Transportation Modes as Perceived by Shallow-Draft Water Carriers: Implications for Improved Marketing Decisions

HENRY B. BURDG and JAMES M. DALEY

ABSTRACT

Many of the most important strategic marketing decisions affect and are affected by organizational buying behavior. The ability to gain insight into the buying decision process facilitates the ability to explain and predict preferences and therefore choice. Transportation producers (carriers) are faced with the need to market their services to users (shippers). The ability of carriers to understand the perceptions of shippers and the methods used in modal and carrier choice is a marketing advantage. However, the first action in assessing shippers' perceptions is to assess carrier perceptions to serve as norms for comparison. The perception assessment methodology, application, and results for water carriers within the shallow-draft water transportation industry are described. The multidimensional scaling technique was used to depict the perceptions of water carriers in relation to the other major modes of industrial freight transportation as described by 18 modal attributes. Carriers were also queried on how they perceive shippers to make modal-choice decisions and what information sources are consulted for the decision process. A profile of the water carrier industry was produced resulting from a 1984 mail survey to the barge and towing firms.

The five major modes of industrial freight transportation offer shippers a mix of alternatives to facilitate the movement of commodities along distribution channels to the ultimate consumer. More and more frequently, shippers are making transportation decisions guided by the logistical-mission concept. The logistical mission is to develop a system for the movement, handling, and storage of materials and products that meets service requirements at the lowest possible dollar expenditure. In seeking the least-total-cost system, trade-offs are being assessed among the specific characteristics (attributes) that modes inherently offer in response to the specific service requirements of shippers.

Traditionally water carriers have considered domestic barge and railroad as the only transportation modes in contention for the long-haul movement of domestic intercity bulk commodities. Transportation statistics suggest, however, that water carriers as an industry should consider pipeline as a bold competitor. In 1982 the Interstate Commerce Commission (ICC) reported that oil pipelines moved some 558 billion ton-miles of freight, about 25 percent of the total domestic intercity freight for that year. Competition should also be considered as coming from deep-draft water vessels making coastal movements to transport domestic intercity freight. The box- (container-) on-barge concept places water carriers in competition with motor freight and the container dimension of the railroad. No one mode holds a monopoly on intercity freight movements, which indicates that shippers do indeed make modal-choice decisions.

The current understanding of modal-choice behavior focuses the decision process on the buying center member's perceptions and attitudes. These perceptions may or may not match reality. Understanding more about shippers' attitudes and perceptions is paramount to the development of a true marketing program. Steiner and Miner (1) find that little research has been done concerning the ways in which managers perceive the environment, the classification of these perceptions, or the explanation of the different perceptions that influence their decisions.

In general, there is a gap between the theory of industrial buying behavior and the practice of industrial marketing. The gap is so wide that practitioners have the common perception that researchers know little about actual industrial marketing or buying (2). Consequently, practitioners have an aversion for so-called "market research" and "theory." This feeling rests on the belief that experience, direct contact, and intuition are the only essential inputs into the development of a selling strategy. Previous study suggests that the rate of development of marketing research is directly related to how adequate one considers existing channels of communications to be between producers and consumers (3). Twedt's study on the use of marketing research suggests that about 50 percent of companies are doing some form of distribution research (4,p. 8). This would imply that communication is not as effective as producers perceive it to be.

A major reason for the theory-practice gap is the lack of specific guidelines or tools that practitioners can use in applying theoretical research to their day-to-day situations (5). Information concerning organizational buying behavior is considered valuable and relevant primarily on the basis of the ability to explain and predict buying decisions such as modal choice.

The purpose of this paper is to start bridging the gap between organizational buying behavior theory and the marketing practices of the shallow-draft water carrier industry. The results of this

analysis provide practitioners with specific information to work with for the improvement of their marketing programs. By using the framework of organizational buying behavior, a profile of the shallow-draft water carrier industry is developed in relation to the industry's perceptions regarding the major modes of industrial freight transportation and the modal-choice decision process. This research serves as the first step in understanding the marketing impacts that arise from perceptual differences between shippers and carriers within this transportation industry and serves as a reference for comparisons.

METHOD

Subjects

The subjects for this study were selected from respondents to a 1984 survey directed toward a target population of U.S. shallow-draft water carriers. This industry includes common, contract, private, and exempt carriers; firms offering towboats and barges for hire; and firms operating towboats and barges. The sampling frame was the 1983 Inland River Guide (6), which contains a listing of 628 domestic barge and/or towing companies. The survey was administered in the form of a census. A three-item multiple response questionnaire survey instrument was mailed in two waves and self-administered by respondents. The instrument generated 175 ratings per respondent for analysis. The results of the census produced a nonprobability judgment sample that reflects the general characteristics of the carrier industry.

