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Stakeholder's perceptions of city logistics: An exploratory study in Brazil

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Abstract

The urban distribution of goods is vital for a competitive market. However, problems arising from this activity reduce the level of quality of life in urban areas. In order to reduce such impacts, solutions should be investigated and implemented considering the different perspectives and objectives of major stakeholders (carriers, retailers, residents and administrators). In this paper, we analyse the stakeholders' preferences and perceptions regarding city logistics schemes. For this purpose, we conducted a survey was conducted to identify the best practices that fit the reality analysed. The results show the convergence of solutions and can thus to guide public policies aiming to improve urban freight distribution.

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1. Main text

Urban goods delivery is an important factor in the dynamics of economic activity in a city as the cargo is an essential element for the existence of a competitive market. Dablanc (2007) states that urban freight distribution is a key activity in the development of cities, with significant importance in sustaining the lifestyle of the population and maintaining the competitiveness of industrial and commercial activities. However, this activity has a direct impact on the city and urban logistics provides solutions to improve its efficiency, reducing congestion and mitigating environmental externalities.

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The main problems related to urban freight distribution are congestion, poor road networks and inadequate loading/unloading operations due to factors such as the size of freight vehicles, the saturation of traffic levels, project failure and bad pavements (Ogden, 1992). Macharis and Melo (2011) point out conflicts between urban activities and goods distribution, generating social, environmental and economic externalities and requiring solutions to improve the efficiency of cargo transportation which take into account mobility, quality of life and sustainability.

Sinarimbo (2005) summarizes the possible solutions and best practices adopted by carriers, retailers and administrators in cities in Asia and Europe, such as the consolidation of goods in urban distribution centers, overnight delivery, access restrictions (based on day, time, weight, etc.) and truck-only lanes, amongst others. In each of these solutions is mandatory to observe the stakeholders involved and their own goals. For Taniguchi et al. (2001), the main stakeholders are the retailers (receipt of goods), carriers (transport of goods), population (live, work and shop in urban areas) and administrators (promote urban development). The city logistics solutions should promote the integration the different views of these stakeholders.

Due to the high complexity of goods distribution activity, information about preferences and perceptions for each stakeholder become essential, especially because their interests are often divergent and conflicting. Golob and Regan (1999) interviewed around 1,200 transport operators, both autonomous and employees of companies of different sizes, about practices, which aim to reduce congestion, classifying them according to their perceived effectiveness. Quak and Koster (2005) evaluated goods distribution from the tenants' point of view, analysing several case studies in the Netherlands. Differential charging by time for road use from the carriers' perspective was the subject of a survey conducted by Holguín-Veras et al. (2006).

In such a context, this paper presents the results of a survey that identified the stakeholders' perceptions regarding urban freight distribution and city logistics solutions in Belo Horizonte (Brazil). We interviewed the population, carriers, retailers and representatives of the municipal government to understand the different perspectives and underlying paradigms and identify challenges and solutions in urban freight distribution. To present these results, this paper discusses the methodology and the findings, taking into consideration different studies undertaken throughout the world.

2. Methodology

This study employed survey methodology and we designed the questions to obtain the stakeholders' perceptions concerning problems and solutions related to urban freight distribution. The interview is one of the data collection techniques previously established, as a rational way for a researcher to conduct an effective study to derive knowledge systematically and that is as complete as possible, with minimal effort in terms of time (Rosa and Arnoldi, 2006).

We used Likert scale to assess the importance of the elements and indicate the stakeholders' desires in relation to supporting public policies for urban freight transport. Likert (1932) developed the principle of measuring attitudes by asking people to respond to a series of statements about a topic in terms of the extent to which they agreed with them, thus tapping into the cognitive and affective components of attitudes. Likert scales use fixed-choice response formats and are designed to measure attitudes or opinions. These ordinal scales measure levels of agreement/disagreement.

The survey for residents aimed to evaluate their perceptions regarding the presence of freight vehicles in urban centres, the proportion of trucks on urban roads, fleet age, vehicle size and levels of pollution and congestion. In addition, the survey included questions related to perceptions of city logistics practices in Belo Horizonte. We hosted the survey on Google Drive to facilitate online access. In addition, we conducted the interviews in the central region of Belo Horizonte, taking a random approach to inviting people to respond to the questions.

