance; Safety; Existence of institutional relationships; Different actors and multiple interests; Support services to the Community; Demand; Mobility; Real estate and construction site conditions; Facilities' characteristics.

## 3 – CASE STUDY

### 3.1 Characterization

The downtown (Baixa of Lisboa), mostly with an orthogonal grid and reduced altimetric variety (slopes between 0-3%), is located in the historical center (Figure 1):



**Figure 1 - Limits of Baixa (source: Safeguard Detailed Plan of Baixa (2011))**

The current land use are: 70% of non-food shops, 25% of catering establishments (restaurants, coffee shops, bars), 5% of supermarkets and grocery stores (Census 2011 in (TIS.PT 2012)). The road network has single circulation directions, with footpaths and exclusive BUS lane, which restrict the car traffic and hamper the operations of loading and unloading (L/UL). The parking is carried out on public roads (there are 162 places reserved for L/UL operations) and in underground parks with limited height. The most loaded roads in this area are Rua da Alfândega and Rua do Ouro that recorded: 970 and 659 vehicles/hour (on morning); 907 and 624 vehicles/hour (on afternoon), respectively (data from GERTRUDE system, 2014).

### 3.2 Data

Facts: 1.the catering establishments are 25% of the commercial establishments in the area; 2.there were many beverages trucks circulating at different hours of the day on the area. Concerning those facts, I looked for an efficient solution that could: reduce installation and maintenance costs, arouse the interest and adherence a significant percentage of users. I also looked for a facility that would not require cold or controlled temperature nor would do cross-docking of perishable products. The alternative solutions that were analyzed were: Martim Moniz, Campo das Cebolas and Cais do Sodré (Figure 2):

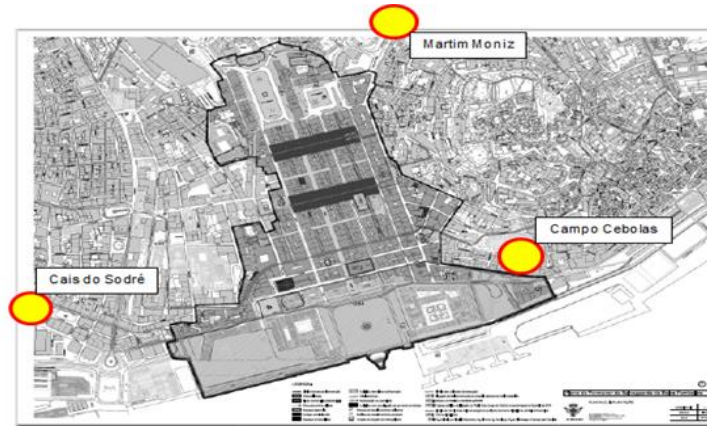


Figure 2 - Location of the three UDC alternative solutions: Martim Moniz, Campo das Cebolas e Cais do Sodré

I decided that I would analyze exclusively the beverages distribution on HORECA channel (hotels, restaurants, coffee shops). I looked for opinions of different supply chain stakeholders: producers; wholesalers; logistics distributors; commercial establishments (hotels, restaurants, coffee shops/snack bars, bars); commercial association of Baixa; board of St.<sup>a</sup> Maria Maior parish; from the town hall (CML): council for the mobility and infrastructure; traffic management division; municipal directorate for mobility and transport, and the public company EMEL (department of mobility), in a total of **24 interviewers** as indicated in the figure (Figure 3):

