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From the Editor...

Welcome to the Fall, 1998 issue of the *Journal of Transportation Management*. As always, I offer my sincere gratitude to the members of the Editorial Review Board who contributed to the success of this issue. I also offer praise to my able and dedicated Associate Editors, Brian Gibson and Steve Rutner. This issue of the *Journal* offers more cohesion in topical coverage than previous issues - by accident rather than by design. The result is an interesting combination of well-written articles that I hope you find useful.

The lead article in this issue, by Alexander Ellinger, Patricia Daugherty and Chad Autry, profiles logistics-related usage of automatic replenishment programs and compares required resource support to ARP performance. The second article, by Blaise Waguespack, Aleksandar Savic and James Baker, examines the impact of an apparent shortage of aviation maintenance technicians upon the growth potential of the air transportation industry. The shortage, if severe, could significantly alter air transportation service characteristics in both domestic and international trade. Richard Jones, in the third article, analyzes the air industry from a different perspective. The study investigates the impact of airline deregulation upon the levels of air transportation service provided in non-hub airport locations. As many opponents of deregulation in the industry feared, service levels have declined in the non-hub airports represented in the study. David Menachof and Anthony Damian take an interesting look at the historical development of corporate mergers and alliances in the ocean shipping industry in the fourth article. Their study demonstrates that merger/alliance activity among ocean shipping firms closely follows such activity in general industry. In the final article of this issue, Stephen Parker and John Kent continue to investigate the ocean shipping industry from a distinctly different vantage point. Their article seeks to identify the key determinant criteria used by import and export shippers when going through the process of selecting an international containership carrier. Take the time to evaluate each offering in this issue. I think you will be glad that you did.

This issue of the *Journal* is the third under the continuing financial sponsorship of the International Intermodal EXPO - the world's largest logistics and transportation related trade show. If you missed the most recent EXPO (the 16th, April 20-22) in Atlanta, Georgia, then make plans now to attend the 17th annual EXPO April 11-13, 2000, again in Atlanta, Georgia. See the back cover of this issue for more information. I again thank John Youngbeck, CEO of the EXPO, and his board of directors for their commitment not only to the *Journal of Transportation Management* and Delta Nu Alpha International Transportation Fraternity but also to the future of logistics and transportation education.

Speaking of commitment and financial support, remember that we cannot survive and continue to publish without reader support. Please join or renew your membership in Delta Nu Alpha International Transportation Fraternity and subscribe to the *Journal of Transportation Management.* Share this issue with a colleague and encourage him/her to subscribe today!

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OBJECTIVES

Editorial Policy. The primary purpose of the *JTM* is to serve as a channel for the dissemination of information relevant to the management of transportation and logistics activities in any and all types of organizations. Articles accepted for publication will be of interest to both academicians and practitioners and will specifically address the managerial implications of the subject matter. Articles that are strictly theoretical in nature, with no direct application to the management of transportation and logistics activities, would be inappropriate for the *JTM*.

Acceptable topics for submission include, but are not limited to carrier management, modal and intermodal transportation, international transportation issues, transportation safety, marketing of transportation services, domestic and international transportation policy, transportation economics, customer service, and the changing technology of transportation. Articles from related areas, such as third party logistics and purchasing and materials management are acceptable as long as they are specifically related to the management of transportation and logistics activities.

Submissions from industry practitioners and from practitioners co-authoring with academicians are particularly encouraged in order to increase the interaction between the two groups. Authors considering the submission of an article to the *JTM* are encouraged to contact the editor for help in determining relevance of the topic and material.

The opinions expressed in published articles are those of the authors and do not necessarily reflect the opinions of the editor, the Editorial Review Board, Delta Nu Alpha Transportation Fraternity, the International Intermodal Expo, or Georgia Southern University.

PUBLISHING DATA

Manuscripts. Four (4) copies of each manuscript are to be sent to Dr. Jerry W. Wilson, Georgia Southern University, P. O. Box 8154, Statesboro, GA 30460-8154. Manuscripts should be no longer than 25 double-spaced pages. Authors will be required to provide electronic versions of manuscripts accepted for publication. Guidelines for manuscript submission and publication can be found in the back of this issue.

Subscriptions. The *Journal of Transportation Management* is published twice yearly. The current annual subscription rate is $35 in U.S. currency. Payments are to be sent to: *Journal of Transportation Management*, Delta Nu Alpha Transportation Fraternity, 530 Church Street, Suite 700, Nashville, TN 37219.

AUTOMATIC REPLENISHMENT: THE RELATIONSHIP BETWEEN RESOURCE COMMITMENT AND PROGRAM PERFORMANCE

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Some firms have adopted a new approach to order fulfillment, i.e., automatic inventory replenishment. With automatic replenishment programs (ARPs), sellers replenish or restock inventory based upon actual product usage and stock level information provided by buyers. This paper reports on a recent survey of logistics professionals regarding ARP involvement. In addition to providing a profile of current usage, the research also examines the relationship between investment in automatic replenishment-related resources and ARP performance. Firms making a greater commitment to ARP (in terms of resource allocation) reported enhanced day-to-day operational performance and greater success in the overall performance of the trading relationship.

INTRODUCTION

Inventory management, i.e., deciding what to stock, how much, and where, is one of the most difficult tasks businesses face. Traditionally, forecasts have driven production and distribution scheduling—usually with mixed results at best. Thus, high priority has been given to finding better ways to manage demand in order to overcome forecasting-related problems and improve service levels (Fisher et al. 1994). One of the solutions that offers great promise is demand-based replenishment, i.e., restocking or order fulfillment based upon actual point-of-sale data. While a variety of terms are used to describe such programs, e.g., continuous replenishment planning (CRP), vendor managed inventory (VMI), quick response (QR), and efficient consumer response (ECR), the umbrella term automatic replenishment programs will be

used to describe any inventory replenishment program that falls within the broad guidelines. Specifically, automatic replenishment describes an exchange relationship in which the seller replenishes or restocks inventory based upon actual product usage and stock level information provided by the buyer.

With potential for improved efficiency, enhanced profitability, and reduced costs, the programs have received extensive coverage in the popular press (Mathews 1994; Robins 1995; Casper 1996). Considerable rewards are believed to be associated with automatic replenishment programs. However, the programs are resource intensive in terms of implementation and maintenance.

Most published work relating to automatic replenishment has focused on case-studies and anecdotal accounts in the grocery industry (Fernie 1994; Whiteoak 1994). Only one empirical study was identified relating to automatic replenishment issues. Fiorito, May, and Straughn (1995) conducted a quick response survey among retailers. Thus, the current research was undertaken to assess the extent of involvement in automatic replenishment-type programs and to gauge their impact on business operations. Considering that extensive financial and managerial resources are required to support such programs, is there a "pay off" in terms of performance?

Automatic Inventory Replenishment

Automatic replenishment programs require close ties between trading partners, extensive exchange of information, and advanced technology support (Cottrill 1997; Keh and Park 1997). Product usage and stock level data are typically transmitted by a retailer via EDI or Internet to the distributor or manufacturer (Stratman 1997). Actual sales data, which are often transmitted several times per day, trigger replenishment quantities. When merchandise is ready for shipment, sellers often provide advance notification (Advance Ship Notices) electronically to buyers.

Responsibility for the replenishment decision may be assumed by the buyer or by the vendor. For example, with VMI systems, vendors receive withdrawal and current balance information from retailers and then replenish to a pre-determined inventory level. Vendors can arrange shipments, build loads, and cut purchase orders in such a manner that optimizes transportation and inventory planning. With CRP, the retailer (or purchaser) maintains more control over replenishment decisions. However, the decisions are still based upon actual sales data (Andel 1996).

Automatic replenishment programs have been credited with a wide range of benefits. For example, case studies have been reported profiling dramatic improvements including increased inventory turns and reduced out-of-stocks at store level. Such store-level improvements and increased sales must be balanced against the likelihood of increased inventory holdings at vendors' warehouses, at least during the initial implementation phase (Heard 1994). However, over time, point-of-sale data can be used to smooth-out the production cycle and bring vendor inventory levels down as well (Nannery 1994).

Automatic replenishment program implementation typically requires significant changes within an organization. Communication linkages and information system support are needed to connect the trading partners. Other operational changes that are likely to be required include a shift to smaller production runs in order to make more frequent, smaller shipments to retail customers. Also, with full implementation, traditional business roles are altered. For example, buying and merchandising roles no longer fit traditional patterns. Buyers no longer have to spend significant shares of their time and

effort on day-to-day re-ordering (Fiorito, May, and Straughn 1995). Finally, substantial commitment is required to support such programs. Resource commitment in a tangible sense (financial support) as well as intangible (managerial support) is critical to program success.

Resource-Based Theory

Many firms are focusing on the innovative utilization of logistical resources to create and add value for customers (Christopher 1993; Fuller, O'Conor, and Rawlinson 1993; Stank, Daugherty, and Ellinger 1998). However, despite recent logistical advances, further theoretical development on the strategic role of logistics remains a key priority (Mentzer and Kahn 1995; Stock 1996). Resource-Based Theory (RBT) of the Firm has significant potential for logistics research (Olavarrieta and Ellinger 1997), and provides the theoretical rationale for the current research.

Proponents of RBT suggest that the real origins of a firm's success are the organization's firm-specific or idiosyncratic resources. According to RBT, firms are bundles of resources (Wernerfelt 1984), which include all inputs that allow a firm to work and implement its strategies (Conner 1991). Firm resources can be tangible or intangible (Hall 1992), and they may be developed inside the firm or acquired in the market. Different classifications of resources have been offered in the literature (Barney 1991; Grant 1991; Amit and Schoemaker 1993; Bogaert, Maertens, and Van Cauwenbergh 1994; Brumagim 1994). The various classifications can be summarized as input factors, assets, and capabilities or competencies.

Input factors are generic resources that can be acquired in the market. For example, automatic replenishment program-related input factors include raw factors (e.g., barcoding equipment, warehouses, computers, and Point-of-Sale scanners) and raw skills (order picking skills, loading and unloading skills, driving skills, and computer-operating and programming skills). When transformed or applied, input factors become part of the firm's assets or capabilities/competencies, contributing directly to the output of the firm.

Assets are stocks of available factors that are owned or controlled by the firm (Dierickx and Cool 1989; Amit and Schoemaker 1993). Assets have the characteristic of being 'visible' resources (Bogaert, Maertens, and Van Cauwenbergh 1994). Examples of automatic replenishment program-related assets are Electronic Data Interchange operations, automatic forecasting and automatic replenishment computerized systems, satellite-based trucking communication technologies, and cross-docking operations.

Capabilities are complex bundles of skills, assets, and accumulated knowledge exercised through organizational processes, that enable firms to coordinate activities and make use of their resources (Schoemaker and Amit 1994; Day 1994; Schulze 1994). Wal-Mart's distribution system (Stalk, Evans and Shulman 1992; Day 1994), Hewlett-Packard's postponement dexterity (Feitzinger and Lee 1997), and Federal Express' reliance on information technology (Lappin 1996) are prominent examples of resource-based logistical capabilities. Examples of competencies related to automatic replenishment programs are organizational processes that facilitate pre-season planning with trading partners, joint planning and forecasting of replenishment/promotion, and the utilization of cross-functional teams.

A difference between assets and capabilities is that assets are related to 'having' while capabilities are related to 'doing', making them more invisible (Bogaert, Maertens, and Van Cauwenbergh 1994). Capabilities/competencies also differ from other firm resources in the sense

that they are enhanced by use (Nelson 1991). The more a capability is utilized, the more it can be refined and the more sophisticated and difficult it becomes to imitate. For example, researchers have emphasized the difficulty in attempting to copy firms' distribution systems (Lambert and Stock 1993). It is suggested that "...distribution can be designed as a unique offering not easily duplicated by competition," (Sterling 1985). Thus, the implementation of an automatic replenishment program can represent a commitment of resources designed to develop a distribution capability/competency that may differentiate the firm from its competitors.

Operationalization of Resource-Based Theory

Operationalization of RBT has proved problematic for researchers due to the inherent unobservability of many capabilities (Godfrey and Hill 1995). Accordingly, the majority of RBT-oriented studies have been conceptual rather than empirical. Attempts to operationalize RBT have involved either the utilization of proxy financial data to represent capabilities (e.g., Rumelt 1991; Markides and Williamson 1994) or the examination of associations between firms' competencies, their related activities, and performance (e.g., Snow and Hrebniak 1980; Hansen and Wenerfelt 1989; Sousa and Hambrick 1989; Conant, Mokwa, and Varadarajan 1990; Miller and Shamsie 1995). Examination of the association between investment in specific resources and performance can provide greater insight. Therefore, the current research focuses on the relationship between investment in automatic replenishment program-related resources and performance.

RESEARCH QUESTIONS

The Resource-Based Theory of the Firm suggests that the degree to which a firm commits resources to develop and facilitate automatic replenishment competency is positively associated with performance. However, the implementation of an automatic replenishment program is not purely a matter of financial commitment. The combination of tangible (financial) and intangible (managerial and temporal) resource commitment is particularly important to the successful development of an automatic replenishment competency.

An illustration of the benefits associated with commitment of both tangible and intangible resources to developing distribution competency is K-Mart's difficulty in matching Wal-Mart's logistical system despite continuous efforts to benchmark and copy it (Barney 1995). Wal-Mart's senior management's recognition of, and investment in, distribution and transportation as a strategic resource is cited as critical to its success (Walton and Huey 1992).

The current study seeks to provide a better understanding of the relationship between firms' commitment of resources to automatic replenishment programs and performance in achieving specific automatic replenishment-related goals, as well as on more global measures of performance such as profitability and the overall success of inter-firm relationships.

Research Question 1a:
Is the commitment of resources to automatic replenishment programs associated with the attainment of specific automatic replenishment-related performance goals?

Research Question 1b:
Is the commitment of resources to automatic replenishment programs associated with profitability?

Research Question 1c:
Is the commitment of resources to automatic replenishment programs associated with the overall success of inter-firm relationships?

RESEARCH METHODOLOGY

Based on a review of the literature and interviews with five logistics professionals, a survey of automatic replenishment practices was developed. The survey was pretested with six other persons: three logistics professionals, two consultants, and one academic researcher. The survey was modified with respect to their input. Two versions of the instrument were then developed: one for retailers and one for manufacturers.

Telephone calls were placed to a random sample of manufacturer and retailer members of the Council of Logistics Management, with the purpose of screening for involvement in automatic replenishment. Of the 762 total contacts, 247 (32.4%) were deemed ineligible because their firms were not using automatic replenishment or had yet to fully operationalize their system. Of the remaining 515 contacts, 282 agreed to participate. The other contacts either refused to participate (24), or failed to respond to multiple phone messages (209). Surveys were mailed to 282 individuals with reminder cards two weeks later.

A total of 104 surveys were returned of which six had excessive missing values, yielding 98 usable surveys. Of the 98 respondents, 75 were from manufacturing firms and 23 from retailing firms. The average annual sales volume and the average number of employees for respondent firms were $3.2 billion and 37,481 respectively. The respondent base represents a wide range of industries. The most highly represented industries were food and beverage (31.3%), electronics (12.2%), chemicals (9.2%), and apparel (8.2%). A demographic breakdown of the respondents is included in the Appendix.

Analysis of non-response bias was performed by comparing early versus late responses, as recommended by Armstrong and Overton (1977). The responses provided by the last quartile of respondents (those considered to be most similar to non-respondents) were compared to responses provided by the first three quartiles of respondents. The comparison of group mean responses to survey items revealed no significant differences (at $p < .05$) for the variables analyzed. Accordingly, non-response bias was not considered to be a problem.

RESULTS

The research findings provide a profile of automatic replenishment program involvement as well as respondents' perceptions of their firms' automatic replenishment program success to date. As shown in Table 1, the most common type of automatic replenishment program is vendor managed inventory (VMI). In addition, a high number of firms (nearly 37%) are involved in continuous replenishment programs (CRP). Other types of automatic replenishment had lower levels of involvement—supplier-managed inventory, quick response, jointly managed inventory, efficient consumer response, and distributor-managed inventory. However, these exploratory findings may be a function of the sample and are not necessarily generalizable.

Slightly over one-third of the respondents indicated that their firms are involved in more than one type of automatic replenishment program.

Automatic Replenishment Program Success

To examine how well automatic replenishment programs are performing, respondents were provided with a list of automatic replenishment-related goals and were asked to indicate how effective their firms have been in achieving them. The items on the list were initially developed based upon a review of the literature, and were later refined as a result of input received during initial interviews and the pre-test phase of the research. A total of 11 items were included; a 7-point scale was utilized (1 = not at all effective, 4

TABLE 1

INVOLVEMENT IN AUTOMATIC REPLENISHMENT PROGRAMS

Automatic Replenishment Program Type	Frequency*	Percent
Vendor-Managed Inventory	45	45.92
Continuous Replenishment	36	36.73
Supplier-Managed Inventory	16	16.33
Quick Response	12	12.24
Jointly-Managed Inventory	10	10.20
Efficient Consumer Response	9	9.16
Distributor-Managed Inventory	4	4.08
Other	18	18.37

* Multiple responses were possible

= somewhat effective, and 7 = extremely effective). Overall respondent means and standard deviations for the 11 items are shown in Table 2.

