


## Chapter 4

# Evaluating E-Commerce-Related Distribution and Warehousing in Terms of Sustainability

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### ABSTRACT

*In this chapter, the relationships between logistics operations and e-commerce are investigated. The logistics operations are discussed under the distribution and warehousing subjects. The effects of e-commerce on these activities are analyzed by considering the social, environmental, and economic dimensions of sustainability in a broad perspective. For evaluating distribution of e-commerce products, current last-mile operations, trends, and future expectations are investigated in the sustainability concept. Furthermore, the effects of e-commerce on warehouse types and operations are presented. Besides that, location and layout of warehouses, materials used in warehouse buildings, and material handling equipment are discussed with a sustainability perspective.*

### INTRODUCTION

In the last 50 years, the population of the world increased by almost 108% and the ten-year average population growth is almost 16%. (United Nations Department of Economic and Social Affairs, 2019) Since the borders of the world have evaporated by the effect of globalization and the widespread usage of the internet, the purchasing behavior of the consumers of the growing population has been chang-

DOI: 10.4018/978-1-7998-4601-7.ch004

ing rapidly in a global environment. Customers have begun to prefer purchasing from online stores to use their time more efficiently. This change and the global economy affected many industries such as manufacturing and lead to emerge new sectors such as e-commerce.

According to Lawrence et al. (1998) e-commerce is “buying and selling information, products, and services using any of the thousands of Internet computer networks”. In 2019, worldwide e-commerce sales were US\$ 3.53 trillion, and e-commerce revenues are forecasted to increase to US\$ 6.54 trillion in 2022 (Clement, 2019). E-commerce retailing is growing 20% while the traditional retailing is growing 6% annually. However, e-commerce is still just a small part of the total €21 trillion retailing markets in the projection of 2019 (Laudon & Traver, 2016).

In the last decade, logistics has been greatly influenced by the growth of e-commerce. Logistics and cargo companies have been forced to change their operations and facilities to keep pace with the growth of e-commerce and to adopt new delivery services, delivery points and shorter delivery times. These firms have to provide various tailor-made solutions to meet their customers’ fulfillment operations and last-mile delivery requirements. In the meantime, partial shipments and cargo shipments have increased. New distribution models for last-mile-delivery, have emerged. Customer demands are more various and in smaller sizes according to the past (Boysen, Fedtke, & Weidinger, 2018). Due to changing of customer order types, warehouse operations such as receiving, storing, picking and delivering and types have also changed. Fulfillment centers (FC) are established to meet the customers’ changed expectations.

By e-commerce become widespread, consumers visit and shop from brick and mortar (B&M) stores less than before. Although consumers’ movement has decreased (Mokhtarian, 2004), the transportation of goods that is triggered by e-commerce has increased all around the world. Increment of transportation level caused traffic congestions. Furthermore, it produces air pollution and noise. That means a decrease in life quality especially in the center of the cities. According to the U.S. Energy Information Administration Report on energy usage (2019), in 2018, about 28% of total U.S. energy consumption was due to transporting people and goods. Besides that, transportation is the largest producer of greenhouse gas emissions (GHG) with 29% in 2017 (Environmental Protection Agency, 2019). Warehouses also play a significant role in producing GHG. By air conditioning, lighting and material handling operations, warehouses produce 13% of supply chains GHG (World Economic Forum, 2009).

The effect of transportation on energy usage and carbon emission takes the attention of the researchers and leads them to focus on the issue from a sustainability perspective. Because it is a popular subject for the last three decades, sustainability has many definitions. One of the accepted definitions is “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” (World Commission on Environment and Development., 1987). There are three major aspects of sustainability; environmental, economic and social.

Environmental sustainability is defined as “*a condition of balance, resilience, and interconnectedness that allows human society to satisfy its needs while neither exceeding the capacity of its supporting ecosystems to continue to regenerate the services necessary to meet those needs nor by our actions diminishing biological diversity*” by Morelli (2011). Environmental sustainability issues usually include GHG, air and water pollution, biodiversity, waste management, recycling, water consumption, energy consumption, usage of neutral resources, usage of renewable energy, environmentally-conscious customers and businesses, environmentally-friendly products, environmentally-friendly packaging. Economic sustainability is defined as “*maintenance of capital, or keeping capital intact*” (Goodland et al., 2002). Economic sustainability issues usually include global e-commerce sales and the percentage of e-commerce in gross domestic products (GDP) and the cost of products. McKenzie (2004) defines

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