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SciVerse ScienceDirect
Procedia - Social and Behavioral Sciences 39 (2012) 783 – 795
Procedia
Social and Behavioral Sciences

The Seventh International Conference on City Logistics

Adoption assessment by carriers and retailers to use an urban consolidation center - A case study in Brazil

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Abstract

Growing concern over environmental issues has prompted public and private institutions to seek ways to mitigate the impacts of their operations. The urban distribution of goods is an important subject to study because the increase in vehicle traffic in big cities from suboptimal logistics systems aggravates greenhouse gas emissions. An urban distribution center (UDC) is an important alternative to improve logistics process in cities and decrease the negative effects of freight transport. Demand analysis is a fundamental part of the process of choosing where to set up an UDC. This paper presents a model for retailers and carriers to assess the adoption of an UDC, through the stated preference technique and elements from adoption theory. Additionally, this article presents the results of the view of public institutions about city logistics initiatives and urban distribution center benefits. This methodology was applied in Belo Horizonte (Minas Gerais) and Fortaleza (Ceará). The results shed light on initiatives to establish urban distribution centers in these cities, emphasizing that although UDCs offer important benefits, not all actors are ready to implement them.

Keywords: Urban distribution center; stated preference tecnique; adoption theory

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 doi:10.1016/j.sbspro.2012.03.147

1. Introduction

Lima (2005) [1] pointed out that the growing circulation of goods in cities has increased congestion in central regions. Crainic *et al.* (2004) [2] highlighted that the main factors in this phenomenon are the current production and distribution model, based on low inventories and just-in-time (JIT) deliveries, as well as the explosive growth of e-commerce, which generates significant volumes of home deliveries. Furthermore, according to Crainic *et al.* (2004) [2], public authorities promote few policies on freight transport in cities, variously involving regulation of parking, road access and time windows for loading/unloading, among others. This is because governments treat urban freight circulation as an essentially a private activity. Czerniak *et al.* (2000) [3] pointed out that many local authorities consider job creation and regional competitiveness to be more important than logistics concerns, so that improving the efficiency of transport systems is seen as less important in the decisions of public officials.

According to Quak and Koster (2009) [4], regulations on the movement of vehicles affect the distribution of goods to retailers and the environment considerably. In this sense, the authors reported that the positive impacts of restrictions of time windows and vehicle capacity, such as increasing the attractiveness of downtown regions and the quality of life, also have negative environmental impacts, since they increase the emission levels of CO2, NOx and PM10.

Browne *et al.* (2007) [5] observed that more economically efficient urban distribution operations resulting from new public policies and/or private initiatives do not necessarily increase the social and environmental sustainability of a region. In many cases the opposite happens, i.e., operations with less regulation increase the impact on the environment, demonstrating that in these cases measures are imposed for good reason.

The identification of policy measures and private initiatives that can both make urban distribution activities more efficient and reduce the social and environmental impacts of these operations is crucial to improving living conditions in cities (Browne *et al.*, 2007) [5]. Crainic *et al.* (2009) [6] noted that new models to manage urban distribution have been proposed to mitigate the problems arising from this activity. These models emerge from the field of city logistics, which consists of considering the urban environment (shippers, carriers and society) as an integrated logistics system to be optimized. In this sense, Taniguchi *et al.* (2001) [7] established the concept of city logistics as "the process of optimization of the transport and logistics activities by private companies in urban areas, considering traffic, congestion and energy consumption within the economic structure."

The prohibition of heavy vehicles in city centers can be beneficial in terms of visual intrusion, noise and physical intimidation, but the number of trips performed by lighter vehicles can accentuate the use of fossil fuels and pollutant emissions (Browne *et al.*, 2007 [5]; Quak and Koster, 2009 [4]). To reduce these problems, one alternative is the use of urban distribution centers to improve the logistics process of big cities. In Brazil, research involving urban distribution centers is still incipient, with only a few studies addressing this topic, such as Carrara (2007) [8], who conducted a location study in the city of Uberlandia. In addition to the location, the measurement of the potential demand of the main actors involved in urban goods distribution was established as an important step toward assessing the feasibility of an urban distribution center. Thus, this paper presents a model for adoption assessment of retailers and carriers in relation to using an urban distribution center, developed based on the stated preference technique and adoption theory. To explain the method, we initially discuss some characteristics of urban distribution centers and their consequences on some actors involved in cities. Then we present the adoption model and the results of its application in the cities of Belo Horizonte (Minas Gerais) and Fortaleza (Ceará), before presenting our concluding remarks.