Automatic replenishment programs have been effective in achieving some of the more basic program-related goals. The respondents reported that their firms had been successful in terms of improving/increasing customer service levels (5.47), fewer stock-outs (5.33), improved reliability of deliveries (5.15), and faster inventory turns (4.93).

The respondents indicated that their firms have been moderately effective in achieving automatic replenishment objectives relating to program efficiencies as illustrated by their success in reducing over-stocks (4.78), inventory holdings (4.76), returns and refusals (4.62), handling (4.56), costs (4.50), and product damage (4.45).

The lowest level of program success is associated with reducing the need to discount product (3.96). Automatic replenishment attempts to exactly match supply and demand. However, even with careful monitoring, joint planning, and other processes aimed at exactly predicting demand, mismatches occur due to market conditions, changing consumer preferences etc.

Resource Commitment and Performance

The Resource-Based Theory of the Firm suggests that resource commitment and performance are positively related. Respondents were asked to indicate the extent of their firms' management commitment to automatic replenishment, the extent of their firms' resource commitment to automatic replenishment, and the extent to which thorough advance automatic replenishment program planning occurred within their firms. A 7-point scale with 1 = little, and 7 = substantial was utilized. Respondents' overall mean scores for all three items were relatively high, which is indicative of the considerable investment in resources that firms in the sample have made to implement automatic replenishment programs. Overall respondent means and standard

TABLE 2

EFFECTIVENESS IN ACHIEVING AUTOMATIC REPLENISHMENT RELATED GOALS

Goal	Mean*	Standard Deviation
Improved/increased customer service	5.47	1.31
Fewer stockouts	5.33	1.21
Improved reliability of deliveries	5.15	1.41
Faster inventory turns	4.93	1.47
Reduced overstocks	4.78	1.54
Reduced inventory holdings	4.76	1.64
Reduced returns and refusals	4.62	1.52
Reduced handling	4.56	1.47
Reduced costs	4.50	1.46
Reduced product damage	4.45	1.62
Reduction of discounting	3.96	1.60

* 7-point scale 1= not at all effective 7= extremely effective

deviations for the three resource commitment items are reported in Table 3.

To assess associations between resource commitment and performance, the three items were combined into a summary combination measure for resource commitment. Cronbach alpha for the three-item measure was .89 indicating a high level of reliability for the measure. Respondents' firms were classified as either high or low with respect to automatic replenishment program resource commitment based upon the summed score of responses to the three items (possible scores ranged from 3-21).

A split was made at the fiftieth percentile to form two groups. Thus, firms scoring 15 or more (on a 3 - 21 scale) were designated as high resource commitment firms, while the low resource commitment group consisted of firms scoring 14 or less on the summary combination measure for resource commitment. Results of t-tests performed to examine differences in means between the high and low resource commitment groups on specific automatic replenishment program related goals are presented in Table 4.

The results strongly suggest that performance on specific automatic replenishment related goals is positively associated with resource commitment. The high resource commitment group had significantly higher levels of achievement ($p = .05$) on specific automatic replenishment related goals than firms in the low resource commitment group on 10 out of the 11 items. In only one instance, reduced product damage, no significant difference was found between the high resource commitment and low resource commitment groups.

TABLE 3

COMMITMENT TO AUTOMATIC REPLENISHMENT PROGRAMS

Global Measure	Mean*	Standard Deviation
The extent of management commitment to Automatic Replenishment Programs	4.85	1.55
The extent of resource commitment to Automatic Replenishment Programs	5.25	1.36
The extent of thorough advance planning for Automatic Replenishment Programs	5.26	1.28

* 7-point scale 1= minor 7= substantial

TABLE 4

T-TESTS OF DIFFERENCES IN MEANS:
HIGH RESOURCE COMMITMENT VS. LOW RESOURCE COMMITMENT
IN ACHIEVING AUTOMATIC REPLENISHMENT RELATED GOALS

Goal	T-tests of differences in means* High resource commitment	Low resource commitment
Reduced costs	4.91**	3.94
Reduced inventory holdings	5.17**	4.22
Faster inventory turns	5.28**	4.47
Increased/Improved customer service	5.80**	5.02
Reduced handling	4.94**	4.02
Fewer stockouts	5.72**	4.75
Reduced product damage	4.74	4.11
Reduced returns and refusals	4.96**	4.16
Reduced overstocks	5.27**	4.03
Reduction of discounting	4.47**	3.36
Improved reliability of deliveries	5.58**	4.66
Summary Variable	56.60**	47.86

* 7-point scale 1= not at all effective 7= extremely effective
** Significantly different at 0.05

To assess the association between resource commitment and performance from an aggregate achievement perspective, a single summary variable was created by consolidating the 11 automatic replenishment program goal items. Not surprisingly, when a t-test was performed to compare means for the two groups, firms in the high resource commitment group (mean = 56.60 on an 11-77 scale) indicated significantly higher success in achieving automatic replenishment related goals than firms in the low resource commitment group (mean = 47.86).

Next, to examine associations between resource commitment and more global measures of performance, respondents were asked to consider their most important ARP relationship and to indicate how profitable it had been (7 point scale: 1 = highly unprofitable, 7 = highly profitable), and to rate the overall performance of the relationship (7 point scale: 1 = highly unsuccessful, 7 = highly successful). Overall sample means for profitability and for overall relationship performance were 4.85 and 5.18 respectively (standard deviations: 1.43 and 1.42). Once again, t-tests were performed to assess performance differences between the high and the low resource commitment groups. The results are shown in Table 5.

No significant difference was found between the two groups for ARP relationship profitability. Considering the financial and managerial commitment required to support automatic replenishment programs, this is not surprising. However, while profitability was not shown to be significantly higher with greater resource commitment, resource commitment was found to be related to relationship performance.

The high resource commitment group respondents rated the overall success of their most important ARP relationship significantly higher (mean = 5.50) than the low resource commitment group (mean = 4.70). Although a myriad of psycho-social factors, like trust and cooperation, may also influence the status of automatic replenishment program relationships, this finding can be regarded as a tentative indication of an association between resource commitment and more global measures of performance. Resource commitment in support of ARP's can be a building block—respondents in the high resource commitment group were

TABLE 5

T-TESTS OF DIFFERENCES IN MEANS: HIGH RESOURCE COMMITMENT VS. LOW RESOURCE COMMITMENT BY PROFITABILITY AND OVERALL RELATIONSHIP PERFORMANCE

Goal	T-tests of differences in means* High Resource Commitment	Low Resource Commitment
Profitability	4.92	4.72
Overall Relationship Performance	5.50**	4.70

* Individual items were measured on a 7-point scale with 1= not at all effective and 7= extremely effective, and then combined.

** Significantly different at 0.05

"happier" or believed that the trading relationships had been more successful.

DISCUSSION

Our examination of the resource commitment/performance relationship suggests a strong positive association between resource commitment and performance on automatic replenishment program-related goals. High resource commitment firms were significantly better performers than low resource commitment firms on ten of the eleven items as well as on the aggregate summary variable. However, results were mixed when relationships between resource commitment and more global measures of performance were assessed. While there was no significant difference between groups on relationship profitability, the high resource commitment group rated the performance of their most important ARP relationship as far more successful than respondents in the low resource commitment group. These findings strongly suggest that firms may enhance specific goal-related performance by committing resources to automatic replenishment programs. In addition, the findings offer evidence that resource commitment may also affect perceptions of overall relationship success.

Perhaps the most interesting finding to emerge from this research is the magnitude of the perceived performance differences between the high and low resource commitment groups on specific automatic replenishment-related goals. Once again, it should be noted that the respondents did not represent firms in various stages of automatic replenishment program implementation. Rather, all respondents were selected on the basis that they had implemented automatic replenishment programs. Prospective respondents who stated that their firms had not yet fully operationalized automatic replenishment programs were not deemed eligible to participate in the study. Thus, all respondent organizations in the sample had committed resources to operationalize automatic replenishment programs.

The results demonstrate consistently robust performance differences between respondents in the high and low resource commitment groups. Since all firms in the sample have already invested the considerable amount of time, money, and effort that is required to operationalize an automatic replenishment program, the magnitude of the differences is somewhat surprising. The findings suggest that firms who are prepared to commit additional resources to enhance their automatic replenishment programs may see even better performance. In sum, the current research indicates, as suggested by Resource-Based Theory, that firms may derive considerable performance benefits from focusing on the commitment of financial, managerial, and temporal resources to the development of an automatic replenishment competency.

Managerial Implications

Budget allocations within the firm are generally contentious and highly competitive. Everyone wants the same thing—a bigger share of the pie. The current research provides strong support for justifying budget allocations. Based on these findings, greater resource commitment (related to automatic replenishment programs in this instance) is related to enhanced performance. The firms that have committed greater resources are doing a better job operationally day-in and day-out. They indicated better customer service, fewer stock-outs, etc.

Differences were also noted on a higher or more strategic level. Resource commitment was not found to be related to higher profitability. Intuitively, this would be expected. It is unlikely that a firm can "spend more" to improve service and customer relations and simultaneously expect to improve profits. However, the firms making resource commitments to automatic

replenishment programs seem to be reaping benefits in terms of overall relationship performance. Such an assessment would seem to bode well for the future. Resource commitment is related to performance. Better performance can encourage long-term relationships and, eventually, influence firm profitability.

Future Research

This study offers empirical evidence to support the basic premises of Resource-Based Theory and the relationship between resource commitment and performance. The research setting involved one very specific firm application—involvement in automatic inventory replenishment programs. Future research should further explore the proposed relationship by testing in other domains. The tenets of RBT should be widely generalizable; however, further empirical testing is required.

The current research addressed the issue of resource commitment at a general level. No attempt was made to determine the prioritization of resource allocations or to identify the most important elements. For example, with automatic replenishment programs, an array of input factors ranging from barcoding equipment to order picking skills are commonly utilized. Are some input factors more important, i.e., should be funded first? Future research should explore this issue.

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APPENDIX

RESPONDENT BREAKDOWN BY INDUSTRY

Industry	Frequency	Percent
Food and Beverages	30	31.3
Electronics	12	12.2
Chemicals	9	9.2
Apparel	8	8.2
Miscellaneous Manufacturing	6	6.1
Pharmaceuticals	4	4.1
Medical Equipment	4	4.1
Health and Beauty Care	3	3.1
Transportation Equipment	3	3.1
Paper Products	2	2.0
Rubber	2	2.0
Fabricated Metals	2	2.0
Industrial and Commercial Machinery	2	2.0
Other	9	9.2

EMPLOYEES AND AUTOMATIC REPLENISHMENT

Total Number of Employees	Frequency	Percent
100,000 or more	3	3.1
10,000 to 99,999	19	19.4
1,000 to 9,999	34	34.8
100 to 999	21	21.5
less than 100	6	6.1

Maximum: 200,000
Minimum: 15
Mean: 37,481

EMPLOYEES AND AUTOMATIC REPLENISHMENT
(continued)

Employees Committed to Automatic Replenishment	Frequency	Percent
100 or more	9	9.2
75 to 99	6	6.1
50 to 74	5	5.1
25 to 49	7	7.1
less than 25	55	56.1

Maximum: 440
Minimum: 1
Mean: 39.43

RESPONDENT JOB TITLES

Title	Frequency	Percent
Manager (Miscellaneous)	17	17.3
Logistics Manager	15	15.3
Director of Logistics	12	12.2
Vice President Logistics	7	7.1
Distribution Manager	5	5.1
Director (Miscellaneous)	5	5.1
Director of Distribution	4	4.1
Vice President Distribution	3	3.1
Director of Transportation	3	3.1
Distribution Center Manager	3	3.1
Customer Service Manager	2	2.1
Other	11	11.2

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ASSESSING THE IMPACT OF THE SHORTAGE OF AVIATION MAINTENANCE TECHNICIANS ON AIR TRANSPORTATION

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Global aviation activity is poised for a decade of sustained growth. While economic difficulties are a fact of life in the aviation transportation industry, the future demand for aviation transportation services is promising. One factor that may greatly dampen this projected growth may be the lack of qualified aviation maintenance technicians (AMTs) necessary to keep the air transport fleet flying. This investigation examines the future of global aviation activity while presenting factors impacting the corresponding lack of growth in the AMT population that threaten the future of air transportation.

INTRODUCTION

This research report investigates the relevant supply and demand issues concerning Aviation Maintenance Technicians (AMT). Immediate and long term effects upon the aircraft maintenance environment are evaluated. The analysis focuses on three areas: (1) the general economic forecast for the US aviation industry; (2) an overview of the global aviation maintenance industry in general; and (3) current developments within US AMT and global maintenance training.

All aspects of the aviation industry have sustained cyclical trends and AMT hiring has seen these same cycles (Lombardo 1998; Young 1998). However, the aircraft maintenance industry from general aviation to the major air carriers is positioned for a rather dramatic change within the next five years. One change the aviation maintenance industry has to deal with is the impending shortage of qualified AMTs. Already some flights have been cancelled due to a lack of maintenance personnel and firms are scheduling maintenance procedures weeks in advance. The days of being able to call a

maintenance facility in the morning and fly the plane in for service that afternoon are gone (Lombardo 1998).

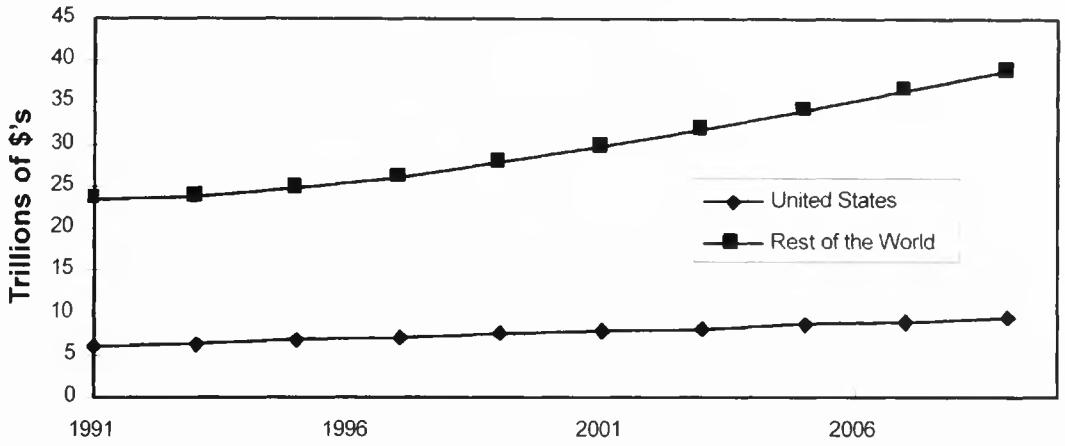
The recent supply of AMTs is approximately 11,000 newly certified aviation mechanics annually. The recent annual demand for just the major air carrier industry alone has been around 10,000 AMTs (Lewis 1998) with one forecast predicting the demand for AMTs through the year 2004 averaging about 15,000 new hires per year (Lombardo 1998). When considering the additional need for AMTs within the commuter, general aviation, third party outsourcing firms, and even the manufacturing sector, it is easy to see that the current surplus of 1,000 AMTs not needed by the major air carriers is not enough to satisfy the forecast demand. Even though the current market situation is not yet extreme, changing market conditions within the next five years warrants considerable concern and proper planning.

THE AVIATION INDUSTRY OUTLOOK AN OVERVIEW

The Economic Environment

The growth within the US aviation industry is linked directly to the performance of the US economy. With no significant inflationary pressure, the US economy has maintained its current expansion, now into its seventh year. This is the third longest expansion period in the post-World War II era. Real Gross Domestic Product (GDP) has averaged a gain of 2.9% annually since the early 1990's, and just recently the GDP growth for 1997 was 3.6%. World GDP also increased, at an annual rate of 2.6%. Even when factoring in current regional uncertainties, the strongest showings have been within the Asia-Pacific sectors, up an average of 7.8% per year (FAA 1998). Figure 1 represents the recent and anticipated US and World economic growth over the next 12 years as measured by GDP.