For carriers, we structured the survey to examine perceptions of urban congestion and operating costs and to analyse the acceptability of solutions such as truck-only lanes and overnight delivery. Furthermore, the questionnaire investigated willingness to pay on the part of the carriers, which would be recovered through savings in time and improvements in operations, contributing to the effectiveness of the proposed measure or practice. The carriers were approached in the loading and unloading spaces of the central region of Belo Horizonte and were invited to participate in the research.

To access the retailers' point of view, we designed the survey to include questions regarding goods delivery and the costs associated with the operations. The interviewers visited the stores in the central region of Belo Horizonte and the person responsible for the store was invited to take part in the interview.

For the government, the survey included questions concerning the subjects addressed with carriers and retailers regarding city logistics practices, such as overnight delivery, restriction of freight vehicles, truck-only lanes and possible financial or tax incentives to promote the participation of stakeholders in practices or programs related to urban goods delivery.

3. Results

The surveys were conducted in Belo Horizonte (Brazil), the capital of Minas Gerais, which has approximately 2,491,109 million of inhabitants distributed over 331.401 km², this being the sixth largest city in terms of population in Brazil. The Metropolitan Region of Belo Horizonte (BHMA) has 5.8 million habitants distributed in 34 municipalities. It is the third largest urban agglomeration in Brazil and comprises the political, financial, commercial, educational and cultural centre of Minas Gerais State, representing around 40% of the economy and 25% of the state population. The BHMA is the 62nd largest urban agglomeration in the world, the seventh largest in Latin America and the biggest in Brazil outside the Rio-São Paulo area. Belo Horizonte has the 5th largest GDP of Brazil's cities, a fleet of 1,596,084 vehicles, 69% cars and 14% cargo vehicles, indicating a motorization index of 1:56 inhabitants per vehicle (IBGE, 2014).

In 2009, BHTRANS (a mixed capital organization responsible for transport throughout Belo Horizonte) implemented many restrictions in the Central Region of Belo Horizonte. This resulted in an alteration in the fleet of freight vehicles to comply with legislation and a consequent increase in the number of freight vehicles (Oliveira, 2014). The central region has an area of 8.66 km².

The detailed results below refer to the major solutions investigated. The results indicate the perceived level of efficiency for each measure presented, where the values range from 1.00 to 5.00; the closer the value is to 1.00 the less efficient the measure is perceived to be and the closer to 5.00, the more efficient it is considered to be.

We surveyed 315 residents between 1 and 22 May 2014 through the Internet questionnaire and conducted face-to-face interviews in September 2014. In addition, we undertook interviews with 283 carriers from 9 June to 6 August 2014 and 335 retailers from 23 June to 29 August 2014 in each establishment. Regarding the municipal government representatives, we interviewed eight people between 3 November and 16 December 2014, according to the availability of the respondents. All respondents are active in company transport in the city of Belo Horizonte.

3.1. Exclusive lane for urban freight transport

Fig. 1 shows the values for each respondent group concerning the practice of dedicating track or an exclusive route to urban freight vehicles. The carriers perceived the exclusive lane to have the highest level of efficiency (3.73), with approximately 40% of respondents reporting willingness to pay for the use of such a lane; this increased to 50% with the provision of some incentive, such as a discount on fuel. Forkenbrock and March (2005) and Trowbridge et al. (1996) point out that for carriers, gains in travel times and productivity are significant in terms of cost. Thus, it is possible to infer that the carriers perceive the exclusive lane as having advantages in terms of time lost in congestion.

