Enhancing Transportation Efficiencies Through Carrier Collaboration

Synopsis:
Some trucking companies have begun to look outside their operations for additional efficiencies by “cooperating with competitors,” i.e. with other carriers. This has been referred to as Collaborative Transportation Management. We present simple examples where a firm (i.e. a trucking company or an organization that has its own private fleet) can enhance its transportation efficiencies through Less-than-Truckload collaboration. The results can include both reduced cost and improved customer service.

Key words: Truckload, Less-Than-Truckload, Collaborative Transportation Management, Collaborative Logistics

Introduction
The business landscape is constantly evolving and the internet has fostered opportunities that were once not available. “Cooperation” has become a buzzword in industry; the internet is an ideal platform to nurture these cooperative initiatives.

However, more recently, “collaboration” has gained a lot of attention. It indicates a stronger relationship, between firms or supply chains, than cooperation. We broadly define collaboration as: “The coordinated flow of material and information within and between supply chains’ vertical and horizontal structure. The goal is to mutually improve the efficiency of the supply chains locally, among collaborating members, and globally across all supply chains involved.”

The key to supply chain collaboration is a mutually beneficial outcome for all collaborating members. Still, many are skeptical about the outcome of
collaboration. Some suggest that collaboration may lead to a conflict if not managed correctly. Therefore, there was a need to establish guidelines. Voluntary Interindustry Commerce Standards Association (VICS) developed Collaborative Planning, Forecasting, and Replenishment (CPFR) for this purpose. CPFR is a nine-step business process model for value chain partners to coordinate sales forecasting and replenishment in order to reduce variance between supply and demand (Aichlmayr, 2000).

In this paper we focus on Carrier collaboration which falls into another business process model also developed by VICS, known as Collaborative Transportation Management (CTM). In academia the term “Collaborative Logistics” is widely used when referring to transportation collaboration, but we use CTM as it is prevalent in industry.

There are two types of collaboration in CTM, namely shipper and carrier collaboration. Shipper collaboration has been the focus of recent academic studies (Ozener and Ergun, 2006; Ergun et al., 2007). However, carrier/Less than Truck Load (LTL) collaboration has not been studied to date. Carrier collaboration may lead to benefits different from shipper collaboration. Therefore, it needs to be studied independently. We highlight these benefits in the context of LTL carriers by using simple examples. This is the main contribution of our paper.

The paper is organized as follows. Section 1 explains CTM and its associated benefits. Section 2 details carrier collaboration. Concluding remarks are given in Section 3.

**Collaborative Transportation Management (CTM)**

The search for collaboration in transportation is a direct result of global and local supply chains reacting to competitive pressures. The roots of both CPFR and CTM are in Vendor Managed Inventory (VMI). VMI involves a collaborative partnership between the supplier and retailer and has been identified with many benefits. However, it has two main deficiencies.

Firstly, VMI transfers responsibility to the manufacturer while the retailer still dictates most of the rules, which makes the collaboration ineffective. Secondly, VMI fails to consider the influence of the carrier. The benefits of collaboration depend on transportation carriers, who need to be part of the collaborative process to avoid surprises on the timing and sizes of planned shipments. Carrier capacities and the transportation lead times can then be aligned with supply chain efficiency.

CPFR and CTM were developed by the VICS to address these two inefficiencies. CTM (Sutherland, 2006) was an extension of CPFR to include the carrier as a Supply Chain player, to reduce costs, increase asset utilization, and improve service and revenue. CTM views the shipper, carrier and receiver as three “principle players” in...
the supply chain. We think the progression from VMI to CTM is almost evolutionary.

The basic principle underlying CTM is quite simple. By collaborating with potential competitors, companies are integrating multiple supplier and carrier networks. This allows firms to benefit from expanded opportunities. Collaboration itself is enabled by sharing information and enhanced communication between all “collaborating partners.”

This raises two important questions. The first is, How much information should be shared? This depends on the degree of collaboration. Sutherland (2006) suggests four levels of collaboration; the extent of information sharing increases with each level.

The second question is, How can information sharing be facilitated? It is facilitated by use of a safe and common information hub. Such hubs are usually maintained by 3PLs such as Nistevo or Transplace, who provide confidential and specialized collaborative services.

An important benefit from CTM is improvement in customer service. This is the most important factor for firms to stay competitive. Over time, the service requirements have become more stringent due to internet orders and promised delivery dates. Therefore, transit time uncertainty needs to be reduced to attain the desired service.

One consequence of a company’s mission to achieve excellent customer service is the resulting increase in transportation cost. In recent years, greater driver turnover and deadhead miles, revised hours of operation and heightened security have all contributed to the soaring cost of transportation. Companies have resorted to CTM, working together to eliminate inefficiencies, reduce costs and improve service.

CTM also applies across different time horizons, from strategic to operational. Strategic plans concern supply chain network design, fixed asset planning, etc. Tactical-level plans involve collaboration in transportation procurement and contracting. The most dynamic form of CTM is operational collaboration. This pertains to enhancing asset utilization through better shipment and carrier management, and improved fleet routing and scheduling.