Forty-six firms (7.32 percent) were culled from the sample because the listings were no longer in business. From the actual population (N = 582) a usable response rate of 30.93 percent (n = 180) was achieved.

Procedure

Two major dimensions of research were pursued: (a) how water carriers perceive the different modes of transportation and (b) how carriers perceive the modal selection process followed by shippers in their transportation decisions.

The importance of factors (product and service attributes, namely, freight charges, transit time, etc.) that shippers use in their evaluation of alternative modes as well as shipper perceptions of each mode for each factor influence preferences for alternatives and therefore choice. Transportation modal attributes were identified from an extensive literature review and a pretest applied to waterway users and carriers. The pretest was undertaken to recognize and reduce ambiguity resulting from the items and terminology included in the questionnaire. Preliminary questionnaires were administered to a group of local water carriers and shippers, which resulted in only minor revisions to a few questionnaire items.

Data used to measure water carriers' perceptions regarding attributes were collected by using importance ratings, which were obtained with a 5-point Likert scale on which 1 indicates that the attribute was very unimportant and 5 indicates that it was very important. Perceptions of the amount of each important factor offered by each modal alternative are a determinant of choice behavior. These perceptions were also evaluated by respondents with a 5-point Likert scale on which 1 indicates that the factor definitely was not offered and 5 indicates that it definitely was offered. Mean scores were calculated for comparison and the multidimensional scaling (MDS) technique was used to depict a spatial configuration of respondent perceptions. Data were analyzed using the MDPREF algorithm to develop the perceptual map for carriers as proposed by Carrol and Chang (7).

Carriers were asked to respond to questions concerning how they perceive that shippers make modal-choice decisions. Multiple situational scenarios were presented to which a respondent indicated a degree of agreement on a 5-point Likert scale on which 1 indicates strong disagreement and 5 indicates strong agreement.

RESULTS

Although the respondents represent a nonprobability sample, the authors view the results as representative of the population of water carriers. However, in no instance should the results of this research be implied to statistically infer sample responses to the total population.

In most business settings policy decisions that formulate and drive a marketing program originate from the upper levels of management. Approximately 96.1 percent of the respondents to this survey held the title of manager or higher. The average respondent is a vice president holding a bachelor's degree in business administration. He has worked for an average of 2.3 companies, acquiring some 19 years' experience in the transportation field. The average respondent has worked 14 years with the present company and supervises 61 employees.

Firms represented in the survey possess a broad mix of asset size and annual gross revenue receipts. The average firm generates between $5 million and $10 million in annual revenues from an average of $7.5 million in total capital assets. The commodity transport mix for respondent carriers is shown in Table 1. The typical waterway bulk commodities--chemicals, petroleum, coal, and farm products--are represented by the respondent carriers. The degree of commodity movement specialization demonstrated in

TABLE 1 Commodity Mix Transported by Shallow-Draft Water Carriers

Waterborne Commerce Commodity Classification	Percentage of Carriers Transporting Commodity
28 Chemicals and allied products	50.9
29 Petroleum and coal products	47.3
11 Coal	45.3
01 Farm products	44.1
32 Stone, clay, glass, and concrete products	34.3
13 Crude petroleum	30.0
10 Metallic ores	22.9
40 Waste and scrap materials	18.9
33 Primary metal products	13.0
34 Fabricated metal products, except ordnance, machinery, and transportation equipment	12.4
41 Special items	11.8
35 Machinery, except electrical	10.7
08 Forest products	9.4
26 Pulp, paper, and allied products	8.3
24 Lumber and wood products, except furniture	8.2
14 Nonmetallic minerals, except fuels	7.6
39 Miscellaneous products of manufacturing	7.1
37 Transportation equipment	5.9
09 Fresh fish and other marine products	2.9
20 Food and kindred products	2.4
30 Rubber and miscellaneous plastic products	2.4
36 Electrical machinery, equipment, and supplies	2.4
19 Ordnance and accessories	0.6
25 Furniture and fixtures	0.6

