Impact of coalitions formation on carbon and cost savings in road freight transport

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Purpose:

A recent statistics in the UK show that 30% of vehicles are running empty and only 61% of vehicles are utilised to their maximum loading capacity in the UK road freight transport sector (DfT, 2019). There is a potential to reduce both cost and carbon emissions by improving vehicle utilisation in the road freight transport operations. Horizontal collaboration among companies is an effective way to bundle transport resources to increase carbon and cost savings from road freight transport operations. Several studies show that horizontal collaboration has potential for coalition gains up to 30% cost savings and up to 54% carbon savings (Guajardo et al., 2018; Vanovermeire et al., 2014; Lozano et al., 2013).

Cooperative game theory has been applied in previous studies to analyse possible outcomes, studies what participating organisations can achieve, which coalitions can form, how gains can be divided in such coalitions, and whether the outcomes are robust, fair and stable (Guajardo et al,. 2018; Vanovermeire and Sörensen, 2014). The participating companies in horizontal collaboration can achieve better gains when the size of collaboration increases (Guajardo and Rönnqvist, 2015). According to cooperative game theory, grand coalitions offer better gains compared to formation of sub-clusters. However, grand coalitions may not be the best strategy as coordination costs increase as the coalition grows in size (Lozano et al., 2013). For small sized companies, these coordination costs have the potential to outweigh any benefits. Previous works have focussed on grand coalition formation and not considered the size of the participating firms. Some participating firms in a coalition may be better off forming smaller clusters instead of joining a grand coalition. This paper focuses on formation of coalition in the FMCG sector and identifying which clusters are likely to achieve the lowest cost carbon abatement when the size of the firm and coordinaton costs are taken into account.

Design/ methodology/ approach:

This paper reviewed existing literature to develop a framework for coalition formation and identify coordination costs. This framework was applied to real-world data and findings from a previous study to understand its impact on coalition formation (Dadhich et al., 2016). The data considered 9 FMCG companies during a single month that includes postcode of origins and destination of trips, type of vehicle used, quantity moved and frequency of movements.

The carbon and cost savings were calculated by merging transport flows and using Shapley value for their allocation.

Findings:
The finding presents cost components involved in the formation of coalition and increases understanding of their impact on coalition formation. By forming a grand coalition, companies can achieve higher cost savings but the impact of coordination costs may lead to the formation of smaller coalitions instead of large coalitions.

Value:
The research on size of firms involved in horizontal collaboration from a coalition perspective is scarce in the road freight transport sector. This paper contributes to the existing literature of 'determining and dividing gains' by providing empirical evidence of coordination costs on the coalition formation.

Practical Implications (if applicable):
Findings from this research will help managers to understand which collaboration clusters are more beneficial for horizontal collaboration. In addition, the results will provide valuable insights into coalition formations when size of firm is considered in horizontal collaboration clusters.

References:

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