

Submitted 29.04.2016. Approved 23.11.2016.
Evaluated by double blind review process. Scientific Editor: Nelson Kuwahara

WHAT IS NECESSARY TO IMPROVE THE BRAZILIAN INTERMODAL TERMINALS? THE SHIPPERS' POINT OF VIEW FROM THE STATED PREFERENCE APPROACH

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ABSTRACT: This study investigates the features of the services that shippers of bulk agricultural products need from intermodal terminals. Agribusiness usually is positively affected by logistics performance, since it normally involves extensive supply chains made up of a large number of agents. The answer to this question may help us understand why Brazilian shippers mainly use road transportation to move low value-added products over long distances and may also help us improve intermodal terminal facilities. Applying the Stated Preference technique, shippers ranked constructs in the following order: reliability, time period, customer relations, cost, and flexibility. The results indicate that constructs associated with quality of service are more highly valued. This implies that there are new points of reference for the transport market which favor the use of long-term contracts and closer relationships.

KEYWORDS: Intermodal freight transport, agribusiness logistics, service levels, infrastructure, transportation demand and supply.

1. INTRODUCTION

Agribusiness has been extremely important to the Brazilian economy, and Brazil has played a prominent role in this sector worldwide. The 2014/2015 total for national grain production was 207.7 million metric tons, and this country is one of the most important players in the world in the coffee, sugar, ethanol, and orange juice markets. This level of trade significantly affects the internal demand for freight transportation and logistics as a whole since this sector's production and raw materials are mainly located in the North, Midwest and huge areas of the Northeast, far away from the country's ports. However, this demand is concentrated on roads, which has caused congestion and traffic jams on port access roads, leading to increases in freight rates and storage costs in port areas, as well as shipment delays and even losses. In this respect, the operation of intermodal terminals plays an important role in minimizing these effects. If operated efficiently and at low cost, intermodal terminals can act as catalysts by offering lower-cost operations which provide access to higher load capacity. But if these operations are not in accordance with shippers' expectations and needs in terms of cost and reliability, they may be indifferent to intermodal freight transportation and contract services which may be more expensive but will be more reliable.

Therefore, this study seeks to answer the following question: What kind of service do shippers of bulk agricultural products need from intermodal terminals to make this an attractive alternative? In this article, transportation is analyzed in relation to management services, focusing on how shippers form their expectations for these services. In the traditional approach, the management of transport is discussed more as a process (Ng, Ferrin, & Pearson, 1997; Neuschel & Russell, 1998) and its flow is measured by its operating performance and costs (Meixell & Norbis, 2008; Mason, Ribera, Farris, & Kirk, 2003; McCann, 2001). Furthermore, most of the previous studies have actually focused on single mode freight transportation problems from the perspective of logistics service providers or production companies. There are few papers that have focused on intermodal freight transportation problems as compared to unimodal transportation systems.

This topic has a significant impact on the daily lives of agribusiness firms. Transport management involves decisions about how to move materials and finished products between different points within a business

network. As transport services are a component of logistics, expectations concerning their performance have become more complex. The search for efficient logistics processes has led to other service attributes being incorporated into core transport decision making, such as meeting deadlines, cost transparency, and the development of appropriate services that can be integrated with suppliers and customers.

Thus, against the backdrop of the effect of transport services on business competitiveness, this study seeks to analyze the relevant factors involved in making a decision about hiring transportation services. We believe we can contribute socially to public policy by helping improve the responses to regulatory and other issues and thus shift transport loads away from road transport, which is what would be expected in a large country with low-value added freight transportation like Brazil, by applying the Stated Preference approach to the operations management research area. This is a powerful tool that has more often been used by other research fields that are concerned with better understanding agent behavior.

This study is structured as follows: after our introduction we describe our theoretical framework for studying logistics as a business strategy. The next section presents the nature of this study and the methodological procedures that we use to achieve our proposed objectives along with details of the strategies and actions used in researching the application of the stated preference. Then we present the study's results, detailing the characteristics of the intermodal terminals in the region under study, our results in terms of constructs, and a discussion of these results. Finally, we present our conclusions.

