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*Editorial*

# Sustainable Freight Transport

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## 1. Introduction

This Special Issue of *Sustainability* reports on recent research focusing on the freight transport sector. This sector faces significant challenges in different domains of sustainability, including the reduction of greenhouse gas (GHG) emissions and the management of health and safety impacts. In particular, the intention to decarbonise the sector's activities has led to a strong increase in research efforts, which is also the main focus of the Special Issue.

Sustainable freight transport operations represent a significant challenge with multiple technical, operational, and political aspects; the design, testing, and implementation of interventions require multi-disciplinary, multi-country research. Promising interventions are not limited to introducing new transport technologies, but also include changes in framework conditions for transport, in terms of production and logistics processes [1]. Due to the uncertainty of impacts, the number of stakeholders and the difficulty of optimization across actors, understanding the impacts of these measures is not a trivial problem. Research, therefore, is not just needed on the design and evaluation of individual interventions, but also on the approach of their joint deployment through a concerted, public/private programme. This Special Issue addresses both dimensions, in two distinct groups of papers—the programming of interventions, and the individual sustainability measures themselves.

The first 7 papers, besides offering insights about freight sustainability measures, also address progress in the different, typical stages of programme preparation: (1) defining the objectives and the problem; (2) learning from past experiences; (3) systematic generation of solutions; (4) understanding system behaviour; (5) scenario building; and (6) evaluation of policies. The second group of papers focuses on the evaluation of specific solutions to reduce the carbon content of transport. This concerns a wide range of measures, including improved capacity utilisation, electrification, regulatory measures, alternative fuels and vehicle aerodynamics. We introduce the contributions in more detail below.

Within the first group, the opening paper of *Abiye Tob-Ogu, Niraj Kumar, John Cullen and Erica Ballantyne* reports on a systematic literature review of sustainability intervention mechanisms [2]. Two important findings are: (i) the identification of information and communication technology as an opportunity to drive changes towards sustainable transport; and (ii) the strong geographic compartmentalisation of the literature, confined to continental silos. The authors find that relatively few papers are based on collaborative work across continents.

The contribution of *Hongli Zhao, Ning Zhang and Yu Guan* focuses on the identification of the relative importance of factors determining air cargo safety for dangerous goods [3]. They find that, besides regulation of dangerous goods acceptance, the capacity and quality of equipment and facilities also play a role. A potential implication of these results is that, in the area of safety, benefits of innovations in trade facilitation may be constrained by the available physical infrastructure.

*Kinga Kijewska and Mariusz Jedliński* introduce the concept of policy durability for sustainable urban freight transport [4]. In urban freight transport, many policies are known to have been abandoned only a few years after their introduction. The authors analyse the causes and provide directions for more robust policy making, focusing on the inclusion of critical stakeholders that need to be involved to make measures succeed. In most roadmaps for decarbonisation in the freight transport sector, a shift of loads is advocated from current trucks to high-capacity vehicles or even other modes of transport.

The recent experiences with these policies in Sweden are evaluated by *Inge Vierth, Samuel Lindgren and Hanna Lindgren* [5]. In their ex post analysis of the impacts of the introduction of longer and heavier vehicles in Sweden, they find that this measure has not had any discernible effect on modal split. The share of different types of emissions of road transport changed, however, leading to a higher share of GHGs.

An important element of discussions about impacts of policy measures concerns the rebound effects of measures. Increased efficiency may reduce emissions per unit moved but may also increase the number of units moved, due to the demand effect, thus partly neutralising the effects of measures. Often, these rebound effects are assessed through the cost and time elasticities of freight transport. In an original contribution, *Franco Ruzzenenti* explains how elasticities as currently used can be misleading [6]. His main assertion is that tabulating flows as is done today neglects the complex interdependence between flows that is present in networks and that is essential for considering rebound effects. Therefore, he develops a new line of thinking using network theory that may prove important for sustainability analyses.

Two further contributions take the perspective of practical solution scenarios at the country and sector level, respectively. For Spain, *Carlos Llano, Santiago Pérez-Balsalobre and Julian Pérez-García* develop scenarios for emission reduction of domestic freight transport [7]. They build up a consistent flow database, develop default emission projections, and study the impacts of a shift of freight from road to railways. Studies that link the analysis of modal shift potential to detailed flow databases are scarce, and may support the development of modal shift policies that take into account the supply chain context of goods flows.