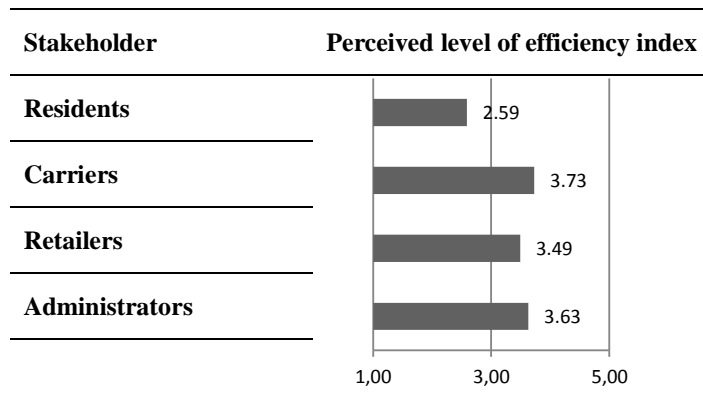


Fig. 1. Perceptions of the exclusive lane solution.

The government representatives, although rather more modestly (3.63), also perceived that segregating traffic by distinguishing between passenger vehicles and freight vehicles would bring gains for both sets of road users and would also improve product distribution operations. The administrators recognize that further studies is needed, particularly jointly with the carriers, to define assumptions, guidelines and even details, such as, for example, the price of tolls. De Palma et al.'s (2007) study highlighted that the cost of the toll cannot be too or drivers will use alternative routes and yet not too low because this would make the operation of this solution financially unviable.

The benefits for carriers can be measured by monetary value unlike the benefits for the population, which are difficult to measure. According to Poole (2009), travel time gains and reducing congestion show considerable potential, opening the possibility of charges for private vehicles for the use of the service without the presence of freight vehicles. Chu and Meyer (2009) also point out that exclusive lanes reduce pollution and the results can be estimated through mathematical modelling. Despite the obvious results, the perception of efficiency of the exclusive track mode by other users of the road was low (2.59), possibly because residents perceive it only as reducing the space for private vehicles on the main urban highways, which are already saturated and suffer from recurrent problems with traffic jams.

In relation to retailers, the existence of dedicated lanes for freight vehicles would not directly affect their businesses, despite the fact that congestion is responsible for delays in the receipt of goods and that these delays can lead to lost revenue. Because of this, the perception of the efficiency of exclusive lanes was high amongst retailers at 3.63.

In general, those involved, except for the general population considered the practice of dedicating lanes or having exclusive routes for urban freight delivery

3.2. Urban Distribution Center

Fig. 2 depicts the values for each respondent group in relation to the perceived efficiency level of consolidating goods in urban distribution centers (UDC), an option not presented in the survey for the general population. The government representatives perceived this scheme as very efficient, with a value of 4.13. Several results in the literature corroborate this: Van Duin et al. (2012) reported reductions of 20% in the distance travelled and Köhler (2003) showed a 60% reduction in the total distance. Despite considering this is a very good measure, the government representatives recognized that the implementation could be very expensive or even unfeasible in terms of the need for spaces in dense urban areas, indicating the need for incentives to implement the measure.

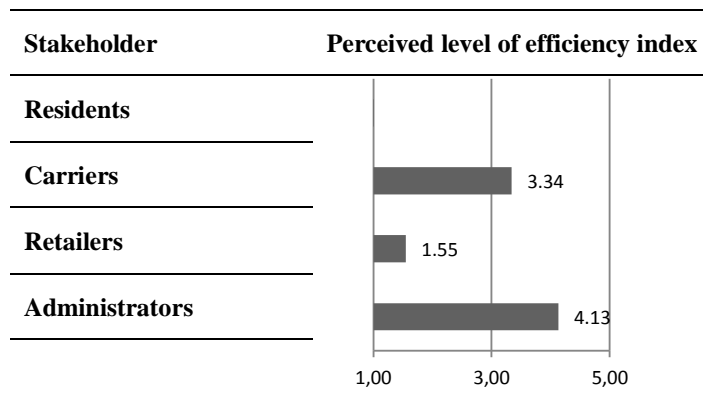


Fig. 2. Perceptions of the urban distribution center.

