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# Establishing a Motor Carrier Research Agenda

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## ABSTRACT

The motor carrier industry represents an important linkage in a variety of industry supply chains and accounts for a substantial level of total logistics cost. This article combines a review of motor carrier research over the past 10 years (1996-2006), with input from executives representing common and specialty carrier services, to identify key areas of interest to guide future motor carrier research.

## INTRODUCTION

Transportation is an important link supporting the success of supply chain operations in most industries. Of the \$736 Billion dollars in domestic transportation cost identified in the 17<sup>th</sup> Annual State of Logistics Report, fully 79% (\$583 Billion) were attributed to motor carrier costs. Motor carrier costs accounted for 49% of total logistics costs and over 4% of the US GDP in 2005 (Wilson 2006).

While supply chain management and logistics as areas of research have received considerable attention over the last decade, the authors sought to investigate the extent of research focused on the motor carrier industry. The purpose of this article is two-fold. First, a review of the past ten years of published research in the area of motor carrier management and operations is presented including topics and

extent of coverage. Second, to offer a practical perspective of future research opportunities and interests, the authors' interviewed executives of leading motor carriers including truckload, less-than-truckload, temperature controlled, flatbed, and tank carriers. Combined, the review of research and insights from the professionals interviewed are used to suggest important topics for consideration in an on-going motor carrier research agenda.

The next section reviews research topics specific to the motor carrier industry from logistics and transportation related journals. The review is followed by results from depth interviews with executives from the motor carrier industry. The final section combines these inputs to suggest a topical agenda for consideration in future studies involving motor carrier management and operations.

## Motor Carrier Research: 1996-2006

The focus of this study involves management and operational issues in the motor carrier industry. It excludes research concerned with broader economic and federal or state government policy issues as well as issues related to civil and mechanical engineering applications in transportation. Article abstracts were reviewed for the 1996–2006 issues of the logistics and transportation related journals included in Table 1. In addition, an electronic search was conducted in the Emerald and Business Source Premier Databases for studies involving motor carrier management and operations that may be published in other general or topical scholarly publications.

Articles were selected for review if the topic focused on motor carrier management and/or operations. Articles which addressed broader transportation research topics of which motor carriers were one of many transportation alternatives were excluded from the review.

A total of 111 articles were identified with a specific research focus on motor carrier related issues from the journals reviewed. Table 2 identifies the numbers of articles from each of the respective journals. A review of article abstracts revealed 11 categories of research. The articles were each assigned to one of the eleven

topical categories. In cases where article content may be associated with more than one category, the assignment was made to that area which appeared to be most predominately addressed in the study. Table 3 identifies each category, as well as the number and percentage of articles assigned to the respective categories.

Thirty two articles focused on research involving the development and testing of modeling algorithms. These studies incorporated methodologies including linear and mixed integer modeling, heuristics, genetic algorithms, game theory, and simulation. The primary area of study involved variations on routing and scheduling algorithms (Pankretz 2005; Zhong and Cole 2005). Studies also considered potential solutions to load optimization and matching problems (Morabito, Morales and Widmer 2000) as well as fleet sizing (List et al. 2003).

Of the fourteen articles identified in the industry structure/competition category, a majority continued to investigate the impact and implications of deregulation on areas such as market structure (Giordano 1997), cost efficiency and profitability (McMullen and Man-Keung 1999; Silverman, Nickerson and Freeman 1997). A few studies considered shifts in strategy (Feitler and Corsi 1997; Feitler, Corsi and Grimm 1998) and market expansion (Hanna and Maltz 1998).