Operational collaboration implies high complexity and information requirements. However, as competition forces carriers to reduce costs, they have little choice but to master collaboration. Our work relates to a special form of operational CTM. This will be explained in the following section.

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**Carrier Collaboration**

**Motivation**

In shipper collaboration, Shippers form “communities” and collaborate in order to bundle lanes. A lane is a contiguous portion of highway or road, considered by the carrier as a single link for routing purposes.
Carriers prefer bundled lanes, as they may lead to what are termed “continuous moves”. Continuous Move Routes (CMR) are ones in which the carrier’s truck is always full. Such a route will ideally have zero deadhead miles and no asset-repositioning costs. The latter costs are incurred when a truck travels empty between two stops. Reduction in asset repositioning costs can lead to large savings for carriers, since trucks travel empty twenty percent of the time.

This reduction in cost allows carriers to offer more competitive rates to the shipper, thereby providing an incentive for shippers to collaborate. Shipper collaboration also leads to “recurring” work for drivers, which is important as driver turnover has reached a record high in recent years.

CSCMP’s 18th Annual State of Logistics report states that transportation costs made the biggest leap by increasing 9.4% from 2005 to 2006. The cost incurred in 2006 by motor carriers alone was a staggering $635 billion US. This further splits into intercity and local (Figure 1) and amounts to $432 billion and $203 billion respectively. Therefore, even a small percentage decrease in cost through collaboration can translate to substantial reductions in real cost.

Shipper collaboration enables lower costs because of the bundling of lanes by a single carrier. Still greater benefits could be achieved if there were multiple carriers, and they collaborated. We call this “carrier/LTL collaboration”. There are two types of carriers, Truck Load (TL) and LTL. TL carriers provide a point to point service, similar to the linehaul or intercity route represented in Figure 1. In this case, repeatability of routes and continuous moves as a result of combining lanes are worthwhile.

LTL carriers, on the other hand, are concerned with delivery of small shipments, ultimately over a limited geographical region, similar to local delivery shown in Figure 1. LTL collaboration aims at designing continuous moves which minimize asset-repositioning cost. As before, the bundling of routes is certainly beneficial, but the loads tendered to LTL carriers are usually small in size and not predictable. Therefore, benefits from shipper collaboration are much reduced for LTL carriers.

**LTL/Carrier Collaboration**

For the reasons mentioned above, carriers need to be involved in LTL collaboration. The linehaul truckloads that arrive at a breakbulk point (Figure 1) are broken into smaller shipments and delivered using LTL carriers. As LTL carriers serve geographical regions that are more localized, especially in urban freight transportation, this leads to overlapping routes.
If routes overlap and trucks are traveling less than full truckload, there may exist opportunities for carriers to collaborate, improve asset utilization and reduce asset-repositioning costs. This was the question that led us to investigate carrier collaboration. The benefits to LTL carriers of carrier collaboration are similar to the benefits to TL carriers of shipper collaboration. However, the underlying process of collaboration is quite different. Hence, there is a need to study carrier collaboration independently.

Similar to shipper collaboration, carrier collaboration also requires formation of carrier communities. These communities are usually supervised and facilitated by 3PLs, ensuring that all parties honor their side of the agreement. Carriers agree upon rules guiding collaboration, e.g. information-sharing policies, security model, etc before joining the community.

Carrier collaboration initiatives are important, since pressure to ship sooner has led to half-full trucks delivering goods in urban regions. This poor asset utilization leads not only to low carrier revenues, but also to greater congestion in cities. Congestion in urban areas is becoming an increasingly important problem for both commuters and environmentalists.

There is, in addition, the pressure for shippers to reduce inventories that formerly protected against supply chain uncertainty, but now these are additional deliveries in lightly-loaded vehicles. Competition largely prevents carriers from raising their rates, hence carriers will benefit from forming networks and collaborating. These communities will lead to expanded opportunities, reduced infrastructure expenses and, as a result improved efficiency, diminished costs to operate the transportation service.

Urban areas are thus particularly suited for carrier collaboration. In many cities, there is a limited number of points of entry for trucks. (In Toronto, for example, there are about four points of entry from major highways.) Breakbulk points often are located at these entry points. Once carriers breakdown their loads into smaller shipments there, they may combine some of those loads, provided that overlapping routes correspond to trucks that are not entirely full. In other words, spatial orientation of routes, time windows and truck capacity are all factors that determine successful collaboration.

Before proceeding further we define two important terms: “Deadhead miles” are those that the truck travels empty, while “extra miles” are those that the truck travels inefficiently. Consider carriers A and B. Carrier A is traveling extra miles if carrier B can accommodate a customer of carrier A in its route and incur a smaller increase in route distance than the decrease in route distance of carrier A. This is the inefficiency indicated in the definition of extra miles.

Next we explain the details of carrier collaboration. For simplicity we assume no time windows in the examples to follow. One of the possibilities for collaboration occurs
when the routes of both carriers overlap (Figure 2), and one of the trucks (red/solid route) has sufficient space to accommodate the loads of all customers from another carrier’s route (black/dashed route). In this case, the red carrier saves a truck while the black carrier has higher asset utilization and lower deadhead and extra miles. The decrease in cost can be shared between the collaborating customers.