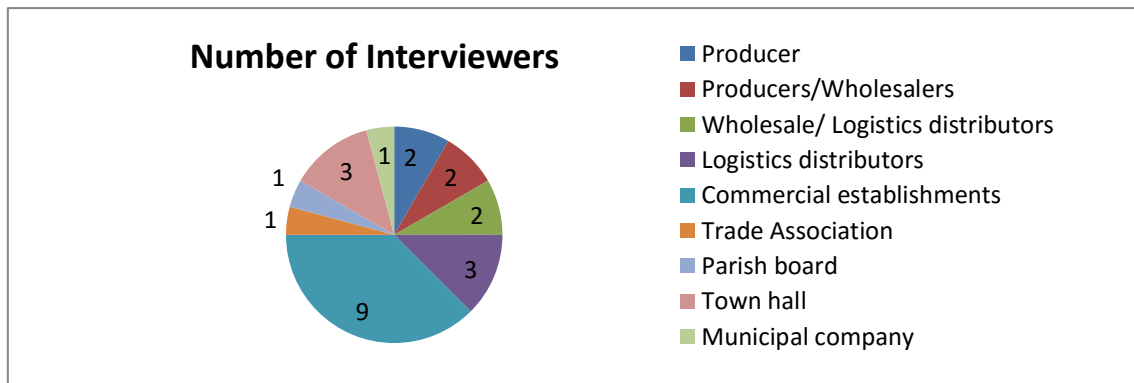


Figure 3 – Number of interviewers by function in the supply chain

I chose a diversified sample of 9 commercial establishments, ranging from five star hotels to family restaurants and renowned chefs restaurants, and also undergoing to small snack bars that had the following characteristics (Table 1):

| NUMBER OF SUPPLIERS<br>(OF THE 9 ESTABLISHMENTS)  | DELIEVERY FREQUENCY<br>(OF THE 9 ESTABLISHMENTS)  |
|---|---|
| <ul style="list-style-type: none"> <li>• 2 (2 establishments)</li> <li>• 4 (1 establishment)</li> <li>• 5 (1 establishment)</li> <li>• 6 (2 establishments)</li> <li>• 10 (2 establishments)</li> <li>• 13 (1 establishment)</li> </ul> | <ul style="list-style-type: none"> <li>• 1 time/week (3 establishments)</li> <li>• 2 time/week (3 establishments)</li> <li>• 3 time/week (2 establishments)</li> <li>• 1 time/biweekly (1 establishment)</li> </ul> |

**Table 1 - Number of suppliers and Delivery frequency of the commercial establishments (HORECA)**

The remaining supply chain stakeholders were (are) solid companies operating for many years in the logistics sector and beverages distribution in Portugal, some with international projection or being market leaders. The companies contacted were; SCC/Novadis, UNICER (producers); DIAGEO, PERNOD-RICARDI (producers/wholesalers); GARCIAS, SOLBEL (wholesale/logistics distributors); LOGIC, LUÍS SIMÕES, URBANOS (logistics distributors).

The information was collected through semi-structured interviews with a pre-established script, with open questions, closed and semi-closed, structured into four distinct groups: I. Identification; II. Customized characterization of stakeholders operation in downtown and their interests by UDC; III. Factors of UDC location; IV. Selection of alternative locations.

## **4 - RESULTS**

### **4.1 Results and Analysis**

In this chapter I will analyze in detail exclusively the issues about factors and micro-factors of location and the selection of alternative locations for the UDC in Lisbon's downtown.

### **4.2 Factors of Location**

#### **4.2.1 More relevant factors**

I presented a 22 factors list (rather mentioned in the literature), to the private sector (excluding commercial establishments) and to the public sector and asked "What are the five factors considered most relevant when choosing the UDC location?". The rate scale was: "Fundamental / Relevant / Not Relevant" and the answers were (Table 2):

| <b>CLASSIFIED AS:</b>   | <b>RESULTS</b> | <b>PRIVATE SECTOR</b>   | <b>PUBLIC SECTOR</b>   |
|---|----------------|---|--|
| <b>"Relevant plus Fundamental"</b><br>for the largest number of answers<br>(and to a percentage > = 50% of answers) |                | <ul style="list-style-type: none"> <li>• Costs</li> <li>• Access distance</li> <li>• Infrastructures</li> </ul>   | <ul style="list-style-type: none"> <li>• Environmental impacts</li> <li>• Access roads</li> <li>• Demand</li> <li>• Accessibility conditions</li> </ul>  |
| <b>"Not relevant"</b><br>to 90 to 100%  |                | <ul style="list-style-type: none"> <li>• Governance</li> <li>• Environmental impacts</li> <li>• Socioeconomic impacts</li> <li>• Existence of institutional relationships</li> <li>• Quality of institutional relationships</li> <li>• Quantity of institutional relationships</li> <li>• Mobility</li> <li>• Accessibility conditions</li> <li>• Reliability and service requirements</li> <li>• Real estate and construction site conditions</li> </ul> | <ul style="list-style-type: none"> <li>• Labor</li> <li>• Time</li> <li>• Socioeconomic impacts</li> <li>• Quality of institutional relations</li> <li>• Quantity of institutional relationships</li> <li>• Support services to the Community</li> <li>• Distribution conditions</li> <li>• Reliability and service requirement</li> </ul>   |
| <b>"Not relevant"</b><br>for about 80%  |                | <ul style="list-style-type: none"> <li>• Time</li> <li>• Support services to the Community</li> </ul>   | <ul style="list-style-type: none"> <li>• Governance</li> <li>• Access distance</li> <li>• Safety</li> <li>• Existence of institutional relationships</li> <li>• Different actors and multiple interests</li> <li>• Support services to the Community</li> <li>• Demand</li> <li>• Mobility</li> <li>• Real estate and construction site conditions</li> <li>• Facilities' characteristics</li> </ul> |