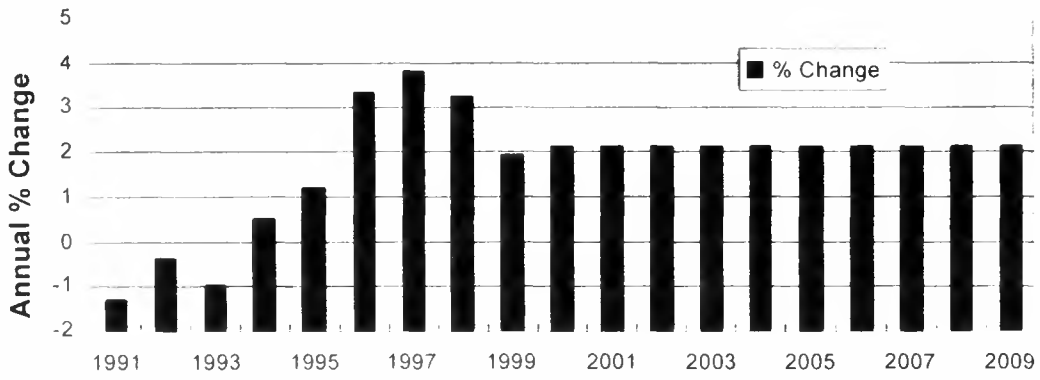
Figure 1
GDP Forecasts for the U.S. and the Rest of the World
(Figures based on $1990)



Source: FAA Aviation Forecasts, Fiscal Years 1998-2009

This growth in both world and US economies will have a major impact upon the demand for aviation services. One potential factor to consider when forecasting economic activity, and its impact upon the aviation industry, is fuel prices. For example, the Gulf War of the early 1990's, and its effect upon world oil prices had serious ramifications for the aviation industry (FAA 1998). Changes in future oil prices must therefore be included in any long-term economic outlook. Fortunately, fuel prices are expected to stay relatively stable throughout the long-term (Figure 2).

Figure 2
Oil & Gas Price Changes



Source: FAA Aviation Forecasts, Fiscal Years 1998-2009

According to the FAA Aviation Forecast (1998-2009) additional positive indicators of economic growth in the US relate to demographic and income trends in the long-term. The results of an aging population, associated with growth in disposable income for the older generations, contribute to the positive indications of increased demand for air travel. As the generations become older their tendency is to spend more on air travel (FAA 1998). The current and future elderly populations have more time and money to travel than previous generations. The result is increased leisure travel among the elderly, especially once baby boomers begin to reach retirement age.

By combining the factors of US and global GDP growth, oil price stabilization, and an aging population, the long-term future for the economic environment affecting the aviation industry looks positive. In the short run however, different international regions may experience dramatic financial and economic fluctuations. Though the effect on the US domestic aviation market would not be significant, the increased level of globalization by US based aviation organizations may result in short term economic difficulties. For example, US trade and travel to Asia has been affected due to the recent downturns in that regions economic fortune. Thus, while the world marketplace demonstrates some instability, the current and long-term growth prospects for the US aviation industry are encouraging.

The Air Carrier Environment

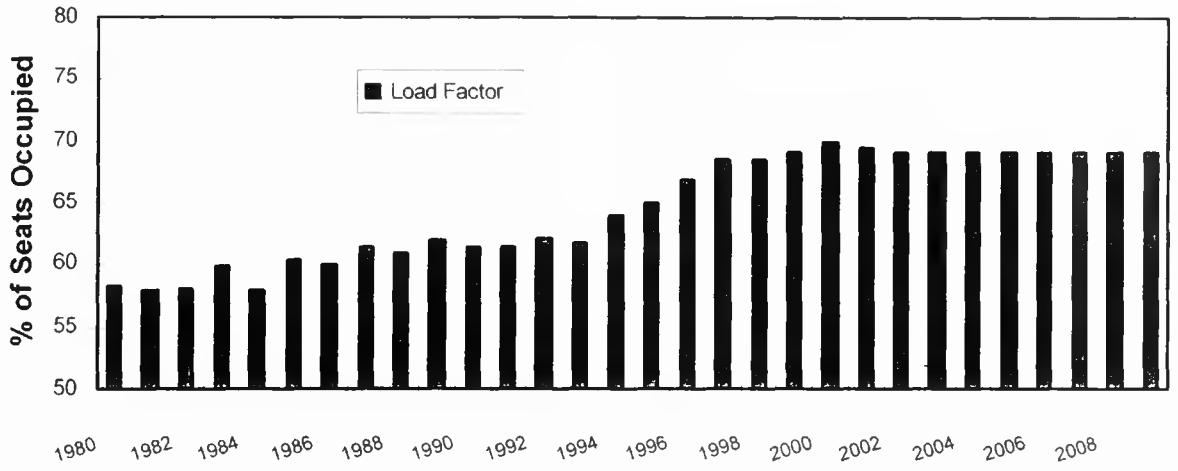
The recent 1997 fiscal year was an overall success for the US major air carriers. Industry wide available seat miles (ASMs) rose by roughly 3%. On the other hand, the more exciting news

was that revenue passenger miles (RPMs), or demand, grew by 5.1%. The result was record level load factors across the board for the large U.S. air carriers that averaged 70.3% for 1997. Figures 3 and 4 represent the expected economic situation for the air carriers:

Figure 3
U.S. Commercial Air Carriers Scheduled Passenger Enplanements

Source: FAA Aviation Forecasts, Fiscal Years 1998-2009

Figure 4
U.S. Commercial Air Carriers Passenger Load Factors
(Domestic)



Source: FAA Aviation Forecasts, Fiscal Years 1998-2009

The air carrier predictions are based on expectations of promising economic growth. The fiscal performance of the U.S. airlines within recent years has been healthy, but that is a direct result of overall economic conditions. The domestic air carrier market has proven to be very sensitive to economic conditions. During the early part of the 1990's, the domestic carriers lost more money and market share than foreign competitors. However, during the recent resurgence in the economy the domestic air carriers have financially outperformed their foreign competitors. This performance directly relates to the validity of any aviation forecast. Almost all indicators point to a positive growth within the air carrier industry. Because the success of the airlines is strongly correlated with the economy, any negative or slow growth periods within the forecast period could result in a considerable downturn in critical operating characteristics, such as expected ASMs or load factors.

The U.S. aviation industry operates in a dynamic environment. Two major factors contributing to potential changes in the marketplace are business travel substitutions and aircraft retirement (FAA 1998). Communications technologies, particularly in the later half of the forecast period, may significantly impact business travel. Developments in computer interfaces and teleconferencing, in addition to video/computer conferencing, are major forces that may hinder the growth of the business travel segment. Also, retirement of a considerable number of aircraft will occur in the near future. Stage-2 aircraft are replacing quieter more efficient stage-3 aircraft (FAA 1998). These retirements should improve the overall industry productivity and consequently lead to enhanced economic conditions.

Additional factors contributing to change within the industry are:

- Matching supply and demand more accurately through the use of yield management systems
- Continued emergence of low-cost carriers
- Efforts to reduce unit costs and restructuring
- Global strategic alliances
- Increased efficiency and productivity
- Declining real fares

Regional/Commuter and General Aviation Developments

Within the aviation industry, the fastest growing sector is that of the regional/commuter airlines. These carriers have an average RPM increase of 9.6% since 1993 (FAA 1998). The increased number of codesharing agreements between regional/commuters and major air carriers, along with the increased acquisition and consolidation within the regional/commuter industry, has contributed to the significant growth. The transfer of a large number of short feeder routes from the majors to the regional/ commuters has also assisted in maintaining the high growth rates. All of the previously mentioned factors are expected to continue into the future, resulting in a sustained long-term expansion for the regional/commuter industry.

General Aviation (GA) also experienced significant growth. The main contributor to the resurgence within this sector was the General Aviation Revitalization Act of 1994 (FAA 1998). The result has been extremely encouraging with manufacturers almost on the brink of extinction now ramping up to full production. These manufacturers are beginning to re-invest in research and development, create new product lines, and rejuvenate old lines. Within the corporate aviation sector of the GA marketplace most manufacturers' production is sold out through the year 2001 (Shay 1999). General aviation is positioned and ready to realize tremendous growth within the next decade.

THE AVIATION MAINTENANCE INDUSTRY

The maintenance sector of the aviation industry has experienced the same dynamic change that other sectors of aviation have experienced. These changes are primarily due to the maintenance market evolving to meet the needs of its largest client, the major air carriers. The airlines spent over $23 billion on maintaining, repairing, and overhauling (MRO) budgets in 1996. This figure is expected to be over $33 billion by the year 2005 (Ebbs 1997). The primary reason for this growth is that maintenance expenditures are directly linked to the hours that aircraft fly (Figure 5).

Figure 5
U.S. Commercial Air Carriers Airborne Hours

Source: FAA Aviation Forecasts, Fiscal Years 1998-2009

Total aircraft hours for both wide-bodied (WB) and narrow-bodied (NB) aircraft will approach the 20 million hour level by 2009 as indicated in the figure above. This represents the level of demand for aviation maintenance services. The increased utilization of aircraft within the U.S. air carrier industry directly results in increased MRO activities required for the future. Additionally, there are still relatively few new aircraft being utilized and the resulting aging of airline fleets tends to push maintenance costs upward (Strahler 1995).

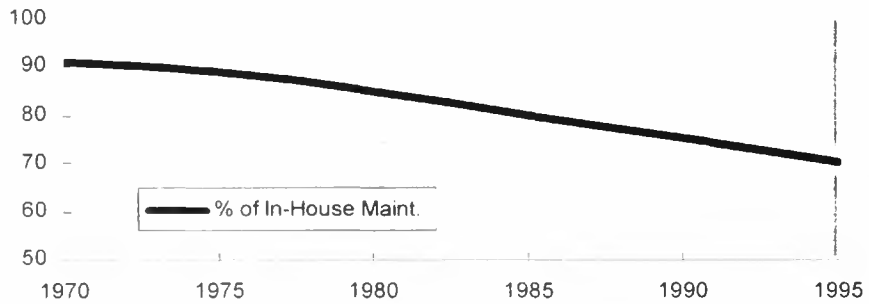
The MRO field is also changing internally and not simply because of changes in hours of aircraft utilization. Airline management is beginning to view maintenance as a non-core activity (Ebbs 1997). The implications for the industry include a shift from maintenance performed in-house at the airline's maintenance facilities to more third party firms or even original equipment manufacturers (OEMs) conducting airline maintenance (Smith and Culley 1997). The aviation maintenance industry is changing its structure to meet market requirements. Five key factors impacting the future of the maintenance industry are (Ebbs 1997):

- Outsourcing
- Increased regulatory oversight
- Greater manufacturer participation
- Restructuring of the supply chain
- Advancements in information technology

Outsourcing

Outsourcing (Figure 6) is the most prevalent change within the maintenance industry. Airlines are realizing that outsourcing can result in significant cost reductions, without hampering the operational requirements of aircraft. More importantly, the airlines can lower their costs without reducing profitability (Ozdener 1995). The indirect activities of purchasing, quality control, engineering, and logistics are not core competencies that many airlines employ (Ebbs 1997) and therefore outsourcing becomes a viable economic option. The airlines are identifying the areas where maintenance legitimately adds value and those maintenance operations that do not add value are being outsourced.

Figure 6
Proportion of Maintenance Work Done In-House



Source: Airline Business

Additionally, there is a trend for some of the large air carriers to turn their maintenance capabilities into subsidiary companies, thus increasing their commitment to maintenance and identifying maintenance as one of the company's core functions. This trend has led to situations where some maintenance is being performed by an airline's competitor (Ebbs 1997).

Oversight

There is also a growing need for airlines that outsource maintenance functions to increase oversight of the MRO stations. The Value-Jet crash accelerated the already increasing regulatory concerns that there was a failure of both company and FAA oversight (McKenna 1996). The crash will cause the airlines that outsource to become "partners" with the firms completing the maintenance. There is a need for increased communication and quality among the airlines and the outsourcing firms. The airline is ultimately responsible for the care of its aircraft, and communicating quality and operational concerns is vital (Ebbs 1997).

Consolidation and New Entrants

Consolidation is affecting the MRO market as well. Several of the largest industry players have recently been acquired by competitors. Combining a number of maintenance sites under the control of one management authority has led to a reduction in maintenance costs. This is forcing the smaller and medium sized repair facilities to find specialized niche areas or consider being acquired. The result is more competitive pricing as the larger players achieve greater economies of scale (Seidenman and Spanovich 1997).

Finally, the OEMs are increasing their presence within the MRO market. Historically, the aftermarket services sector was not even a consideration to the major aircraft, engine, and component manufacturers. Today, OEMs have increased their market share to 15% (Ebbs 1997) with MRO activities becoming a major revenue stream for the companies. A critical factor to the OEMs success is the ability to control parts supply combined with an after sale services package. Even Boeing is entering the maintenance market with its Boeing Enterprises Unit, focusing on airframe maintenance. There is a perceived demand to provide "cradle-to-grave" maintenance support to airlines and their alliances (Warwick 1998).

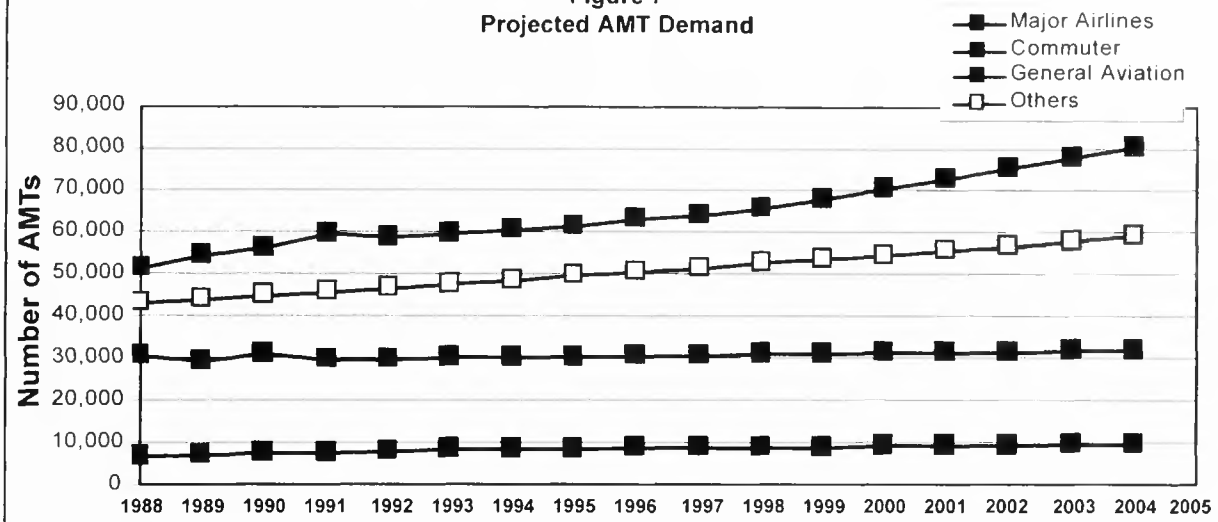
THE AVIATION MAINTENANCE TRAINING ENVIRONMENT

There are approximately 150,000 AMTs working within the U.S. aviation maintenance industry (FAA 1993). Historically, AMTs received training through the military, but over the last several decades the military stream of AMTs available to the aviation industry has diminished. Military AMTs are now trained in highly specialized maintenance functions. Crossover to civilian operations is increasingly more difficult for military AMTs requiring additional training for major air carrier needs (FAA 1993). Currently, the majority of AMTs come from civilian schools. There are approximately 185 AMT certified Part 147 schools throughout the United States. These schools are usually structured around an 18 month training environment encompassing a multitude of technical subject areas (Lewis 1998).

Demand for AMTs

The number of AMTs required within the aviation industry is directly related to the number of aircraft flying and how often these aircraft are utilized (FAA 1993). Different sectors of the aviation industry have different demands for AMTs. One estimate of AMT demand reports that each new transport category aircraft requires an average of 14 additional AMTs for support, each new regional aircraft 4 AMTs, and each new general aviation aircraft 0.15 AMTs (Young 1998). The following chart shows the divided historic and future expectations for each industry segment.