2. LOGISTICS AND TRANSPORTATION IN COMPETITIVE BUSINESS STRATEGY

Intermodal transportation can be defined as "the transportation of freight in one intermodal load unit (container, trailer, swap, box, body, etc.) by using successive modes of transport (rail, waterway, road, etc.) without handling the freight itself when the transport mode is altered" (UNECE, 2009). That means intermodal freight transport combines at least two different transport modes in a single transport chain, mainly consisting of pre-haulage, long-haulage and end-haulage operations. Intermodal transportation is able to provide a more efficient, reliable, flexible and sustainable method of trans-

porting freight and when operated with containers it also supports transport flexibility and offers logistics companies the advantage of economies of scale. The integration of different modes of transport is a more efficient usage of company resources and also improves handling speed and throughput (Rodríguez & Slack, 2013).

Road transportation usually serves as the main integrator between modes of transport because it has excellent capillarity. However, the transfer of freight between modes requires a physical infrastructure that enables the transfer operation to occur quickly at a low cost, without the loss of, or damage to the cargo. At the same time, intermodal transportation requires the synchronization of operations between different modes of transport, which shines a spotlight on research areas such as intermodal freight transportation planning, traffic safety, customer satisfaction and transportation costs, road congestion and environmental pollution (Baykasoğlu & Subulan, 2016).

Transport is the backbone of business logistics, which is viewed as a set of elementary activities that creates value within and between companies, acting as a key success factor in the superior performance of production systems. Traditionally such activities have been identified as inventory, transportation, facilities, and information. These activities contribute greatly to the improvement of operations (Chopra & Meindl, 2007) and businesses competitiveness, especially when the good performance criteria most valued by clients are met (Slack, Chambers, & Johnston, 2007).

Agribusiness usually is positively affected by logistics performance since it involves extensive supply chains made up of a large number of widely dispersed agents involved in low value-added transport. In this context, the lack of adequate transport systems is seen as a growing obstacle to the competitiveness of agribusiness. Conceptually, agribusiness means “the sum total of all operations involved in the production and distribution of foods and fibers” and refers to the post-WWII phenomenon of increasing “unified functions” and the “interdependency” between the agricultural production sector and the pre- and post-farm gate business world (Cook & Chaddad, 2000).

For shippers, transport services are, in general, a pillar of distribution as they directly affect customer satisfaction. In situations that require the organization of competitive products, logistics (delivery) can negatively affect the client’s overall evaluation of products

and services. This may lead to the loss of customer loyalty or the decision to not repurchase due to delivery performance in terms of its cost, damage levels, ability to meet deadlines, and its general consistency of services (Ballou, 2004). As Martins, Xavier, Souza Filho, and Martins (2010) point out, transport has direct and significant interfaces with the areas of finance, production and marketing (customer satisfaction) representing 2% to 4% of company revenues and 30% to 60% of total company logistics costs (Mason et al., 2003). Transport decisions also affect inventories, service levels and production planning (Holter, Grant, Ritchie, & Shaw, 2008).

According to Wanke and Zinn (2004), value creation, that is, the creation of a product or service or the features that make their consumption desirable, can happen in a few moments. The role of logistics is to deliver value to those interested in possessing a product. To do this, the values of place and time have to be added. The value of place consists of making the product available at the most appropriate place in order to fulfill the desire to possess it, whether this is through a retail store or a wholesaler or even in the customer’s home. The value of time implies that the transfer of the ownership of the property should be performed at the desired time.

In terms of bulk agricultural products, of all the key logistics activities that we have looked at, transport is the one that creates the most value. Bowersox, Closs, and Cooper (2002) suggest that the management of transport should be performed by evaluating transport services based on parameters that demonstrate performance, such as the following:

- Speed: time spent in transit
- Availability: the ability to provide service to any origin or destination
- Reliability: the potential variation in the total time involved in providing a service
- Capacity: the ability to handle any load and any amount
- Frequency: the ability to act at any time

The efficient flow of production at low cost becomes strategic for organizations and a great challenge for logistics. An efficient transport system reflects choices between modes, with each one having its own characteristics that can and should be exploited in the development of transport strategies. The arrangements

of classic transport modes and their respective characteristics, according to Ballou (2004), are:

- Waterway: high hauling capacity, low costs for large distances, with both low speed and flexibility
- Road: higher agility and flexibility, but high costs for smaller distances
- Rail: average hauling capacity, average agility, low flexibility, and average costs for medium distance
- Air: high speed, low hauling capacity, high costs, and high flexibility
- Pipeline: low hauling flexibility, low agility, and low costs.

However, restrictions due to natural endowments or scale often lead to transport systems that are structured around hubs. Thus the shipping structure for a rail system may be deployed at a particularly advantageous point which, for example, covers a distance of 300 miles for the catchment of freight, thus consolidating the railway operation. This is what is called an intermodal operation, one which involves a shipper's usage of more than one mode of transport to ship goods from their origin to their destination.

