LEAN & GREEN EUROPE

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Giving significance to big data in supply chains

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Lean & Green: true sustainability

Since the publication of the first edition of the Greenhouse Gas Protocol (GHG Protocol) in 2001 a growing number of companies in logistics have started to measure and report their carbon emissions as part of their social responsibility efforts. Over the years more and more companies have seen that the efforts to reduce the emission footprint are aligned with increasing the competitiveness of the company, which is especially the case for reducing their logistics' footprint. Emission footprints have proven to be reliable indicators of costs and effectiveness of processes and supply chains. Improving emission footprints and the competitiveness of the company at the same time represents true sustainability.

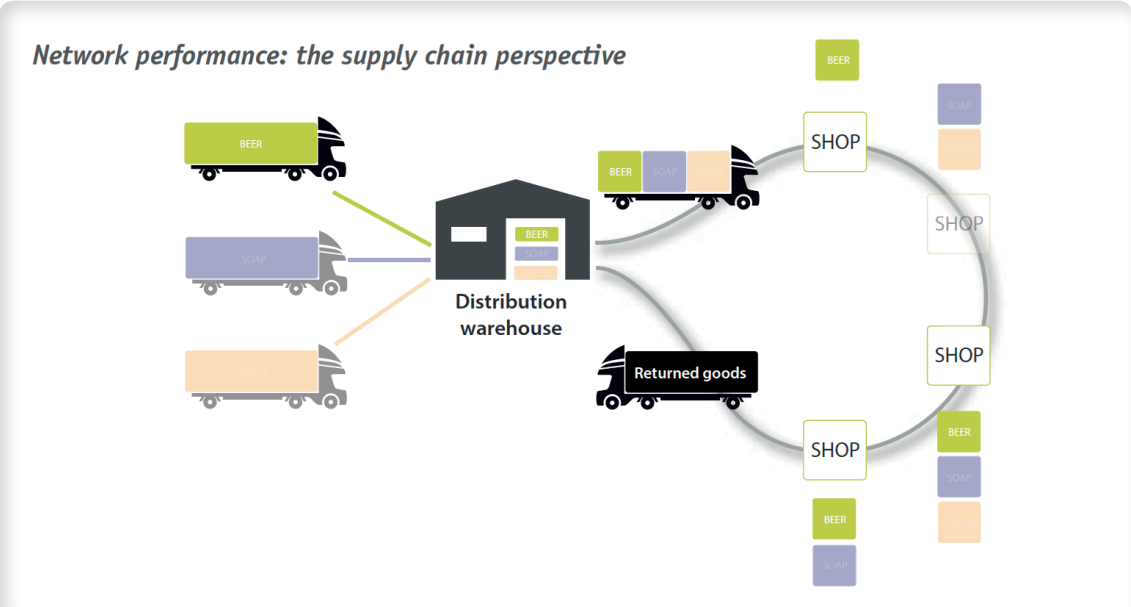
The Lean & Green program has given these companies a platform to set themselves goals and learn from their peers. The voluntary challenge to reduce their CO_2 emissions by at least 20% in five years has proven to focus and energize companies, resulting in lower emissions, lower costs and a better position in the market. Now that many Lean & Green participants have embarked upon their journey and are starting to realize their initial reduction targets, the wish to set new challenges has been voiced. However, to reduce unused capacity further, innovation and cooperation in supply chains are essential.

Besides, the frontrunners want to be able to benchmark themselves against peer groups and best practices in their sector, identifying untapped potential improvements, and gaining competitive advantage by being able to actually show they are best in class.

