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Welcome to the Transportation Research Forum's 1998 Annual Meeting

These proceedings contain those papers presented at the 40th Annual Meeting of the Transportation Research Forum, held in Philadelphia from October 29-31, 1998, that were received by the deadline publishing date. All papers were reviewed by the Program Vice President to assess their suitability for inclusion in these volumes. Additional papers may be made available by some of the presenters at the time of the Conference.

The Transportation Research Forum (TRF) is an independent organization of transportation professionals providing pertinent and timely information to those who conduct research and those who use and benefit from research. It functions as an impartial meeting ground for carriers, shippers, government officials, consultants, university researchers, suppliers, and others seeking an exchange of information and ideas related to both passenger and freight transportation. The Transportation Research Forum started with a small group of transportation researchers in New York in 1958 and the first national meeting was held in St. Louis in 1960. National meetings have been held annually since 1960 at various cities throughout the U.S. and Canada.

Numerous TRF members and supporters aided in the development of this year's Forum, but it is authors of the papers, the organizers and contributors to the various panels, and the session chairs who make TRF annual meetings so worthwhile and enjoyable. The conference program simply reflects the interests, enthusiasm and commitment of those members of the transportation community. Special thanks go to Patrick and Judy Little who graciously agreed to assemble this year's proceedings for me. Without their help, the job of Program Chair would have been much more of a burden.

A number of other TRF members also assisted in the development of this meeting. Randy Resor and Jim Blaze were constant sources of ideas and encouragement. When help was asked for, they came through repeatedly. Other TRF members provided help with the program in their areas of interest. I want to thank Alan Bender, Michael Belzer, Ken Ericksen, Paul Gessner, Harold Kurzman, Scott Ornstein, Clint Oster, and Peter Smith for their help. Claire LaVaye at the University of Texas assisted with promoting the meeting on TRF's website. Finally, Rick Guggolz provided valuable assistance on the businees arrangements for the conference.

We are also grateful to those companies and organizations who have sponsored awards or made other contributions to the success of the Forum. These include: LTK Engineering, The Metropolitan Transit Association, and RailTex. Among our own members, we are especially indebted to the TRF Foundation, the Cost Analysis Chapter and the Aviation Chapter for their assistance and support.

These proceedings are prepared and distributed at the TRF Annual Forum as a means of disseminating information and stimulating an exchange of ideas during the meeting. Every effort has been made to reproduce these papers accurately. TRF, however, assumes no responsibility for the content of the papers contained in these volumes.

Richard Golaszewski
Program Vice President
October, 1998

PERFORMANCE EVALUATION OF CARRIERS BY NORTH AMERICAN LOGISTICS SERVICE FIRMS

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INTRODUCTION

In Phase I of this research program—exploring the practices of manufacturing companies in their evaluations of the performance of transport suppliers—it was surprising to find very few differences between Canadian and American companies. It was also noteworthy that few differences existed between firms shipping high value goods and those shipping low value goods. However, there were significant differences between companies operating according to Just-in-Time (JIT) requirements and non-JIT companies in their use of quality programs and of formal carrier performance monitoring. Phase I concluded that manufacturing companies involved in JIT processes are more likely to engage in carrier monitoring than those not involved. Many of the carrier performance measurement systems used by manufacturers did not appear to be that well established scientifically, and remained the purview of large companies.

The results of the carrier survey (the first part of Phase II) were not similar. Carrier participation in systems monitoring their own performance was high and the size of firms undertaking performance evaluation was quite diverse. The reliance of carriers on customer surveys involving subjective evaluation was also extraordinary. The limited interest in performance as expressed in terms of measurable and quantifiable performance measures was of concern.

This paper will review the findings of the second part of Phase II, examining the view of logistics service companies (LSCs) about their practice of carrier performance monitoring. According to LaLonde and Maltz (1992), logistics is among the most commonly outsourced business support services. Therefore, a discussion of carrier performance cannot be complete without the views of all buyers of carrier services. This article will explore, descriptively, how those views differ between third party firms that own transport assets and those that are pure service suppliers.

