



Freight distribution in megacities: Perspectives of shippers, logistics service providers and carriers



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ABSTRACT

We analyse the opinions of shippers, logistic service providers (LSPs) and carriers related to regulations and issues faced by these companies regarding freight distribution in megacities, and the logistical performance measures likely affected by those regulations and issues. We present a review of the freight distribution literature focusing on a large number of freight distribution aspects, such as regulatory, collaborative, environmental, logistical and risk. We also investigate some logistical performance indicators adopted by the companies. Subsequently, we conduct a survey with 147 companies working in the São Paulo Metropolitan Region (SPMR). We use multivariate analysis of variance to assess the logistical performance indicators and non-linear canonical correlation analysis to identify the most relevant freight distribution attributes. The results that the majority of carriers are located inside the SPMR and efficiently handle these issues better than others actors. The lack of collaboration, cargo theft, traffic congestion and some regulations affect the LSP's logistical performance. Moreover, the actors perceive regulatory aspects, mainly traffic congestion, and a lack of security for deliveries in unsafe areas as the significant issues for deliveries in megacities.

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1. Introduction

Disorganised population growth in megacities has created considerable challenges for the free flow of vehicles and people and for the distribution of goods into and out of these cities (Dablanc, 2007). The distribution system has become increasingly complex because of increases in demand, government regulations, traffic congestion, high-frequency deliveries in lighter vehicles, environmental issues, and deliveries in unsafe areas (Crainic et al., 2004). Shippers, logistics service providers (LSPs) and carriers, located inside and outside megacities, are urged to work efficiently and collaboratively to maintain their competitiveness in the freight distribution channel and address issues and regulations present in megacities.

Companies located outside megacities that serve customers located inside megacities may have limited knowledge of local traffic patterns, unsafe areas, narrow streets, and regulations. Because of fluctuations in demand, long transport distances, and

restrictive delivery windows, these companies tend to deliver their goods with low logistical performance, i.e., late deliveries, damaged deliveries, freight theft, and the use of different-sized vehicles without planned routes. To address these issues, some companies use terminals and distribution centres (DCs) positioned at various points on the periphery of the megacity. The use of these terminals allows loads to be transferred to smaller trucks to avoid the use of large trucks in crowded urban areas (Allen et al., 2012; Portugal et al., 2011); use of DCs allows large collections of goods to be stored and separated into smaller loads for further distribution (Hesse and Rodrigue, 2004). Terminals also allow companies to contract with local carriers that have expertise in delivering goods securely, with high logistical efficiency. These companies are located on the outskirts of megacities; by operating efficiently in a connected freight distribution system, they reduce congestion (Figliozzi, 2007). They have a higher level of logistical performance and are able to address issues and regulations more efficiently than companies located outside megacities because they can respond to demand for reliable, regular, and flexible delivery of relatively small quantities of products (Allen et al., 2012). They also focus on only one region; they maintain collaborative actions with several retailers to adjust delivery schedules as required and tend to develop expertise in local delivery.

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Some companies are motivated to work in a collaborative environment (Cherrett et al., 2012) and share logistical information through information technology (IT), as well as logistical costs related to warehousing and transportation, to achieve common objectives. These companies (“actors”) include shippers, logistics service providers (LSPs), and carriers, and have a direct influence on the freight distribution system (Ballantyne et al., 2013). Each actor has different perceptions related to regulations and issues in the movement of goods (Figliozzi, 2007). However, all actors have the same objective: to satisfy the needs of the final customer.

In our study, we seek to determine whether companies located inside or outside megacities perceive the same issues and regulation intensity and whether their logistical performance is affected by regulations and issues regarding megacity freight distribution.

Our paper aims to:

- Develop a profile of companies that provide the best logistical performance in freight delivery.
- Summarise the opinions of shippers, LSPs and carriers regarding regulations and issues.
- Discuss how freight operators address regulations and issues and operate simultaneously and efficiently inside and outside megacities.

Many researchers have examined the issues (Muñuzuri et al., 2005), regulations (Hensher and Golob, 1999; Stathopoulos et al., 2012), and logistical performance indicators (Lu, 2003) in freight distribution. They recognise urban logistics issues and regulations may affect the logistical performance of companies. However, these studies have been carried out separately and do not take into account the profiles of the deliveries (direct delivery to stores, number of vehicles used daily, number of stores supplied daily) or profiles of companies.