3. METHODOLOGICAL DEFINITIONS

This is an empirical, exploratory study that seeks to characterize the needs and expectations of shippers in terms of the services that intermodal terminals provide for bulk agricultural operations. This study was developed according to criteria proposed by Collis and Hussey (2009): in terms of its objectives, it is an exploratory study; in terms of the process used, this is a quantitative study which uses inductive logic. The type of procedural methodology used is a survey, with non-probability sampling based on accessibility.

Malhotra (2001) points out that exploratory research is appropriate in areas with little accumulated knowledge where the understanding of the phenomenon is not sufficient or even non-existent. In such cases, the empirical character of the research relies on data collected from the field and the use of additional research sources.

The logic used for this study is inductive, which involved approaching the subject with regard to the thinking and/or arguments used in relation to it,

with the study's objective being not only the production of thought, but also the orientation of reflections on these thoughts. Moreover, the inductive method seeks to generalize specific results from one or a number of cases for all similar occurrences in the present or future.

3.1. Sample

The sampling procedure used was non-probabilistic, based on accessibility and typicality. The choice of this form of sampling was made due to the difficulty of getting access to these companies. Collis and Hussey (2009) confirm that it is sometimes difficult to obtain a sample, particularly when dealing with sensitive issues or those that may be confidential. In this situation, sampling involves the selection of units that agree to participate in the study and provide the information necessary for the research (Hair, Anderson, Tatham, & Black, 2005).

In this study, our sample consists of 40 interviews with 40 customer managers of intermodal terminals distributed across states in southern Brazil: Paraná, Santa Catarina, and Rio Grande do Sul. Our units of research analysis are large shipping companies which are users or potential users of intermodal terminals for bulk agricultural products. The observation units were the managers involved in the operational management process for these units. According to estimates from IBGE (2011), southern Brazil leads the nation in grain production, with the share of total Brazilian production being 20.2% for Paraná, 17.3% for Rio Grande do Sul, and 4.1% for Santa Catarina.

The types of terminals surveyed were Rail-Road, when the freight travels a medium distance and is then unloaded to be delivered; Road-Rail, when the freight travels a short distance by road and is then loaded into railcars for medium distance travel; and Road-Rail-Waterway, which is good for long distances in which the cargo starts out by truck, continues over longer distances by railcars and ends the voyage with the largest portion being by ship. To support these transfers between transport carriers, terminals offer transshipment which provides other services that complement processing and trading. The most common services offered by the terminals are: pre-cleaning, cleaning, drying, purging, storage, segregation, and blending and storage, in the case of grains.

3.2. Research strategies, data collection, and the type of information

We performed our data collection by distributing stated preference cards. The research strategy adopted consisted of onsite visits. The purpose of the interview was to obtain information on a given subject, which was then used to perform diagnostics and collect data.

The interviews covered questions addressing our transportation constructs and attributes. The ranking of the shippers' preferences was obtained through the survey by using the Stated Preference technique, which we will cover in more depth in the next section.

3.3. Stated Preference technique

The statistical analysis for understanding the shippers' preferences can be conducted by means of multivariate statistical techniques. These include joint analyses of revealed preference and stated preference, with the latter selected for its suitability for the purposes of this study. This technique appears more suitable than other techniques because it essentially deals with hypothetical situations or situations in which the preferences or choices cannot be directly observed. According to Almeida and Gonçalves (2001), these options may be hypothetical, but they should be feasible given that respondents can easily imagine them.

The market analyses supported in the stated preference technique rely on various concepts relating to human behavior to explain the preferences displayed by agents, both people and organizations, who attempt to maximize their satisfaction. This behavior is also vital for making business decisions in an attempt to maximize the use of the resources employed in the organizational system.

According to Ortúzar (1998), stated preference is a set of methodologies based on declared judgements by individuals about hypothetical situations presented to them. Stated preference uses techniques involving the planning of experiments to develop hypothetical alternatives which are presented to respondents. Analyzing situations that do not necessarily exist then allows us to identify the relevant features for service users in the study.

Through the technique of stated preference, it is possible to identify the relative importance of each attribute. As strategic input, the use of this information enables us to further configure the service so that it comes as near as possible to the agent's

desires. Thus some studies in logistics have used stated preference to become familiar with the valuation of attributes related to the quality of transport services (Martins & Lobo, 2011; Martins, Lobo, Labegalini, & Carrieri, 2008).