LITERATURE REVIEW

Although the use of third party logistics (TPL) is a relatively new phenomenon in North America, the concept developed much earlier in Europe (Bardi and Tracey, 1991; Randall, 1991). Transport deregulation yin the early 1980s effectively opened the way to the formation of broad-based TPLs in North America. In recent years, a competitive marketplace and the opportunities afforded by restructured manufacturers have encouraged further growth in this industry. The pattern of third party usage is expected to continue in the future, but the extent of this future growth is not known. Aertsen (1993) identified a number of reasons why companies do not contract out distribution; the loss of control of the customer interface accompanying outsourcing was found to be the largest single factor inhibiting wholesale adoption of

outsourcing. Rao, Young and Novak (1993) also noted that their reputation for good customer service or potentially liability may be of such importance to some manufacturers that they will be unwilling to trade off the potential loss of goodwill against the benefits of outsourcing. The importance attached to customer contact in effective supply chain management will likely cap the growth of third party logistics at some time in the future.

Third party logistics has been described by Lieb, Millen and Wassenhove (1993, p. 43) as

> the use of external companies to perform logistics functions which have traditionally been performed within an organization. The functions performed by the third party firm can encompass the entire logistics process or selected activities within that process.

A TPL may identify and purchase transport services both on its own account or on behalf of a client company (i.e., a shipper or consignee). If the situation is one of purchasing on its own account, the cargo space may be sold *ad hoc* to several clients to service the consolidation market or on-sold to another TPL.

Of importance to this research is the move away from price-oriented transaction-specific carrier selection and towards alliances and negotiated transport service contracts, already reported by a number of authors (Brooks, 1995; Gibson *et al*, 1993; Crum and Allen, 1991; Kleinsorge *et al*, 1991). Although Phillips (1991) concluded that more innovative contractual arrangements will continue to develop, it is not entirely clear that buyers of carrier services have fully put in place the systems they need to evaluate their purchases. There have been articles on performance measurement from the perspective of the purchasing manager, often drawing conclusions about the types and effectiveness of those systems in place (e.g., Dumond, 1991). However, this work has generally not focused specifically on the purchase of transport services. Therefore, this research investigates the processes of carrier performance monitoring by third party service firms purchasing those carrier services.

A review of the literature points to two areas of research relevant to this project—carrier selection criteria and carrier performance measures. Generally, most research has been focused on the former, and predominantly based on shipper surveys. The criteria by which shippers choose carriers have been studied for over two decades and these studies were broadly reviewed, from the shipper point of view, in the article prepared on Phase I (Brooks, 1998). Carrier performance measures, from the point of view of the carrier, were examined in the first part of Phase II (Brooks, forthcoming). The reliance of carriers on customer surveys to assess performance was noticeable. Although it is true that customer satisfaction is an important element in a customer's choice of carrier, satisfaction is driven by human factors, and is a product of both performance metrics which meet or exceed expectations and the communication of those performance metrics as a transfer of information about the transaction. A rational review of superior service delivery should but may not result in a satisfied customer. Likewise, the existence of acceptable (to the carrier) customer satisfaction surveys should not serve as an excuse for failing to evaluate performance and establish service delivery targets.

A.T. Kearney (1985) defines performance as the ratio of actual output to a defined standard output. This standard may be an industry benchmark or a company defined goal. This definition points to the need to measure performance in quantifiable terms. Mentzer and Konrad

(1991, p. 33) note that "performance measurement is an analysis of both effectiveness and efficiency in accomplishing a given task." The efficiency would then be what A.T. Kearney is concluding as performance but what is effectiveness? Rhea and Shrock (1987) conclude that meaningful assessment of distribution effectiveness encompasses more than evaluating customer satisfaction. A comprehensive assessment of distribution performance includes external evaluation of effectiveness (meeting or exceeding customer expectations) and an internal evaluation of efficiency (resource utilization) in order to achieve long-run profitability.

The use of the term "third party" implies an external and arm's length relationship between the buyer and the seller of the transport service. However, a carrier may be listed in a directory as a third party service provider by *Inbound Logistics* (July 96) even when it is not at arm's length in its relationship with the carrier. A recent listing of the top 50 TPLs in the United States noted that 28 of the 50 were asset-based TPLs. As noted by Sheffi (1990), asset-owning logistics providers have an inherent potential conflict between their customers' interests and their own. For this reason, the use of the term TPL is avoided in the balance of this article and the term logistics service company (LSC) is used. An LSC may be a true third party provider of logistics services or may be affiliated in some way with transport assets and therefore may be more likely to align its interests with those of the carrier rather than its customer. This is a matter for future investigation.

