# Development & Implementation of a Sustainability Performance Improvement Model on Transport and Logistics Chains in the French Forest Based Sector

Frank Müller

Institut technologique FCBA, Pôle Economie Energie et Prospective | 10, avenue de Saint-Mandé, 75012 Paris

☎ +33 (0)1 40 19 48 77 | ✉ frank.mueller@fcba.fr

*Background & objective*

One of the main challenges the French forest based sector (FBS) faces today refers to timber transports between the source of raw material and its industrial transformation, i.e. the production of sawn and energy wood, pulp & paper as well as the panel industry. Timber transport related expenses are accounting for 20% up to 40% of raw material costs (Le Net et al., 2011). Additionally, transport is inextricably linked to substantial direct, indirect and cumulative undesirable impacts on society and environment (Chester & Horvath, 2009; Piecyk, 2012; Rodrigue et al., 2009; Schreyer et al., 2004). For instance, global transport accounts for 14% of global greenhouse gases (OECD, 2001). Lead and particulate matter are contributing to air pollution and health risks (ibid.). Schreyer et al. (2004) quantified the external costs of freight transport caused in 2000 (resulting from e.g. accidents, noise, and air pollution) to about 3 % of the EU17's GDP. The demand in timber transport in the French FBS is predicted to further increase over the next decades (Le Net et al., 2011, Agreste, 2013). Moreover, in certain regions a shortage of timber is expected (Logibois, 2013). As a consequence, companies might have to increase their sourcing radius, coming along with growing volume of timber transport, thus, both related material costs and externalities.

Given this background, the overall objective of the research project is to contribute to the development of more sustainable transport[1] solutions along the upstream value chain of the French forest based sector.

*Approach*

The study combines theoretical and empirical research along three interlinked research phases, applies a systems approach, i.e. taking a logistics and supply chain management perspective (see e.g. Stock et al., 2001; Heaver, 2001; Caddy et al., 2007), and uses mainly qualitative methods. The first phase aims for a critical reflection of existing theories on transport and logistics management along supply chains in the light of sustainability issues, combined with the generation of a general understanding of real world conditions in the French forest based sector. This phase is based on an extensive exploratory literature review, field observations and expert interviews. Doing so builds the basis for more precisely defining both research question and research methodology. The second phase combines these results with an in depth analysis of real world conditions to develop a theoretical framework for more sustainable transport from a supply chain and logistics management perspective. This framework will be transferred into a model for future application in the upstream value chains (supply networks) of the French forest based sector. The third phase aims to test this model in the scope of selected case studies, establishing jointly with different actors of selected network(s)/ supply chain(s) scenarios for more sustainable transport solutions. Finally, these scenarios will be evaluated using a selected (to be identified), and if necessary adjusted, sustainability performance assessment tool.

---

[1] Here and in the following referring to freight transport

*Initial insights*

Transport activities are affecting various different sustainability aspects. An exhaustive overview on parameters influencing transport performance regarding those aspects seems to be not available. Some authors, however, have started to address this issue for selected aspects (Richardson, 2005; McKinnon, 2012; Piecyk, 2012). Piecyk (2012), for instance, focuses road freight transport and related $CO_2$ emissions. She describes the latter as a sequence of outputs: $CO_2$ ultimately results from fuel consumption while the latter in turn is an output of total vehicle kilometers and this, again, a function of road tonne kilometers, etc. (Piecyk 2012). She linked these outputs to their directly and indirectly influencing logistics variables, including for instance carbon intensity of fuels, fuel efficiency, empty running, loading factor, average length of haul, handling factor and modal split (ibid.).

We distinguish two general, complementary ways to address these variables – adjusting technology and/or organisation. Our main interest refers to the organisational level. That is, the focus lies on rather intangible aspects such as organisational structures and processes with direct or indirect influence on the variables above. Sanchez-Rodrigues et al. (2010) identified "insufficient supply chain integration" as a "main driver [...] impacting the sustainability of transport operations" (p.61). Understanding cooperation (despite nuances in definition often also referred to as coordination and/or collaboration; see e.g. Hammer 2006) as a means towards better integration (cf. Hammer 2006), the research centres on different types of cooperation such as degree, direction and scope. The study, thus, aims to realise "external synergies across the supply chain and the diverse actors within it" (Brewer 2001, p.354) through better coordination among the different actors. This seems particularly interesting considering the transport characteristics and supply patterns upstream the French forest value chain, involving numerous actors with both competitive and non-competitive relation[2].