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**TABLE 1**  
**LOGISTICS AND TRANSPORTATION RELATED JOURNALS INCLUDED IN STUDY**

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*Transportation Science*  
*Journal of Transportation Economics and Policy*  
*Transportation Research A: Policy and Practice*  
*Transportation Research E: Logistics and Transportation Review*  
*Transportation Journal*  
*Journal of Transportation Management*  
*International Journal of Physical Distribution and Logistics Management*  
*Journal of Business Logistics*  
*International Journal of Logistics Management*  
*Transportation Quarterly*

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**TABLE 2**

<b>Journal</b>	<b># Articles</b>	<b>% Articles</b>
<i>Transportation Science</i>	22	19.81
<i>Transportation Research E: Logistics and Transportation Review</i>	19	17.11
<i>Journal of Transportation Management</i>	18	16.22
<i>Transportation Journal</i>	16	14.41
<i>International Journal of Physical Distribution and Logistics Management</i>	11	9.91
<i>Journal of Business Logistics</i>	5	4.50
<i>Transportation Quarterly</i>	4	3.60
<i>Journal of Transportation Economics and Policy</i>	2	1.80
<i>Transportation Research A: Policy and Practice</i>	1	.90
<i>Miscellaneous Journals (12 separate journals)</i>	13	11.12

**TABLE 3**

<b>Category</b>	<b># Articles</b>	<b>% Articles</b>
Models/Algorithm Development	32	28.8
Industry Structure/Competition	14	12.6
Information Systems	13	11.7
Organizational Relationships	11	9.91
Human Resources/Employment	10	9.01
Asset Management	9	8.11
Performance Measurement	6	5.41
Operations	5	4.50
Quality Management	4	3.60
Finance/ Economic	4	3.60
Safety	3	2.70

Thirteen articles involving information system related studies were distributed among three primary topics, those involving the implementation and application of electronic data interchange (EDI) technologies for communication between shippers and carriers

(Crum, Johnson and Allan 1998; Clarke 2000), the application of mobile communications technologies such as satellite technologies for fleet management (Parker, Kent and Manrodt 2000; Manrodt, Kent and Parker 2003), and the emerging usage models and internet technologies

for promotion, planning and management (Golob and Regan 2003; Kent, Parker and Schaefer 2003)

Studies of buyer/supplier relationships in the motor carrier industry have addressed carrier involvement in relationships (Gentry 1996; Gentry 1996), criteria and differing perceptions regarding criteria used in carrier selection (Premeaux 2002; Kent and Smith 2006), and relationship trends (Crum and Allen 1997).

The majority of studies concerned with human resource issues have focused on driver recruitment and retention. These studies have investigated factors such as the nature of the driver/customer relationship (Keller 2002), the driver/dispatcher relationship (Keller and Ozment 1999), managerial issues (Min 2002) and the impact of regulation (Peoples and Peteraf 1999) and on driver retention.

Asset management issues have focused on life cycle costing and vehicle replacement (Hanna, Stapleton and Zoll 2004), fleet design (Taylor, DuCote and Wicker 2006), terminal layout (Gue 1999; Bartholdi and Gue 2004) and fuel performance (McCarthy and Tay 1998).

The six articles involving performance measurement looked at the role of benchmarking and scorecards as a basis for performance measurement (Poli and Scharage 2003; van Donselaar and Kokke 1998) as well as shipper perceptions regarding LTL carrier performance (Keller 1996).

Areas more specific to operations that were contained in the studies involved the application of routing and scheduling methods (McKinnon and Yongli 2006), the usefulness of traffic information (Golub 2002) and the value of advanced load information (Tjokroamidjojo, Kutanoglu and Taylor 2006).

Quality issues in motor carrier operations addressed issues related to service quality (Crosby and LeMay 1998) and assessments of

quality practices and improvement programs (Wisner and Lewis 1996).

Studies involving finance and economics have looked at such issues as rate adjustments (Smith, Campbell and Mundy 2004), firm size (Ellinger, Lynch and Hansen 2003), and asset financing (Zingales 1998).

Finally safety related studies included comparisons of safety performance by commodity (Horrace and Keane 2004), assessing the cost benefit of safety programs (Moses and Savage 1997) and assessing the potential for improved safety processes (Mejza and Corsi 1999).