TABLE 2 Shallow-Draft Water Carrier Commodity Specialization Profile

Waterborne Commerce Commodity Classification	Percentage of Carriers with 50 Percent or Greater Volume
01 Farm products	17.6
29 Petroleum and coal products	11.2
32 Stone, clay, glass, and concrete products	10.7
28 Chemicals and allied products	9.5
11 Coal	9.4
13 Crude petroleum	3.5
34 Fabricated metal products, except ordnance, machinery, and transportation equipment	1.2
35 Machinery, except electrical	1.2
41 Special items	1.2
20 Food and kindred products	-[a]
26 Pulp, paper, and allied products	-[a]
33 Primary metal products	-[a]
39 Miscellaneous products of manufacturing	-[a]
40 Waste and scrap materials	-[a]

[a] Less than 1.0 percent.

the sample is shown in Table 2. In over 17.0 percent of the respondent firms, the transportation of farm products made up more than 50 percent of the firm's volume. In general, it can be concluded that there is not a high degree of commodity movement specialization within the water carrier industry. Carriers transport a wide variety of bulk commodities in a mix that serves the shippers' needs; only a limited few carriers can capture a dominant market share sizable enough to specialize in the transportation of only one commodity.

Carriers were asked to indicate the importance of transportation attributes used in the evaluation of alternative modes. The most important factors described by water carriers, shown in Table 3, include satisfaction of customers' requirements, low freight charges, loading and unloading facilities, and a low frequency of cargo loss or damage. Factors such as promotional and entertainment benefits and short transit time were not considered important in relation to the other 16 items.

To gain an understanding of modal perceptions and the amount of each important factor offered by each mode, a perceptual map was produced. The carrier's perceptual map is shown in Figure 1. In the MDS approach, each factor is represented by a vector passing through the origin of the two-dimensional space; the modal alternatives are represented as points in the same space. To determine how much of a factor a mode is perceived to offer, draw a vector for the factor through the origin, then draw a line perpendicular to this vector from the mode's position in the space. The relative position of the factor vector represents the relative perception of how much of the factor is offered by the mode. The closer the mode is to the head of the factor vector, the more the mode is perceived to offer.

For example, on the factor vector for low freight charges (see Figure 1) carriers perceive domestic barge to have significantly lower freight charges than any other mode. Pipeline is perceived to have the next lowest freight charges, followed by railroad, motor carrier, and air freight. Not only is the ranking relevant, but the distance along the vector provides a measure of similarity. Thus, carriers perceive domestic barge as a unique transportation method having distinctly lower freight charges than rail, motor carrier, and air, which are perceived as quite similar.

The value of the perceptual map is that it graphically portrays the perceptions of respondents for multiple factors and multiple alternatives in a single two-dimensional space. Analysis of the map provides the current position of each mode in relation to all the factors and modal alternatives. An ideal point was also calculated representing a hypothetical transportation mode possessing just the right combination of attributes that carriers perceive as ideal for meeting transportation needs.

Information regarding the modal-selection process suggested that carriers view the shipper's transportation manager as playing an important role in the collection of information about the features of the different transportation methods. The transportation manager would also play an important role in evaluating, negotiating terms and rates, and identifying the need for a transportation method.

The respondents indicated that the evaluation of a transportation method followed a fairly routine methodology. Carriers perceive two similar procedures: (a) a list of important factors would be developed and only those transportation methods that offered the features would be considered and (b) the transportation manager would determine an overall rating for each alternative transportation method by evaluating each alternative mode against a comprehensive list of features.

Carriers were also asked their perceptions concerning the information sources that transportation managers consult to obtain information that would help identify and evaluate transportation methods.

TABLE 3 Carriers' Perception of Importance of Factors in Selecting a Transportation Method

Factor	Mean Response Score[a]	Standard Deviation
Satisfaction of customers' requirements	4.766	0.587
Low freight charges	4.500	0.791
Loading and unloading facilities	4.485	0.983
Low frequency of cargo loss or damage	4.474	0.754
Equipment available	4.448	0.728
Consistency in service	4.419	0.733
Dependable transit time	4.378	0.873
Allowance for large shipments	4.331	0.912
Satisfaction of suppliers' requirements	4.240	0.962
Flexibility in meeting special customers' needs	4.198	0.814
On-time pick-up and delivery	4.169	0.912
Employees with positive attitudes and good manners	4.163	1.019
Information concerning shipment provided	4.000	1.037
Ability to carry large and/or odd-sized freight	3.878	1.072
Convenient pick-up and delivery times	3.854	1.088
Assistance in claims handling	3.632	1.116
Short transit time	3.506	1.152
Promotional or entertainment benefits	1.721	1.141

[a] 1 = very unimportant; 5 = very important.