Several authors have contributed to research on and provided examples for different types of inter-organisational cooperation towards more efficient transport. To name just a few: Bahrami (2003), for instance, focused horizontal cooperation between logistics service providers (though in a different sector), highlighting consolidation of deliveries as means to reduce the overall transport distance bridged. Frisk et al. (2010) are referring to horizontal cooperation e.g. in terms of wood bartering, which is a frequently used approach in the Swedish FBS (ibid.). Mason et al. (2007), in contrast, discuss amongst others a combination of horizontal and vertical cooperation, referring for instance to pallet networks, (however, again in a different sector) which "create and exploit a single point of control for the whole operation with a modular pallet system" (p.195). In their work the authors refer to what is called collaborative transport management, a concept which is defined by VCIS[3] (2004) as "a holistic process that brings together supply chain trading partners and service providers to

---

[2] The early steps of the French forest value chain are characterised by specific technical transport requirements and a particular network structure, involving various different actors including forest owners, cooperatives, forest experts (forest cultivation/ management), forest entrepreneurs and carriers. The latter typically are highly atomised and of small nature (Le Net et al., 2011). About 85% of wood transports are based on hire or reward (hired mostly by the receiver of the transport goods), whereas about 15% of the industries transport on their own account, simultaneously offering transport services for other timber processing industries (ibid.). The main transport mode for wood and cork in France is road based (92% of overall tonne kilometers, 98% of overall tons transported; EU25 about 79% and 89% respectively), compared to ca. 8% (2%) transported by rail (ibid.). Water based transport plays a minor role. Major transport related inefficiencies have been identified particularly with respect to empty (back-) haulage and insufficient or missing route optimisation (Logibois 2013).
[3] Voluntary Interindustry Commerce Solutions Association, now part of GS1us

drive inefficiencies out of the transport planning and execution process" (p.3). The studies identified so far, however, do neither explicitly draw a link to transport sustainability nor do they look at a wider network of different actors and supply chains (as can be observed for wood products industries in France and other countries; cf. e.g. Aguilar 2008) but are limited to dyadic or triadic relationships. The intended research aims to contribute filling this gap.

Proposing inter-organisational cooperation as promising means to improve the sustainability performance of transport in the French FBS, it is required to identify in more detail if and how such examples given above, as well as other cooperation based solutions, can be applied with which specific gains. That is, a key task of the intended research is to identify, which form(s) of cooperation is (are) suitable to be applied in the context of the upstream supply network of the French FBS in terms of scope, intensity and direction (valuable input here can be derived for instance from the "framework for an efficient implementation of logistics collaborations" by Audy et al., 2012). This endeavour also requires identifying the transport related sustainability indicators (and their potential trade-offs) relevant for the sector, how they are influenced by which logistics variables and, in turn, which actors are influencing these key determinants (to which degree, based on which decisions within which business context). As starting point, the existent framework of Richardson (2005) and Piecyk (2010) can be drawn on. Moreover, further elaboration of the existing inter-organisational relationships is required.

*Expected results*

This research project is expected to contribute to approaches on logistics and supply chain management suitable to drive improvements in the sustainability performance of both the forest wood product related transport sector, thus, also overall supply chain sustainability. More precisely, the research results will i) highlight the role of different actors' activities, routines and market forces with respect to their potential influence towards more sustainable transport, particularly from a supply network perspective; ii) shed light on requirements and barriers supporting and hindering concerted action, inter-organisational information exchange and re-structuring of networks; and iii) provide insights into transport decision making in consideration of sustainability objectives and its potential trade-offs, serving also the further development of decision support instruments such as performance assessment tools. Moreover, results are expected to help practitioners in understanding the strategic relevance of (the manner and degree of) collaboration to identify and implement options for more sustainable transport.

## References

Agreste, (2013), <u>La forêt et les industries du bois</u>, Ministère de l'Agriculture de l'Agroalimentaire et de la Foret, Montreuil Sous Bois.

Aguilar, F. X. (2008),.Effect of Centrifugal Forces on Cluster Patterns in the Softwood Lumber Industry of the United States, *Forest Science*, Vol.54n°2, pp. 242-249.