2. Urban distribution centers

The cargo consolidation of different shippers and carriers in the same vehicle associated with operational coordination in cities is seen as one of the most important ways to mitigate the negative externalities caused by freight transportation in urban centers (Benjelloun and Crainic, 2009 [9]; Benjelloun et. al., 2009 [10]; Crainic *et al.*, 2009 [6]; BESTUFS, 2008 [11]; Browne et. al., 2007 [5]; Nemoto et. al., 2006 [12]; Browne, et. al., 2005 [13]). Therefore, the urban distribution center (UDC) concept is considered an important instrument among urban logistics initiatives (Crainic et. al., 2009 [14]).

The UDC concept involves separating logistics activities inside and outside the city (Rooijen and Quak, 2009 [15]). Browne *et al.* (2005) [13] defined an urban distribution center (UDC) "as a logistics facility that is situated in relatively close proximity to the geographic area that it serves, as a city centre, an entire town or a specific site (e.g., shopping center), from which consolidated deliveries are carried out within that area." Many deliveries are consolidated in some way, but this is not always best from the perspective of the city. Supply chain operators optimize their deliveries at the flow origin, for example a distribution center, while for the good of the city as a whole, the optimization considering the destination should take precedence (Rooijen and Quak, 2009 [15]). Quak (2008) [16] highlighted that urban distribution centers are among the city logistics initiatives to improve the sustainability of cities by changing the physical infrastructure used by the urban freight transport.

Browne *et al.* (2007) [5] mentioned some of the costs and benefits for those involved in involved in the UDC schemes. In relation to costs, there can be increases from another stage of handling and delivery and the high investments in information technology. In relation benefits, the authors reported that an UDC can reduce the delivery time in congested areas, total fuel consumption and number of vehicles for urban distribution operations and optimize retailers' stocks. However, Rooijen and Quak (2009) [15] pointed out that the adhesion of retailers and carriers is a crucial factor for such a logistics initiative, since the increased participation of these agents in the scheme will maximize its benefits and decrease many of the costs involved. BESTUFS (2008) [11] indicated that a synergistic network for urban distribution of goods is a key factor for the success of an UDC.

3. Methodological fundamentals

To develop a model to assess the adhesion to an urban distribution center, we used two important concepts: adoption theory and the stated preference technique. In relation to the adoption theory, Figueiredo (2005) [17] pointed out that many innovations do not achieve the expected results for failure to satisfy the requirements of potential adopters. So, to be successful in introducing innovations to system, it is important to understand the issues related to this process, such as to assess the potential users and the factors that influence their adoption decisions.

According to Rogers (1995) [18], adoption refers to the decision of any person or organization to use an innovation. According to Oliveira (2007) [19], to adopt an idea, even when the benefits are obvious, is often very difficult. Many innovations require a long period, sometimes years, to be totally accepted.

Rogers (1995) [18] observed that diffusion is the process in which an innovation is communicated over time through certain channels among members of a social system. Thus, the diffusion of a new idea leads to social change, a process in which changes occur in the social structure of the system. When new ideas are invented, diffused, adopted or rejected, they leave certain consequences, leading to social change. Still, individual decisions about an innovation are not instantaneous, they occur over time.

One way to assess the main elements of adopting an innovation is through the stated preference technique, which identifies the relevant factors in the adoption process. According to Almeida (1999)

[20], the manifestation of an individual preference in relation to a service reflects the behavior of a number of options available.