Figure 2: Reduction in number of vehicles and empty miles

The lack of space to accommodate some of the customers from another carrier’s route will make the aforementioned scenario infeasible. In this case, collaboration may still be beneficial if it can result in reduction of extra miles traveled.

Figure 3: Reduce extra miles that may have been traveled

To illustrate, consider the two routes shown in Figure 3. The nodes of the red/solid route marked R1, R2 and R3 are the customers that can be profitably transferred to the black/dashed route. After collaboration, the resulting routes, (shown on the right) allow the red carrier to reduce extra miles traveled, and allow the black carrier to reduce deadhead miles while increasing its asset utilization. If profits can be shared, this exchange is mutually beneficial.

The situations described above, of collaborating and transferring loads at an entry point, may not be possible if trucks are full and have large loads to be delivered early in the route. Once these initial loads are delivered, the trucks will have excessive empty space and low asset utilization. To counter this disadvantage we need to make the collaboration more dynamic. Carriers must be able to transfer goods, if possible, after they have left the depot and while they are performing deliveries.

A stylized example of this is shown in Figure 4. The transshipment point is marked TP. B1 is the node on the black/dashed route from which the truck deviates to pick up the loads of R1 and R2 at node TP. The tradeoffs here are the increase in deadhead miles as a result of the deviation to pick up loads at TP, and the reduction in extra miles as a result of collaboration. The new routes resulting from collaboration do not overlap. Again, collaboration leads to a “win-win” situation for both carriers.

Figure 4: Transshipment at the customer's site

Once time windows are introduced, collaboration results in yet another
advantage. By transferring customers from one route to another, we increase the routing time of one carrier while reducing the routing time of the other. The route from which customers are transferred will have a shorter routing time. In addition to reducing extra miles, the associated truck will be available for reuse much earlier. This may allow the same vehicle to be used for the next set of local deliveries. Therefore, we not only save in distance but also in time, which may translate to better service and higher overall asset utilization. In fact, even the carrier to which passengers are transferred will enjoy increased asset utilization.

Moreover, collaboration between carriers also increases customer service. Accidents and breakdowns can be common in urban areas. A breakdown can prevent a company from providing the promised service. As a result, the carrier may become less competitive because of a perceived decrease in reliability.

Today’s trucks are equipped with state of the art communications systems; these new transportation management systems allow information to be shared in real time. Once carriers are in a collaborative community, the ease of information transfer can allow other alternatives to be considered in case of an accident or breakdown. Contingency plans can be made to deliver the goods to the destination as promised.

The features and benefits of carrier collaboration can be defined, but the implementation is quite challenging. This requires strong commitment from all carriers in the community. Further, efficient transfer of goods is crucial in achieving substantial gains in collaboration.

There are many unanswered questions which we are currently analyzing. These questions focus on information sharing, facilities for goods exchange, facility ownership, carrier community size and connectivity within the community.

**Conclusion**

Both practice and the theory explained in this paper suggest that collaborating with potential competitors can lead to synergy. Due to its unique benefits, collaboration in LTL transportation needs to be studied in addition to TL collaboration.

We have given simple examples to illustrate these benefits and presented challenges that need to be faced while implementing LTL collaboration. Our future research aims to answer many of these implementation issues and show that LTL collaboration can be used to promote excellence in logistics practice.

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About the authors

Selvaprabu Nadarajah is a Research Assistant at the Waterloo Management of Integrated Manufacturing Systems Laboratory (WATMIMS) and a Master of Applied Sciences Candidate in the Management Sciences department, University of Waterloo, Canada. He has a Bachelor’s degree in Aerospace Engineering from the Indian Institute of Technology-Madras, India. His research interests include algorithm design and large scale optimization techniques applied to Supply Chain Management. Mr. Nadarajah has presented at conferences in Canada and India and has given guest lectures in Undergraduate optimization classes.

James H. Bookbinder is a Professor of Management Science at the University of Waterloo. He has a decade of full-time industrial experience, and continues to work with transportation carriers and third parties on the analysis of logistics and supply chain strategies. Jim is a past-president of the Canadian Operational Research Society and past-chair of the Transportation/Logistics Section of INFORMS. He holds an MBA from the University of Toronto and a PhD from the University of California, San Diego.

Dr. Bookbinder is Director of WATMIMS, the Waterloo Group for research in logistics and manufacturing. For 15 years he has been an Associate Editor of Naval Research Logistics, and was formerly an AE of Operations Research (“OR Practice”). His current research includes extension of NAFTA supply chains to Latin America; inventory-transportation management in the New Economy; and lessons that Europe can teach the NAFTA countries. Jim has edited a special issue on “Global Logistics” for Transportation Research E: Vol. 41 (6), 2005; http://authors.elsevier.com/sd/article/S1366554505000529. He attends two to three conferences per year and gives the same number of invited talks in Canada and the U.S.