Figure 7
Projected AMT Demand

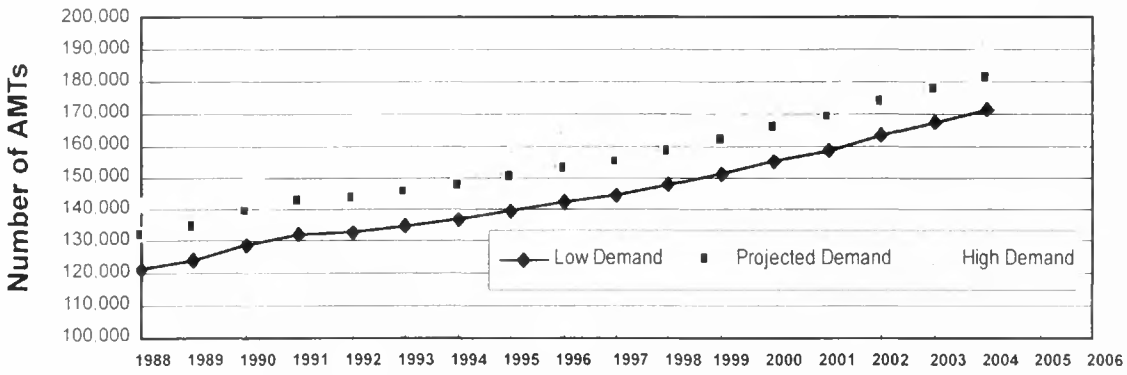


Source: FAA-Pilots and AMT's for the 21st Century, Availability and Quality 1993

The major airlines have the highest demand for AMTs, but they are closely followed by the "Others" maintenance category, which includes third party maintenance firms, OEMs, and firms that work for the federal government. This forecast was created in 1993, before the tremendous growth within the regional and commuter segment of the industry, passage of the General Aviation Revitalization Act (1994) and before many of the major airlines began a new purchasing cycle of replacement aircraft. Therefore, the demand for the fastest growing sector, regional/commuter aviation, may be understated and the forecast does not take into account the recent airline purchasing behavior. Additionally, early retirements from the AMT workforce is adding to the needed technician demand at the present time (Young 1998). Combining this demographic force with the growth in the regional/commuter market indicates that there will be additional pressure on the demand for AMTs at the air carrier level. The current supply of AMTs may become inadequate, as each category of the aviation market - from general aviation to the major air carriers - competes to attract qualified AMTs. Figure 8 demonstrates total projected AMT demand, with high and low estimates. Due to the recent changes in the regional/commuter and general aviation segments, the "high" projected AMT demand is the best representation of the situation currently affecting the domestic aviation industry.

Currently, there is no immediate crisis involving the demand of AMTs. The supply of AMTs is satisfying the demand of the major U.S. carriers (Lewis 1998), although some manufacturers and maintenance organizations are reporting having open positions for technicians the firms cannot fill (Shay 1999). However, as the previous sections indicate, the aviation industry is positioned for dramatic growth within the coming years, and without proper planning firms could be hard pressed to find quality candidates as overall industry demand for AMTs increases. The recruitment and retention of qualified AMTs is becoming more expensive and vital for the success of any maintenance organization (Berner 1998). In the past, airlines and maintenance firms kept a qualified pool of AMT candidates and when a new technician was needed they could easily find one within the pool. Today this is becoming more difficult as everyone—airlines, OEMs, and third

Figure 8
High, Low and Projected AMT Demand



Source: FAA-Pilots and AMT's for the 21st Century, Availability and Quality 1993

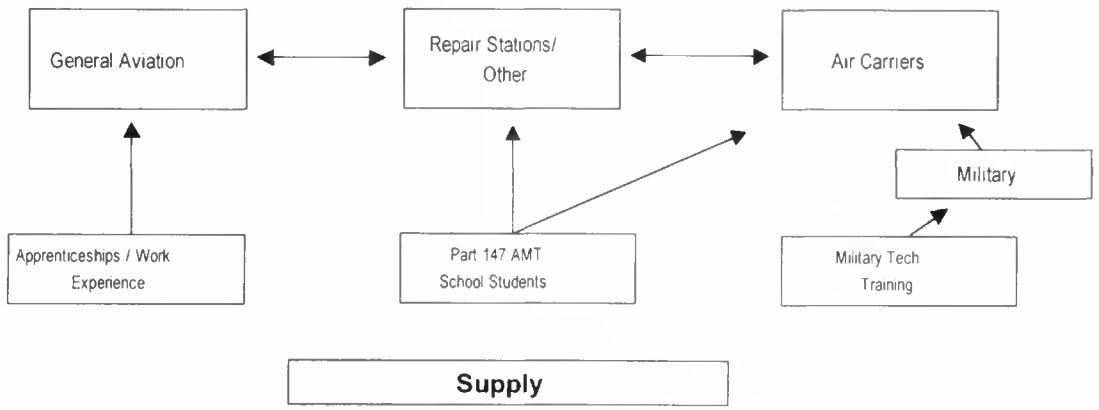
party outsourcing firms—are all competitively recruiting for the dwindling pool of applicants (Berner 1998; Lombardo 1998; Shay 1999).

Supply of AMTs

Figure 9 shows the supply lines for AMT technicians and how there are three main sources from which the industry can acquire AMTs. Historically the military was the leading supplier, but recently, the military supply has slowed and will continue to be a less significant factor in providing AMTs (Lombardo 1997). Now the Part 147 AMT schools are the leading suppliers of AMTs.

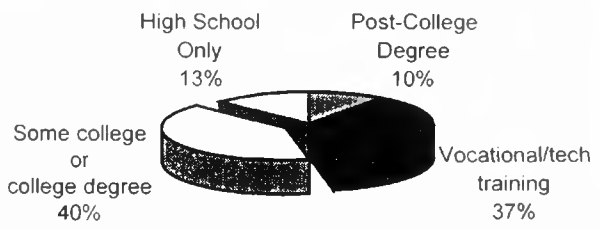
As mentioned, the majority of candidates entering the AMT field are from civilian-trained AMT schools. There are several concerns that the pool of students entering these schools will not be able to meet the quality requirements of the industry. Students entering the AMT schools need to posses greater skills in science, math, english, and communication (FAA 1993). Otherwise those entering the AMT workforce will not have the skills necessary to keep a modern airfleet operating. In a survey conducted of transportation sector companies (airlines, OEMs, and MROs), currently 72% of those entering lack motivation, 56% lack the ability to write clearly and concisely, and 50% lack the ability to work

Figure 9
Demand



with figures (Reed 1998). The apparent skills shortage is of considerable concern to future AMT employers because the increased technical requirements of newly manufactured aircraft will involve hiring AMTs with higher levels of education. This would lead to schools having to offer an increasing level of technology-specific training, which could lengthen the time students must take to complete these courses. Lengthening of the training process would lead to further increasing supply problems. The current level of education of AMTs is illustrated in Figure 10.

Figure 10
Education Level of Current AMTs



Source: Aviation Maintenance

Over half of the AMTs working today have no college education at all. This may satisfy today's requirements, but as airlines replace old DC-10s and 747s with 777s, increased skill levels will be needed. Also, students who are quality candidates considering entering the AMT field are drawn away by larger salaries in the automotive, robotics, and heavy machinery industries. The airlines are offering competitive salaries but only after several years of experience (Young 1998). The other fields have more immediate payoffs.

At the same time that quality issues are becoming an important factor in AMT training, demographic indicators are also causing some concern. Currently, there are fewer candidates available to enter AMT schools from the baby bust (Generation X) cohort. This decreased youth population, in conjunction with the growth of high technology applications within the aviation industry, will result in further AMT supply problems in the near term.

The solution is for airlines and other maintenance firms to work closely with educators and government regulators to establish standardized airline-oriented training programs (Young 1998). There has to be some additional motivational factors introduced to the AMT training environment to encourage young people to enter the field (Shay 1999). As the Baby Boomlet (Generation Y) begins maturing and looking for career opportunities at the turn of the century, efforts must be made to educate this cohort on the number of opportunities in the AMT field. These efforts could be accomplished with stronger industry participation. Greater industry participation and involvement can only improve any supply issues that emerge. Schools with close ties to the aviation industry will be able to attract higher quality candidates and consequently those industry partners would have a better trained pool of available candidates.

AMT-Part 147 School Trend Analysis

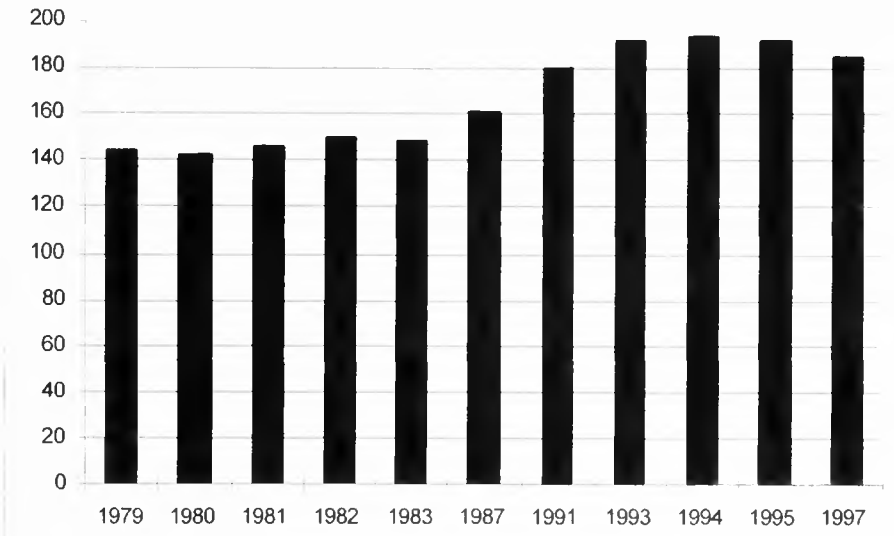
In order to fully understand the reasons for the fluctuating number of AMTs per year, several aspects of the industry were studied. An analysis of the number of schools offering an Airframe and Powerplant (A&P) program during the past 20 years was also conducted. To ensure reliability, the reference source used was FAR Part 147 Advisory Circulars (AC) with the subject heading: *Directory of FAA Certificated Aviation Maintenance Technician Schools.* The data compiled from the advisory circulars covered the following years with the respective document numbers (AC numbers):

1979	AC 147-2T	1991	AC 147-2Z
1980	AC 147-2U	1993	AC 147-2AA
1981	AC 147-2V	1994	AC 147-2BB
1982	AC 147-2W	1995	AC 147-2CC
1983	AC 147-2X	1997	AC 147-2DD
1987	AC 147-2Y		

The gaps exist because advisory circulars were not issued yearly. This may present a problem when trying to determine when a specific school either initiated or ceased operations. The problem is most noticeable between the years 1983 to 1987 and 1987 to 1991, where within the three-year gap several schools initiated or ceased operations without specific dates.

The analysis indicated a fairly stable number of schools per year from 1979 to 1983. However, in 1987 the number of Part 147 schools began to grow every year until 1994, when the number peaked for the period of analysis with 193 schools. The years 1995 and 1997 began to indicate a cessation of growth and a gradual decline in the number of schools offering an A&P program. The results of the analysis are graphically depicted in Figure 11.

Figure 11
Number of Schools Per Year



The Immediate Future and Managerial Implications

Consolidation within the AMT training industry is taking place. Consortiums of schools banding together with industry partners are attempting to solve some of the more immediate supply concerns. Delta Air Lines has officially launched the Delta Air Lines Career Academy for Aviation Technology (DALCAAT). The academy partners the airline with select high schools around the country including New York City's Aviation High, South Atlanta High in Atlanta, Denbigh High School in Hampton, Va., and Skyline High School in Dallas; a first for a major air carrier (PR Newswire 1998, Fiorino 1998). While not guaranteeing employment with Delta, the program offers students financial assistance, internships, scholarships and summer employment programs (Fiorino 1998). Additionally, certain regions of the country with a high concentration of aviation maintenance schools are consolidating and partnering with firms from the industry to not only attract more students of a higher quality, but also to avoid going out of business. In Texas a group of seven colleges and aviation industry representatives from the state (Hughes) formed the Texas Aviation Maintenance Technician Consortium (TAMTC) (Shay 1997). Schools are now more than ever considering partnerships both with industry and competitors.

Besides the partnerships mentioned above, airlines are actively becoming involved in the operation of aviation maintenance and management programs. United Airlines recently donated a Boeing 737-200 to Southern Illinois University at Carbondale. The plane, which is fully equipped and operational, will allow students in the aviation management, maintenance management and flight programs hands-on instruction on one of the most popular passenger airplanes in the world (Philanthropy Journal On-line 1999; UAL Press Release 1999). In addition to aiding schools, some airlines are becoming actively involved in the aviation maintenance training business. AirTran just graduated this past March the first class from their new apprentice maintenance program.

Completed over a 12 to 24 month period, depending upon individual performance, the program emphasizes on-the-job training for aircraft maintenance students (Business Wire 1999). "The program was established to attract candidates who will become competent, experienced and well rounded technicians and valued team members," says Robert W. Zoller, senior vice president maintenance and engineering, AirTran (Business Wire 1999).

The research presented demonstrates the need for airline, OEM, and MRO managers to become active in stimulating the supply of aviation maintenance technicians in an attempt to solve the impending shortage. As some researchers have noted (McGrath and Waguespack 1999) firms may have to investigate quasi-backward integration strategies or tapered integration to address their technician and maintenance needs. For the firms selecting this course of action (such as AirTran above), a recognized benefit is the ability to shape the curriculum to the needs of the airline and to have some assurance about the skills of technicians completing the course. While beginning such a program requires additional capital expenditures, increased costs to the firm, and implies a long term commitment on the part of management, the benefits from lower recruitment costs, lower initial training costs and the knowledge that the new technician is already familiar with your aircraft systems and procedures, greatly offsets the additional burden to the bottom line of the firm. The value added skills brought into the organization by graduates of such programs assure that while the total demand for aviation maintenance technicians may not be met, the quality of skills possessed by these technicians meets the needs of the maintenance industry.

Currently the aviation maintenance industry faces a situation of overcapacity (Ionides 1999; McKenna and Scott 1997). The number of firms and available facilities outnumbers the current demand for services. Aviation maintenance firms, especially OEM and MRO firms, not only face a competitive marketplace that is putting downward pressure on price, but now a skilled mechanic shortage that may exert upward pressure on a major cost component of the firm, labor. Consolidation of the MRO industry is occurring (Gallacher 1999). With the forecasted needs of the major passenger carriers, and other segments of the air transport industry (general aviation, cargo, regional, etc...) for technicians, the OEM and MRO segments will need to become more active in the training infrastructure. Airlines are taking the necessary steps to position themselves to train and recruit new aviation maintenance technicians. OEM and MRO firms must become competitive not only for maintenance customers, but also for the supply of qualified maintenance technicians. The OEM and MRO firms are in danger of becoming too competitively focused, while not prepared for a major issue that could ultimately limit the amount of business the firms could acquire.

The future for air transport, while facing some economic difficulties in areas throughout the world, appears promising. The industry is starting to react to a major non-economic problem that may hamper this growth, the lack of qualified AMT mechanics, both in the U.S. and globally. Airlines, OEM organizations, third party maintenance firms and air transportation trade associations are taking actions to address this shortage. The maintenance industry is now willing to work with the schools and universities to address the coming shortage and forums are being held to address the situation (Shay 1999). The question remains though, will these actions be enough in the short term to meet the needs of the air transport industry now and in the future?

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TWENTY YEARS OF AIRLINE DEREGULATION: THE IMPACT ON OUTLYING SMALL COMMUNITIES

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Many rural communities over the years have had to endure reduced levels of scheduled transportation services to the point that some have indeed experienced a cessation of services. Accompanying the deregulation of airlines in 1978 was the expressed fear that transportation services would continue to spiral downward and various communities would lose their population bases. This study investigates the two decades of airline deregulation and the impact that that 1978 legislation has had on small communities that are situated 100 air miles or more from any hub airport. Chief among the findings are: (1) that service levels have indeed deteriorated as indicated by the fact that over one-quarter of the non hubs lost all service, (2) of those locations that retained some service, nearly two-thirds experienced reduced levels of service, and (3) the overall pattern of population growth remained approximately the same whether service was eliminated, reduced, or increased.

INTRODUCTION

Transportation has long been an area of interest for economists, geographers, logisticians, marketers, sociologists and other students of economic and social development. Indeed, from very early on in the development of this country (as well as others for that matter), transportation has facilitated the movement necessary for some geographical points to flourish as production centers and distribution centers. In addition to sustaining individual consumers who now make their livelihood in those locations, the transportation lifeline connects approximately 20% of the Nation's consumers who live in locations that are depicted as rural. While the urbanization of America has been inexorably proceeding from 5% in 1790 to 25% just after the Civil War to 64% following WWII to 75% in 1990, the information "revolution" is providing the impetus to alter this trend. The question that arises is, can the transportation system meet the needs of these changing times?

Over the decades there have been few who have argued that the U.S. transportation system is not the best in the world. While it is still true that the U.S. system is without equal on an overall basis, there are fears that the quality and quantity of transportation to and from this country's rural areas is on a general decline. Rural transportation, as true with other aspects of rural life, must be considered part of a broad policy base. Numerous policy measures have

been proposed to alleviate the pressures on our urban areas; measures involving jobs creation, energy availability, etc. Although certain measures have been suggested to improve our rural transportation system as well, it appears nonetheless that our transport alternatives may be reducing the attractiveness of those towns and villages situated substantial distances from cities. On the one hand, while obtaining goods may be more expensive in outlying areas, this is clearly an economic trade-off made by those living there. On the other hand however, public transportation alternatives to and from small towns are becoming more scarce almost regardless of one's ability to pay.