In sum, the paper is intended to report on the incidence of performance evaluation on the part of logistics service firms as well as report on the broad performance measures in use. It is not complete, however, as will be seen.

METHODOLOGY

In the overall research program, three groups—buyers, carriers and logistics service firms—were contacted in two countries, Canada and the U.S.A, over the course of three and one-half years. The first article (Brooks, 1998) focused on the survey of 960 buyers, while the second reported the results of a survey of 480 firms in each of two supplier groups: Canadian carriers and U.S. carriers. This paper reports the findings of the third survey of 480 firms in two other supplier groups: Canadian LSCs and U.S. LSCs. All survey work was conducted by mail questionnaire. The findings reported here present only the results of the survey of logistics service firms.

The response results are shown in Table 1. The response rate for U.S. firms is particularly disappointing. The potential for non-response bias—the inaccuracies that arise from failure to obtain information from a sizable portion of sample members—is certainly present. Two of three causes of non-response bias are clearly evident: refusal to respond (choosing not to participate) and inaccessibility to the researcher (the target respondent had moved with an expired forwarding order and 14 different directories failed to relocate the firms; the original telephone was disconnected and no new listing was found in the area code). There is significant disagreement in the literature as to how the non-response bias could have been reduced through alternate approaches at the research design stage (the findings of Yu and Cooper; 1983, compared with those of Yammarino, Skinner and Childers, 1991 for example). Yu and Cooper argue in favour of telephone interviews but it was decided early in the pilot testing of Phase I that visual presentation offered greater clarity to the respondent than aural. Also, respondents were asked to supply sample forms and mail survey allowed for reply paid responses. The reasons for

the disappearance of a substantial number of directory listed firms is now a matter for speculation.

Although it was intended that a number of research hypotheses be tested, the U.S. LSC subset is too small to draw definitive conclusions about the differences between Canadian and U.S. service suppliers and between those with and without monitoring programs. The findings reported here are therefore descriptive—discussing the incidence of and practices in carrier performance monitoring by such service firms, keeping in mind the potential for non-response bias casts a shadow over this discussion.

Table 1: Response Experience

	Canada	U.S.A.
Questionnaires Mailed	240	240
Usable Questionnaires Returned	60	17
Questionnaires Returned but Deleted From Analysis (1)	2	0
Other Returns (2)	46	94
Replied, Refusing to Participate (3)	25	17
Non-respondents	107	112

Notes: (1) These were deleted as a review of the responses proved they were inappropriate companies.

(2) Address Unknown, Moved with Expired Forwarding Order or No Longer Active as a Business.

(3) A number of companies refused because of company policy, insufficient volume to be interested, or they did not believe the study was relevant to their business.

Table 2 illustrates the spread of modal services supplied by the responding firms. In the previous study of carriers, it was interesting to note that 53% of the carrier respondents indicated that they act as logistics service firms! Approximately 40% of logistics service firms indicate that they own transport assets. The remainder of the group do not own transport assets and provide a service to cargo owners and may be considered to be more like buyers of carrier services than may be the case for their asset-owning counterparts.

Table 2: Modes Supplied by LSCs

Mode	Asset-Owning LSCs	Pure Service LSCs
Truck	31	40
Ocean	9	29
Intermodal	13	31
Rail	10	23
Air	18	33
Other (including courier)	8	13
$\pi =$	32	45

Notes: (1) More than one mode could be checked. Respondents checked an average of 2.78 modes for asset-owning LSCs and 3.75 modes for pure service LSCs.