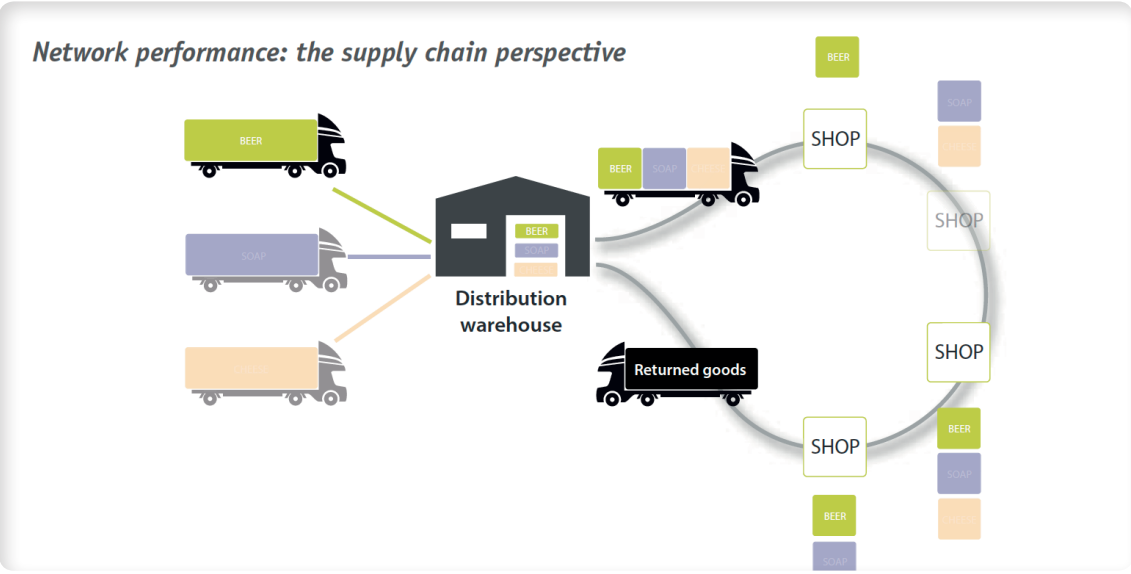
The Lean & Green rating framework gives significance and meaning to measurements

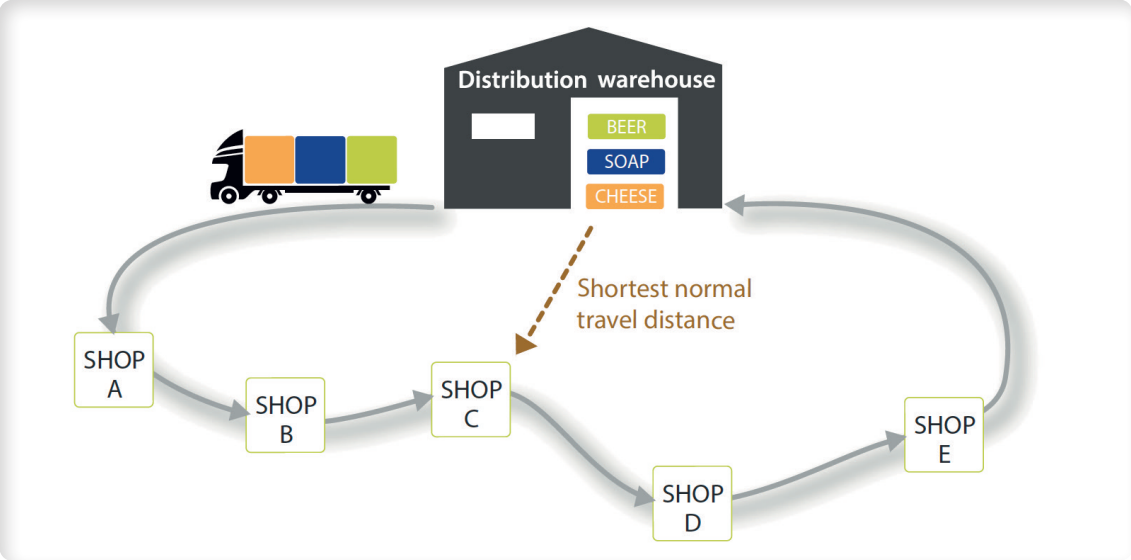
With the growing number of companies measuring and reporting on their emissions, numerous carbon footprint calculation standards (models and methodologies) have been developed. The Lean and Green rating framework has been developed to give significance and meaning to the emission data: the Key Performance Indicators (KPI's) should be aligned with the challenge of innovation and cooperation in supply chains. The first need is to identify the relevant KPI's that foster cooperation and innovation, and at the same time allow for peer group comparison. Experimenting with several Lean & Green frontrunners showed that multiple KPI's are needed, as no single KPI can do justice to the complexity of supply chains and the different roles and responsibilities.