PURPOSE

The purpose of this study is to investigate the impact that airline deregulation has had on small communities in the U.S. in the 20 years that the industry has had economic freedom. While the passage of the Airline Deregulation Act of 1978 (PL 95-204) on October 24, 1978 may be best remembered for the removal of pricing, entry and exit restrictions as they applied to the major domestic trunklines (now major carriers) such as American, Delta and United, the same statute created a need for commuter airline service (now referred to as regional airlines). The question addressed here is how well the small communities are being served twenty years after the fact. Inasmuch as "the national transportation policy statement, a preamble to the Airline Deregulation Act of 1978, specifically calls for a comprehensive and convenient system of continuous scheduled airline service for small communities and isolated areas," (Davis and Dillard 1982) one would expect service in 1998 to be rather like that of 1978.

BACKGROUND

Many scholars consider the transportation and rural community equation to be of crisis proportion. Reich (1987, p.38) envisions this country becoming a bicoastal economy and "if rural America is to be revived, rural transportation will have to become more accessible and efficient." The difficulties associated with rural life and transportation upheavals are well documented (Kihl 1988, Schwab 1987). In a most descriptive fashion, Shultz (1987) envisions (as an outgrowth of deregulation) "an increasing number of small communities undoubtedly will shrivel like corn in a drought."

Airline deregulation as it has involved small communities has attracted the attention of many researchers. Several have focused on the federal subsidy aspect that Congress built into the 1978 deregulation legislation which was supposed to allow communities a decade (but still continues) to prepare for the possible impact of deregulation (Cunningham and Eckard 1987, Vellenga and Vellenga 1986, Addus 1985 and 1984, J.R. Meyer 1981). Others have suggested that state and local governments play a prominent role in providing air service to small communities (Williamson, Cunningham and Singer 1982). While interest concerning deregulation and its impact on small communities has lagged behind that focusing upon the implications regarding major cities and major carriers, some works have been put forth (Jones and Cocke 1985, Stephenson and Beier 1981).

PUBLIC TRANSPORTATION DEMISE

A transportation system is generally inclusive of several modes: rail, motor (auto, truck, and bus), air, water, and pipeline. Insofar as passenger travel is concerned, there are fewer options and the number of those options is becoming smaller. Only the private automobile continues as a viable option for many individuals who live in small outlying communities. Notwithstanding the ubiquitous automobile, in some instances weather makes this a difficult option. Moreover, for certain individuals, their age, medical condition and/or the total cost of operating an auto preclude this option.

From the standpoint of movement to and from small communities, rail service has become in the last few decades nearly nonexistent, while water transportation has hardly ever been an option for most communities. Bus service, while often viewed as the backbone for rural common carrier service, is rapidly being curtailed. As one news magazine states "For many Americans who live in small towns, when there's no Greyhound, there's no exit" i.e., from the community (Gallagher 1990). The thought that "there is always the Greyhound bus"..that will "take you to obscure places you call home and away from places you never want to see again...when you've got no car, when the airfare is too high (or there's no airport at all), when the railroad tracks have long gone to weed" (Gallagher 1990) rings somewhat hollow these days. Greyhound, while serving 9,500 communities in 1990 (Gallagher 1990), is providing service to only 2,600 destinations today (Greyhound 1998).

Air transportation at one time certainly was considered the answer to overcoming major distances associated with life in smaller communities. With the deregulation of the airline industry, that vision has been altered significantly as more and more small communities face the difficulties of reduced service or worse yet an abandonment of service. The U.S. Department of Transportation contends that General Aviation (GA) aircraft also provide access to intercity (or town) movement via the many thousands of airfields where scheduled service is now available. DOT's figures show the number of airports growing from 6,881 to 18,224 during the period from 1960 to 1995. Further, if one possessed the resources to own and maintain a general aviation aircraft, only 667 of those airports are FAA certificated and but 446 of those airports have FAA or FAA contracted towers (U.S. DOT, 1997). Consequently, while marketers are fond of referencing the ever mobile consumer, it is difficult to maintain that general aviation is the answer to the small community transportation problem.

AIRPORT CLASSIFICATION SYSTEM

Over the years the Federal Aviation Administration (FAA) has developed a system of classifying airports predicated on the volume of passenger activity at each location in relation to the total of domestic passenger activity. In summary, that system is as follows:

Large Hubs: Enplane 1.00% or more of the Nation's passengers. Examples are Chicago, San Francisco and Washington D.C.

Medium Hubs: Enplane .250% to .999% of the Nation's passengers. Examples are Buffalo, Indianapolis and Salt Lake City.

Small Hubs: Enplane .05% to .249% of the Nation's passengers. Examples are Colorado Springs, Knoxville, and Shreveport.

Non-Hubs: Enplane fewer than .05% of the Nation's passengers. Examples are Bozeman, MT, Macon, GA, and Williamsport, PA.

According to the U. S. Department of Transportation, in 1995, there were 29 large hubs (67 airports), 33 medium hubs (59 airports), 58 small hubs (73 airports) and 561 non hubs (593 airports). (U.S. DOT 1997)

Given the definitions cited above, it is rather understandable that most, if not all, airports serving smaller communities will fall into the non-hub airport category. It should be noted however, that not all of the cities and towns served by a non hub airport are necessarily sparsely populated. Indeed, non hub designations include many in the size category of places such as Glasgow, MT (population 3,656) and Hancock, MI (population 4,565) while many others reflect the size of Pocatello, ID (population 51,344) and Huntington, WV (population 53,941).

RESEARCH DESIGN

In October 1978, the FAA data indicated that there were 503 non-hub airports in the 48 contiguous states and commercial service was provided at 485 non-hubs or 96.4% of the total(CAB 1981). One of the recurring themes heard throughout the debate regarding the wisdom of deregulating the Nation's airlines centered upon the service that would be extended small outlying cities and towns. Opponents of deregulation early on warned that the result would be "less service ... particularly on the low-density routes serving small communities" (J.R. Meyer et al. 1981). Indeed, this prophecy seems to have been borne out in the score of years since deregulation was implemented. As of January 1, 1998, after allowing for the 20 new non hubs that have begun to receive service since 1978, only 320 non-hub airports were receiving scheduled commercial air service.(RAA 1998)

Obviously some non-hub airports are located relatively short distances from large, medium or small hub airports. Therefore as the result of their proximity to a hub airport, some locations have experienced relatively little dislocation since the discontinuation of service occurred. For example, Benton Harbor, Michigan is 20 air miles (and 30 road miles) from South Bend Indiana (a small hub airport), and 70 air miles (and 91 road miles) to Chicago (a large hub airport). Nonetheless, there are other non-hub airports that are located a days drive from any hub airport. Butte, Montana, for example, is 192 air miles (224 road miles) from Billings, MT (the nearest small hub airport), 266 air miles (318 road miles) from Spokane, (the nearest medium hub airport) and 477 air miles (600 road miles) from Seattle (the nearest large hub airport). Unquestionably, the further a small community is located from any hub airport, the greater the hardship if service is eliminated and, in some instances, even a reduction in service can have a negative impact. Consequently, this study is designed to investigate the impact airline deregulation has had on small communities that are located at least 100 air miles from any hub airport. This is unmistakably a conservative measure of distance since road (or driving) distances can be considerably further. For example, North Bend, OR is 71 air miles from the closest hub airport, Eugene, OR (a small hub) but is 105 road miles from that community.

Of the 485 non hubs listed by the FAA as having scheduled commercial airline service in 1978, 110 non hubs are located at least 100 air miles from the nearest hub of any size. On October 1, 1998, approximately 20 years following the passage of the Deregulation Act, according to the Official Airline Guide twenty-nine (or 26.4%) of those 110 small communities are not receiving any scheduled airline service.

Thus, from the above figures it can be deduced that 81 of the "original" 110 non hubs have retained some level of service since 1978. In fact some locations have shown gains in service levels, at least from the standpoint of seats available at the specific location. Other cities and towns have not been as fortunate, however, inasmuch as they have experienced a reduction in service levels although not to the extreme of having scheduled service eliminated.

To determine the shifts in non hub service, the number of airline seats available per week was employed. While the number of flights into a non hub could have been used, that figure conceals the fact that various aircraft are configured quite differently insofar as seating capacity is concerned. For example, the Beech 1900D (Raytheon Aircraft) seats 19, the Embraer 120 Brasilia seats 30, the Saab 340 seats 35, the Canadian Regional Jet Series 200 (Bombardier Aerospace) seats 50 and the Boeing 737-300 series has the capacity for 128 passengers.

Service thus is defined as seats available per week and not the quality of that service. While many officers of various chambers of commerce

and governmental officials have testified that their locale does not receive jet service or as frequent service as they desire, the fact remains that they do receive service and for this study that is what was assessed (U.S. Senate 1996). Furthermore, while some research has centered on factors such as seating comfort, noise levels, food and beverage service, etc. they were also not evaluated in this study (Jones and Cocke 1981, Davis and Dillard 1982).

FINDINGS

The base year data (1978) for the 81 non hubs that have experienced continued service since deregulation originated with the Civil Aeronautics Board (1981). Following the "sunset" of the CAB and the data that it generated, comparable present-day data are not readily available; so for this study they were computed using flight data published in the Official Airline Guide(OAG). The data were developed by selecting all flights listed in the OAG that arrived at each non hub (one assumes that each seat in turn departed that location as well) and determining the number of seats per flight and ultimately compiling those numbers into the measure of "seats per week" at each location. This process requires, as noted previously, that the configuration for each aircraft be determined as well as any airline configuration differences that exist from airline to airline. The comparison of the number of seats per week available at each non hub located at least 100 nautical miles from any hub airport for the years 1978 and 1998 is shown in Table 1.

It is fairly obvious from the data depicted in Table 1 that, on an overall basis, deregulation has not been particularly kind to outlying small communities. Indeed, of those small communities that experienced continuous air service since 1978 and are at least 100 nautical miles from any hub airport, 60.5% (49 of 81) are experiencing a lower level of service (i.e., seats available) now as compared to just prior to deregulation (as of October 1, 1978). In the aggregate, the 81 small communities lost 9.42% of the capacity that they had in October 1978. Some locations, contrary to the overall slippage in service levels, experienced major increases e.g., Mountain Home AR 729.09%, Grand Rapids MN 386.11%, Jackson Hole WY 292.67% and Brownwood TX 151.47%. As the data show however, several of the locations that had major improvements did so with a rather small numerical base in 1978. Still there are numerous cities and towns that have had to confront major disruptions in service, e.g., Iron Mountain MI -86.84%, Cape Girardeau MO -82.91%, Alamosa CO -79.37%, Laramie WY -78.75% and Twin Falls ID -75.36%.

TABLE 1
Changes In Service to Small Communities
1978 vs. 1998

	Available Service		
Community	October 1 1978	October 1 1998	Percent Change
Aberdeen SD	3,740	1,972	- 47.27%
Abilene TX	3,285	1,925	- 41.40
Alamosa CO	1,750	361	- 79.37
Alliance NE	532	722	+ 35.71
Bozeman MT	5,090	7,529	+ 47.92
Brownwood TX	136	342	+151.47
Cape Girardeau MO	2,112	361	- 82.91
Carlsbad NM	960	323	- 66.25
Casper WY	4,546	2,030	- 55.35
Cedar City UT	707	570	- 19.38
Clarksburg WV	2,239	1,235	- 44.84
Cortez CO	1,050	380	- 63.81
Crescent City CA	560	630	+ 12.50
Devil's Lake ND	672	361	- 46.28
Dodge City KS	850	627	- 26.24
Duluth MN	11,094	10,919	- 1.58
Durango CO	4,482	2,891	- 35.50
Elko NV	1,512	2,250	+ 48.81

Eureka/Arcata CA	3,868	3,687	- 4.67
Farmington NM	3,280	2,280	- 30.49
Flagstaff AZ	1,226	1,317	+ 7.42
Ft Leonard Wood MO	2,481	342	- 86.22
Gallup NM	1,400	361	- 74.21
Garden City KS	799	893	+ 11.76
Gillette WY	1,782	840	- 52.87
Glasgow, MT	456	228	- 50.00
Glendive MT	228	342	+ 50.00
Goodland KS	442	684	+ 54.75
Grand Canyon AZ	3,848	6,314	+ 64.09
Grand Rapids MN	180	875	+386.11
Great Falls MT	10,410	10,137	- 2.63
Hancock MI	1,946	1,645	- 15.47
Harrison AR	1,400	456	- 67.43
Harve MT	129	228	+ 76.74
Hays KS	816	836	+ 2.45
Helena MT	2,314	4,905	+111.97
Hibbing MN	3,066	1,358	- 55.71
Huntington WV	7,525	2,952	- 60.77
Idaho Falls ID	1,974	3,559	+ 80.29
Int'l Falls MN	0	910	+
Iron Mountain MI	4,620	608	- 86.84
Jackson Hole WY	1,050	4,123	+292.67
Jacksonville NC	4,215	2,229	- 47.12
Kalispell MT	3,884	4,099	+ 5.54
Key West FL	2,674	6,537	+ 44.47
Kirksville MO	270	312	+ 15.56
Klamath Falls OR	2,722	962	- 64.66
Lake Havasu City AZ	814	475	- 41.65
Lamar CO	442	684	+ 54.75
Laramie WY	1,699	361	- 78.75
Laredo TX	2,406	2,035	- 15.42
Liberal KS	1,000	361	- 63.90
Marquette MI	2,310	2,463	+ 6.62
Mc Cook NE	1,165	722	- 38.03
Miles City MT	228	456	+100.00
Missoula MT	5,769	8,287	+ 43.65
Mountain Home AR	55	456	+729.09
New Bern NC	3,074	1,850	- 39.82
North Platte NE	2,350	760	- 67.66
Pasco WA	7,004	9,672	+ 38.09
Pellston MI	2,206	2,170	- 1.63
Pendleton OR	1,739	999	- 42.55
Pierre SD	2,396	2,344	- 2.07
Pocatello ID	1,813	2,049	+ 13.02
Presque Isle ME	2,548	760	- 70.17
Redding CA	2,432	2,420	- 0.49
Riverton WY	1,379	779	- 43.51
Rock Springs WY	1,750	475	- 72.86
Roswell NM	875	836	- 4.46
St George UT	617	1,260	+104.21
Sault St Marie MI	672	735	+ 9.38
Scottsbluff NE	2,700	855	- 68.33
Sidney MT	228	323	+ 41.67
Silver City NM	936	209	- 77.63
Springfield MO	13,822	15,686	+ 13.49
Steamboat Springs CO	2,464	630	- 74.43
Twin Falls ID	4,261	1,050	- 75.36
Walla Walla WA	2,796	999	- 64.27
Williston ND	570	399	- 30.00
Wolf Point MT	228	361	+ 58.33
Yuma AZ	2,008	1,230	- 38.75

At the outset of any study that focuses on the well-being of a community, it must be acknowledged that many variables can account for that community's growth or decline. One factor that is often cited as vital to the welfare of a city or town is transportation. Surely if one listens to the officials of communities that are about to lose part or all of their scheduled transportation service, whether rail, bus or air, one could only surmise that the community in

question undoubtedly will decline if not fade away completely. In fact, the arguments given for continued service are not too dissimilar to those large cities that contend that a major league professional sports franchise will "make or break" that city.

While it is obvious that more detailed research is needed to adequately measure all the variables (geographical, economic and social) and their contributions to a community's growth or decline, it is interesting nonetheless to compare the population figures of the 81 communities that maintained some level of service with the 29 communities that had their service eliminated during the period involved in this study (1978-1998). Table 2 presents the population figures (1980 to 1996) for those communities that lost their scheduled air service. From the data provided in Table 2 it is difficult to fully accept the argument that with the service so goes the community since 21 (or 72.4%) of the cities and towns gained in population during the period. Again it must be emphasized that a number of factors may be at play here (e.g., retirement locations, gambling).

In regard to the corresponding population figures for those communities that had ongoing operations throughout the two decades, the growth pattern shown in Table 3 is nearly identical to those locations that completely lost their service. During the time period involved in this study, of those locales that had continuous service, 57 of the 81 (or 71.3%) cities or towns experienced population growth while 23 (or 28.7%) suffered a decline in population (one non hub serves a military installation and population figures are not generally available).