3.3.1. Survey of shipper preferences

This study consists of three basic steps: elaboration, execution and analysis. In the elaboration stage, we defined the constructs to be studied and also analyzed the number of levels for each construct which determine the complexity of the experiment. Moreover, we needed to determine how to interview as well as how to analyze the data.

3.3.1.1 Interviews

In the execution phase, each respondent was personally approached onsite and asked to rank the alternatives according to his or her preferences. According to reports from Camargo (2000), ranking is a less tiring methodology for respondents under the presented conditions. In this method, blocks of cards are presented separately and randomly, and the respondent ranks them, starting with the alternative that seems the most useful to him or her.

The research strategy consisted of conducting interviews onsite. According to Craighead and Meredith (2008), studies using respondents' perceptions about reality have increased their relative participation in operations management studies through a movement that encourages researchers to "come out of their offices" to gain a more direct observation of the phenomenon being studied. Consequently, these findings have greater relevance for managers and for the elucidation of the problems being addressed.

For the elaboration of this research instrument, practical guidance in terms of Brazilian reality was sought through the dimensions relevant to the assessment of transport in Schluter and Sena (1999), and Valente, Novaes, Passaglia, and Vieira (2008). In addition to our theoretical review, this research instrument also used the experience of previous official documents that had similar purposes, such as the Brazilian National Land Transport Agency (ANTT, 2005) and the World Bank (BIRD/ANTT, 2006). The constructs and their respective levels are shown in Table 1.

Table 1. Selected constructs, respective levels, and numeric codes

Constructs	Levels	Code
		Number
Time Period	Short: delivery made quickly	1
	Long: deliveries made within a period 2 times slower than the service offered by a carrier or truck driver	0
Customer relations	Accessible information: the operator provides facilities for communication and contact for negotiation and the company (shipper) has information about the status of the cargo in transit	1
	Hindered information: the operator does not offer facilities for communication and contact for negotiation and the company (shipper) does not have information about the status of the cargo in transit at the needed time	0
Cost	Satisfactory: reasonably lower (up to 20% lower) than the service offered by a carrier or truck driver	1
	Unsatisfactory: equal or very close (AT LEAST 10% higher) to a service offered by a carrier or truck driver	0
Reliability	High: the service is reliable, leaving the shipper without concern about the punctuality and integrity of the load	1
	Low: the service is unreliable, leaving the shipper concerned about the punctuality and integrity of the load	0
Flexibility	Capillary Service: meets multiple points, reaching different destination points (customers and ports)	1
	Rigid service: few routes, few destination points would be attended by the service	0

Source: Elaborated by the authors

3.3.1.2. Data analysis

To analyze the data resulting from the stated preference technique, the multinomial logit model was used. Assuming that the error term of the utility function (1) is governed by a Gumbel distribution, the multinomial logit (Ben-Akiva & Lerman, 1985) can be written as follows:

$$P_n(i) = \frac{e^{\beta_k X_{ink}}}{\sum_{j \in C} e^{\beta_k X_{jnk}}} \tag{1}$$

in which is the probability of the alternative i for each construct being chosen by the individual n (n=40) within a set of possibilities C, which are

the arrangements showed in the groups of five cards, as detailed above. Responses were statistically analyzed using the algorithm developed by Souza (1999).

In implementing the experiment, it was decided not to present all possible combinations of levels and constructs to respondents, that is, to use the fractional factorial. The obtained results were derived from the rankings made by respondents of six groups of five cards, with eight cards using the technique of partially-balanced incomplete groups suggested by Souza (1999). Often, a single repetition of a factorial experiment went beyond the capabilities of researchers, or provided more precision than needed for the estimation of the main effects (Cochran & Cox, 1978).

The use of fractional repeat experiments was proposed by Finney (1945). Since then, these experiments have been used in many applications, especially in industrial development. Their main attraction is that they permit the inclusion of five or more factors in an

experiment of practical size, so that the researcher can quickly determine how the factors affect the outcome.

4. RESULTS: ANALYSIS AND IMPLICATIONS

Among the terminals studied, three different types of terminals were found, which were:

- Rail-Road Terminals: Terminal G;
- Road-Rail Terminals: Terminanals A, B, C, D, E, F, I and L, and
- Road, Rail-Waterway Terminals: Terminals H, J, K and M.

By analyzing Table 2, we find that although 100% of the terminals offer storage services to their customers, special services, such as segregation cells for non-genetically modified crops and blends, are not so widespread.

