March 17th — 18th, 2021 | Darmstadt, Germany
Interdisciplinary Conference
on Production, Logistics and Traffic
www.icplt.org

ICPLT – Modal shift for freight transport in France: will a supply policy be enough?

Francois Combes[1] and Patrick Niérat[1]

[1] *Univ Gustave Eiffel, IFSTTAR, AME/SPLOTT, France*

Abstract. Freight transport is an essential economic activity. The current organisation of the French and global economy and industry implies massive commodity movements; the efficiency of freight transportation is a critical driver of global economic productivity. However, freight transportation generates negative impacts (including climate change, pollution, congestion, etc.) Consequently, public policy often aims at an increased role of non-road transport modes (rail and inland waterway), in order to "remove trucks from roads". Today, in France, the mode share of road is 89% in tkm (from 51% in 1974). This is seen as excessive, and major political actions have been implemented over the past decades to reduce it, without success. In the current global context, mode shift is, again, discussed, as a way to contribute to recover economically. Therefore, it is important to analyse why rail freight is so weak in France. This is the objective of this article, which provides possible causes, based on the geography of commodity flows, the cost structure of rail transport, and the preferences of shippers. The paper is focused on inland transportation. The conclusion is that an indiscriminate improvement of supply cannot achieve what was failed in the past; that rail cannot do everything; and that a fine land use planning approach is necessary to the improvement of the rail mode share.

1 Logistics and mode choice

Shippers belong to supply chains: groups of firms which contribute together to produce and distribute goods [1]. A critical issue of supply chain management is how goods will be made available to customers: the *level of service*. This concept encompasses several dimensions, including how the goods are delivered (leadtime, reliability, etc.), the risk of shortage, the number and position of shops where they can be bought, etc. The choice of transport mode is but one of the several decisions shippers have to make when managing a supply chain.

From a supply chain standpoint, shippers' preferences regarding freight transport stem from three main causes: production constraints, consumer preferences, and geography. Figure 1 illustrates three typical configurations. In case (a), large quantities of a homogenous good are extracted and carried in bulk towards a given destination where they can easily be stored before they are consumed in predictable amounts. Heavy, non-road transport modes are often profitable in such situations. Case (b) is more complex: heterogenous goods are produced in a unique location but are carried towards many distinct destinations, where the demand is relatively random. It is sometimes possible to rely, partly, on non-road modes. The third case (c) is the least adequate for non-road modes: production is disaggregated and decentralised, destinations are numerous and scattered, goods are very heterogenous, storage is costly, and demand is largely random.

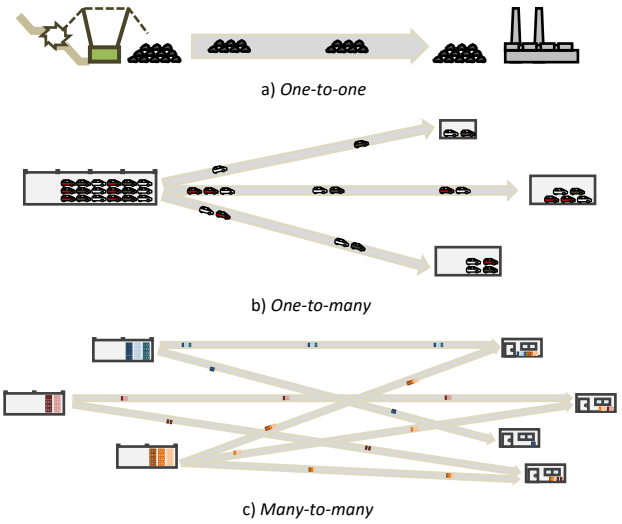

Figure 1: Various supply chain configuations

In order to understand mode choice in freight transport, one should have in mind the following facts: first, supply chains are extremely heterogenous. There is nothing common between the logistics of heavy industry and that of B2C e-commerce. Second, non-road modes are most often not compatible with the constraints of shippers. Third, consumers' preferences play an important role: our preference for variety, instantaneity and low prices put an enormous pressure on supply chains. In a way, we are all guilty. Regarding logistics and the preferences of shippers, [2, 3, 4].

2 The technical solutions

In order to shift a commodity flow from road to a non-road mode, it is necessary that the speed and cost of the alternative are at least as good. It is sometimes simple, sometimes complex, sometimes simply impossible.

If a shipper sends enough commodities towards a receiver to use a unit train or a barge, those modes will be efficient (Figure 2, cases 1 and 2). The shipper and receiver have a branch line, or a wharf. In France, these conditions are met for no more than a few hundred firms.

For smaller quantities, and for firms with branch lines, the wagonload solution is preferable (case 3). A few wagons can be dispatched together; they are then carried towards the receiver, but not directly. They go through marshalling yards, where they are grouped, then divided, before they are delivered at destination. Collection on the branch line implies fixed costs (locomotive, driver, train path). The unit costs decrease with the number of wagons dispatched together. If the collection is too slow or if there aren't enough wagons, it will be too expensive. Then, one should renounce to an unprofitable operation.