TABLE 2
Population Changes of Communities That Lost Commercial Air Service - 1980 To 1996

Community	1980	1996	Percent Change
Austin NV	370	405	+ 9.46%
Baker OR	9,471	9,693	+ 2.34
Battle Mountain NV	2,749	4,296	+ 56.28
Bowman ND	2,071	1,602	- 22.65
Columbus IN	30,614	32,963	+ 7.67
Craig CO	9,239	8,504	- 7.96
Eagle Pass TX	21,407	27,554	+ 28.71
Ely NV	4,882	4,978	+ 1.97
Enterprise AL	18,033	21,253	+ 17.86
Eureka NV	650	1,577	+142.62
Fillmore UT	2,083	1,988	- 4.56
Frenchville ME	1,450	1,169	- 19.38
Hermiston OR	9,642	11,160	+ 15.74
Inyokern CA	800	900[a]	+ 12.75
La Grande OR	11,793	12,228	+ 3.69
Lake of Ozarks MO	534	701	+ 31.27
Mackinac Island MI	479	455	- 5.01
Milford UT	1,293	1,241	- 4.02
Osage Beach MO	1,992	3,163	+ 58.79
Rawlins WY	11,547	8,947	- 22.58
Richfield UT	5,482	6,057	+ 10.49
Richland WA	33,578	37,445	+ 11.52
Sidney NB	6,010	6,128	+ 1.96
Sterling CO	11,385	10,535	- 7.47
Tonopah NV	1,952	3,616[a]	+ 85.25
Trinidad CO	9,663	8,831	+ 8.61
Wells CO	1,218	1,479	+ 21.43
Winnemuca NV	4,140	8,004	+ 93.33
Winslow AZ	7,921	10,420	+ 31.55

[a] population figure is for the year 1990

TABLE 3
Changes in Population of Small Communities
1980 Vs. 1996

Community	1980 Population	1996 Population	Percent Change
Aberdeen SD	29,956	25,088	- 16.25%
Abilene TX	98,315	108,476	+ 10.34
Alamosa CO	6,830	7,739	+ 13.31
Alliance NE	9,869	9,702	- 2.69
Bozeman MT	21,645	28,522	+ 31.77
Brownwood TX	19,396	19,255	- 0.83
Cape Girardeau MO	34,361	35,464	+ 3.21
Carlsbad NM	25,496	26,535	+ 4.08
Casper WY	51,016	48,800	- 4.34
Cedar City UT	10,972	17,811	+ 62.33
Clarksburg WV	22,371	17,410	- 22.28
Cortez CO	7,095	8,781	+ 23.76
Crescent City CA	3,075	6,866	+123.28
Devil's Lake ND	7,442	7,672	+ 3.09
Dodge City KS	18,001	22,430	+ 24.60
Duluth MN	92,811	83,699	- 9.82
Durango CO	11,426	13,923	+ 21.85
Elko NV	8,758	19,371	+121.18
Eureka/Arcata CA	36,491	42,463	+ 16.37
Farmington NM	31,222	37,936	+ 21.50
Flagstaff AZ	34,743	55,094	+ 58.58
Ft Leonard Wood MO	n/a	n/a	n/a
Gallup NM	18,161	20,591	+ 13.38
Garden City KS	18,256	25,366	+ 38.95
Gillette WY	12,134	19,202	+ 58.28
Glasgow, MT	4,455	3,656	- 17.93
Glendive MT	5,978	4,557	- 23.77
Goodland KS	5,708	4,834	- 15.31
Grand Canyon AZ	1,348	1,499[a]	+ 11.20
Grand Rapids MN	7,934	8,162	+ 2.87
Great Falls MT	56,725	57,758	+ 1.81
Hancock MI	5,122	4,565	- 10.87
Harrison AR	9,567	11,537	+ 20.59
Harve MT	10,891	10,232	- 6.05
Hays KS	16,301	17,911	+ 9.88
Helena MT	23,938	27,982	+ 16.89
Hibbing MN	21,193	17,600	- 16.95
Huntington WV	63,684	53,941	- 6.71
Idaho Falls ID	39,590	48,079	+ 21.44
Int'l Falls MN	8,417	8,000	- 4.95
Iron Mountain MI	8,341	8,530	+ 2.27
Jackson Hole WY	4,571	5,614	+ 22.82
Jacksonville NC	17,056	69,889	+309.76
Kalispell MT	10,648	15,678	+ 47.24
Key West FL	24,382	25,339	+ 3.93
Kirksville MO	17,167	17,107	- 0.35
Klamath Falls OR	16,661	18,580	+ 11.52
Lamar CO	7,713	8,473	+ 9.85
Lake Havasu City AZ	15,909	39,503	+148.31
Laramie WY	24,410	26,583	+ 8.90
Laredo TX	91,449	164,899	+ 80.32
Liberal KS	14,911	17,551	+ 17.71
Marquette MI	23,288	17,016	- 26.93
Mc Cook NE	8,404	7,926	- 5.69
Miles City MT	9,602	8,882	- 7.50
Missoula MT	33,388	51,204	+ 53.36
Mountain Home AR	8,066	11,236	+ 39.30
New Bern NC	14,557	21,464	+ 47.45
North Platte NE	24,479	23,369	- 4.53
Pasco WA	17,944	23,910	+ 33.25
Pellston MI	565	597	+ 5.66
Pendleton OR	14,521	15,893	+ 9.45
Pierre SD	11,973	13,422	+ 12.10
Pocatello ID	46,340	51,344	+ 10.80
Presque Isle ME	11,172	9,213	- 17.53
Redding CA	41,955	76,616	+ 82.61

Riverton WY	9,588	10,050	+ 4.82
Rock Springs WY	19,458	19,742	+ 1.46
Roswell NM	39,676	47,559	+ 19.87
St George UT	11,350	42,763	+276.77
Sault St Marie MI	14,448	15,300	+ 5.90
Scottsbluff NE	14,156	14,400	+ 1.72
Sidney MT	5,726	4,971	- 13.19
Silver City NM	9,887	12,007	+ 21.44
Springfield MO	133,116	143,407	+ 7.73
Steamboat Springs CO	5,098	6,768	+ 32.76
Twin Falls ID	26,209	31,989	+ 22.05
Walla Walla WA	25,618	28,529	+ 11.36
Williston ND	13,336	12,718	- 4.63
Wolf Point MT	3,074	2,874	- 6.51
Yuma AZ	42,433	60,519	+ 42.62

SUMMARY AND CONCLUSIONS

In the 200 plus years of this country's history, small communities, situated well away from population centers that attract a major share of transportation activity, have struggled to maintain their economic and social viability in the face of declining public transportation options. In most instances, those communities have not enjoyed the economic benefit of being located advantageously on a major river, highway or railroad. Nevertheless most have survived as the result of some other advantages among which could be good soil, a steady, honest albeit small workforce, and lower taxes and crime rates. Over time all modes of transportation have found varying degrees of diseconomies associated with serving these outlying areas. In the end, many carriers in all modes of transportation have found it necessary to reduce or eliminate service to these small communities.

Undoubtedly, marketers and consumers located in those outlying towns and cities as well as those attempting to reach the rural customer have experienced considerable anxiety. Twenty years ago the Airline Deregulation Act granted the Nation's airlines the freedom to serve communities based upon profitability standards without the onerous cross-subsidy *quid pro quo* that required service to the contrary. Most assuredly there are and have been subsidies that have allowed the continuation of service notwithstanding economic losses. Section 419, Essential Air Service Subsidy Payments for 1997 totaled more than $40 million, covering 70 locations in the 48 contiguous states with the average subsidy to maintain service to those cities and towns amounting to $572,067 annually (RAA 1998, Jones and Cocke 1984).

In the 110 cases in which each community is located at least 100 air miles from any other hub airport, 29 of the communities lost all scheduled air service. In regard to the remaining 81 communities, 49 have endured service cuts (i.e., fewer seats available per week) while 32 are experiencing service improvements. Insofar as the aforementioned fear is concerned, i.e., a reduction or elimination of service will cause the population of the city or town to spiral downward, the apprehension seems unfounded. That is not to say that some cities and towns did not experience a population loss. However, twenty-one of those 29 confronted the cessation of service and obviously found ways to compensate for the loss of one degree of freedom, i.e., one less transportation option.

Probably a more startling and possibly more confounding finding evolving out of this study, is the fact that those cities and towns that have had a continuation of some level of service experienced a nearly identical pattern of population growth as did those that lost all service. This paradox clearly suggests that more research is needed to understand the numerous other variables, demographic, economic and geographic, and how they relate to one another in effecting change in small communities.

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MERGERS AND ALLIANCES IN THE LINER SHIPPING INDUSTRY: AN HISTORICAL PERSPECTIVE

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This article chronicles the history of mergers and alliances in the liner shipping industry during the past century, before focusing on the latest wave of mergers to hit the industry. Each merger wave in the liner shipping industry generally coincided with merger waves from the general industrial world. The incentive for each wave of mergers seemed to be different, with the most recent wave focusing on synergy between the merging companies. The reduction of competing firms through mergers has implications for the shipper and these are also examined.

INTRODUCTION

In the present decade, mergers and strategic alliances have become the model for liner shipping companies in coping with the globalization of the world economy. The present day competition and rise in the cost of capital has resulted in a steady fall in profits. Liner shipping companies "are characterized by operating scheduled services between predetermined ranges of ports on a continuous basis." (U.N.) Most liner shipping service today is focused on containerized freight traffic. Competition in the liner shipping industry has been in existence since the days when sailing ships were introduced. The intense competition at the turn of the last century can be compared to the present day competition in the liner shipping industry. The commonality between the two periods represents an attempt to increase price stability and profitability. This paper will chronicle the merger history of the liner shipping industry and conclude with the current rationale for the most recent wave of merger activity and how it might affect the shipper.

HISTORY OF THE MERGERS AND THE MERGER WAVE CYCLE

Four periods of high merger activity, called merger waves, can be identified in the history of US and UK industrial development. During these

periods, consolidation of various industries took place. The liner shipping industry was one such industry affected by these merger waves. In the US, these industrial merger waves occurred between 1897-1904; 1916-1929; 1965-1969, 1984-1989, and most recently in the early 1990's continuing to the present. The reason for the occurrence of these merger waves was different for each period. The first wave resulted in monopolistic merger, the second wave for oligopoly, the third wave for conglomerate merger, the fourth wave was the period of hostile and mega-mergers and the present day merger's objective is strategic gains (Gaughan 1996). The merger activity in liner shipping has coincided with the merger activity in other industries. Mergers, acquisitions and alliances in the liner shipping industry have always occurred in a periodical wave manner. From the data collected (see Appendix), the merger waves in the liner shipping industry can be categorized into four periods, 1875-1898; 1914-1926; 1964-1973; and 1981-1989, which with little exception correspond to the general industrial merger waves. The present day merger activity can be traced from 1995-present day. These periods of merger waves saw increased activity of mergers, acquisition and alliances.

The First Merger Wave: 1875-1898

In the late 19th century, steamships used to regularly ply between Europe and India/Far East, but the competition was not very severe. The opening of the Suez Canal in 1869, which reduced the voyage duration, increased the effective carrying capacity of each vessel and created cutthroat competition among the shipowners, finally resulting in the formation of shipping conferences. It was one of the first types of mutual pact among shipowners to protect their interests. In the following years, many conferences were formed to safeguard shipowner interests (Deakin and Seward 1973). The period before 1900 saw heightened activity in the formation of shipping conferences and the period between 1890-1898 saw increased merger activity.

This merger wave occurred after the depression of 1883 and peaked between 1898 and 1902. General industry mergers during this period were horizontal and often resulted in a monopolistic market structure (Gaughan 1991). Similar monopolistic market structures were also witnessed in the liner shipping industry, where the conference system created a price cartel. An example to this effect was rate fixing set by the shipowners of the Calcutta conference for the carriage of tea (Deakin and Seward 1973). It was financial factors which forced the end of the first merger wave, including the collapse of the shipbuilding trust in 1900 and the crash of the stock market in 1904 in the US (Gaughan 1991).

The Second Merger Wave: 1914-1926

The second wave of mergers in the liner shipping industry occurred during the First World War and continued until 1926. While the first wave was merger for monopoly, the second wave was merger for oligopoly. The booming economy after the first World War provided the investment capital for these mergers (Gaughan 1996). During this period, the largest merger was that between British India Steam Navigation Company and the Peninsular & Oriental Steam Navigation Company, followed by the Ellerman Lines & Hall Lines merger to form Ellerman Line (Deakin and Seward 1973). The second merger wave ended with the stock market crash of 1929.

The Third Merger Wave: 1964-1973

The third merger cycle occurred between 1964 and 1973. The introduction of container services to the liner trades in the mid 60's brought in a revolution, not only in handling methods, but also in the whole structure and operation of general cargo transportation. The desire to build container ships and the related specialized handling facilities in ports required heavy, capital

intensive investments. Mergers during this wave transpired due to the heavy investment requirements of containerization, which made it virtually impossible for a single liner shipping company to undertake alone (Fossey 1996). Again, the mergers in the liner shipping industry coincided with the merger wave of other industries. Mergers in the third wave were conglomerate in nature (Gaughan 1991). Several mergers and consortia were formed during this period such as Overseas Containers Ltd (OCL), a closely knit pooling and joint marketing firm comprising British & Commonwealth, Furness Withy, Ocean Transport & Trading and P&O. The purpose was to formulate and develop strategy for converting UK-Far East liner services to containers. A year later this was followed by other UK-based operators; Ben Line Steamers, Blue Star Line, Cunard Steamship Co, Ellerman Lines and T&J Harrison formed Associated Container Transportation (ACT). The third merger wave subsided when the stock market fell in 1969 (Gaughan 1991).

The Fourth Merger Wave: 1981-1989

The fourth merger wave occurred between 1981 and 1989 and was again different from previous merger waves as general industry concentrated more on hostile take-overs. During this period few mergers took place in the liner shipping industry. However, the airline industry experienced numerous acquisitions and consolidations due to deregulation (Gaughan 1996).

The Current Merger Wave: 1995-Present

The present day mergers have differentiated themselves from all previous merger waves and have been classed as merging for strategic gain. This is very much true with liner shipping where mega-mergers and alliances have been formed due to increased competition and reduced profits. Deregulation in the airline industry resulted in mega-mergers; similar effects can be felt in the liner shipping industry in which global deregulation has resulted in mega-mergers and alliances. The present day liner shipping industry is faced with alliances such as Global, Grand, Sealand-Maersk and mega-mergers such as P&O-Nedlloyd (See Tables 1 and 6).

Thus, it is clear that the liner shipping industry has experience merger wave cycles, which coincided with the merger wave cycle experienced by other industries. These merger cycles were experienced during the bullish phase of stock markets and during periods of a liberal banking system fuelled by deregulation, which are the main ingredients of mergers and acquisitions. Therefore, it is apparent that liner shipping is very much affected by the ups and downs of the overall market. The ups and downs of other industries do have an impact on liner shipping and the statement that shipping is a derived demand is very much true.

OBJECTIVES OF MERGERS AND ALLIANCES

As with all business activity, there must be justification for engaging in either a merger or an alliance. We look at the theoretical basis for acquiring strategic gain in terms of synergy and then examine whether or not they apply in the "real world" based on actual merger activities.

Synergy

Synergy basically refers to the coming together of firms to produce a corporate combination which is more profitable than the sum of the individual firms profit combined (Gaughan 1991). There are two types of synergy that firms try and exploit when participating in mergers and alliances; Operating Synergy and Financial Synergy. Both are explained briefly in the following paragraphs.

Operating Synergy

Operating synergy refers to the efficiency gains

or operating economies that are derived in horizontal or vertical integration. Cost reduction is one of the main sources of operating synergy as a result of economies of scale, due to the reduction in the per unit cost that results from an increase in the size or scale of a company's operations.

In the context of the liner shipping industry, the present day merger/acquisition/alliances have increasingly concentrated on operating synergies, especially economies of scale (Drewery).

One of the main advantages of mergers/ alliances is the ability to cut costs by the rationalization of resources available to both the merging firms. Since competition is very severe in the liner shipping industry and the freight rates in certain trade lanes have fallen by 25% in the last three years (Bray 1997), the operating profit of the companies cannot be enhanced by increasing the freight rate. Therefore, the only alternative left is to reduce the cost of operation by merging the companies together. Alliances aim to cut costs by means of slot chartering/vessel sharing agreements, joint terminal contracts, common use of equipment and even by the joint purchase of ships and equipment. P&O-Nedlloyd is aiming to achieve $100/TEU savings from their merger. Table 1 highlights the estimated annual savings projected by the recent alliances.

Financial Synergy

Financial synergy refers to the impact of a corporate merger/acquisition on the costs of capital to the acquiring firm or the merging partners. The cost of capital is lowered when the corporate combination occurs which evinces the presence of financial synergy (Gaughan 1991).

The combination of two companies reduces the risk of bankruptcy, provided the cash flows are not correlated. If the acquisition/merger lowers the volatility of the cash flows then the supplier of the capital may consider the firm less risky. The risk of bankruptcy would be less, given the fact that wide swings up and down in the combined firm's cash flow would be less likely. As a result, the banks feel confident enough to lend money to such firms due to the lessening of the risk element. The merger of P&O-Nedlloyd resulted in P&O-Nedlloyd securing a credit line of $1 billion, which will be used for financing the newly merged line and new ships on order (Containerization International Jan. 1997).

TABLE 1
PROJECTED SAVINGS THROUGH MERGER/ALLIANCE

Alliance / Merger Name	Projected Cost Savings (millions)
Sealand - Maersk Alliance	$ 100 / Year
P&O-Nedlloyd Merger	$ 200 / Year
NOL-APL Merger	$ 130 / Year
DSR-Senator Merger	$ 65.67 / Year

A larger company enjoys more advantages in the financial market as compared to a relatively small company. The advantage gained is in the form of lower costs of raising capital as it is generally less risky than with a smaller firm. The effect of P&O's merger reduced the group borrowing by $354.3 million (P&O Annual Report 1996).

