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Minimizing the trade-off between sustainability and cost effective performance by using autonomous vehicles

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Abstract. The activities of the most enterprises are related to the difficulties while adapting to the current market demand, therefore, it is vitally important to define and solve the arising problems. Today consumers require non-expensive, personalized, ecological products just on time to their doorstep. Most government policies in this area are focused on the customer rights, demand in sustainable products and on stemming the environmental impacts of unsustainable production practices. However, the authors' of the current scientific publications are discussing the limited possibilities to achieve the cost effective performance and sustainability. The conducted literature analysis indicates that there is a lack of industry 4.0 practices for supply chain management. The presented publication considers the competitiveness strategy, which contributes to sustainable and optimal costs management. The supply chain must evolve and shift from the traditional to more sustainable solutions. The Internet of Things, big data analytics, cloud computing, cyber-physical systems along with autonomous vehicles and logistic clusters can help to maintain the competitiveness advantage in the long-run. The proposed approach also provides flexibility, redundancy and adaptive abilities to manage the logistic cluster, which allows limit the trade-offs between sustainability and cost effective performance. The simulation of the logistic network was done using the real data from the specialists' interviews within the food industry. The obtained results showed that by implementing the autonomous vehicles strategy along with the consolidation warehouses CO₂ emission level can be decreased by 22%. Moreover, the rest stops are not required during the trip because of the autonomous vehicles implementation in the supply chain. The proposed strategy also decreased costs of the whole logistic network. Currently the practical implementation of the developed distribution strategy is limited by the legislation and infrastructure issues, which should be solved aiming to reach sustainable supply chain and cost effective performance.

Keywords: food industry, industry 4.0, sustainable supply chain, competitiveness, autonomous vehicles.

JEL: L66, O32, C15

1. Introduction

Competitiveness advantage is an important factor to achieve for enterprises in order to earn profit and maintain a favorable position over the long-run. Due to the globalized market, enterprises must adapt their activities to the consumers demand. On one hand, the manufacturing process has required to change from mass production to more personalized products. The achievement of personalized products has increased the production costs. Moreover, today many products can be purchased worldwide, because users have access to products from all over the world. Therefore, the supply chain costs effective performance must also be taken in to consideration, because the product costs has already increased due to the personalized production processes. Consequently, cost effective performance is one of the key aspects of competitiveness advantage, which in this paper is defined as the ability of the organization to deliver top performance services at the lowest possible management costs. If the distribution costs would increase also, the enterprises would loss its competitiveness advantage from the perspective of cost effective performance. On the other hand, government and consumers started to be more concern of the environment effect, which is caused due to the supply chain and manufacturing processes. In the present work, a sustainable supply chain is defined as effective operational management with minimal negative environmental effect. The main problematic area of the transportation processes as a sustainability factor is CO₂ emission level. In order to achieve sustainable supply chain proper distribution strategy must be adapted. Moreover, the CO₂ emission level minimization possibilities will be focused on innovative technologies and clustering processes usage in the proposed competitiveness strategy. Current scientific literature amplifies the necessity to make trade-off between sustainability and effective cost performance (Esfahbodi et al., 2016; Morrison-Saunders and Pope, 2013; Houlton, 2011; Beckmann et al., 2014; Seuring, 2013; Studies, 2012). Esfahbodi et al., (2016) centered their review on empirical evidence to

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