The stated preference technique involves assessing the individual preferences of users and their behavior according choice models. This type of approach allows analyzing situations that do not exist yet, and identifies characteristics of the system under study that are relevant to users. Also, stated preference techniques enable examining the combinations of attributes and their variability, since it allows knowing the relative importance attached by users to each attribute selected. Thus, it becomes possible to envision various situations and closely examine the interests of users to these situations.

The stated preference technique is a method of interaction between research and behavior theory (Novaes *et al.*, 1996) [21]. The paradigms used for behavior modeling of people are not concerned with behavioral theory alone, but also with methods that can be used to test issues of this theory. The use of this technique is justified by a lack of data about urban distribution centers, since there are no records on the implementation of such a scheme in Brazil. Thus, this technique allows assessing the potential demand in relation to an UDC by measuring its main attributes. For detailed information on the stated preference technique applied to urban transportation planning, in the city logistics context, see Oliveira *et al.* (2010) [22].

4. Proposed models

These models were developed to analyze the adhesion of carriers and retailers to an urban consolidation center in Brazil. These agents have the greatest interest in implementing this system because it can reduce congestion and consequently decrease the costs of urban distribution. But this scheme can also require an additional step in the supply chain, implying higher costs. The model was developed considering some peculiarities of transporters and retailers and the benefits the UDC will provide for them.

To develop the adoption model using the stated preference technique, it is necessary to define the model's attributes. Attributes are the principal characteristics of the current system, with a direct impact on the adoption of the proposed system.

After assessing the potential costs and benefits for transporters, considering the study of Browne *et al.* (2007) [5], we identified the most relevant for Brazilian reality, defining the following attributes for the model:

- Load Factor: amount of load (weight and/or volume) transported by the vehicle. It is assumed that the UDC improves load factor;
- Parking: loading and unloading space in the urban center. It is assumed that the potential reduction in the number of freight vehicles in city centers with the UDC may improve parking conditions;
- Partnership: service in cooperation with other carriers. It is assumed that the UDC will require the sharing of loads among carriers;
- Investment: allocation of resources in new technologies for freight distribution in downtown areas. One consequence of the UDC is the need to invest in new technologies such as GPS (global positioning system) and electric vehicles.

For each attribute considered in the study, we defined two levels of choice: the first level corresponding to the current situation and the second level considering the consequences of implementing the UDC. Table 1 shows the attributes and description of the respective levels considered in the transporters' assessment.

Table 1. Attributes and respective levels considered to assess carriers' adhesion

Attributes	Levels
Load Factor	0: Current Situation
	1: UDC improves load factor
Parking	0: Current Situation
	1: Easy to find place to park for loading and unloading
Partnership	0: Current Situation
	1: Partnership with others carriers to improve cargo consolidation levels.
Investment	0: Current Situation
	1: Investment in new technology

Similarly, we identified the following attributes for retailers:

- Cost: Retailers' financial sacrifice to achieve the goals. It is assumed that one consequence of the UDC is an increase in costs because of the addition of a stage in the supply chain;
- Delivery Service: the way that retailers are served by their suppliers. It is considered that the UDC improves the delivery service trough greater operational flexibility, for example, the possibility of splitting orders and reducing the number of deliveries;
- Reliability: credibility of retailers in relation to services provided by carriers. It is assumed that the UDC will improve the service reliability by, for example, improving the delivery punctuality;
- Stock versus Display: the amount of products in inventory against the amount of products displayed. It is assumed that the UDC provides extra space for displaying products by reducing the need for storage areas.

Table 2 shows the attributes and description of the respective levels considered in the retailer's assessment.

Table 2. Attributes and respective levels considered to assess retailers' adhesion

Attributes	Levels
Cost	0: Current Situation
	1: Potential increase in costs of the cost
Delivery Service	0: Current Situation
	1: Improvement in delivery service
Reliability	0: Current Situation
	1: More reliable transport service
Stock versus Exposure	0: Current Situation
	1: Decrease in stock and increase of product display

After defining the attributes and levels, we determined that the alternatives would be presented to the respondents in the form of cards, which were formulated following factorial arrangements, using a 1.1 test, as formulated by Souza (1999) [23], with a 24 factorial design, with balanced blocks of four alternatives, as developed by Souza (1999) [23]. The survey was conducted personally to capture other important aspects and/or views for adoption or rejection of the UDC. The cards were presented to the

interviewees to allow them to rank the alternatives. This is the form of interview most widely used, because it is less tiring to the respondent (Almeida, 1999) [20]. The data were processed using the LMPC software (Multinomial Logit with Conditional Probability), developed by Souza (1999) [23]. The software tests the null hypotheses of all the attributes to verify the adherence of the results and uses the likelihood method to obtain of the alternative parameters and also the model calibration.