Stock Market Response to Synergy

The popular objective of any company is to increase earnings per share (EPS) and many mergers have been justified in terms of the effect on EPS. Earnings per share is based on accounting profit which is subject to accounting policies on stock valuation, asset depreciation, bad debts, profit on long term contracts, provisions for accrued income and expenditure. The price-earnings ratio (P/E) is equal to the share price divided by the earnings per share.

Neptune Orient Line (NOL) in April made a friendly acquisition bid on APL for $33.5 per share, which amounted to a total of $825 million (Bray 1997). The individual figures of both companies and their combined figures are displayed in Table 2 .

TABLE 2
EFFECT OF MERGER ON FINANCIAL STATUS FOR NOL AND APL

	NOL	APL	NOL + APL
EPS (US $)	$ 0.0202	$ 0.0211	$ 0.2008
Price/Share (US $)	$ 0.8198	$ 20.36	$ 1.5132
P/E Ratio	40.5	964.9	7.53
No. of shares	722,300,000	24,600,000	722,300,000
Total Earnings	$ 14,590,460	$ 519,060	$ 145,109,520
Total Market Value	$ 592,141,540	$ 500,856,000	$ 1,092,997,540

The earnings per share (EPS) and number of shares are obtained from the individual companies' profit and loss accounts for 1996. The price per share (PPS) is the average of the share prices 20 days before the take-over. The EPS of the combined firm is $0.2008 , which is greater than the EPS of the individual companies. If the merger decision is made on the basis of EPS, then this is an extremely profitable merger.

Another key index as to the state of a company is its share price. A company which has not been performing profitably for a long time must use new strategies to give sufficient returns to its shareholders. One of the strategies is the merger/acquisition with/of a similar type of company. Share prices of both merging/acquiring companies are affected upon disclosure of the merger/acquisition activity. The effect on the share price depends on the expected costs and benefits of the deal and market expectations that the deal will actually be consummated. Studies have shown that shareholders of acquired companies are the big winners, receiving on average a 20% premium in a friendly merger and a 35% premium in a hostile take-over, whereas shareholders of acquiring companies receive small returns that are not statistically different from zero for friendly mergers (Copeland, Koller & Murrin 1991).

Observe the case of Neptune Orient Lines (NOL) $825 million acquisition bid for American President Line (APL), under which NOL will acquire all 24.6 million outstanding shares at $33.5 per share. The day NOL made the disclosure of its intention of making a friendly acquisition of APL, the share prices of APL rose sharply from $21.5 to $29.75—a rise of $8.25 (Figure 1). The share prices of NOL rose gradually in Singapore dollars, from S$1.20 to S$1.26, which was an increment of S$0.06 (Figure 2).

In the case of NOL's acquisition of APL, the premium received by the target shareholders (APL) is considerably higher than the increase in the share price of the acquiring firm (NOL). The acquisition announcement has resulted in a rise in both the companies share prices— NOL's share price rose by 7.2% and APL's share price rose by 45.2% and is summarized in Table 3.

FIGURE 1

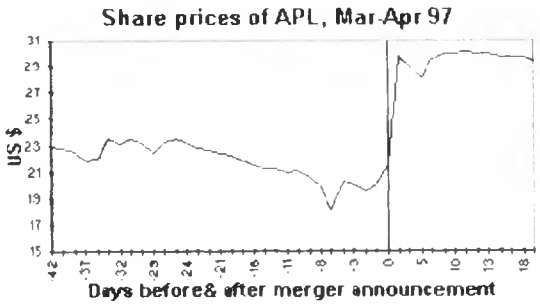
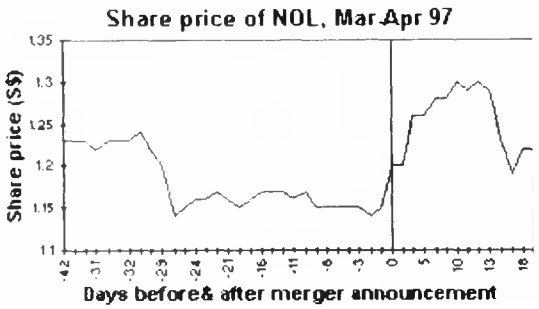


FIGURE 2



In another recent merger, Figures 3 and 4 show the market reaction to the initial disclosure of the merger of the liner shipping divisions of P&O and Nedlloyd. The day the announcement of merger was made known, the share price of P&O increased from 517 pence (06th Sep 96) to 560.5 pence (09th Sep 96- 7th and 8th Sep being Saturday and Sunday), which was a jump of 43.5 pence. The same reaction was demonstrated in Nedlloyd's share price which increased from 39.5 Fl (06th Sep 96) to 45.5 Fl (09th Sep 96), an increment of 6Fl.

Movements of share prices before the announcement were different in both cases but, after the merger disclosure, synchronous movements in the share prices can be observed before the actual merger has taken place. This can be attributed to the fact that the market reaction to any event affecting either company affects its merging partner, even though they have not legally merged. However, the behavior of share price acts as if they have merged.

It is observed that the percentage increase in the share prices is identical for both the companies, approximately 15% (See Table 4). The identical increment in the share prices can be attributed to the fact that the shareholders anticipate equal gains to both the companies through the synergies achieved through the merger.

The rise in the share price on the announcement of merger/acquisition reflects the market's expectation of the effect of the merger on shareholders of the acquiring and acquired companies. It reflects the markets expectation of the costs and benefits of the proposed merger and the probability that the merger will go through. A positive reaction from the merger announcement reflects the shareholders anticipation that the merger will result in positive gains. A falling share price following the announcement reflects shareholders sentiment that the merger will not be beneficial and they should not approve the deal (Copeland, Koller & Murrin 1991). In the case of the above mentioned mergers, the reaction of the shareholders was positive. Shareholders approve of the proposed merger and anticipate wealth maximization in the near future through the resulting synergies.

Based on data in Table 5, we observe that many companies' operating profits from the liner shipping sector have fallen. While some companies have reported rises, their net operating profit has been used. These companies are diversified into other marine and non-marine sectors and, for many of them, the rise in the profitability is attributed to these sectors. For many companies, the return on investment has steadily fallen from double digit figures in the late 1970's to near zero or below today (Lloyds List 1996 C).

TABLE 3
PRE AND POST-ANNOUNCEMENT SHARE PRICE ACTIVITY

Company's Name	Mean of Share price 20 days before announcement	Mean of Share price 20 days after announcement	% rise in the share price
NOL	S$1.16	S$1.25	7.8 %
APL	US$20.36	US$29.58	45.2 %

Source: Datastream International, NOL company code-997373, APL company code-944881

FIGURE 3

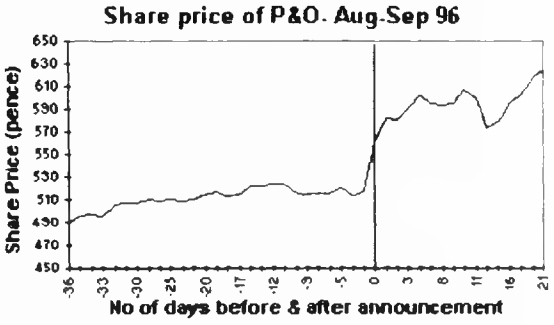


FIGURE 4

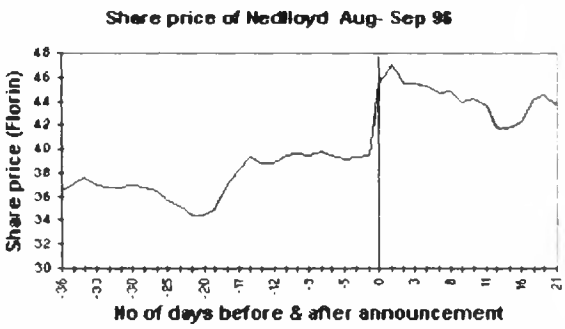


TABLE 4
PRE AND POST-ANNOUNCEMENT SHARE PRICE ACTIVITY

Company's Name	Mean of Share price 20 days before announcement	Mean of Share price 20 days after announcement	% rise in the share price
P & O	517.8 Pence	593.5 Pence	14.6 %
Nedlloyd	38.51 Florins	44.28 Florins	14.9 %

Source: Datastream International, P&O company code-901127, Nedlloyd company code-912796.

As a result of the falling operating profits, liner companies have entered into alliance agreements, merging and acquiring each other, so that the costs can be reduced.

The oligopolistic character achieved by these firms can be studied by understanding the concentration ratio of these firms with respect to the tonnage held by them. Table 6 shows that the top 6 alliance groups will control 42.7% of the World's TEU in service. This percentage is expected to increase at a steady rate due to the cost savings accrued through the alliances and mergers. These cost savings amassed through alliances and mergers will be used to offset the possible price reductions in the freight rates charged. This trend should result in other smaller firms merging or quitting the trade. Firms preferring to remain independent and not responding to these changes will end up bankrupt

TABLE 5
PROFIT/LOSS OF MAJOR LINER SHIPPING COMPANIES

Company name	Profit type used	1995	1996	Fall/Rise
P&O	Liner Operating Profit	40.1m £	30.3m £	Fall (24%)
Nedlloyd	Liner Operating Profit	57m Dfl	25m Dfl	Fall (56%)
Hapag-Lloyd	Liner Operating Profit	265m Dm	230m Dm	Fall (13%)
K-Line	Liner Revenue	1.61b US$	1.53b US$	Fall (5%)
MOL	Net Operating Profit	-4.64m US$	20.9m US$	Rise(351%)
Maersk	Tankers and liners Net Operating Profit	1.16b Dkk	1.21b Dkk	Rise (5%)
Yang Ming	Net Operating Profit	2.82b NT$	3.67b NT$	Rise (30%)
Sea-Land	Net Operating Profit	254m US$	318m US$	Rise (80%)
APL	Net Operating Profit	68.4m US$	141m US$	Rise(106%)
ZIM	Net Operating Profit	54m US $	14m US$	Fall (74%)
NYK	Net Operating Profit	148.8m US$	208.4m US$	Rise (40%)
Hanjin	Net Operating Profit	134.3m US$	161.8m US$	Rise (20%)
NOL	Liner Revenue	1.0b US$	1.05b US$	Rise (5%)
OOCL	Operating Profit after Financing	71.8m US$	60.2m US$	Fall (16%)

Source: Individual Company Annual Reports or company websites.

or absorbed by larger companies except for companies operating in the niche market sector. The final market structure emerging in the next decade will be oligopolistic, given the current regulatory situation.

Growth and Expansion of Merging Firms' Sales and Market Share

World container trade has been increasing at a steady pace. This has been attributed to the growth in world trade which is steadily rising at a rate of 8% by volume per year and world ship slots have been expanding at 22% per year, according to figures in Containerization International's 1997 Yearbook. The growth in world trade results in increased market share for the liner companies. In this expanding market, shippers are looking closely at a carrier's ability to provide a wide range of high quality services at reasonable prices. Larger carriers are in a better position to offer the variety and quality of service desired and, therefore, should experience significant gains in market share (Lloyd's List 1996A).

Today, shippers have focused on reducing the number of carriers they associate with and look to one-stop shopping for all their global shipping needs. Liner shipping firms can only offer this broad range of services through mergers or by joining alliances with other companies and thus sharing the resources and know-how.

TABLE 6
MARKET CONCENTRATION OF TOP 6 LINER SHIPPING ALLIANCES

No	Alliance	Company		Total TEU	% Market Share
1.	Sealand-Maersk	Sea-land Service		203,244	4.3%
	Alliance	Maersk		200,919	4.3%
			Total	**404,163**	**8.6%**
2.	Global Alliance	A.P.L		81,262	1.7%
		M.O.L		126,415	2.7%
		Nedlloyd		117,114	2.5%
		O.O.C.L		76,419	1.6%
		M.I.S.C		-	-
			Total	**401,210**	**8.5%**
3.	Grand Alliance	Hapag-Lloyd		85,722	1.8%
		NYK/TSK		129,731	2.8%
		P&O		100,243	2.1%
		N.O.L		77,937	1.7%
			Total	**393,633**	**8.4%**
4.	Kawa Yang Co	K Line		83,634	1.8%
		Yang Ming		81,229	1.7%
		Cosco		183,726	3.9%
			Total	**348,589**	**7.4%**
5.	Tri-Con	Hanjin		115,815	2.5%
		ChoYang		33,277	0.7%
		DSR-Senator		70,908	1.5%
		U.A.S.C		40,000	0.9%
			Total	**260,000**	**5.5%**
6.		Evergreen		205,224	4.3%
		Total alliance TEU		**2,012,819**	**42.7%**
		Total World TEU		**4,700,000**	**100%**

Source: Containerization International Yearbook 1997

The statistics of the container industry show that, by the end of 1996, the number of containers passed the 10 million mark. If present day growth remains steady, then by 2005, the number of containers will reach 20 million. It is believed that these alliances will control 85-90% of the world's container ships (Lloyd's List 1996B).

The liner shipping industry previously has been involved in consortia membership but the membership was limited to cargo or revenue sharing arrangements. Falling freight rates and increasing costs are the reason that these liner companies are switching from pure trade lane arrangements to global alliance agreements (Lloyd's List 1996A).

Joining forces with other carriers on a global basis offers an easy entry into markets previously considered impenetrable. American President Line (APL) had for a long time yearned to join the Europe-Far East trade and its membership with Global Alliance has made its entry into this trade possible without having to spend heavily. In turn, APL has offered the other alliance members its know-how and operational assets in the US and transpacific. Similarly with the Grand Alliance, NYK & NOL were able to slot charter Hapag-Lloyd tonnage across the Atlantic while Hapag-Lloyd was able to take advantage of its partners' strength on the transpacific.

CONCLUSION

The liner shipping industry in the past two years has been in the limelight with respect to the number of mergers and alliances which have shaken up the industry. The whole industry is presently undergoing restructuring. However, the merger waves experienced in the liner shipping industry have coincided with general industry merger waves, which implies that the liner shipping industry is very much dependent on other industries and the ups and downs in the global market very much affect its performance. The current state of the world economy may even take its toll on the liner shipping industry by causing several bankruptcies before conditions improve.

The implication for shippers, as a result of this consolidation, is less choice and higher freight rates in the long term. Less choice for the shipper may result in a decreased ability to serve their customers. Although there is currently far more capacity available than shippers' demand, a rationalized liner shipping industry will attempt to slow, or even stop, the growth in capacity, creating the climate for increases in freight rates. Today's benefits of lower freight rates may lead to tomorrow's rate increase, as the industry consolidates into a tighter and tighter group controlling a greater percentage of the market share.

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APPENDIX

HISTORICAL MERGER EVENTS OF MAJOR LINER COMPANIES:

Predecessor	Year	Event
Hapag-Lloyd	1875	Hapag bought Adler Line.
-	1875	UK-Calcutta conference formed.
NYK	1885	NYK was found through a merger between shipping assets of Mitsubishi and Kyodo Unyu Kaisha.
Hapag-Lloyd	1890	Hapag bought Carr Union Line.
-	1892	Conference of North European Lines formed (North Atlantic Conference) comprising of Hapag, NDL, Holland America and Red Star.
Hapag-Lloyd	1898	Hapag bought King Sin Line.
Nedlloyd	1908	KPM, Rotterdam Lloyd and Nederland Line merged to form Koninklijke Hollandsche Lloyds (KHL).
P&O	1910	P&O bought Blue Anchor Line.
P&O	1914	Merger of P&O and British India Steamship Navigation.
Ellerman	1914	Ellerman lines and Hall Lines merged to form Ellerman Line.
P&O	1916	P&O acquired New Zealand Shipping Co and Federal Steam Navigation Company.
P&O	1917	P&O acquired interest in the Union Steamship Company of New Zealand, Hain Steamship Company and James Nourse Ltd.
P&O	1918	P&O bought Orient Line.