The participation and involvement of retailers is also extremely important, as highlighted by Oliveira and Correia (2014) and including a higher number of larger retailers maximizes the results. Van Duin et al. (2010) show that such an initiative may fail from the point of view of the number of deliveries and the financial returns in the case of low participation by retailers. The results of this research indicate that the retailers perceived the level of efficiency in the UDC option to be very low at a value of only 1.55, albeit without analysing the extent of potential endorsement of such a scheme. These results may indicate uncertainty regarding the benefits of this scheme for urban goods distribution, which is often understood only as resulting in an increase in costs for the retailer.

For carriers, the use of UDCs is clearly advantageous as reductions in distance travelled and operating time directly affect their businesses. In the survey, the level of efficiency was estimated at 3.34.

Measures that rationalize urban goods distribution are not always understood as advantageous, meaning that incentives are necessary for stakeholders, especially for carriers and retailers. It is noteworthy that here the participation of the government is as important as that of carriers and retailers, as in the case of the Cityporto project in Padova (Italy), where the municipal administration has encouraged the establishment of a delivery system with environmentally friendly vehicles from a urban consolidation centre (Gonzalez-Feliu and Morana, 2010). In the case of Cityporto, research was done on the estimated parameters and the government subsidized the project for two years; the participation of retailers increased by 150% in two years (20 to 50), showing that success is possible for city logistics schemes and their financial viability can be assured, meeting the objectives of all involved (Gonzalez-Feliu and Morana, 2010).

3.3. Overnight Delivery

The perceived levels of efficiency for overnight delivery are shown in Fig. 3. For retailers, as with UDCs, this practice was not considered a good solution, showing an efficiency perception index of only 1.50. This may be related to the fact that the measure places a heavy burden on the retailer, especially those that work only during business hours. Only with the incentive of some type of tax exemptions would some retailers (42%) be willing to participate, with low inclination for cooperation between neighboring stores (12%) or shared security schemes (16%).

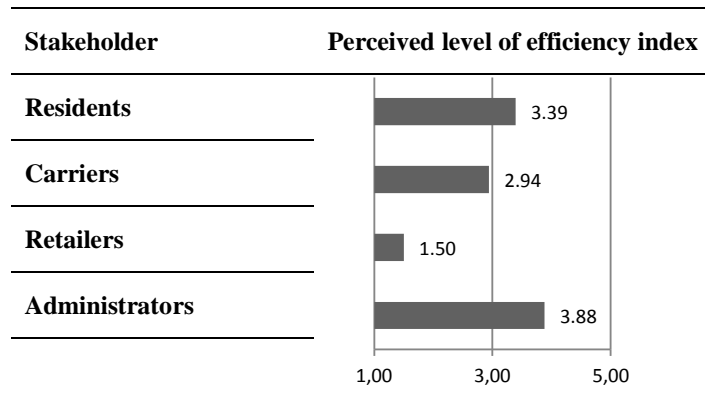


Fig. 3. Perceptions of the overnight delivery solution.

Overnight delivery directly affects the carriers and yet, according to the survey, this option was considered neither particular efficient or inefficient, with an efficiency perception index of 2.94. The willingness of carriers to participate in this type of scheme was good, with approximately 50% of respondents judging it efficient and reporting willingness to participate, a percentage that increased when the scenario involved tax exemptions.

This result is different from the results of Holguín-Veras et al. (2005) in New York, where there is a preference for making deliveries at night due to the time lost in traffic jams during the day. Palmer and Piecyk (2010) identified savings of 60 minutes per trip and 68 tons of CO₂ per year by making overnight deliveries at a supermarket in the UK, indicating potential savings and a means of rationalization for carriers.

The general population considered the measure broadly efficient (3.39) as it would eliminate part of the heavy traffic in the central area and the main avenues at peak times, with the perception of less congestion without the presence of these vehicles. The government representatives also considered the measure efficient (3.38).

3.4. Loading and Unloading System

We investigated the implementation of exclusive locations for loading and unloading and a reservation system for these places with the use of ITS – Intelligent Transportation System. The results showed in Fig. 4: these options were not included in the residents' survey and the government representatives were questioned only regarding the efficiency of the reservation system.