Reporting about Organization for Economic Cooperation and Development (OECD) research aimed at the decarbonisation of the maritime transport services sector, *Ronald Halim, Lucie Kirstein, Olaf Merk and Luis Martinez* develop pathways for emission reduction [8]. In a systematic study, using a global freight transport and emission model, they consider 4 different pathways. Mobilizing all available technologies, these could lead to a reduction of carbon emissions of up to 95% by 2035, well beyond the current commitment of 50% reduction by 2050. The paper describes the approach and assumptions behind this study, which contributed to the formulation of broadly supported decarbonisation targets by the maritime shipping world.

The second group of papers discusses specific interventions that can be implemented to decarbonise the freight transport sector and approaches that can be applied to evaluate their likely effects. *Jessica Wehner* presents the analysis of opportunities to improve the energy efficiency of operations by increasing capacity utilisation in logistics systems [9]. Her research results in the categorisation of factors that cause unutilised capacity within the categories of activities, actors and areas. These factors are then linked to a number of mitigation measures, such as relaxing delivery schedules, training, and off-peak deliveries, among others. The paper also emphasises the need for a standardised approach to the measurement of environmental impacts of logistics to enable meaningful comparisons between companies.

The potential effects of introducing longer and heavier vehicles (LHVs) in the United Kingdom are investigated by *Heikki Liimatainen, Phil Greening, Pratyush Dadhich and Anna Keyes* [10]. The authors estimate that if LHVs were used similarly in Finland in the transport of various commodities, significant savings could be achieved in truck kilometres, transport costs, and $CO_2$ emissions. Furthermore, lower road freight traffic volumes and reduced emissions are likely to more than offset the possible negative effects of modal shift from rail to road.

*Jesko Schulte and Henrik Ny* focus on overhead line Electric Road Systems (ERS) as a way to improve the sustainability of transporting goods by road [11]. The research show that although ERS may present some severe violations of the sustainability principles, especially in the raw material extraction, production and use phases, they could still be a valuable element in the transition towards a more sustainable freight transport system.

Based on a case study of a Polish town Gdynia, *Jacek Oskarbski and Daniel Kaszubowski* investigate whether a mesoscopic urban transport model already in use there can be populated with urban freight transport data in order to improve evaluation of potential $CO_2$ reductions from the designation of dedicated delivery places [12]. They conclude that this approach produces satisfactory results if basic regulatory measures are considered. However, dedicated freight transport models that can take urban supply chain structure into account are more suitable to study more complex policy options.

*Tharsis Teoh, Oliver Kunze, Chee-Chong Teo and Yiik Diew Wong* demonstrate that opportunity charging offers the potential to significantly reduce the lifecycle costs of using electric vehicles in urban freight transport without increasing related $CO_2$ emissions [13]. The authors also find that other factors also strongly influencing the lifecycle costs are the use of inductive technology, extension of service lifetime, and reduction of battery price. The use of inductive technology and the carbon intensity of electricity generation are the two other factors with a strong influence on $CO_2$ emissions from electric vehicles operating in towns and cities.

*Ján Ližbetin, Martina Hlatká and Ladislav Bartuška* discuss issues related to energy consumption and GHG emissions related to the use of fatty acid methyl esters (FAME) biofuels in road freight transport [14]. They conclude that even though FAME biofuels significantly reduce GHG emissions, their production is highly energy intensive, which translates into steeper fuel prices. Therefore, more research is needed into ways to reduce the energy requirements of FAME biofuels production in order to bring the prices down to an industry-acceptable level.

In the final article, *Erik Johannes, Petter Ekman, Maria Huge-Brodin and Matts Karlsson* focus on aerodynamic improvements for timber trucks in Sweden [15]. While the aerodynamics provide the opportunity to reduce the transport cost of timber in Sweden, the changeover time is found to be the most important parameter to them being economically viable. Hence, in the Swedish timber transport sector aerodynamic kit that does not have to be manually installed is key to the profitability of the investment.

Together the papers in this Special Issue paint a diverse and rich picture of opportunities in the freight transport sector for a transition towards sustainability. They confirm the theoretical availability of a significant and—from the perspective of the global sustainability targets—promising potential for decarbonisation. At the same time, they make us aware of important limitations of policy measures, caveats in our knowledge and weaknesses in our approaches to assess the impacts of policies. All these provide new directions to accelerate R&D, innovation and public policy in the required direction and ultimately create a more sustainable freight transport sector.

**Conflicts of Interest:** The authors declare no conflict of interest.

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