Title: Development of a Carbon-Mapping Framework for the international distribution of fresh fruit

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Abstract

Background: The global distribution of fresh fruit from the southern to northern hemisphere requires a standardised and accurate method to determine the carbon emissions. Due to the difference in production seasons, fresh fruit from the southern hemisphere is in high demand in the northern hemisphere's out of season period. This distribution from the southern to the northern hemisphere is carbon-intensive, since it requires large shipment distances and multiple modes of transport. Further, fruit requires extensive cooling to extend the shelf life. This refrigeration, large number of links and uniqueness of each producer's supply chain (SC) complicates the calculation process even more.

Purpose: Globally there is increasing pressure from consumers and governing bodies to reduce greenhouse gas emissions. Stakeholders in the logistics sector have innovative solutions at their disposal to achieve this abatement. The identification of activities in the SC that require the most improvement is, however, challenging. This can be attributed to the absence of information quantifying SC emissions. The availability of such data will enable stakeholders to develop an overview of SC emissions. Identifying the activities in a SC that are most prevalent in terms of pollution then enables stakeholders to focus reduction efforts. In addition, the ability to determine the carbon emissions due to the distribution of a product would affect suppliers' and customers' preferences. The market will inevitably choose the product with the smallest carbon footprint.

The primary objective that is pursued during this project is the development of a carbon-mapping framework for fresh fruit distribution. This framework enables stakeholders such as logistical service providers, producers, and retail supermarkets to calculate the carbon emissions produced by their activities. The project will only analyse the distribution of packed fruit from a South African packing facility up until the international port of destination. Thus, from the gate of the packing facility to the port of the country of import. The framework will cover fruit types such as stone fruit, table grapes, pome fruit, citrus fruit, subtropical fruit, and lastly exotic fruit.

Research approach: The project will analyse data in order to establish a profile of South African fresh fruit exports. This will be followed by a systematic literature review (SLR) of existing carbon mapping frameworks used for fruit distribution. A literature review of other carbon mapping frameworks, general activities in a fresh fruit SC and generic emission factors for these activities will also be conducted. An analysis of the legislation regarding carbon mapping frameworks will also be performed. This is followed by semi-structured interviews with subject matter experts to determine the generic activities in each fruit type's SC. These activities will then be used to create a generic SC

for each fruit type. The developed SC will then be validated by means of semi-structured interviews once again.

Findings and originality: The SLR identifies a gap in the existing literature. The project also offers insight into the type of activities performed during the distribution of fresh fruit. It further provides examples of generic SC's for different fruit types' distribution.

Research and Practical impact: Having a carbon-mapping framework for the distribution of these fresh fruits would aid stakeholders by simplifying the process of calculating emissions. This would also provide a standard for the industry to determine the emissions associated with fruit distribution and identify the activities with the largest contribution for future reduction efforts. Stakeholders involved in the distribution of fruit will most probably be compelled to state the emissions related to their activities in the future. This ability to state the carbon footprint due to the distribution will be needed to gain access to specific markets. Until this scenario becomes mandatory, the ability to state the emissions related to the distribution of a product will lead to a market advantage.

Keywords: carbon footprint; carbon mapping; distribution; framework; fresh fruit; GHG emissions; logistics; South Africa; supply chain