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Critical review

Impacts of logistics sprawl on the urban environment and logistics: Taxonomy and review of literature

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ABSTRACT

The location of logistics facilities significantly affects not only the activities of urban goods movement, but also the urban environment as these facilities represent major originators and receivers of freight. Recently, the phenomenon of logistics sprawl, i.e. the relocation of logistics facilities away from inner urban areas to suburban areas has received an increasing level of attention from both academics and policy makers. In this paper, a literature review of the various impacts of logistics sprawl is provided with a detailed taxonomy of the impacts. It has been observed that logistics sprawl contributed changes in geography of urban freight, increasing trucks' travelled distance and consequent emissions and impacting the commuting of logistics employment. The paper presents a summary of the empirical findings illustrating the additional distance trucks travel due to logistics sprawl in several European and North American cities. Furthermore, the paper provides an overview of the measures and policies implemented in various metropolitan areas to reintegrate small-scale logistics facilities within inner urban areas to act as consolidation centres.

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1. Introduction

1.1. Introduction to logistics facilities

The location of logistics facilities are constrained by the availability and zoning of commercial and industrial land that are offered by local authorities. Thus, logistics facilities are limited to where they can locate and can only conform to what is offered and where it is already available. There are different types of logistics facilities that require land depending on the category and objective of the facility, which can be a warehouse, distribution centre (DC), truck terminal or intermodal facility (McKinnon, 2009). Furthermore, the various urban land-use structures for logistics activities, which can be centralised, decentralised, clustered or dispersion, have a direct effect on freight movement within urban areas (United Nations Human Settlements Programme [UN-Habitat], 2013, pp. 63). For example, a centralised and clustered land-use setting would require shorter trips and less frequent stops to deliver the same quantity of products compared to a decentralised and dispersed land-use setting. Freight distribution in urban areas encompasses both bulk freight, which includes transporting primary goods and agriculture/forestry products on articulated and heavy rigid trucks, and non-bulk freight, which covers transporting goods and materials for manufacturing, retail, couriers, express and parcel (CEP), construction, hotel, restaurants and catering (HoReCa) industries (Tsolakis and Naude, 2008; Behrends, 2016).

As logistics facilities represent a pivotal component of the overall logistics network, urban planners need to carefully assess the merits and limitations of land use allocation related to these facilities. They affect the overall landscape, resource use as well as the future economic and social geography of suburban areas (Cidell, 2011). Moreover, the location of logistics facilities has several impacts on both public and private urban freight stakeholders. Lindsey et al. (2014) indicated that for public stakeholders, the location of logistics facilities affect regional truck traffic patterns and influence the well-being of individuals in local communities by contributing to several issues such as noise, air quality, safety and congestion. For logistics companies, the location of logistics facilities has considerable implications on total transport costs and the efficiency of their operations (Dablanc et al., 2014; Lindsey et al., 2014). Rodrigue (2013) estimated that up to 50% of the total operating costs of a distribution centre is attributed to transport costs. Furthermore, as logistics facilities represent the end point for urban freight transport, their location considerably affects the distance travelled by freight vehicles (Wygonik et al., 2014).

1.2. Phenomenon of logistics sprawl

Historically, storage of goods was decentralised with multiple warehouses positioned across the supply chain at the manufacturing site and at the receiver's site with intermediate warehouses between these two locations (Allen et al., 2012). The majority of these warehouses were smaller and located in inner urban areas in the proximity of industrial areas, rail yards and docklands (Dablanc and Rakotonarivo, 2010; Cidell, 2010). Due to various factors related to land use control and new requirements for robust operational environments, logistics facilities are currently located in primarily logistics clusters in the outer edges of metropolitan areas close to highway networks, major airports and seaports (Hesse, 2002; Woudsma et al., 2008; Cidell, 2011; Leigh and Hoelzel, 2012; Allen et al., 2012). This trend of outward movement of logistics facilities from inner urban areas to suburban and exurban areas has been termed as Logistics Sprawl. In this paper, Logistics Sprawl is interpreted based on the definition provided by Dablanc and Rakotonarivo (2010) 'the spatial deconcentration of logistics facilities and distribution centres in metropolitan areas'. Other terms such as "freight sprawl" in New York Metropolitan region (Rodrigue, 2004; de Cerreño et al., 2008) and "logistics polarisation" by Hesse (2008) have also been used to describe the movement and relocation of logistics facilities from inner urban areas to suburban areas. However, the term