FINDINGS—PERFORMANCE EVALUATION PRACTICES

Transport supplier evaluation

A total of 77 questionnaires were analyzed, 60 from Canadian companies and 17 from American companies. Both geographic groups overwhelmingly (in excess of 75% of firms) support the notion that transport carriers should formally monitor their own performance independent of whether or not their customers request such monitoring. A significant percentage of the logistics suppliers believe that the monitoring should also be done by the purchaser of the transport services; this view was expressed by 52% and 41% of Canadian and American firms respectively. Of those logistics service firms not supporting purchaser monitoring, the reasons for such views are captured in the following quotes:

> There is no need for 'formal' make work—monitoring; either the service is there or it is not."
>
> The market determines the acceptable level of performance, i.e., bad service breeds reduction in carrier business.
>
> If your carriers meet your price and delivery requirements, they keep your business; if not, they lose. Why spend time, money and resources on formal monitoring? We have real work to do, our business to focus on.

Ten percent of the respondents were of the opinion that performance evaluation should be conducted by a third party audit, either at the customer's or the carrier's discretion. A number of logistics suppliers expressed the view that carriers must know what their performance is, and one observed that "it is a combination of both buyers and carriers" who must monitor the performance of carriers, "the carrier for their very existence and the buyer ... for the service factor."

More than one method of evaluation is perceived as useful for evaluating carrier performance. When questioned about the use and type of formal programs to evaluate transport supplier performance, 59 of the 77 firms indicated they have a formal evaluation program in place (77% and 76% for Canadian and American firms respectively). Half of the firms with formal monitoring programs have developed their own in-house program. Contracted third party audits and customer programs are seldom used, while spot monitoring is used by a quarter of respondents. Other suggestions included the use of ISO 9000 and 9002. However, when it came time to provide the details of **carrier performance** evaluation, only 37 of the 77 companies had a formal carrier performance program in place (Table 3). As an aside, there were a few firms that indicated they don't have a program, but would write a report if requested for one!

It is noteworthy that 21% of firms do not formally evaluate transport service performance and expect their customers or suppliers to monitor performance and/or advise them of problems.

Table 3: Monitoring Activity By Size of Firm

Number of Employees	Total Number of Companies	With Formal Monitoring	With Report Cards
Less than 100 employees	47	20	8
100 to 499 employees	8	1	0
500 to 999 employees	4	3	3
1000 to 3000 employees	7	6	3
More than 3000	11	7	6
No Answer	3	0	0
Total	77	37	20
Annual Sales	**Total Number of Companies**	**With Formal Monitoring**	**With Report Cards**
Less than $25 million	42	17	7
$25-99 million	13	4	2
$100-249 million	4	3	0
$250-999 million	9	7	7
$1 billion or more	7	4	3
No answer	2	2	1
Total	77	37	20

Table 3 presents size data on the respondents. It is heartening to note that smaller companies are better represented in the LSC group than in either the manufacturer or carrier surveys conducted earlier in the research program and that the percentage using report cards is higher.

Of the 37 logistics service suppliers formally monitoring carrier performance, a substantial percentage (84%) of firms indicated that they measured service performance. Process reviews were used by 47%, while 51% used customer complaint levels. A very low percentage of both Canadian and American firms used third-party audits to evaluate transport performance. The preference patterns between Canadian and American firms were similar but non-response bias prevents the formation of a definite conclusion.

Evaluation by Asset-Owning LSCs

Of the asset-owning logistics firms undertaking supplier evaluation (32 of the 77 respondents), 19 conducted formal monitoring of carrier performance and 13 of these used a report card system for reporting on service performance. Of those carriers using a report card system, only a few did so for all customers; report cards tended to be used primarily for key customers. The form of report cards was varied, but indicated significant ability on the part of many asset-owning LSCs to develop a custom solution for the customer demanding specific information. Slightly more than 30% of asset-owning LSCs indicated a formal reporting system other than the report card approach.

Table 4: Performance Review Timing (Asset-Owning LSCs)

Frequency with which (1)	LSCs should review performance with customers (Q7)	Customers seek a review (Q8)
As often as the customer warrants	47%	NA
Review performance only when there is a problem	NA	22%
Monthly	47%	28%
Only when they are meeting with the carrier's sales personnel	NA	0%
Quarterly	16%	28%
Other (2)	5%	6%
Annually	0%	22%

Note: (1) Totals do not equal 100% as respondents were allowed to check more than one.

(2) *Other included different timing alternatives. NA = Not asked. The wording of the two questions was not* identical given the different focus of the questions.