Hapag-Lloyd	1918	Hapag acquired Hamburg Line.
Hapag-Lloyd	1918	NDL acquired Bremen Line.
P&O	1919	P&O bought Khedivial Mail Line.
K-Line	1919	Kawasaki Kisen Kaisha Line (K-Line) established.
P&O	1920	P&O bought General Steamship Navigation Company.
C.G.M	1920	Compagnie des Massageries Maritime acquired by Chargeurs Reunis.
A.P.L	1921	Pacific Mail Steamship Company acquired by Dollar Steamship Line.
P&O	1923	P&O bought Strick Line.
Hapag-Lloyd	1926	Hapag acquired Deutsh-Australische Dampfschiffs Gesellscaft (DADG)
C.G.M	1931	French government acquired a majority stake in the Generale transatlantique.
A.P.L	1952	Dollar Steamship Lines acquired by Ralph K Davies.
P&O	1960	P&O bought remainder of Orient Line.
K-Line	1964	K lines merger with the Liner department of Iino Line.
N.Y.K	1964	NYK merged with Mitsubishi Kaium K.K
M.O.L	1964	Merger of Osaka Shosen Kaisha (OSK) and Mitsui Steamship Company Ltd.
P&O	1965	Overseas Container Line formed comprising of P&O, Alfred Holt, British & Commonwealth and Furness Withy.
A.P.L	1965	APL merged with Natomas Company.
A.C.T	1966	Associated Container Transportation formed comprising of Ben Line Steamers, Blue Star Line, Cunard Steamship Co, Ellerman Lines and T&J Harrison.
-	1967	Transatlantic Shipping, Wallenius Lines, Cunard, Ellerman, Incotrans form Atlantic Container Line (ACL).
C.G.M	1969	Transat merged its services with Navigation Mixte.
Hapag-Lloyd	1970	Hapag-Lloyd formed by the merger of Americanische Packetfahrt-Actien-Gesellscaft (Hapag) and Nordeutscher Lloyd (NDL).
Nedlloyd	1970	Merger of Royal Interocean Lines, Rotterdam Lloyd, Nederland Line, VNS to form Nedlloyd Group.
CGM	1973	French state owned concerns of Compagnie Generale Transatlantique (Transat) merge to form CGM.
Trio Group	1973	Trio Group consortium formed of NYK, MOL, OCL and Ben Line.
Nedlloyd	1980	Nedlloyd group acquires KNSM-Kroonburgh.
USline	1982	US line buys Moore McCormack.
Crowley	1982	Crowley buys Delta.

P&O	1986	P&O bought rest of the shares of O.C.L.
Global	1995	Global Alliance formed of APL, MOL, Nedlloyd & OOCL.
Grand	1995	Grand Alliance formed of P&O, NYK, NOL & Hapag-Lloyd.
Sealand-Maersk	1996	Sealand-Maersk Alliance formed.
-	1996	P&O-Nedlloyd merger.
-	1997	NOL's acquisition bid of APL.
-	1997	CMA-CGM merger.
-	1997	Hanjin- DSR senator merger.

Source: International Directory of Company Histories, Volume 5 and Volume 6

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DETERMINANT CRITERIA IN THE OCEAN CARRIER SELECTION PROCESS

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This study examines key determinant criteria used by import and export shippers when selecting an international containership carrier. A sample of import and export shippers were asked to evaluate eighteen service characteristics based on whether or not the characteristics were required by their international containership carriers. The results of Pearson chi-square tests indicate a significant difference between import shippers and export shippers on three of the eighteen service characteristics. Import shippers were more demanding of their carriers by requiring door-to-door transportation rates, shipment expediting, and shipment tracing services.

INTRODUCTION

Both industry and academia have begun to place more importance on determining and understanding the selection criteria used in choosing a transportation provider. Differences between motor carriers and shippers perception of choice criteria have been explored by numerous researchers such as Evans and Southard (1974), Abshire and Premeaux (1991a) and Murphy, Daley, and Hall (1997). The effect of deregulation on the selection process was examined by Bardi, Bagchi, and Raghunathan (1989), while Evers, Harper, and Needham (1996) focused on the perceptions of attributes pertaining to intermodal rail-truck services. These studies found a variety of significant differences in the perceptions of shippers and carriers.

While the buyer behavior literature very clearly shows that a variety of evaluative criteria are used in the final selection of a product or service there are those few criteria that must be present for the product or service to be selected. Alpert (1971) referred to those attributes as determinant attributes. These are product or service attributes that actually lead to selection of the product or service and these attributes are generally best determined through the use of direct questioning techniques. It seems clear, based on the concept of determinant criteria, that some criteria are more important in the selection process than are other criteria.

The purpose of this study is to extend the carrier selection literature into international ocean carriers which is a mode of transportation that

has received much less study than other modes of transportation. While other studies have examined perceptual attribute differences between carriers and shippers, this study further expands the literature base by examining not only perceptual attribute differences that exist between carriers and shippers involved in international shipping, but also explores the use of determinant criteria used in the selection process of these carriers.

LITERATURE REVIEW

As noted earlier, Alpert (1971) has shown that certain product attributes are perceived as being more important than other attributes and that for a particular product or service to be chosen these attributes must be present. These attributes are known as determinant attributes as they ultimately determine if the product or service will be purchased. Sinclair and Stalling (1990) point out that consumers tend to look at products as possessing bundles of attributes and that these attributes differ in their contribution to evaluation and choice. They further note that determinant attributes are those that are not only important but also tend to separate one competitor from another and that by understanding those differences, manufacturers can adjust their marketing strategies to fit each market segment.

Over the years, a variety of methods have been used to detect which attributes could be considered determinant in nature. Alpert (1971) reported that a Direct Dual Questioning Determinant Attribute (DQDA) method was most appropriate in uncovering determinant attributes. Saaty (1977) found that an Analytic Hierarchy Process (AHP) provided a method for identifying determinant attributes. More recently, Armacost and Hosseini (1994) refined the AHP technique and produced a technique referred to as AHP-DA which uses the importance results derived from AHP and combines them with difference measures based on priorities of alternatives. The DQDA method and the AHP-DA methods were found to perform in a similar fashion for smaller numbers of attributes while the AHP-DA method was found to be more effective in handling a large number of attributes.

It is reasonably clear that whichever method is used to attempt to identify determinant attributes, the ultimate purpose is still to use those attributes in the formulation of marketing strategy. This can only be accomplished if the product or service provider fully understands the needs of the consumer and how the consumer perceives the product or service attributes in question.

Companies face a real danger when they assume that they understand what their customers perceive as being important. Both Evans and Southard (1974) and Jerman, Anderson, and Constantin (1978) report that most trucking companies do not know which variables influence the choice of carrier or the importance placed on each of these criteria. Bardi, Bagchi, and T.S. Raghunathan (1989) found that transit-time reliability, transportation rates, total transit time, willingness to negotiate rates, and financial stability were considered to be the five most important or determinant characteristics in carrier selection. Research conducted in the shallow-draft industry by Burdg and Daley (1985) found that perceptual differences existed between shippers and carriers in terms of the importance placed on cost.

Foster and Strasser (1990) reported that carriers still do not have a good understanding of how shippers select carriers or modes of transportation. Carriers and shippers continue to disagree on the importance of cost. Carriers perceived cost to be more important than shippers. Differences were also found in selection criteria importance between rail and motor carriers with motor carriers ranking transit time as the most important criterion and rail carriers ranking schedule reliability as the most

important criterion. These results indicate that various types of carriers seem to place higher levels of importance on different selection criteria than do shippers. Morash and Calantone (1991) found that the service criteria of on-time delivery, reliability, and safe delivery were all ranked by shippers well above cost factors in the consideration of carrier selection. Abshire and Premeaux (1991b) found that most carriers do not understand how selection criteria factors influence the choice of a carrier. Shippers and carriers were ask to determine the importance of 35 selection criteria. Of those 35 criteria, the perceptions of importance differed on 19 items. They conclude that carriers may not be emphasizing the most important selection criteria as perceived by shippers which could result in lower levels of satisfaction and therefore, the replacement of the carrier. Evers, Harper, and Needham (1996) also report that the perception of service which the carrier provides may range from being completely wrong to totally correct. They suggest that when the perceptions are inaccurate, carriers must provide shippers with a more complete picture of their services or provide the services which they are not presently providing. They contend that the failure to do so will lead to dissatisfaction with the carrier and therefore the use of another carrier.

The literature presented clearly shows an industry which has yet to come to terms with how and why particular modes or specific carriers are selected. The present study is intended to help identify the determinant criteria used by importers and exporters in the selection of an international ocean carrier.

METHODOLOGY

The research methodology utilized in this study was a mail survey. The survey was one page in length and was sent to 125 companies. The sample companies consisted of import shippers, export shippers, and containerized transportation companies. The import and export shipper companies consisted of the top 50 import shippers and the top 50 export shippers ranked by total Twenty-Foot Equivalent Units (TEUs) by the Journal of Commerce (1997). The 25 transportation companies consisted of the population of ocean containership carriers that call on the United States ocean water ports also published by the Journal of Commerce. A total of 58 usable surveys were returned resulting in a 46.4% overall response rate.

Each of the companies in the sample was contacted by phone to determine the most senior person responsible for the import management or export management functions in the import shipper and export shipper companies respectively. The containerized transportation companies were contacted by phone to determine the most senior marketing person responsible for import and export customers. In addition to confirming the appropriate contact person their address information was also confirmed. Subsequently, all potential respondents were mailed a cover letter explaining the purpose of the study, a copy of the survey, and a postage-paid return envelope. Each respondent was given a list of 18 characteristics that are likely to be used as factors in the carrier selection process. They were then asked to select those characteristics that must be present for a carrier to be considered for selection. Pearson Chi-Square values were calculated to evaluate the data for significant differences between the importer and exporter groups based on whether or not they required each of the eighteen characteristics to be present for carrier selection.

Non-response bias was analyzed by comparing earlier responses to later responses for all 18 of the factors analyzed. This is a commonly used procedure for testing for the presence of non-response bias (Armstrong and Overton 1977). No statistically significant differences were found from the comparisons and, therefore, non-response bias was not considered to be a problem.

RESULTS

The carrier selection characteristics used in this study are shown in Table 1 below. These characteristics were selected for use in this study as they have been used in other carrier selection research (Bardi, Bagchi, and Raghunathan 1989; Murphy, Daley, and Hall 1997).

TABLE 1
SELECTION FACTORS FOR OCEANGOING CONTAINERIZED CARRIERS

Transit time reliability/consistency (hereafter, Reliability)
Special equipment (Special equipment)
Pickup and delivery service (PU&D)
Quality of carrier salesmanship (Carrier salesmanship)
Door-to-door transportation rates (Rates)
Freight loss and damage (Loss & damage)
Total door-to-door transit time (Transit time)
Claims processing (Claims)
Shipment expediting (Expediting)
Willingness of carrier to negotiate rate changes (Rate changes)
Frequency of service (Service frequency)
Linehaul services (Linehaul services)
Financial stability of carrier (Financial stability)
Scheduling flexibility (Scheduling flexibility)
Quality of operating personnel (Operating personnel)
Willingness of carrier to negotiate service changes (Service changes)
Equipment availability (Equipment availability)
Shipment tracing (Tracing)

Carrier selection factors. Source: Bardi, E.J., P.K. Bagchi, and T.S. Raghunathan (1989), Motor Carrier Selection in a Deregulated Environment, Transportation Journal 29,5.

As noted earlier, the sample used in this study consisted of three respondent groups: 1) export shippers, 2) import shippers, and 3) containerized transportation companies. The usable sample for this study consisted of 20 exporters (40% response rate), 19 importers (38% response rate), and 19 containerized transportation companies (76% response rate). Each respondent was asked to rate each characteristic on a Likert-type scale where a response of 1 represented a perception of most important and a response of 5 represented a perception of least important. The resulting data are shown in Table 2.

The data shown in Table 2 provide a very different profile in terms of the importance each type of respondent places on each characteristic.

TABLE 2
MEAN SCORES

Factor	Import Shipper	Export Shipper	Carrier
Carrier Salesmanship	2.74	2.45	2.26
Claims	2.32	2.80	2.79
Equipment Availability	1.16	1.00	2.11
Expediting	1.74	2.10	2.47
Financial Stability	1.79	1.70	2.42
Linehaul Services	2.68	2.79	2.32
Loss & Damage	1.58	2.00	2.47
Operating Personnel	1.74	1.85	1.95
PU & D	2.37	2.89	2.63
Rate Changes	1.63	1.35	2.11
Rates	1.74	2.75	2.21
Reliability	1.11	1.45	1.37
Scheduling Flexibility	2.21	2.00	2.53
Service Frequency	1.37	1.30	1.79
Service Changes	2.21	1.80	2.68
Special Equipment	2.58	2.74	2.53
Tracing	1.68	2.40	2.50
Transit Time	1.84	2.20	1.84

For example, Import Shippers rated eleven characteristics with mean scores below two indicating that these items are seen as being very important to them. Export shippers rated seven items below two while Carriers rated only four items below two. These results clearly indicate a difference in the perceptions between the shippers and carriers.

Export shippers and import shippers were given the list of 18 characteristics and asked to select those characteristics that must be present in a carrier service offering for a carrier to be considered for selection. Table 3 shows the frequency and percent that each characteristic was checked as being mandatory by both export shippers and import shippers.

The data shown in Table 3 reveal significant differences between the perceptions of import shippers and export shippers on two characteristics (rates and tracing) at the .05 level and one characteristic (expediting) at the .10 level. In the case of rates and tracing, it is clear that a higher percentage of import shippers find these characteristics to be a requirement than do export shippers. The same is also true for the expediting characteristic. Interestingly, the mean scores of importance given each of these characteristics by the carrier respondents fell between two and three indicating that carriers only saw these variables as being moderately important.

TABLE 3

REQUIREMENT OF THE PRESENCE OF CARRIER SELECTION FACTOR

Selection Factor	Export Shipper n=20		Import Shipper n=19		Pearson Chi-Square
Carrier Salesmanship	n=2	%=10.0	n= 4	%= 21.1	.339
Claims	2	10.0	5	26.3	.184
Equipment Availability	9	45.0	9	47.4	.882
Expediting	2	10.0	6	31.6	.095 **
Financial Stability	5	25.0	8	42.1	257
Linehaul Service	1	5.3	3	15.8	.290
Loss & Damage	3	15.0	7	36.8	.118
Operating Personnel	1	5.0	3	15.8	.267
PU&D	3	15.8	5	26.3	.426
Rate Changes	5	25.0	4	21.1	.770
Rates	2	10.0	7	36.8	.047 *
Reliability	9	45	10	52.6	.634
Scheduling Flexibility	3	15.0	4	21.1	.622
Service Changes	4	20.0	2	10.5	.412
Services Frequency	7	35.0	9	47.4	.433
Special Equip.	5	25	5	26.3	.925
Tracing	3	15.0	9	47.4	.029 *
Transit Time	6	30.0	6	31.6	.915

* Significant at the .05 level
**Significant at the .10 level

CONCLUSIONS

Based on the data shown in Tables 2 and 3 it is clear that the perceptions between import shippers, export shippers, and carriers do differ. If one assumes that those characteristics perceived as being very important in the selection process would attain a mean score of between one and two (i.e., very important) it is obvious that carriers do not perceive many of the characteristics to be as important as do the shippers. This lack of understanding of what shippers deem important would most likely lead to a marketing strategy which would be faulty. By not placing the same amount of importance on seven of the items that import shippers found to be very important and four items that exporters rate as being very important would place the

carriers at a disadvantage in competing for the shippers business. Obviously, those carriers who understand the importance of each item to the various types of shippers and responds accordingly will have a competitive advantage in comparison to those who do not fully understand the importance of each item.

It is also important for carriers to understand the differences in perceptions between importers and exporters. For example, Table 3 reveals that there are significant differences in the perceptions of importers and exporters. These differences were not entirely unexpected. One would assume that importers in the U.S. might be more concerned about tracing and expediting than would exporters. This assumption is made due to the nature of the products being imported. Retail import shippers are replenishing consumer product inventories and manufacturers are frequently staging component parts inventories to support efficient supply chain management strategies. Both types of importers are dependent on tracing and expediting capabilities from their carriers.

It is also clear from the data shown in Table 2 that even though there may not be statistically significant differences between many of the characteristics examined, there are differences in the mean scores which could be used to formulate marketing strategy, thereby giving one competitor a competitive advantage over another. Given that there are a number of carriers to chose from, the one that understands their customers the best will most likely be in the best position to satisfy those customers needs.

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MANUSCRIPT SAMPLE

TEACHING LOGISTICS STUDENTS TO TAKE OWNERSHIP OF INFORMATION INFRASTRUCTURE DEVELOPMENT

Frank W. Davis, University of Tennessee
Kenneth J. Preissler, Logistics Insights Corporation

Logistics systems, developed gradually over the past decades, are undergoing necessary radical change in this era of increasing global competition. This article describes an approach taken by the authors to teach logistics students how to take ownership of designing their own information infrastructure and how to use it to make their organizations more flexible, providing more strategic options.

INTRODUCTION

Advances in information systems technology such as data base management systems, bar code scanning, telecommunications, and image processing have enabled logistics and information managers with vision to reengineer the way the firm conducts its business. The usage of mainframe computers, personal computers, and logistics information systems has been widely studied (Gustin 1989). These studies have universally concluded that there has been a rapid growth in the usage of computers and logistics information systems.

Computer Usage in the Classroom

The usage of computer applications in a logistics course has also been studied. Rao, Stenger and Wu stated that there are several approaches to integrating computers into the classroom in a business curriculum, each with its individual advantages and drawbacks (1992).

Table 1 about here

Systems Development In Practice

The study of the information systems development process of computer applications has been almost universally left up to the computer science, software engineering, and information systems educators and practitioners.

$$y = a + 1x + ax \quad (1)$$

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