There are two supply chain perspectives that are interdependent and should be taken in account: One perspective is the shippers' perspective. This perspective looks at the products that have to be delivered to the customers through a supply chain that could be built by multiple LSP's, several inventory facilities, or other logistics network decisions. This perspective can be expressed in a KPI that indicates the quantity of carbon emissions per unit (ton or m^3) delivered. This perspective will be referred to as 'network performance'.



Another perspective is that of an LSP (transport operator) optimizing his part of several combined supply chains by optimizing multiple products, delivery addresses, routes and transport modes and transport equipment. This perspective can be expressed in a KPI that indicates the quantity of carbon emissions per unit.km (ton or m3) of the LSP. This perspective will be referred to as 'carrier performance'.





COFRET: the basis for allocation of emissions to individual shipments in a combined delivery run is the shortest normal travel distance for a shipment. In this case the shipment to C is compared to other shipments in this run by the shortest travel distance between the warehouse and drop C, not the actual travel distance via A and B.

The intersection of these two perspectives and therefore KPI's is the focal point of innovation.

The Lean & Green framework is aligned with, and builds upon existing standards

The new European Standard EN 16258 'Methodology for calculation and declaration of energy consumption and GHG emissions of transport services' is an important step in creating a harmonized framework for carbon reporting. This standard and the additional work of the COFRET Project for allocating energy use/emissions in distribution shipments provide excellent building blocks for the Lean & Green framework.

However, the EN 16258 leaves some degree of freedom for the application of the standard, and therefore clear choices have to be made to give the required significance to the data. The Lean & Green framework helps to make these choices based on the practical experiences of Lean & Green frontrunners, and chooses to start with the core operational data of a logistic operation. Also other methods such as the Swedish Network for Transport and Environment (NTM) can be used to support in making the right choices.

Core workflow data delivers powerful KPI's through big data

To accurately calculate the KPI's and allocate data to the various partners in a supply chain only limited number of data elements are required, be it on a shipment-by-shipment level in the part of the supply chain that is measured. Shipments are combined in a truck, train or vessel that transports shipments to each predetermined destination. The data elements required per shipment are the origin, the destination and the effective transport resource needed, expressed in weight or volume.

The energy/fuel use by the vehicle is ideally provided on a shipmentby-shipment level as well. KPI's that are based upon the pure core data can easily be aggregated and combined in various ways, without losing their power and validity. Yet this data quality level is not always easily available at this moment.

The quality ladder of data

The challenge is to record, access and process the core data in detail, for instance while using subcontractors. The reality now is that often less specific data is available from the various source systems. However, this less specific data can still be used to calculate the same KPI's, be it with less accuracy and with less information value. An increased data quality to higher levels over the years will remedy that.

The following levels of data quality and detail of data be identified (from high to low):

1 **Specific operational direct data:**
   - Origin, destination and weight or volume per shipment, and the energy/fuel use

2 **Specific operational indirect data:**
   - Weight/volume is calculated by converting other unit indicators (pallets, TEU, containers, etc.) into weight or volume
   - Energy/fuel use is calculated by multiplying distance covered with vehicle specific values

3 **Generic operational data**
   - Generic default values are applied for weight/volume and/or distance covered
   - Generic default values are applied for energy/ fuel use or carbon emissions

4 **Financial data**
   - Financial information (cost, spend) is used to estimate weight/volume, distance covered and energy/fuel use.

Within a company combinations of different levels can be applicable, for instance a company can have specific operational direct data for the in-house operations and generic operational data for subcontracted business.

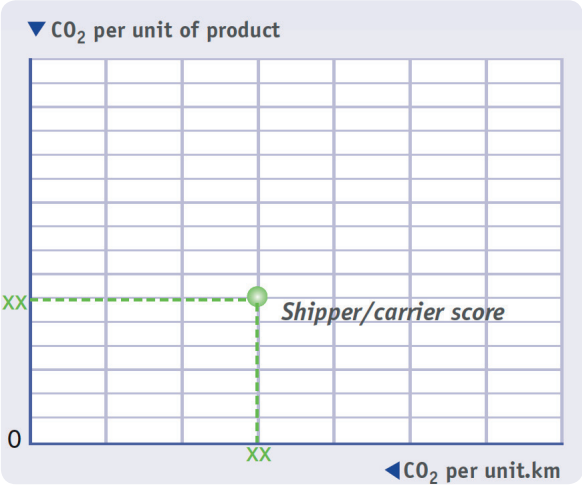
Allocating data from LSP's to shippers for subcontracted operations