From the survey results, we defined scenarios to analyze the probability of choosing the UDC considering the attributes examined and computed the monetization of non-financial attributes to carriers and retailers, considering the average population income of the municipality, to verify the financial outlay of each segment, so as to improve the attribute analysis.

5. Assessment of adoption of urban distribution centers in Belo Horizonte (MG) and Fortaleza (CE)

Belo Horizonte is located in the southeastern region of Brazil (Fig. 1) and has around 2.37 million inhabitants. It is the sixth most populous city in Brazil and has the fifth largest GDP (gross domestic product) among Brazilian municipalities, representing 1.38% of national GDP. The greater Belo Horizonte metropolitan region consists of 34 municipalities and has a population of around 5.39 million. It should be clarified that the local administrative unit in Brazil is the municipality, which is similar to a county in the United States, except each one has a single mayor and municipal council. Most large cities or metropolitan regions cover several municipalities. In October 2009, the Belo Horizonte municipal government issued regulations on the movement and loading/unloading of cargo vehicles. The rules cover the central city area and the access corridors and restrict the circulation of vehicles weighing over 5 tonnes (metric tons) and 6.5 meters long to specific days and times.

Fortaleza is located in northeastern Brazil (Fig. 1) and has around 2.44 million inhabitants, making it the fifth most populous city in Brazil. It has the fifteenth largest municipal GDP. The Fortaleza metropolitan region consists of 15 municipalities and has a population of around 3.65 million.

Fig. 1. Location of Belo Horizonte and Fortaleza in Brazil

In Belo Horizonte, the survey was conducted with representatives of 14 carriers and 25 retailers that provide services in the downtown region. In Fortaleza representatives of 4 carriers and 27 retailers were interviewed.

5.1. Carriers

In Belo Horizonte, the survey results indicate that all companies have difficulty to park their vehicles for loading and unloading in downtown. Some interviewees reported cases where parking spaces were occupied by cars illegally parked. Each vehicle carries out an average of 31 deliveries a day, with 61.5% of transporters making between 20 and 60 deliveries. Garments are the goods moved (40% of the total), followed by foods and beverages (12% each) and other products (36%), with emphasis on electronics, with 55.6% of this amount. The main origin of products is São Paulo state and southern Brazil (52.2%), then Rio de Janeiro state with 17.4%.

Table 3. Carriers' results in Belo Horizonte

Attribute	Coefficient	Standard deviation	T test	RI (t=2.5%)
Load Factor	0.6051	0.2400	2.5211	[0.125;1.085]
Investment	0.6148	0.2396	2.5662	[0.136;1.094]
Parking	1.0503	0.2412	4.3545	[0.568;1.533]
Partnership	-0.1255	0.2326	-0.5397	[-0.591;0.340]

According to the results presented in Table 3 for Belo Horizonte, the attribute of greatest importance for carriers is parking, because of its coefficient in the utility function (1.0503). This result confirms the survey data, which indicated that all carriers have problems finding parking in the area studied. The load factor and investment attributes had relatively similar coefficients, of respectively 0.6051 and 0.6148. This shows a similar level of importance in relation to these benefits. In this sense, the results indicate that carriers are willing to invest in order to improve the current situation of distribution in the city center. However, they see partnership as an obstacle to this process. This occurs because partnership is perceived negatively due to its negative value in the utility function (-0.1255), indicating an adverse point of view in relation to this attribute. Moreover, by the t-test, partnership was rejected (-0.5397) while others were significant for the model. The value obtained in testing the null hypothesis indicated rejection of the null hypothesis for all parameters simultaneously. For the rho test, the value found was 0.2, considered an excellent value by Ortúzar and Willumsen (1990) [24] and Senna (1994) [25].