**Table 2 - Classification of the most relevant or fundamental factors for private sector (except commercial establishments) and public sector**

I did not present the 22 factors list to the commercial establishments therefore I did an open question "What are the factors considered most relevant when choosing the UDC location?" and the answers were (Table 3):

| <b>RELEVANT FACTORS</b>              | <b>NR. ANSWERS</b> |
|--------------------------------------|--------------------|
| Proximity to the customer            | 3                  |
| Surface of the facility              | 3                  |
| Accessibility conditions             | 3                  |
| Costs                                | 4                  |
| Reliability and service requirements | 2                  |

**Table 3 - Most relevant factors of the UDC location for commercial establishments (open question)**

To the trade association I provided the list of 22 factors, and were also pointed out as critical or important the following factors: distance access (proximity to the customer); costs and reliability and service requirements.

#### 4.2.2 Micro-factors

I asked to the private (except to the commercial establishments) and public sectors to range the relevance of four micro-factors:

- Proximity to the customer;
- Proximity to main roads;
- Surface of the facility
- Real estate (land).

The scale was: Fundamental (F) / Relevant (R) / Few Relevance (FR) / Without Expression (W/E). The answers are at the next figures (Figures 4 and 5):

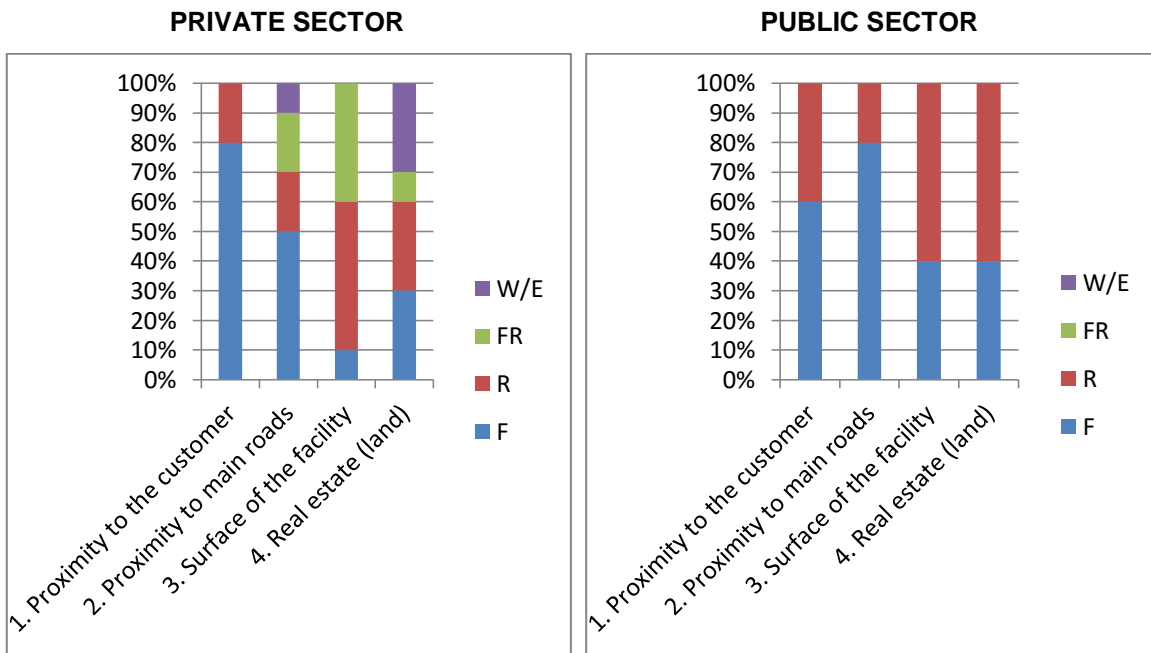


Figure 4 - Relevance rating of micro-factors of UDC location for the private sector (except for commercial establishments)

Figure 5 - Relevance rating of micro-factors of UDC location for the public sector

#### 4.2.3 Selection of alternative solutions

I requested the ranking of the three alternative solutions according to their preferences, attending the micro-factors (chapter 4.2.2). So, it was considered as the location:

- Closer to the customer - Martim Moniz (50%)
- Closer to main roads – Campo das Cebolas (60%)



### 4.3 Conclusions of Case Study

There is no consensus of preference ("Relevant plus Fundamental") of location factors, among private sector (cost, distance access, basic services facilities) and public sector (environmental impacts, access roads, demand, affordability conditions). In fact, although all actors share a common goal, which is the "freight in urban areas", their individual interests often collide (Anand et al. 2012). This different interests was then expected given the different perspectives (on concordance with the literature), as the private sector interests are: minimizing transport costs and celerity (Anand et al. 2012) (Mazzarol & Choo (2003) in (Morgado 2005)) and as the public sector are: environment and urban infrastructure (access roads).