## METHODOLOGY

The primary research component of this study incorporated personal interviews with motor carrier executives. Truckload, less-than-truckload, temperature controlled, flatbed, and tank carriers were represented in the interviews. Each of the interviews was conducted during October 2006. All interviews were conducted in person except one which was conducted via telephone conference call.

The interviews were conducted with the following opening statement: "We'd like an opportunity to get your thoughts regarding issues you feel are most important for future research in the motor carrier industry." Interviewee responses formed a broad foundation from which the interaction then narrowed to areas which appeared to be most significant to the interviewee. Analysis of the accumulated interview responses revealed a grouping into five themes of research interest. Subsequently, the primary research findings were compared to the historical review of motor carrier literature to develop a comprehensive list of topics that may be used to form the bases a research agenda focused on issues relevant to the motor carrier industry. This aspect of a research agenda will be discussed in the *Implications for Future Research* section.

## FINDINGS

This section discusses the findings from the personal interviews with motor carrier executives. After completing all the interviews, findings were integrated into five primary themes. The themes include: shipper/carrier collaboration, risk management, driver recruitment and retention, public policy, and fleet management.

### Shipper/Carrier Collaboration

The issues identified as part of shipper/carrier collaboration include: 1) information sharing and 2) supply chain management. The electronic sharing of transactional information between shippers and motor carriers via Electronic Data Interchange (EDI) has been a critical component of the shipper/carrier relationship for over two decades. However, as stated by one interviewee, "with the increased functionality of the internet, including extensible markup language (XML) and several extranet type applications currently being used to facilitate the sharing of not only the traditional transactional information but also inquiries regarding forecasting and equipment availability, more research should be done in this area." Another interviewee commented on the carriers' ability to gather and transmit critical shipment information to multiple participants in the supply chain.

In regard to the carriers' role in supply chain management several comments were made implying that the "forgotten" or "ignored" link in supply chain management is the motor carrier. One interviewee stated, "when 3PL's are negotiating on behalf of the actual shipper they seem to forget that collaboration is about long term benefits based on quality and focus much more on negotiation for the lowest price." Another carrier commented, "we are very skeptical when a shipper or 3PL discusses collaboration because we have been drawn in all too often just to find out the bottom line to get the contract is based on rates." When asked if

they (the carrier) could identify any examples of a true win-win collaborative relationship only a couple of relationships were identified.

### Risk Management

The issues identified as part of risk management include: 1) safety, 2) insurance, and 3) homeland security. Risk Management was the first issue identified by one interviewee. The interviewee stated, "when we make a sales call the first component of our presentation is on safety and the impact of insurability on a carrier's financial stability and their ability to service their customer." Most of the interviewees discussed the importance of risk management for a motor carrier. The two monetary reasons stated for research attention to risk management were to reduce litigation expenses and to reduce insurance costs. One interviewee stated, "this area could bankrupt our company."

In addition to the monetary reasons as justification for a better understanding this aspect of motor carrier operations, homeland security was also mentioned. Specifically related to hiring drivers, training drivers, and dispatching drivers where hazardous materials are concerned. The U.S. Department of Homeland Security has established policies that directly impact a motor carrier with respect to hauling hazardous cargo.

### Driver Recruitment and Retention

The issue of driver recruitment and retention has been a persistent concern for the motor carrier industry and its continued importance was reflected in our discussions. One interviewee stated, "a better understanding of the personality characteristics for good drivers should allow motor carriers to more accurately target their recruiting efforts." Also related to recruitment, were discussions regarding the need to better understand advertising strategies. Driver recruitment is an area that all interviewees noted as needing more research attention.

Once the driver is recruited and placed on the payroll then the motor carrier's attention must turn toward retaining the driver. Several minutes of the interviews were spent discussing the need for research to better understand "what works" to retain drivers. Motor carriers currently utilize several strategies directed toward driver retention including various pay incentives, choice of equipment, and preferred routing. Finally, directly related to drivers was a discussion with one interviewee regarding continuing education for truck drivers. Areas of interest included small business management courses for owner operators, GED courses, and even college credit courses for truck drivers.

