A Conceptual Framework for the Integration of Transportation Management Systems and Carbon Calculators

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Abstract Greenhouse gas emissions produced by supply chain processes such as manufacturing, warehousing, or transportation have a huge impact on climate change. Hence, they are the focus of possible future regulations introduced by (inter)national institutions. In particular, transportation processes play a decisive role in supply chains and are responsible for a significant amount of greenhouse gas emissions. Therefore, many companies try to quantify the amount of emissions caused by their transportation activities. At the moment, several tools for the calculation of greenhouse gas emissions, so called carbon calculators, are available but their results vary to a large extent depending on the input data, the parameters included, and the methodology used. Especially real time data like traffic conditions or driving habits are not taken into account although they affect the result significantly. For that purpose we present a conceptual framework for the integration of real time data and carbon calculators by linking greenhouse gas emission data with Transportation Management Systems. By doing so, the accuracy of emission estimates from a carbon calculator can be improved.

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1 Introduction

Transportation processes are essential parts of the supply chain as they perform the flow of materials that connects a company with its suppliers and with its customers (Fleischmann, 2005). Only by the appropriate and well-defined use of transportation can a supply chain be successful (Chopra and Meindl, 2004). To support participants of a supply chain in decision-making with regard to transportation, information and planning systems called Transportation Management Systems (TMS) can be used. A TMS enables companies to optimize their transportation activities and related tasks, i.e. for example route planning and status tracking ( Günther and Seiler, 2008).

Transportation processes are responsible for emitting a considerable amount of CO2 and other greenhouse gases, thus having a huge impact on climate change. The discussion to include transportation in possible future regulations introduced by (inter)national institutions gains more and more importance. Having said this, lots of companies are now trying to quantify the actual amount of greenhouse gas (GHG) emissions caused by their transportation activities. At the moment, several tools for estimating GHG emissions from transportation, so called carbon calculators, are available. But their results vary to a large extent, depending on the input data, the parameters included, and the methodology used. Furthermore, real time data such as weather conditions or traffic conditions are usually not considered, making it hard to quantify the actual GHG emissions of a certain transportation process precisely. Therefore, we present a conceptual framework of how the accuracy of GHG emission estimates can be improved by integrating carbon calculators and TMS. Consequently, we are able to consider actual events like accidents, congestion, or varying weather conditions when estimating GHG emissions.

The remainder of this work is structured as follows. In Section 2 we provide insights into state-of-the-art Transportation Management Systems and describe their functions, scope, and limitations. We take a close look at carbon calculators in Section 3 and assess theirs calculation methodologies and the data used. The presentation of our framework in Section 4 is followed by conclusions and opportunities for further research in Section 5.

2 Transportation Management Systems

According to Günther and Seiler (2008) a TMS is a “software used to manage transportation planning and execution”. The main objectives of a TMS are “to plan freight movements, select the appropriate route and carrier, and manage freight bills and payments” (Gartner, 2010). Additionally, the facilitation of the procurement of transportation services and the execution of transportation plans with continuous analysis and collaboration are also considered functions of a TMS (Helo and Szekely, 2005). Due to the vast amount of vendors offering TMS there is a high number of available TMS solutions. They are usually offered in various deployment models, for instance as on-premises installation or managed services.