Moreover, most research on this topic has addressed urban transport with a focus on passenger transport or public transportation (Ballantyne et al., 2013; Lindholm and Behrends, 2012) and on social and economic problems caused by transportation externalities (de Vasconcellos, 2005). A few studies have examined freight distribution with respect to regulations and issues from the viewpoints of companies that work in the consumer packaged goods (CPG) industry channel (Sanches Junior, 2008). Many of these regulations have been adopted in Latin American countries (Mahendra, 2008; Timms, 2014) and in emerging economies, and the study of these regulations as they relate to the logistical performance of companies is on-going.

Our study breaks new ground by analysing the logistical performance of companies, according to profile of deliveries and perceptions of companies related to issues and regulations, from the perspectives of shippers, LSPs and carriers in urban freight transport. We examine the profiles of companies that handle these issues efficiently.

The structure of this paper is as follows: Section 1 includes the introduction; Sections 2 and 3 present a literature review, and Section 4 describes the methodology and profiles of the respondents. Section 5 presents the results and discussion, beginning with Section 5.1, profile of the deliveries, and followed by Sections 5.2–5.4, which address the objectives of this study. Section 6 concludes the paper.

2. Urban freight distribution literature review of issues and regulations

From a logistical perspective, companies face many issues in achieving effective and efficient freight movement within urban areas (Stathopoulos et al., 2012). These issues include increased

traffic congestion, disorganised growth around and inside large cities (requiring additional effort to deliver goods in restricted areas), high number of regulatory rules regarding the circulation, loading, and unloading of vehicles to reduce environmental impact and balance flows, and concerns regarding floods, cargo thefts, narrow or blocked streets, and strikes. To investigate these issues, we focus our empirical research on the triad of shippers,¹ carriers² and LSPs³ that has invested significant resources in improving logistical performance and lowering costs in metropolitan areas.

Based on a literature review and a case study, we identify several regulations and issues faced by the companies. We classify them into five groups (regulatory, logistical, collaboration, environmental, and risk) to investigate the strength of their effects on logistical performance of shippers, LSPs, and carriers in megacity urban freight distribution.

2.1. Regulatory measures versus logistical performance

Regulatory measures seek to control traffic, vehicle access, and land use in strategic regions in large cities. These measures, adopted by local authorities, hinder freight operations by placing restrictions on operations in urban areas (Dablanc, 2007); examples include regulation of parking, loading, and unloading areas (Muñuzuri et al., 2005; Cherrett et al., 2012). Freight operators commonly complain about lack of availability and access to parking, loading, and unloading areas (Ballantyne et al., 2013). Truck restrictions (size, width, weight), zone circulation for trucks (area, time-window) and license-plate-based car rotations⁴ have also been imposed by local authorities to control truck operations inside large centres (Swiatek et al., 2014). In general, truck restrictions are local and conflict with the activities of adjacent municipalities, thereby creating additional problems (Dablanc, 2007). Zone circulation area and license-plate-based car rotations are applied in limited downtown areas to control the flow of vehicles such as heavy trucks. Driver legislation has also been adopted by governments to prevent driver fatigue and ensure drivers comply with legal rest hours (Goel et al., 2012).

These measures can affect logistical performance. They can increase the delivery volume of goods to stores by requiring the use of a large number of light vehicles. Truck restriction by plate magnifies issues because freight operators must schedule trips by the number of plates, and more vehicles are needed to fulfil the deliveries. Moreover, this restriction contributes to a decrease in the vehicle load factor (Arvidsson et al., 2014). In most cases, the measures cause increased inefficiency in the overall transport system (Muñuzuri et al., 2012) and increased logistical costs (Muñuzuri et al., 2005), and negatively influence companies' operations (Stathopoulos et al., 2012). They are formidable barriers to effective, efficient, and sustainable urban freight distribution (Ballantyne et al., 2013).

2.2. Logistical issues and delivery aspects

There are several logistical issues related to delivery and transportation of goods in urban areas that have challenged the effi-

¹ This category encompasses the manufacturing industry.

² Companies that primarily provide inbound and outbound transportation.

³ Companies that have no assets, such as warehouse facilities or their own fleet, and that provide services to customers in the form of responsibility. The activities are performed by LSPs on behalf of a shipper; at a minimum, they include management and execution of transportation and warehousing.

⁴ The car rotation determines that the trucks will have to observe the same system as cars. The licence plate rotation system forbids vehicles to enter an area according to the day of the week and final digit of the licence plate. CET-SP. Companhia de Engenharia de Tráfego. Disponível em <http://www.cetsp.com.br> (accessed 23.06.14) (in Portuguese).

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