The results were similar for Fortaleza: carries have difficulty in parking on the main streets in this city, mainly in the Aldeota district. The results indicated that the investment attribute is rejected by carriers and load factor is important to reduce the number of vehicles and improve profitability, as shown in Table 4. Although companies expressed indifference to the investment, they were favorable to the partnership idea because of the high levels of congestion in the region under review. It is important to highlight that all the attributes were rejected by the t-test, indicating the need to expand the sample. However, there was low receptivity of carriers in Fortaleza to this study, which explains the small sample and consequently the less reliable results. For the rho test, the value found was 0.16, below the reference levels defined by Ortúzar and Willumsen (1990) [24] and Senna (1994) [25].

Table 4. Carriers' results in Fortaleza

Attribute	Coefficient	Standard deviation	T test	RI (t=2.5%)
Load Factor	0.8867	0.5056	1.7538	[-0.10;1.88]
Investment	0	0.5025	0	[-0.98;0.98]
Parking	0.4121	0.3899	1.0569	[-0.35;1.18]
Partnership	0.1363	0.3941	0.3457	[-0.64;0.91]

Analysis of the proposed scenarios to assess adhesion of carriers in Belo Horizonte and Fortaleza (Table 5) revealed there is a significant probability of choosing alternatives that include the implementation of the UDC scheme, except when it includes the partnership attribute. Thus, for example, in Belo Horizonte and in Fortaleza, respectively, 90% and 81%, of carriers would choose an alternative with the presence of all attributes that make up the model, demonstrating the high commitment of carriers to this scheme. Another interesting analysis can be made in relation to individual attributes. For parking the UDC adhesion was 74% in Belo Horizonte and 60% in Fortaleza, for load factor the figures were 65% in Belo Horizonte and 71% in Fortaleza, and for investments 65% of the carriers in Belo Horizonte and 50% in Fortaleza indicated they would be willing to invest in an UDC. However, the acceptance probability of the UDC is only 47% in Belo Horizonte and 51% in Fortaleza when considering only partnership, i.e., without the attributes considered beneficial for carriers. Therefore, cooperation among the various agents engaged in urban distribution, while an essential factor to the success of a UDC, was not viewed very favorably to the carriers in the region analyzed.

Table 5. Probability of the scenarios analyzed by carriers

Scenario	Probability in Belo Horizonte	Probability in Fortaleza
Improved Load Factor, Investment and Parking	91%	79%
Improved Load Factor, Investment, Parking and Partnership	90%	81%
Improved Load Factor and Parking	84%	79%
Investment and Parking	84%	60%
Improved Load Factor, Parking and Partnership	82%	81%
Investment, Parking and Partnership	82%	63%
Improved Load Factor and Investment	77%	71%
Improved Load Factor, Investment and Partnership	75%	74%
Parking	74%	60%
Parking and Partnership	72%	63%
Improved Load Factor	65%	71%
Investment	65%	50%
Improved Load Factor and Partnership	62%	74%
Investment and Partnership	62%	53%
Partnership	47%	53%

Finally, according to the respondents, carriers are willing to make a one-time investment of US$ 7.60 to improve parking for loading/unloading, US$ 4.38 to increase load factor, and US$ 0.91 to establish

partnerships with other companies (the dollar figures are approximate, based on an exchange rate with the Brazilian real (R$) of R$1.70/US$1 at the time of the survey). In Fortaleza, as the attribute (investment) was zero, it was impossible to quantify the model's economic attributes.

5.2. Retailers

Fig. 2 shows the stratification of the retailers' sample in Belo Horizonte. The majority of businesses receive products twice a week, usually just a delivery with two or more cartons, especially for clothing. In Fortaleza, retailers receive products daily with two or more cartons holding various kinds of products, as shown in Fig. 3.