The frequency of performance review was an issue with varied responses. Of the asset-owning logistics firms, the percentage of firms believing in customer-focused reporting (reviews should take place as often as the customer warrants) was similar to those recommending monthly reviews. Monthly reviews were favoured more than quarterly reviews, which were preferred by only 16% of respondents. Annual reviews received no support. In contrast, asset-owning LSCs were asked how frequently users seek to review their performance. Firms are requested by their customers to review performance monthly or quarterly (28% each). Reviews are also sought by

transport buyers annually (an interval not recommended by LSCs), or when there is a problem with performance (22% of the respondents each). None of the responding asset-owning LSCs reported reviews sought by transport buyers when sales staff are meeting with the customer.

For those asset-owning logistics firms using a report card system for performance assessment, 74% of carriers used the system as a method of evaluating and/or measuring process improvement. Only slightly fewer (69%) use the system as part of a formal review of their performance, as input to general discussion over service (58%), or as part of a sales strategy to clients (58%). Report cards to document bonuses, penalties, service-related guarantees were also favoured, while using them as a tool for negotiation ranked last, although 47% of respondents indicated that they use them for this purpose. Clearly, report cards are not seen by asset-owning LSCs as a single-use tool.

Evaluation by Pure Service LSCs

Of the pure logistics service firms questioned in the study (45 out of the 77 respondents surveyed), 18 conduct formal monitoring of carrier performance and 7 of these use a report card system for reporting on service performance, while 11 indicated a formal reporting system other than the report card approach. Of those 7 carriers using a report card system, only 4 did so for all customers. The approaches taken to evaluating performance varied and is discussed later.

Table 5: Performance Review Timing (Pure Service LSCs)

Frequency with which (1)	LSCs should review performance with transport suppliers (Q13)
As often as the customer warrants	NA
Review performance only when there is a problem	28%
Monthly	28%
Only when they are meeting with the carrier's sales personnel	6%
Quarterly	28%
Other (2)	6%
Annually	17%%

Note: (1) Totals do not equal 100% as many respondents checked more than one.

(2) Other included different timing alternatives. NA = Not asked

The question posed to pure logistics service firms regarding how often their performance should be reviewed with customers (Table 5) revealed that of those recommending periodic reviews, monthly and quarterly reviews were favoured equally (28%), as was a review when a problem occurred. There was some interest in annual reviews (17%), but performance reports when meeting with sales personnel was favored by only 6% of respondents.

One logistics service firm noted that "when they [our customers] monitor us daily, they are monitoring our suppliers."

Other Findings

All companies were asked about their use of EDI systems with major customers. Forty-four percent indicated they use EDI systems for all customers who wish to participate, while another 25% indicated they only use EDI systems with major customers. The remainder indicated that they do not offer EDI capability (31%). Two firms responded that they do have EDI capability, though their customers have not shown interest in the system.

QUALITY PROGRAM ACTIVITIES AND PERCEPTIONS

Slightly more than half of the respondents indicated participation in a formal "quality" program or process. Of the 77 responding firms, 42 indicated their company currently participates in this type of program. Only 1 stated that it had participated in such a program in the past but had discontinued the practice, while 34 responded that they had never participated in a quality program.

Of those 42 companies that currently participate in a formal quality program or process, by far the most popular types of programs are ISO 9000 series quality assurance (32%) and in-house systems (21%). Other quality systems are used but not in substantial numbers: Malcolm Baldridge/CABE by 6 of this group, contracted third-party audits by 1, customer or industry association designed programs by another 3 and other programs by 4.

Respondents were also asked if their customers require them to participate in such programs, and/or what percentage of customers do so. One percent of respondents replied that all their customers require participation in such programs, while 3% responded that 75% of customers require them to do so. Of those currently using a quality program, 17% indicated that they do not know what percentage of customers demand participation in a quality program, while 23% estimated that it is less than 25% of their customers. The remainder were split between the two categories: 50-74% or 25-49% of their customers require quality programs (8% and 6% respectively).

