Multimodal Freight Transportation Strategic Network Design for Sustainable Supply Chain: An OR Prospective Literature Review

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ABSTRACT

The strategic network design for multimodal freight transportation is gaining attention from a variety of researchers, such as academic scholars, practitioners and policymakers. Consequently, multimodal freight transportation strategic network design has seen a significant increase in the number of research articles in last two decades. This article evaluates the current state of multimodal freight transportation network design using classification and coding methodology. In this methodology, relevant freight network design articles are divided into different classes such as sustainability aspects, operations research models, available transport modes, the decision maker involved and region of study. The objective of this papers is two-fold namely (a) to identify the existing research in the strategic network design under sustainability aspects, operations research models, available transport modes, actor involved and region of study, and (b) to discuss the new research dimensions of strategic network design for multimodal freight transportation network design.

KEYWORDS

Freight Transportation Network, Literature Review, Multimodal Freight Transportation, Operations Research Models, Strategic Network Design

1. INTRODUCTION

In the global supply chain, network the demand for freight transportation increases year by year. To meet that supply and demand in more sustainable way transportation users and service providers have to combine the different mode of available transportation. In this context, the multimodal freight transportation emerged within all possible transportation systems as the most sustainable mode of transportation between origin and destination of product delivery.

In this article, we aim to review contemporary literature on multimodal freight transportation network design (MFTND), which is a most common concern of scholars, practitioners, and policymakers (SteadieSeifi et al., 2014). Rising the interest to develop a strategic supply chain network for distributing freight over the past few years (Caris, Macharis & Janssens, 2008). After the economic crisis in 2008, the common intention of organizations to minimize transportation cost and better supply chain performance in terms of transportation activities. The best way to obtain this objective was foreseen as an increased cooperation and integration within the actors of the supply chain distribution network (SteadieSeifi et al., 2014). Here actors involved in the distribution network

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may be shippers, logistics service providers (LSPs) or government who makes policies for better transportation network availability.

As the subject of multimodal freight transportation gains more relevance in last two decades, a strategic network planning-based literature review now seems more appropriate, as does identify relevant research gaps for future studies. Also, the strategic planning of the freight transportation is an important function to achieve overall sustainability of the freight transportation and to reduce other transportation externalities like congestion, CO₂ emission, accidents and better vehicle utilization. Consequently, this article provides a selected contemporary publication in Scopus and Web of Science databases. In this paper, a procedure for the literature review is adopted from methodology proposed by (Lage Junior & Godinho Filho, 2010). This article answers the future studies in the multimodal freight transportation strategic network design in following way:

- An identification of most relevant articles related to the MFTND in Scopus and Web of Science databases;
- A detailed classification and corresponding coding of the relevant literature based on a variety of literature classification proposed by (Lage Junior & Godinho Filho, 2010);
- Describe the strengths and weaknesses of the considered studies in the available literature;
- An original future research agenda based on the relevant gaps found in the current literature review.

In order to meet the above-mentioned need of the decision makers, it is a requirement of decision makers to develop optimal solutions for multimodal freight transportation network planning. Previously, some authors have written very good literature reviews on multimodal freight transportation planning such as (Caris, Macharis & Janssens, 2008), (Akkerman, Farahani & Grunow, 2010) and (SteadieSeife et al., 2014). SteadieSeife et al. (2014) review article is one of the most recent contributions to the multimodal transport network planning problem from the year 2005 to the year 2014. The researchers carry out an analysis looking at all three traditional levels of supply chain network planning i.e. strategic, tactical and operational level whereas (Caris, Macharis & Janssens, 2008) gives an overview of the research articles on planning decisions by classifying the planning problems according to the categories of the decision maker and decision level. (Akkerman, Farahani & Grunow, 2010) outline a large review of the transport network planning with especially focus on the food supply chain planning. Their study is related to food distribution management in terms of food quality, food safety and sustainability in the supply chain. Among all review articles strategic planning decisions of supply chain network, is the most critical one which involves long-term decisions with high investment costs. In this article, the review process is limited to the strategic planning of transportation network design with the perspective of operations research methods from the year 2000 to 2017 which provide new research dimensions in future to achieve the greater efficiency of the transportation network.

1.1. The Motivation of Literature Review

The motivation for doing this literature review is that a strategic level planning for freight transportation plays an important role while making a long-term investment decision. This literature review addresses the long-term freight transportation network planning which including various dimensions of sustainability like transportation cost, environmental impact, delivery time as well as the social impact of transportation. A limited literature review paper discussed solely on strategic network design for freight transportation. Therefore, in our view, this article will add significant contribution in the literature of freight transportation strategic network planning. In addition to that, this strategic network planning literature review explores the impact of the environmental and social sustainability while making a network planning decision for the sustainable supply chain.

The detailed structure of this paper as follows. The next section develops a literature review methodology concerning multimodal freight transport, strategic transportation planning and presents a
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