On the public sector the social issues (socioeconomic impacts and support services for the community) were considered as "not relevant", contrary to what would be expected. The relevant factors indicated by the commercial establishments and the trade association (costs, proximity to the customer (distance access)) coincide with the other elements of the supply chain (private sector) and also, partially, with the public sector (access conditions), and also the "reliability and service requirements" were considered relevant.

On the micro-factors (1.proximity to the customer; 2.proximity of main roads; 3.surface of the facility; 4.real estate (land)) it was found that the "surface of the facility", a micro-factor of "facilities' characteristics" was not considered important from the perspective of the operator of a UDC, contrary to what I would expect.

It was concluded that the location "closest to the client" was Martin Moniz (50%) and the location "nearest to main roads" was Campo das Cebolas (60%).

## 5 - CONCLUSIONS

Road congestion problems and its negatives environmental impacts are stated in Lisbon's downtown. I wanted to identify the relevant factors for the location of an Urban Distribution Center (UDC), for the distribution of beverages on the HORECA channel (25% of the commercial establishments in the area). First, it was necessary to review the literature of: urban distribution centers and facilities location (theories, interests and location factors). Then I characterized the study area and the sample of the interviewees. After I indicated the alternative solutions to be selected by the interviewees: Martim Moniz, Campo das Cebolas, Cais do Sodré.

As conclusion **there is no consensus on relevant factors of location of a UDC**, given the distinct perspective of public and private sector (except the case of commercial establishments). The **private sector** indicates as relevant and fundamental factors: cost, distance access, basic services facilities and the **public sector** indicates: access roads, demand, affordability conditions. Opinions also differ between entities or businesses with similar functions in the

supply chain. The relevant factors for the **commercial establishment** (costs, proximity to the customer (distance access)) coincide with other supply chain from the private sector and also, partially, with the public sector (access conditions). The "reliability and service requirements" are also considered relevant by the commercial establishments.

The "**closest to the client**" was Martim Moniz (50%) and the "**nearest to main roads**" was Campo das Cebolas (60%).

Thus, the objective has been fully achieved, however, they were identified some limitations as the size of the sample and non-quantified costs of the analyzed solutions. So it would be interesting to:

- Consolidate the sample: increasing the number of interviewers, promoting round tables (Delphi method) and introducing statistical techniques;
- Quantify the demand;
- Quantify the costs associated to a UDC solution;
- Do an economic feasibility study of a UDC solution.

However, this type of solution to be implemented will require an extreme political will and a cultural change in the private sector as it involves the sharing of information considered confidential by the companies or to work in partnership.

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