Shippers with subcontracted business will have to request LSP's to allocate their emissions to the shippers' specific business. The Lean & Green framework builds upon the allocation rules of EN 16258 and COFRET. An important element in EN 16258 is that allocation of emissions for collection and distribution round trips is based upon the shortest feasible distance (as opposed to real distance covered). With core workflow data the LSP can specify the emissions per shipper based on datasets per shipper. With less detailed data the allocation of LSP's emissions to shippers can be based on average data across all shippers served by an LSP.

The interpretation of the KPI's: giving significance to data

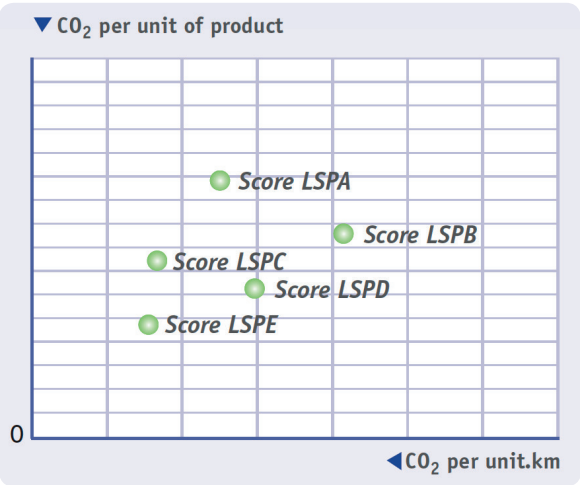
Network performance is expressed in carbon emissions (in kg CO_2) per unit (weight, or volume) transported. Network performance is an expression of how effective the logistics (and with that the transport) network to ship a good/product from the source to the client is organized. In this KPI sourcing locations, locations of factory and warehouses, and locations of clients (= the way shippers have organized their supply chains) greatly impact the outcome of the KPI. Of course other (reduction) factors such as load optimization, fuel efficiency, clean fuels will also have an impact on the outcome of the KPI. As supply chain characteristics hugely vary between industries, comparisons for this KPI are only relevant with industry peers.

Transport performance is expressed in carbon emissions (in kg CO_2) per unit-kilometer. Transport performance is an expression of how efficient the actual transport is carried out on a part of the supply chain for one or more shippers. In this KPI network locations (source, factory, warehouse, and client) do not impact on the KPI, as the KPI is calculated per kilometer. Therefore this KPI is affected primarily by load optimization (efficiency), fuel efficiency, modal choice, and the use of clean fuels. These two KPI's can be plotted on a twodimensional field, indicating the overall performance of the shipper and carrier. This is illustrated in the figure below.

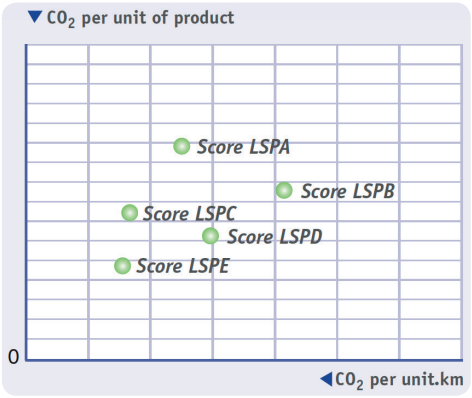


The combined set of KPI's provides a good basis for defining and showing improvements by carriers and shippers (both separately as well as combined). The result of individual actions by both shippers and carriers can be assessed by studying the movements in the KPI's, and shippers and carriers can jointly discuss what the best outcome for their specific supply chain is.