The results for Belo Horizonte are shown in Table 6. In this city, cost is an attribute with significant importance, given its high value in the utility function coefficient (-1.1319). However, the coefficient's negative sign in the utility function indicates an inclination contrary to the UDC scheme. The results of t-test indicated that delivery service is not a significant attribute for the model and were considered irrelevant by the retailers interviewed, since its result (1.3398) is rejected. This fact may reflect a situation where retailers are satisfied with the current delivery service from their suppliers, so the additional gains from the use of an UDC may not be relevant. The results for Belo Horizonte demonstrate that adhesion of the retailers to the UDC idea depends mainly on the potential additional costs, by improving the service reliability of carriers and increasing the space for the display of products in their stores. For the rho test, the value found was 0.2.

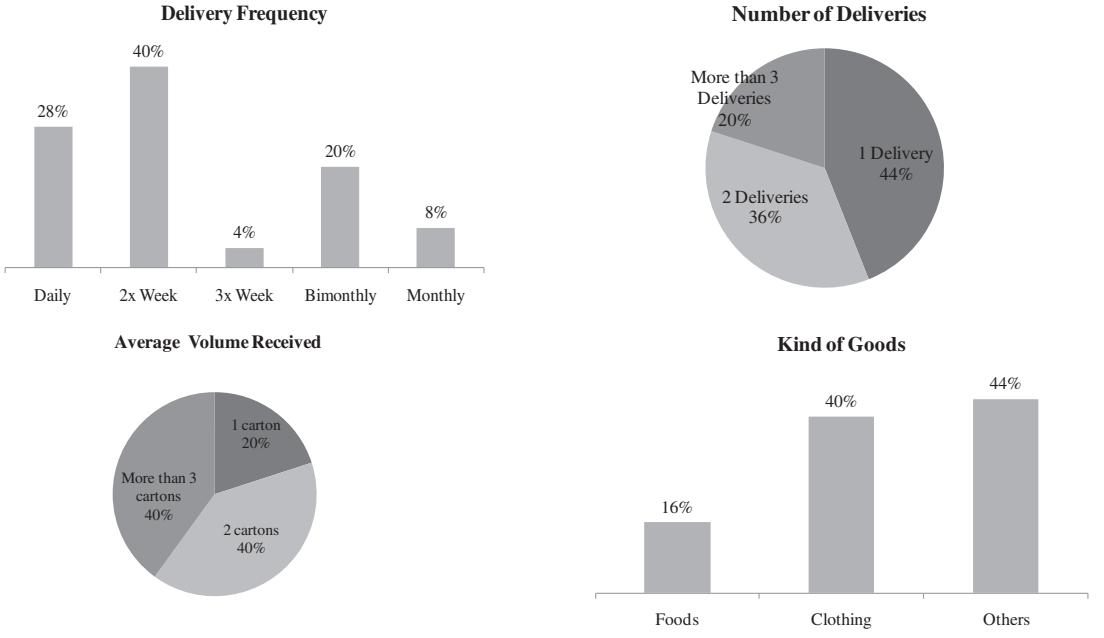

Fig. 2. Sample Stratification from Belo Horizonte

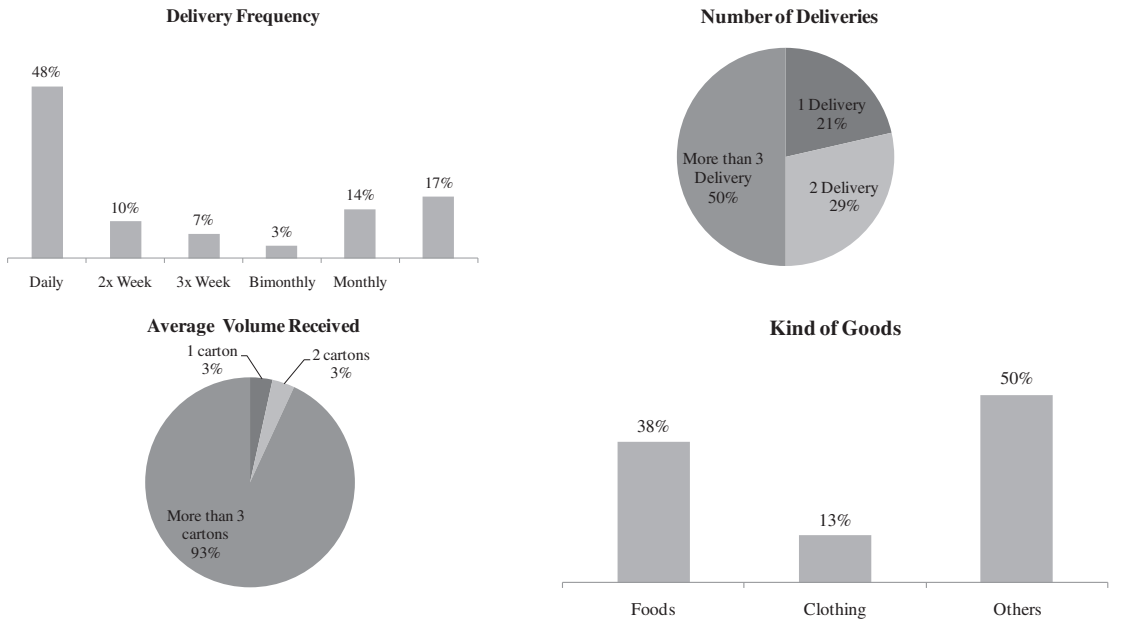

Fig. 3. Sample Stratification from Fortaleza

The results for Fortaleza are shown in Table 7. In this city, cost is an attribute with significant importance, given its high value in the utility function coefficient (-1.1319). However, the negative sign in of the coefficient indicates an inclination contrary to the UDC scheme. The results of the t-test indicated that cost is not a significant attribute for the model, since its result (-1.7190) is rejected. Moreover, the coefficient's negative sign indicates rejection by the retailers interviewed of this attribute. Therefore, the results demonstrate that adhesion of the retailers to the UDC idea in Fortaleza depends mainly on reliability and delivery service. For the rho test, the value found was 0.29.