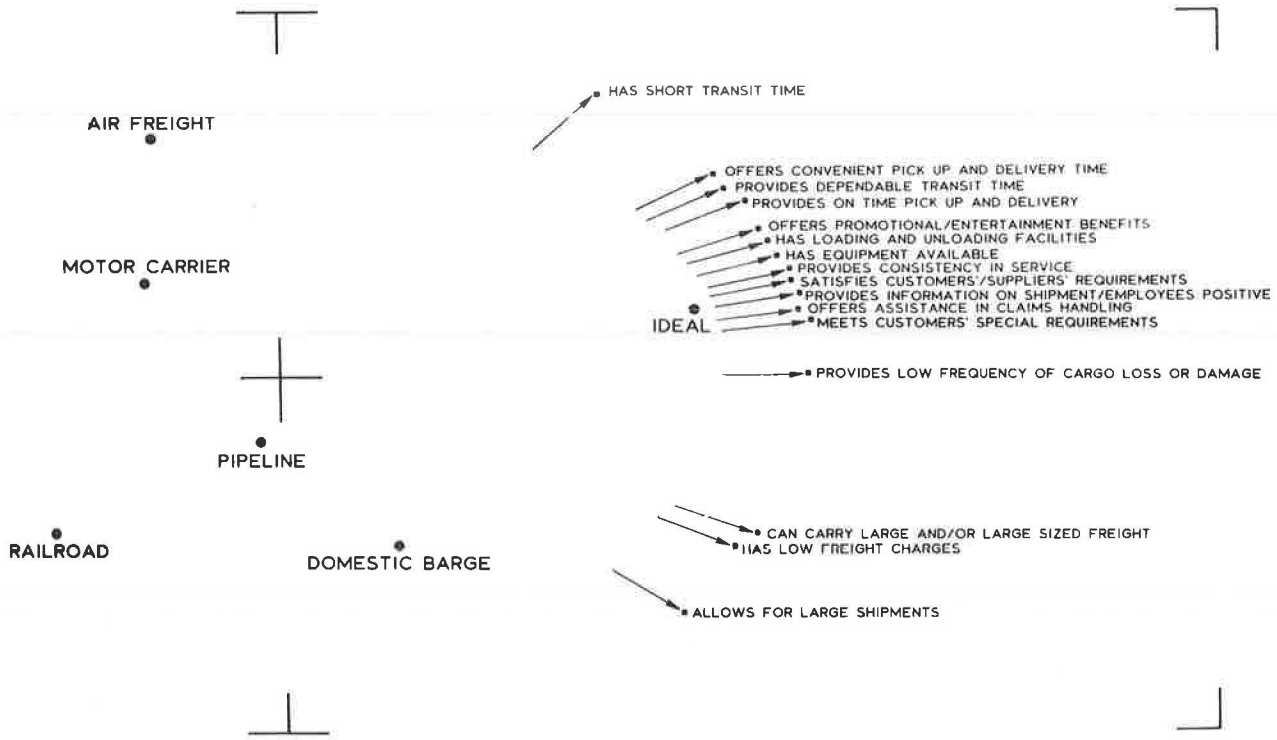

FIGURE 1 Perceptual map of shallow-draft water carriers.

The results are shown in Table 4. Carriers identified current users of the transportation method as the most frequently consulted source of shipper information.

A previous study (8) conducted by the authors in 1982 asked waterway shippers similar questions about information sources. By comparing mean response scores, it can be concluded that carriers have perceived the use and mix of information sources differently than shippers. The results of the comparisons are also shown in Table 4. Not only did the rank order of sources change, but for five of the nine sources, a significant difference was found ($p < 0.05$) between mean response scores.

DISCUSSION

What can be readily identified and empirically quantified is that water carriers are inherently biased toward their mode. Carriers perceive domestic barge as a very desirable form of transportation for the movement of industrial freight and are indifferent to the remaining four modes. This finding is also reinforced when the perceptual map (Figure 1) is reviewed and the relative position of domestic barge versus the ideal mode is compared. To the waterway carrier, the ideal transportation mode more closely resembled domestic barge and least closely resembled railroad. However, the desired characteristics of the ideal mode are far superior to any existing mode in operation today.

Respondents perceive domestic barge as a distinctive transportation mode quite dissimilar from other modes. Of particular importance is the large relative distance between barge and railroad, which indicates that very large changes in the respective attributes would be required before the respondents would consider railroad to be similar and therefore a close transportation substitute. The interpretation that must be rendered as a result of these findings is that on average, water carriers do not perceive barge and rail to be in direct competition. If this were not the case, the two modes would have been perceived as similar, occupying the same relative position on the perceptual map. This finding is so radically different from the industries' "official" position on water-rail competition that the dichotomy, at first look, appears ridiculous.