FINDINGS—PERFORMANCE MEASURES

There was remarkable consistency between asset-owning and pure service LSCs on the key service points that should be included in an effective monitoring system. On-time delivery is clearly critical, as are on-time pick-up and accurate billing, as can been seen from Table 6. Further, a number of firms stressed the importance of customer service response time and other customer relations factors.

Table 6: Most Commonly Identified Service Elements for Monitoring

Service Element	Asset-Owning LSCs	Pure Service LSCs	All LSCs
On-time delivery	100%	98%	99%
On-time pick-up	94%	96%	95%
Accurate billing	84%	71%	77%
Loss/damage experience	78%	71%	74%
Right equipment supplied	59%	73%	68%
Accurate documentation	56%	69%	64%
Equipment cleanliness	59%	51%	55%
Cycle time	31%	38%	35%

Note: This question was answered by all companies. For those companies using formal carrier performance monitoring programs, the patterns and priorities were generally similar although loss and damage became equivalent to accurate billing. In no particular order, other service points included customer service response time, timely reporting and resolution of service problems, accurate tracking information, bar code scanning compliance, and driver appearance/attitude.

But what specifically is measured by the service firms? Of the 9 asset-owning companies willing to write about their report cards, all indicated that content was confidential, that it was customized for the particular customer or that it was computer-generated. Further detail on service elements monitored was not forthcoming. Only 1 asset-owning LSC provided a "report card" for closer scrutiny. It was a detailed printout for a particular customer for a specified period of time and sorted by all shipments as well as inbound and outbound ones. The "all shipment" data were sorted by region, weight, revenue to the LSC and revenue per shipment. Most important, for outbound shipments, the shipments were categorized numerically by destination and slotted into "on-time," 1 day late, and 2+ days late categories. An on-time percentage measure was then calculated so that it could be seen at a glance.

Although nine pure service firms provided additional comments on their monitoring programs, only one pure service firm provided a "report card" as requested. The remainder noted their own particular approach, ranging from monitoring complaint levels to a "three strikes" program. (The name of this program indicates that only two problems or complaints are allowed; a third removes the offender from future consideration.) Some also used ISO non-conformance reports. The one report card provided was not an analytic report card as it did not measure discrepancies from expected performance in any manner; it did however provide the LSC's customer with a summary of the usual shipment information including pick-up and delivery dates for each transaction for that particular customer. By subtracting the pickup and delivery dates, and matching this to the various destinations, a customer could decide for themselves if the service provided was acceptable. The LSC indicated that it also produced a service failure report for the carriers it used.

CONCLUSIONS

On the basis of the survey of users of transport services, Phase I concluded that many of the carrier performance measurement systems used by manufacturers did not appear to be that well established scientifically, and that such performance evaluation activity is primarily conducted by larger companies. The results of the carrier survey were not similar. Carrier participation in systems monitoring their own performance is high and the size of firms undertaking performance evaluation was quite diverse. It is difficult to draw definitive conclusions about logistics service firms, particularly given the poor response rate from U.S. companies and what appears to be the high turnover rate of such companies. However, it can be said that, unlike manufacturers, formal monitoring is being conducted by smaller firms. One of the smaller pure LSCs reported that small firms do not need to conduct formal monitoring because they are acutely aware of service failures.

In Phase I, manufacturers often relied on subjective evaluation. The number of manufacturers employing quantifiable objective metrics was small and the metrics used appeared to be very company-specific. This was also true of the carrier respondents supplying report cards for review. The reliance of carriers on customer satisfaction surveys was noticeable. LSCs do not appear to be further along than the other two groups.

Although it is true that customer satisfaction is an important element in assessing performance, it is insufficient, as argued by Rhea and Shrock (1987). Surely, ten years after the publication of their framework for evaluating performance, and given the radical change in the operating environment with carrier reduction strategies, distribution outsourcing and more widely adopted barcode and satellite information technologies, performance evaluation should be further advanced. This is not particularly evident from the findings of this survey. On the bright side, however, researchers should feel more comfortable that where performance metrics exist, they are customer-driven.

It appears that, in North America, the measurement side of determining internal efficiency is not as widely adopted as was anticipated. Customer surveys are only one output measure and it is through the details of measuring internal efficiency and external effectiveness that buyers and sellers of transport services will be able to secure long-term profitability and competitive advantage.

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