Combined transport is another solution (case 4). Any firm can use it. The freight is loaded into a specific container, the swap body. Those are different from shipping containers. The swap body is carried by road towards a terminal where it is loaded on a train. The freight can consist in one shipment of 20t as well as hundreds of parcels. In order for combined transport to be competitive, the cost of principal transport operation (the train movement) must be very low. This requires that the train is full. Furthermore, the terminal has to be adequately located. Indeed, only firms located in a certain area around (but not centered on) the terminal may use it [5]. Finally, the lead time requirements demand that the trains are direct and at a frequency of at least once per day. The competitivity of combined transport increases with distance, and with the density of firms in the vicinity of the terminals. In France, this technical solution is limited to direct relationships between Paris and Lille, on one hand, and half a dozen large urban areas in the south of France, on the other hand.

Maritime combined transport (case 5 and 6) is specific to the case where one destination is a maritime port. Lead time constraints are often less stringent. This explains the success of the transport of containers on the Seine and the Rhône.

As a conclusion: the technical possibilities for mode shift are far from being universal. In some cases, there aren't any.

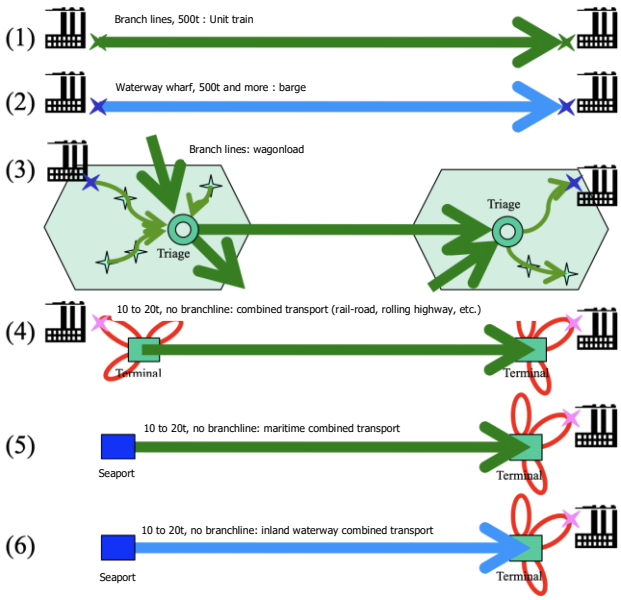

Figure 2: Non-road inland technical solutions

3 Some directions to improve mode shift

Many policy instruments can be implemented to improve the share of non-road modes: cost

reduction, efficiency improvements, taxes, new infrastructures, etc. They lower the competitiveness threshold of non-road modes. However, this threshold moves slowly: even a substantial modification of the relative costs of road and non-road modes will not engender a significant shift between them.

The competitiveness of non-road modes depends very closely on the economic geography. If the firms which are potential candidates to non-road modes are seldom and scattered, try to accommodate each of them can be so costly that it will prove impossible to both provide an efficient service and ensure the economic survival of the carriers. A supply policy should follow a few rules of thumb:

- infrastructure should be developed where they are relevant: heavy industrial goods movements, combined transport on a limited number of axes, maritime transport, etc.;
- it should go together with a fine land use planning policy, aiming at improving the consistency between the economic geography and the cost efficiency of non-road modes [6]. In more detail:
    - for wagonloads, firms should be located along existing branch lines, where there is already a viable demand;
    - branch lines where traffic is low and without growth perspective should be let go;
    - firms should be located in the market area of combined transport terminals;
- providing non-road modes services everywhere should not be an objective.

Rolling highways should also be discussed. This technical solution consists in carrying semitrailers with specific wagons. It is aimed at transit traffic. This kind of service cannot target regional and interregional traffic, which is structurally diffuse. Besides, the development of rolling highways will be, to a point, at the expense of combined transport.

A mode shift policy for freight transport must acknowledge the fact that non-road modes cannot do everything. For decades, in France, huge financial amounts were invested to improve the share of these modes. Maybe they slowed down their decline, but they could not reverse the trend. The current economic geography of France is unfavourable (contrarily to other European countries.) In addition, such a policy should not be an indiscriminate investment aiming to serve all territories alike. It should be targeted and go together with a precise land use planning strategy, coordinated at the local, regional and national levels.

References

1. Rushton, A., Croucher, P. and Baker, P. *The handbook of logistics and distribution management: understanding the supply chain.* Kogan Page Publishers, (2014)
2. Baumol, W. J., & Vinod, H. D. An inventory theoretic model of freight transport demand. *Management science*, 16(7), 413-421 (1970)
3. Combes, F. Logistic imperatives and mode choice. In *European Transport Conference*, Glasgow, UK (2010)
4. Combes, François, and Lóránt A. Tavasszy. Inventory theory, mode choice and network structure in freight transport. *European Journal of Transport and Infrastructure Research* 16.1 (2016).
5. Niérat P. Market area of rail-truck terminals: pertinence of the spatial theory. *Transportation Research part A*, 31(2) 109-127 (1997)
6. Niérat P. Report modal : un problème de réseaux ou une question de services ? *Recherche transports sécurité* 27, 273-282 (2011)