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Assessing the performance of intermodal city logistics terminals in Thessaloniki

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Abstract

This paper presents a comparative analysis of two urban intermodal freight transport terminals focusing on last mile distribution: the port of Thessaloniki (ThPA) and Kuehne + Nagel (K+N) distribution center in Thessaloniki. Through the pairwise comparison of the two different supply chain interchanges, a decision support tool is provided to the terminals' operators and their customers and partners, namely shippers, forwarders, transport companies, users or customers. The evaluation of the terminals' performance is elaborated based on a tailored multi criteria Key Performance Indicator (KPI)-based assessment framework, while the selection and significance (weight) of the incorporated criteria and respective KPIs is predetermined by the involved stakeholders through a multi stakeholder participation scheme using the pairwise comparison according to the Analytic Hierarchy Process (AHP) approach. ThPA terminal is ranked first according to its performance pertaining to the role of an intermodal interchange for the wider geographical area of Thessaloniki, however K+N terminal's performance index was slightly lower, while in several KPIs and criteria it seems to perform better.

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Keywords: city logistics, multi-stakeholder, multi-criteria evaluation framework, key performance indicators, comparative analysis, performance indices, sensitivity analysis, AHP

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1. Introduction

Urban economies are evolving rapidly towards a higher level of material intensiveness. Moving freight within urban areas is a common urban transportation challenge that impacts many large metropolises. The means over which freight distribution can take place in urban areas as well as the strategies that can improve its overall efficiency while mitigating congestion and environmental externalities. It includes the provision of services contributing to efficiently managing the movements of goods in cities and providing innovative responses to customer demands (Rodrigue et al., 2013). Taniguchi et al. (1999) define city logistics as “*the process for totally optimizing the logistics and transport activities by private companies in urban areas while considering the traffic environment, the traffic congestion and energy consumption within the framework of a market economy*”.

Freight terminals can be described as nodes, where goods are freighted between two or more transport modes, and facilitate logistics operations that cover the needs and services of the whole transportation chain. These terminals

are fully geographically defined areas, managed by public or private actors, and where all activities, including transport, handling and distribution of cargo are operated by several enterprises, such as transport and logistics providers or users, established within the terminals (Gogas & Nathanail, 2014).

In literature, several approaches for defining a typology for freight terminals, are met. For example, based on the geographical coverage, volume and capacity, Weigmans et al. (1998) identified five characteristic types, namely: a) mainport terminals, which provide deep-sea, rail, truck and barge connections worldwide, b) International European terminals, which also provide deep-sea, rail, truck and barge connections, but on a more continental level, c) national terminals that operate on country level, and provide rail, barge and truck connections, d) regional terminals, operating mainly as regional distribution centers, offering low cost budget solutions, and e) local terminals, which provide a rather simple connection with rail or barge. Rodrigue and Hatch (2009) defined three types of terminals, including port terminals, rail terminals and distribution centers. The European project REFORM, identified four categories of transport and logistics terminals, i.e. city terminals, freight villages, industrial and logistic parks and special logistic areas (Nathanail, 2007). Lastly, the European project CLOSER, proposed a simpler approach of the REFORM typology, using fewer characteristics and adding one more category thus, rural terminals. A summary of the characteristics of this typology follows (Andersen & Eidhammer, 2011):

- *Special logistics areas*, are usually ports or airports having a national or international orientation, and operated by airport or maritime port authorities.
- *Industrial and logistic parks*, usually covering a large area with big industrial and transport companies. The majority of them is located in the outskirts of the cities or in old industrial areas. Their orientation is regional or national.
- *Freight terminals*, receiving usually public influence on their operation, are mainly located in the outskirts of cities, and they have regional or national orientation.
- *City terminals*, are usually located in or in close vicinities to the cities. These terminals are typically operated by forwarders and retailers.
- *Rural terminals*, having a similar role with city terminals, are sometimes controlled by smaller local companies.

The performance of freight terminals relies on the performance of multiple processes that are undertaken within these areas. The role and performance of terminals that are located in the outskirts of the cities, such as industrial and logistic parks, affect the performance of urban distribution to a large extent, and consequently determine the structure of city logistics.

The aim of this paper is to develop and demonstrate the assessment of the performance of two intermodal freight and logistics terminals in the wider Thessaloniki area, ranking them as per their role as interchanges and interconnectors amongst the intercity freight flows and urban deliveries. The multi-criteria evaluation framework takes into account as parameters both quantitative and qualitative indicators associated with the wider supply chain operational activities and attributes, aiming at the facilitation of the decision-making process concerning the optimum terminal selection. The evaluation methodology is implemented in two terminals in Greece, a privately operated rail-road freight terminal (city terminal), and the Port of Thessaloniki (special logistics area). A short profile of the two terminals is provided below:

- 1) The private terminal is an inland intermodal freight terminal, managed and operated by a logistics service provider and forwarding company (Kuehne+Nagel), which imports and exports goods to/from Greece also including last mile distribution in greater Thessaloniki area using the road and railway network.
- 2) The port of Thessaloniki is managed by Thessaloniki Port Authority S.A. The port provides handling services for various types of cargo, shipping services, passenger maritime services and customs services. Apart from the trucks, accessibility to the freight terminal is provided by rail underpinning intermodality.

This paper reviews and implements methodologies, transport and logistics related network models and Key Performance Indicator (KPI) – based methods for the comparison of the two terminals, in terms of size, handling equipment, hours of operation, throughput (e.g. containers' arrivals) and other components. In addition, it examines the ownership and operational characteristics of the terminals and highlights the efficiencies and the reasons for customer and freight forwarder choice of a particular terminal, which is of great interest to the overall supply chain considerations in the context of decision making from the side of the terminal users. For the evaluation, a Multi-

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