Audy, J.-F., Lehoux, N., D'Amours, S., & Rönnqvist, M. (2012), A framework for an efficient implementation of logistics collaborations, *International Transactions in Operational Research*, Vol.19n°5, pp. 633-657

Bahrami, K. (2003), *Horizontale Kooperationen in der Transportlogistik kurzlebiger Konsumgüter*, Deutscher Universitätsverlag, Wiesbaden

Brewer, A. M. (2001), *Organizational Logistics: Definition, Components, and Approaches*, in A. M. Brewer, K. J. Button, D. A. Hensher (Eds.), *Handbook of Logistics and Supply-Chain Management, 2 ed.*, pp.11-28., Pergamon, Elsevier, Amsterdam, London, New York, Oxford, Paris, Shannon, Tokyo.

Caddy, I. N. & Helou, M. M. (2007), Supply chains and their management: Application of general systems theory,

*Journal of Retailing and Consumer Services*, Vol. 14 n°5, pp. 319-327.

Chester, M. V., Horvath, A. (2009), Environmental assessment of passenger transportation should include infrastructure and supply chains. *Environmental Research Letters*, Vol.4 n°2, 024008.

Frisk, M., Göthe-Lundgren, M., Jörnsten, K., Rönnqvist, M. (2010), Cost allocation in collaborative forest transportation, *European Journal of Operational Research*, Vol.205 no°2, pp.448-458.

Heaver, T. D. (2001), *Perspectives on global performance issues*, in A. M. Brewer, K. J. Button, D. A. Hensher (Eds.), *Handbook of Logistics and Supply-Chain Management, 2 ed.*, pp.11-28., Pergamon, Elsevier, Amsterdam, London, New York, Oxford, Paris, Shannon, Tokyo.

Le Net, E., Bajric, F., Vötter, D., Berg, S., Anderson, G., Roux, S. (2011), *Identification of existing transport methods and alternative methods or new approaches with data about costs, labour input and energy consumption*, EFI Technical Report, Joensuu.

Logibois, (2013), *Avant-Projet Logibois, Rapport Final*, FCBA, Visial SA, ADI, IMS, AFB, BEM, Beynel, FIBA.

Mason, R., Lalwani, C., Boughton, R. (2007), Combining vertical and horizontal collaboration for transport optimisation, *SCM: An International Journal*, Vol.12 no°3, pp.187-199.

McKinnon, A. (2012), *Environmental sustainability: a new priority for logistics managers*, in A. McKinnon, M. Browne, A. Whiteing (Eds.), *Green Logistics. Improving the environmental sustainability of logistics, 2nd ed.*, pp.3-29, Kogan Page Publishers, London, Philadelphia, New Delhi.

OECD, (2001), *OECD Environmental Outlook*, OECD, Paris.

Piecyk, M. (2010), *Analysis of Long-term Freight Transport, Logistics and Related CO2 Trends on a Business-as-Usual Basis,* Heriot-Watt University, Edinburgh.

Piecyk, M. (2012), *Carbon auditing of companies, supply chains and products*, in A. McKinnon, M. Browne, A. Whiteing (Eds.), *Green Logistics. Improving the environmental sustainability of logistics, 2nd ed.*, pp.51-70. London, Philadelphia, New Delhi.

Richardson, B. C. (2005), Sustainable transport: analysis frameworks, *Journal of Transport Geography*, Vol.13, pp.29-39.

Rodrigue, J.-P., Comtois, C., Slack, B. (2009), *The Geography of Transport Systems (2 ed.)*, Routledge, London, New York.

Sanchez-Rodrigues, V., Potter, A., Naim, M. M. (2010), The impact of logistics uncertainty on sustainable transport operations, *International Journal of Physical Distribution & Logistics Management*, Vol.40 no°1/2, pp.61-83.

Schreyer, C., Schneider, C., Maibach, M., Rothengatter, W., Doll, C., Schmedding, D. (2004), *External costs of transport. Update study*, INFRAS, IWW, Zürich, Karlsruhe.

Stock, J. R., Lambert, D. M. (2001), *Strategic Logistics Management (4 ed.)*, McGraw-Hill.

VICS (2004), *Collaborative Transport Management - White Paper*, CTM Sub-Committee of the VICS Logistics Committee, version 1.0