Carriers identify as the most important factor in selecting a transportation method the satisfaction of customers' requirements. This observation is consistent with today's concept of marketing, which is the anticipation of customer needs and the direction of a flow of need-satisfying goods and services from producer to customer (9). The term "customer" refers to the shipper's customer, generally recognized as the consignee. To that end, the factor of satisfaction of customers' requirements is a general one encompassing the marketing concept as goods move down the distribution channel.

The factor identified as second most important,

TABLE 4 Shipper Utilization of Information Sources as Perceived by Shippers and Carriers

Information Source	Mean Response Scores[a]		
	Carrier (N = 168)	Shipper (N = 109)	z-Score
Technical journals	2.80	2.72	0.73
Trade journals	3.18	3.16	0.24
Carrier salespeople	3.77	3.60	1.46
Advertising brochures	2.84	2.35	4.78[b]
Current users of the transport method	3.87	3.24	6.14[b]
Trade conference or exhibits	2.69	2.43	2.27[c]
Personnel in firm	3.77	3.47	2.38[c]
Outside consultants	2.63	2.08	4.79[b]
Trade associations	2.73	2.51	1.80

[a] 5.0 = consult nearly all the time; 4.0 = consult rather often; 3.0 = occasionally consult; 2.0 = seldom consult; 1.0 = never consult.

[b] Significant at $p < 0.001$ level.

[c] Significant at $p < 0.05$ level.

low freight charges, is consistent with the traditional economic approach of mode and carrier selection. When the first two factors are viewed in combination, however, the elements of the total-cost approach of physical distribution are readily perceived by carriers.

The question that arises with great marketing implications for water carriers is, Do carriers have an accurate perception of what is important to shippers in modal and carrier choice? Anderson et al. (10) conclude from their research on buyer and seller perceptions within the intramodal (carrier selection within one transportation mode) transportation choice that significant perceptual differences exist between shippers and carriers. The resulting differences have managerial implications as far as altering a carrier's marketing strategy to improve its effectiveness.

Water carriers perceive domestic barge, motor carrier, and pipeline all to have about the same transit time characteristics. Do shippers have that same perception? Is short transit time important to shippers? Will shippers tend to shift to an alternative mode if their perceptions of transit time are altered? To improve strategic marketing effectiveness it is necessary to measure the perceptions of shippers and compare the results with the perceptions of carriers. Only then will carriers truly understand whether they are attempting to meet customers' needs.

The environment in which the water carrier industry finds itself operating has changed dramatically in the last 10 years. The suggested analogy is the change in conditions from slack-water canoeing to white-water rafting. In today's turbulent, rapidly changing complex environment organizations are doing all they can to adapt to new opportunities and threats. As a result, long-range planning has little use within the water carrier industry. To cope with change the concept of strategic planning must now be firmly integrated into a carrier's management style.

Strategic planning assists management in making nonrecurring, significant decisions that affect the basic nature and direction of the organization as a result of a changing environment. The process translates into strategy formulation and program and operational planning. The foundation of strategic planning rests on marketing intelligence and marketing research.

Kotler (11,p.139) defines marketing research as "the systematic design, collection, analysis, and reporting of data and findings relevant to a specific marketing situation." Although marketing research is specifically commissioned, either internally or externally, marketing intelligence is data from external sources--overt, covert, and unsolicited in nature. Programs of intelligence and research are now needed in the water carrier industry. The industry, speaking through the National Waterways Conference (12), says:

> Gone is the old-boy network of grizzled barge operators playing Mark Twain up and down the nation's rivers. Today's bargeman better have an MBA under his belt, or at least a few in his employ, in order to deal with his competition.

To that end, the traditional mind set of carriers must be unfrozen and retraining and new practices put into being. This process should include owners, executives, and managers. Personnel at this level that do not hold current (within 10 years) education in the fields of logistics, physical distribution, marketing, or transportation now require additional training. Programs can be developed through trade associations or found at any major college or university.

In recognition of the limitations of this study, the results would suggest that transportation carriers could greatly enhance their marketing programs if they could compare their perceptions with those of shippers. The mechanism for such work is marketing research. The authors would surmise that carriers are not well attuned to the wants and needs of the shipper, which results in misdirected resources. Further research assessing shipper perceptions would render the hypothesis true or false. In addition, longitudinal analyses of transportation attribute perceptions clearly are desirable and may help to clarify and support this and previous studies.

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