Table 2. Services offered by the intermodal terminals

Service	A	B	C	D	E	F	G	H	I	J	K	L	M
Pre-cleaning			●	●					●		●	●	●
Cleaning	●		●		●				●		●	●	●
Drying			●		●				●		●	●	●
Purge			●			●			●		●	●	
Blend			●			●			●			●	●
Segregation	●		●	●	●	●			●		●	●	
Storage		●		●		●	●	●		●			

Source: Study results

4.1 Analysis of the shippers' stated preferences

The results of our statistical model are presented in Table 3. The t-test considers the significance of the β parameters, indicating that the results will be significant if they are above the value given in the t-student table. The LMPC software (Souza, 1999) used considers the t-test to have a significance level of 95% for these parameters.

Table 3. Statistical results relative to the constructs

Construct	Coefficient	Error	T-test	IC-(t=2.5%)
Time Period	0.8614	0.279	3.008	(0.304;1.419)
Customer relations	0.5384	0.252	2.1366	(0.034;1.042)
Cost	0.3299	0.221	1.4939	(-0.112;0.772)
Reliability	0.9935	0.250	3.9806	(0.494;1.493)
Flexibility	0.0184	0.230	0.0798	(-0.442;0.479)

Number of respondents = 40
 Number of cases = 120
 F(Betas_0) = -127.1222
 F(Betas_1) = -105.3964
 LR (-2[F(0)-F(B)]) = 43.4515
 Rho = 0.1709
 Rho (Ajt) = 0.1316

Source: Study results

The reliability construct has a higher correlation coefficient, indicating a very strong correlation, which means that the population sampled places reliability as the most important quality in terms of terminal service, and indicates that the attribute of flexibility has less importance statistically because its correlation coefficient is very weak. According to Shikimura (2006), a very strong association exists for values between 0.90 and 1.00 and there is a very weak correlation for values between 0.00 and 0.19.

Regarding the t-test, Marques (2003) emphasizes that values above 2 are usually indicated as suitable for this type of experiment: as seen from the results, the attribute of reliability is statistically the most significant for respondents with a value of 3.9806. This result also shows that there are significant differences for respondents in choosing between levels 0 and 1 for this attribute. The attribute of flexibility, with the lowest result in the t-test, has the lowest relevance for respondents. In addition, this possibly indicates that there is no significant difference in making respondents choose between levels 0 and 1 for this attribute, which is statistically proven by the low score of 0.0798.

The next test was that of the likelihood ratio $LR = -2\{L(0) - L(b^*)\}$ which aims to simultaneously test the null hypotheses of all parameters. According to Ben-Akiva and Lerman (1985), if the LR value is greater than the $\chi^2(\alpha, r)$ value, the null hypotheses of all parameters are simultaneously rejected. In this study, the results of 43.4515 for the LR test indicate that the null hypotheses should be rejected, so the parameters are therefore useful and relevant.

In this sequence, it is possible to see the test results of the q^2 statistic (pseudo-coefficient of determination – Rho): to Ortúzar and Willumsen (1990), the q^2 statistic has limited theoretical value from 0 to 1, but its value between 0.2 and 0.4 indicates an adjustment that is considered excellent for the multinomial logit model. In the case of the results found in this study, the Rho has a good performance with a value of 0.1709.

Another test available in Souza's (1999) LMPC software is the test for comparing alternatives in order to know which combination of attributes and cards was most often chosen and to individually test the significance of each alternative (each card shown). This test showed that all the alternatives are significant.

After completing the analysis of the results obtained with the LMPC software, it is concluded that the

data in Table 2 is significant. Thus, the utility function can be described as follows:

$$FU = (0.8614 \chi_1) + (0.5384 \chi_2) + (0.3299 \chi_3) + (0.9935 \chi_4) + (0.0184 \chi_5)$$

where

FU = the function of utility

χ_1 = time period

χ_2 = customer relations

χ_3 = cost

χ_4 = reliability

χ_5 = flexibility

The fact that the coefficients are all positive indicates that for the respondents there is a gain in passing from level 0 to level 1 for these respective constructs.

4.2 IMPLICATIONS OF THE RESULTS

According to Meixel and Norbis (2008), the criteria most often applied in hiring transport services, worldwide, are: above all, trust in the service, time in transit (time), and logistics costs, followed by the indices of breakdowns, vehicle availability/service flexibility, service, and shipping and service quality. For Brazilian industrial shippers, Martins et al. (2011) identified the constructs of safety and reliability as the most important services provided by carriers, followed by time period, cost, customer relations, and attending to customers' special needs. Martins, Lobo, and Pereira (2005) identified the constructs of guarantee, consistency, availability, time period, and reliability. In the present study, the presented constructs were ranked in terms of priority in the following order: reliability, time period, customer relations, cost, and flexibility. The first three may be referred to as constructs for responsiveness as opposed to cost, following the criteria for operational performance.