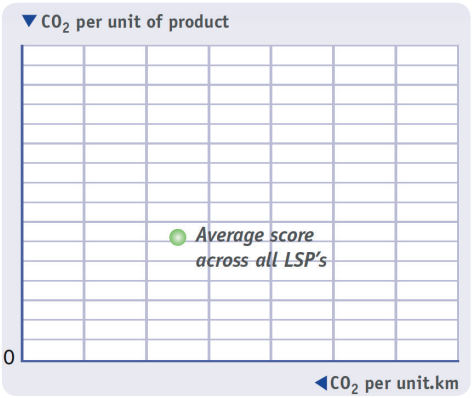
In addition, best practices and benchmark data can provide a further stimulus for both carriers and shippers to achieve performance levels of frontrunners. The performance can be measured for different combinations of shippers and carriers:



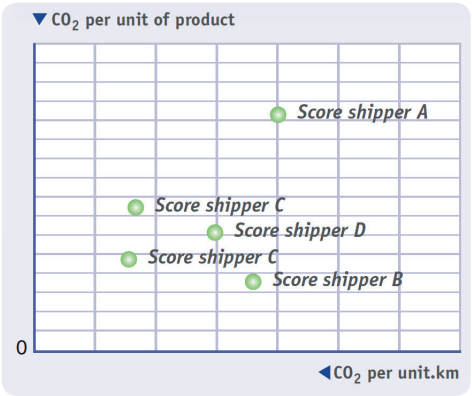
- A shipper can define the individual performance for all the LSP's used. Each LSP will have a different point in the graph. This will give insight on the performance of the different LSP's and corresponding parts of the supply chain that are covered by these LSP's. Comparing different LSP's and parts of the supply chain helps to identify further improvements and to define best practices within the supply chain of a specific shipper.



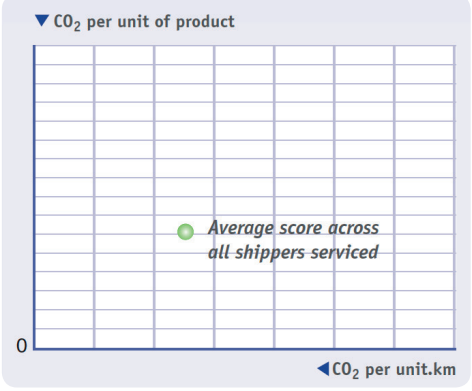
- A shipper can also define the average performance for all the LSP's used. This will result in one point on the graph for the entire supply chain. This number can be benchmarked against companies in the peer group.



- A LSP can define the individual performance for all the shippers serviced. Each shipper will have a different point in the graph. This will give insight on the performance for the different shippers serviced. Comparing different shippers helps to identify further improvements and to define best practices within the services provided to different shippers.



- A LSP can also define the average performance for all the shippers serviced. This will result in one point on the graph for the entire operations. This number can be benchmarked against LSP's in the peer group.



Aggregation

The KPI's can be aggregated on different levels without losing their significance. Aggregation can be done by an LSP, aggregating the scores for all the shippers serviced, and by a shipper, aggregating the scores for all the LSP's used. On a timescale, scores can be defined per shipment or can be aggregated per period (month, year, etc.).

The scores per shipment can be useful in making choices (e.g. selection of LSP, modality, route) ex-ante, while the scores per period will provide a basis for assessment and monitoring ex-post.

Implementation and development

The principles of the Lean & Green framework and the required calculations are simple when good operational data is available, or when used in ex-ante projections and simulations.
Access to good operational data may require combining data from various IT-systems which may not be possible yet due to financial and operational limitations. The alternative is to start with a lower quality of data and improve over time.

The KPI's should be benchmarked within peer groups with more or less similar operational characteristics. Existing typologies like FTL/LTL/Groupage/Parcel/Mail for LSP's are possibly sufficient. The actual benchmarking will show what definition of peer groups is practical.

Road transport and air transport IT systems are highly developed: a lot of data is already available in various operational systems. For other modalities the data availability is currently relatively immature. Specific measured values are not always available for cargo trains or inland waterway vessels, while the use of default values is not representative for barges due to large differences in fuel combustion per barge and currents in the rivers.

Carbon emissions by equipment used at transport nodes (e.g. container terminals, warehouses, cooling and refrigeration) should also be taken into account to give an accurate view on performance. There are no clear rules yet for allocation of emissions at transport nodes. Incorporation of more specific data on transport nodes can also be improved over time.

Other publications in this series

2013 (1) **Giving significance to big data in supply chains**

2015 (2) Metrics for continuous improvement of the supply chain performance

2016 (3) Analytics

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