Table 6. Retailers' results in Belo Horizonte

Attribute	Coefficient	Standard deviation	T test	RI (t=2.5%)
Cost	-1.1319	0.1620	-6.9853	[-1.456; -0.808]
Delivery Service	0.2013	0.1503	1.3398	[-0.099; 0.502]
Reliability	0.8054	0.1554	5.1845	[0.495; 1.116]
Stock versus Exposure	0.5254	0.1535	3.4428	[0.221; 0.836]

Table 7. Retailers' results in Fortaleza

Attribute	Coefficient	Standard deviation	T test	RI (t=2.5%)
Cost	-0.2649	0.1541	-1.7190	[-0.573; 0.043]
Delivery Service	1.1379	0.1739	6.5776	[0.792; 1.484]
Reliability	1.7852	0.1939	9.2086	[1.397; 2.173]
Stock versus Exposure	0.5231	0.1649	3.1722	[0.193; 0.853]

Table 8 shows the adhesion results for Belo Horizonte and Fortaleza. The cost attribute has great importance in retailers' adoption of the UDC plan (24% in Belo Horizonte and 43% in Fortaleza). This is because the probabilities associated with its presence have relatively low values in relation to the possibility of UDC adoption. In addition, when this attribute is not present, the probability increases considerably, reaching 82% when all other attributes are selected in Belo Horizonte and 97% in Fortaleza. Analyzing UDC adoption in the scenarios in which the attributes are evaluated separately, the probability of adopting the scheme with improved reliability is 69% in Belo Horizonte and 84% in Fortaleza, while improvement of display space has 63% probability in both cities and improved delivery service has 55% probability in Belo Horizonte and 76% in Fortaleza.

Participation in the UDC can cause an interesting tradeoff for retailers, because it can increase operating costs but improve profitability because of greater in revenues, due to the increase in display space and/or decrease in costs because of more reliability and faster service. The net analysis of this tradeoff by retailers culminates in adherence to the new distribution system.