The results reflect the shippers' concerns regarding the expectations of their own logistics operations, the enforcement of contracts and logistics costs as well as the quality and allocation of transport systems. Initially, shippers expressed interest in operations occurring within expected time periods, with reliability and competitive costs. Moreover, as indicated by Wanke (2012), lower tolerance for low levels of reduced service and an aversion to the risk

of loads being stolen is also reflected in the tonnage transported annually.

Thus the coefficients, obtained in formatting the services that shippers have indicated that they wish, provide a dimension for the level of quality expected from the operation of intermodal terminals. This alternative may become more expensive, but this should be offset by increased reliability, allowing a reduction in storage costs in port areas as well as shipping losses caused by delays in operations and transit during exporting.

On the other hand, this rationale for decision-making can also be discussed from the point of view of the allocation of transport systems. In this sense, transportation costs are considered qualitatively in addition to the freight costs associated with modes, which are evaluated vis-à-vis the costs relating to service quality, which include speed and total delivery time, reliability, and other logistical performance indicators.

Concerning the qualitative aspect, transportation systems have to provide services that meet the shippers' expectations. In addition to being a competitive differential in favor of the carrier that is aware of these demands, the improvement of quality in transport can reduce the cost of the final product as a result of lower transaction costs and reduced losses.

Therefore, the declining relative importance of shippers' concerns regarding cost may indicate a significant change in the market with regard to the priorities considered in hiring freight. In the bulk agricultural segment, the freight market historically has prioritized price as the most relevant construct, which has made transport a commodity. However, valuing the guarantees that only big operators can give involves prioritizing longer-term contracts and relationships, which tells the market that large shippers are negotiating primarily with transportation companies that have their own fleets.

An immediate impact of this trend may be a reduction in the participation of freight agencies. These have been established due to the disorganization and fragmentation of the service provider segment, in which the autonomous participant ("truck driver") is predominant, as are those carriers which have small fleets which often consist of a single vehicle.

On the other hand, this process of qualifying service and professionalism is necessary for the road transport of loads to maintain competitiveness in light of

the recent expansion, although often understated and not so widespread, of other modes of transport. In this new scenario, it seems clear that the autonomous participant is undergoing a drastic decrease in importance in this market and is increasingly dependent on subcontracting through transportation companies.

5. CONCLUSIONS

This study seeks to investigate the constructs that are desired by shippers when they look for services that fit their needs in terms of intermodal terminals for bulk agricultural products. These responses can help us understand why a country of continental dimensions that mainly produces and ships low value-added products over great distances mainly uses road transport. In this article, transportation has been analyzed in relation to the management of services, focusing on understanding how shippers form their expectations of services.

Using the stated preference technique, the shippers we have surveyed have indicated that, among the presented constructs, their priorities can be ranked in the following order: reliability, time period, customer relations, cost, and flexibility. The results reflect shippers' concerns regarding the fulfillment of contracts and logistics costs as well as the quality and allocation of transport systems. Initially, shippers expressed interest in operations occurring within an expected time period, with reliability, and at competitive costs. On the one hand, shippers have little margin for error; therefore, they seek to minimize costs with reduced storage in port areas and reduced losses of shipments caused by delays in operations and transit during the export process. In this light, the use of only one mode of transport, normally road transport, has been safer in terms of the time period required and the total time taken by these operations.

Fundamentally, though, this study has confirmed the results of previous studies by showing that constructs associated with the quality of service are more highly valued than are those related to cost (freight rate). This implies new points of reference for the freight market, in which aspects of quality and service performance should increasingly dominate. This should indicate an increased use of long-term contracts and relationships, which will thus involve greater participation on the part of carriers, with truck drivers being replaced or subcontracted. This would mark an important step towards the

professionalization of transport services and would finally make inroads on the historic view of transport as a commodity.

We believe we have made practical contributions to the field through our approach to infrastructure issues which may also prove relevant to regulatory issues relating to the improvement of the transportation system, especially in terms of logistics in Brazil. In terms of academic contributions, we have introduced the Stated Preference technique to the operations management research area, which is a powerful tool in that it provides a deeper understanding of agent behavior.

ACKNOWLEDGMENTS

We wish to thank Fapemig and CNPq for providing funding for this project.

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