"logistics sprawl" is more widely used in the literature. The transformation and movement of older logistics facilities were accomplished by small adjustments in their spatial arrangement with the conversion of older facilities to other uses such residential, commercial or mixed-use and establishing new and large facilities in suburban and exurban areas (Hesse, 2008; Cidell, 2010; UN-Habitat, 2013, pp. 65).

Several studies have observed that a number of large metropolitan areas in Europe (Hesse, 2004; Dablanc and Rakotonarivo, 2010; Allen et al., 2012; Heitz and Dablanc, 2015), North America (de Cerreño et al., 2008; Bowen, 2008; Cidell, 2010; Dablanc and Ross, 2012; Dablanc et al., 2014; Woudsma et al., 2015) and Japan (Sakai et al., 2015) have experienced logistics sprawl at different scales. It can be argued that literature on the impacts of logistics sprawl might be difficult to evaluate as it is spread across various research fields including transportation, urban planning, economic geography, operations research, just to name a few. The majority of literature on the relocation of logistics facilities has paid more attention to the economic benefits and competitive advantages with regard to logistics companies. Existing literature on the topic fails to establish a widely acknowledged and accepted taxonomy of the impacts of logistics sprawl on the urban environment and logistics. Sakai et al. (2016) emphasised that majority of studies on logistics sprawl have focused more on the changes in the location of logistics facilities while the impacts of these relocation shifts have not been carefully considered.

The freight industry appears to have contradicting issues in urban areas, as it is required to operate efficiently and sustainably and adjust to the increasing urban freight activities. This has to be achieved with the majority of customers and retailers being located in inner urban areas while logistics facilities have been forced to relocate to the periphery of metropolitan areas (Labussière and Nappi-Choulet, 2014). Inner urban areas still constitute a major retail and freight destination and attract/generate significant levels of freight movements with very limited supply of available and affordable commercial and industrial land to establish and operate logistics facilities. The volume of freight movements in the central city area has significantly increased due to economical, operational and social factors. A more thorough evaluation and improved understanding of the impacts of logistics sprawl will facilitate more effective public policies and urban planning to efficiently and harmoniously re-integrate logistics facilities and preserve freight infrastructure in inner urban areas.

The motivation for reviewing existing literature on the impacts of logistics sprawl is two-fold. It was observed that a literature review on the impacts of logistics sprawl has been missing even though the field has received more attention recently from scholars and practitioners. This narrative review paper attempts to take a first step, to the best of our knowledge, in proposing a comprehensive taxonomy of the different impacts of logistics sprawl. The analysis presented in this paper contributes to addressing the gap in knowledge and provides a description of how this phenomenon has impacted the urban environment and logistics industry. This paper examines the scholarly literature and critically evaluates the studies that have reported on the impacts of logistics sprawl to check for the different dimensions and patterns that could be used to classify the various impacts of logistics sprawl. This paper is organised as follows. Section 2 highlights the applied method used in this review paper followed by Section 3, which describes the leading factors that have contributed to the relocation of logistics facilities from inner urban areas to suburban areas. Section 4 features the proposed taxonomy of the impacts of logistics sprawl on the urban environment. Section 5 presents some of the measures and solutions implemented in several urban areas in Europe and North America to reintegrate small-scale logistics facilities in inner urban areas. Section 6 provides a concluding summary and recommendations for future research.

2. Review methodology

This paper utilised several channels to identify relevant literature regarding impacts of logistics sprawl. Academic databases such as Science

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