In Brazil there are no reports of deployment of the UDC concept presented in this work. In some other countries, mainly in Europe, this system has been implemented by the public sector, with the main goal of minimizing costs. The results in this work indicate that this involvement may be justified also for Brazilian reality, since retailers' adhesion level increases when the scheme is implemented at no cost for this segment, with the probability rising from 55% to 82% in Belo Horizonte and 63% to 97% in Fortaleza.

Table 8. Probability of the scenarios analyzed for retailers

Scenario	Probability in Belo Horizonte	Probability in Fortaleza
Improved Delivery Service, Reliability and Exposure	82%	97%
Improved Reliability and Exposure	79%	91%
Improved Delivery Service and Reliability	73%	95%
Improved Reliability	69%	84%
Improved Delivery Service and Exposure	67%	84%
Improved Exposure	63%	63%
Lower Cost with Improved Delivery Service, Reliability and Exposure	60%	96%
Lower Cost with Improved Reliability and Exposure	55%	89%
Improved Delivery Service	55%	76%
Lower Cost with Improved Delivery Service and Reliability	47%	93%
Lower Cost with Improved Reliability	42%	82%
Lower Cost with Improved Delivery Service and Exposure	40%	80%
LowerCost with Improved Exposure	35%	56%
Lower Cost with Improved Delivery Service	28%	71%
Lower Cost	24%	43%

Although cost is significant attribute for retailers to adhere to the UDC idea, retailers are willing to invest to improve the current urban distribution conditions. In this respect, the respondents in Belo Horizonte are willing to pay US$ 3.17 to improve reliability, US$ 2.08 to decrease stocks and increase product exposure, and US$ 0.80 to improve delivery service. In Fortaleza, the respondents are willing to pay US$ 26.72 to improving reliability, US$ 7.83 to increase product exposure, and US$ 17.03 to

improve delivery service. These results indicate that retailers want improvement in urban distribution and are willing, especially in Fortaleza, to invest in this improvement.

5.3. What do public institutions think about UDC?

We conducted a similar survey among representatives of public institutions in Belo Horizonte and Fortaleza to investigate their thinking about the UDC idea. Among the attributes investigated were financial subsidies, decreasing congestion, GHG emissions, noise and visual pollution. We interviewed six experts from public institutions in the cities surveyed. The results show that all the experts are aware of city logistics initiatives and recognize the UDC concept as a solution to reduce the number of cargo vehicles in cities. However, the public sector would not be willing to provide financial subsidies, given the negative value of this coefficient, while reducing congestion would be the greatest contribution.

This result corroborates the findings of other studies that have indicated a lack of government city logistics initiatives (Braga and Oliveira, 2008) [26]. Thus, convincing the public of the benefits of an urban consolidation center and that it can reduce the impacts of urban distribution is a challenge for successful implementation of such an initiative.

6. Conclusion

In this paper we presented a model to assess adhesion of transporters and retailers to the use of an urban distribution center (UDC). The model was developed by using the stated preference technique with elements of adoption theory. To validate the model, we performed a survey in two Brazilian cities. The results indicate that retailers and carriers are willing use an UDC and identifies critical factors for successful implementation of this initiative.

In conclusion, we stress that the choice of attributes is a key factor in the model developed. Therefore, we sought among the UDC features those best adapted to Brazilian reality. However, some regions may have specific conditions that require adaptation of existing attributes or inclusion of new ones in the model. Finally, the model developed in this paper presented a way to assess the potential demand for UDCs, which are considered one of the main initiatives of city logistics by private and public institutions aiming to mitigate negative externalities of freight transport in cities.

In Brazil, the implementation of city logistics initiatives is a huge challenge because of the growing problems of goods distribution in cities. There is general recognition that the solution is not unique and to be successful it needs the involvement and commitment of retailers, shippers, government and the population at large, because, as highlighted by Taniguchi *et al.* (2001) [7], the objectives of stakeholders are diversified and need to be considered for the success of any paradigm shift and acceptance of new forms of distribution.

Acknowledgements

We thank CNPQ (National Council for Scientific and Technological Research), FAPEMIG (Minas Gerais State Research Foundation), UFC (Federal University of Ceará) and UFMG (Federal University of Minas Gerais) for supporting this research project.

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