### **Public Policy**

The issues identified as part of public policy include: 1) infrastructure, 2) sustainability, and 3) hours-of-service (HOS). While not included in our literature review, every interviewee mentioned highway infrastructure as an increasingly important issue for government to address. The importance of gaining a better understanding of infrastructure was explained from two perspectives. First, is the need for improvements in the physical highway infrastructure in the form of smoother, wider, and straighter roads. Second, a means of handling transportation delays caused by existing infrastructure improvements is needed.

Sustainability, or as referred to in several of the interviews, "the cost of being green" is an area which needs more research and was discussed in several of the interviews. From a public policy perspective, sustainability is embodied through EPA emission laws and directly impact equipment costs for the motor carrier. The fuel efficiency perspective on sustainability is discussed in the fleet management section. Finally, as has been well documented in recent years in the popular press, HOS continues to be an area of concern for the motor carrier.

### **Fleet Management**

The issues identified as part of fleet management include: 1) the role of the fleet manager (dispatcher), 2) fuel—including fuel efficiency, alternative fuel sources, and fuel surcharges, and 3) asset utilization. As described by a truckload motor carrier, "The role of the fleet manager in our operations can have tremendous impact on driver retention, customer service, and overall operations efficiency. We need to better understand the levers related to their role and positively enforce them whenever possible. Our company views the fleet manager as a VP of Operations for a small carrier."

The fleet management view of sustainability is more of an efficiency perspective. The combination of more fuel efficient engines, tires, aerodynamics, and alternative power sources to minimize idling were all discussed in the interviews. Additionally, alternative fuel sources were expected to be an area which will need more research.

Asset utilization was the second application area (along with EDI which was already discussed) within the purview of information technology that was described as needing more research. Specifically, the continued integration of mobile communications systems and decision support systems for load solicitation, load planning, and automated dispatch.

### **IMPLICATIONS FOR FUTURE RESEARCH**

The implications for future motor carrier research were deduced primarily from the interviews and secondarily integrated with the extant motor carrier research. Each of the topical areas is listed below. The authors attempted to rank the topics in order of importance; however a limitation was the small number of interviews. This limitation should be explored in future

research via a survey directed to a larger audience of motor carrier managers.

First, as identified in the literature review, safety has been one of the least researched topics. However, risk management (including safety, insurance, and homeland security) was mentioned by most of the interviewees as areas needing more research. This area is listed first due to the relative gap between the level of importance perceived by the interviewees' and the lack of existing research. Certainly, the popular press has published many articles on the impacts of homeland security requirements on transportation.

Second, organizational relationships have received a moderate amount of attention in the existing literature and were frequently mentioned, in the context of supply chain management and collaboration, as needing more clarification regarding the motor carriers' role in each. The interviewees' were clear in stating that they feel their role in both collaboration and supply chain management is misunderstood. Due to the apparent disconnect between the perceptions of the interviewees' and the tremendous attention collaboration and supply chain management have received in academic

journals, popular press, and within conference proceedings, the topical area is listed the second most important for future research.

Third, human resources have received a moderate amount of attention in the extant literature and, in the form of driver recruitment and driver retention, received a moderate amount of attention within the interviews. This area appears to be most important for the truckload segment of the motor carrier industry.

Fourth, is the area of public policy. Public policy issues were not examined as a part of the literature review. However, hours-of-service, infrastructure, and sustainability each received a moderate level of attention during the interviews. Due to the relative gap between the literature and the interviewees' perceived importance, the authors included this area as needing additional research.

Finally, receiving a moderate level of attention in the extant literature and moderate to low level of attention in the interviews is the area of asset or fleet management. Specifically, there is a need for more research attention in the area of fuel—including fuel efficiency, alternative fuel sources, and fuel surcharges.

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