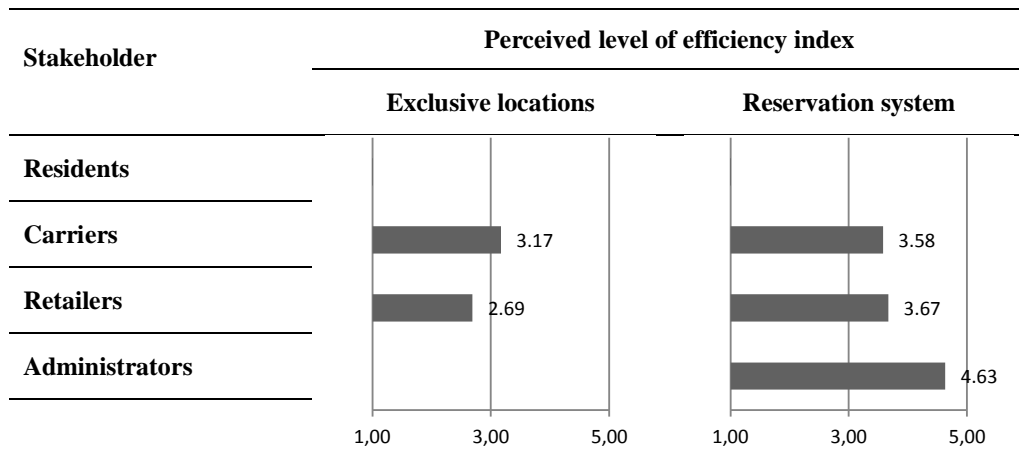


Fig. 4. Perceptions of the loading/unloading system solution.

The retailers did not believe that paying to park freight vehicles would be an efficient option (2.69). Nevertheless, they perceived a reserve system as efficient (3.67) and almost 70% reported willingness to participate if it were free; for a paid system, the willingness to pay reduced to 30%.

For the carrier, the demand for places in which to load and unload is a problem. Oliveira and Guerra (2014) indicate that approximately 10 minutes on average is spent in search of available places. The carriers did not consider that charging would be a very effective measure (3.17), but believed that a reservation system would have better potential to improve operations (3.58), with approximately 50% of respondents indicating willingness to pay to use the system. The government representatives considered the reservation measure efficient (4.63) and also foresaw their role in the implementation as mediators or providers of incentives, mainly financial.

4. Conclusion

The number of stakeholders in city logistics, as well as their different goals and characteristics, makes urban goods distribution expensive and often below the minimum level of economic and financial viability. Thus, understanding the needs and desires of stakeholders and discussing the results of research shown in the literature are essential to obtain efficient solutions, particularly as when solutions are implemented without discussion with all stakeholders, the level of success is low.

The solutions for optimizing and rationalizing the urban distribution of goods should not be performed alone and with the involvement of some stakeholders. The concept of city logistics provides for the implementation of more than one scheme and takes account of the fact that each stakeholder has different objectives and perspectives and that it is important for these differences to be considered in proposing solutions. In addition, the success or failure of a range of measures is related to the level of participation of those involved, especially in this case transporters and retailers, in the design, planning and implementation of solutions. The financial viability of the measures is also essential, increasing the importance of government participation with regard to the provision of initial funding and incentives for the implementation and enforcement of measures. The investigation of different perceptions and preferences of all those involved in the urban goods distribution process is vital to mitigate externalities and problems related to city logistics.

The results of this research indicate that the city logistics solutions investigated for the Brazilian context exhibit a good level of acceptance by carriers and government. However, retailers show resistance to any proposed solution. This resistance may be the result of lack of knowledge concerning the benefits of the solutions or a paradigmatic shift in resistance. For the population, any solution that would bring about improvements in urban traffic is perceived as important.

Considering the results obtained in this research, it is important to make clear to all stakeholders the importance of the solutions for the urban distribution of goods. Therefore, the government in particular should promote seminars and workshops, such as those developed by the BESTUFS project. In addition, subsequent to this research, the transferability of the schemes discussed in this work to the Brazilian reality is being analysed, drawing on the methodology developed by the Turblog project. The goal is to adapt the solutions to the Brazilian reality, ensuring the feasibility of a number of schemes aimed at reducing the externalities of urban freight transport in Brazilian cities.

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