APPLICATIONS AND LIMITATIONS OF YIELD MANAGEMENT PRICING SYSTEMS BEYOND THE AIRLINE AND HOSPITALITY INDUSTRIES

by

Jeffrey A. McCarthy

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Signature of Author _____
MIT Sloan School of Management
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Certified by _____
Richard Schmalensee
Gordon Y. Billard Professor of Management and Economics
Thesis Supervisor

Accepted by _____
Jeffrey A. Barks
Associate Dean, Master's and Bachelor's Programs

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ABSTRACT

A number of companies in a variety of industries are looking to the airline industry as a model for improving the profitability of their own operations. Specifically, it is the ability of passenger airlines to realize significant benefits through the use of yield management pricing systems which has attracted this attention. The objective of this thesis is to profile the experiences of four companies in four different industries (excluding the passenger airline and hospitality industries) which have incorporated some form of yield management practices into their operations.

This thesis begins by defining the concepts involved in yield management, and describes the types of environments which have traditionally been considered the best candidates for the application of yield management systems. Following this overview, the results achieved in the airline industry attributable to the adoption of yield management systems are summarized. A survey of recent yield management literature is also offered.

The remainder of the thesis consists of profiles of the adoption and use of yield management by companies in the following industries: consumer truck rental; ocean shipping and inter-modal cargo transportation; heavy truck manufacturing; and radio broadcasting. Based upon these case studies, some observations are offered concerning the potential applications and limitations of yield management systems beyond the traditional realms of the airline and hospitality industries.

Thesis Supervisor: Richard Schmalensee
Title: Gordon Y. Billard Professor of Management and Economics

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Chapter 1: Introduction and Background

Yield management, which is the integrated management of price and capacity, has been considered by Robert Crandall, Chairman and CEO of AMR and American Airlines, to be "the single most important technical development in transportation management since we entered the era of deregulation in 1979." [1] Indeed, the concept of yield management was largely pioneered by the passenger airline carriers, and as a result most of the research that has been conducted on this topic has focused on the airline industry. Following the development of yield management by the airline industry, the other notable business sector to formally embrace this practice in recent years has been the hospitality industry, which for many years had already been employing a number of the component concepts of yield management.

While the taxonomy has thus evolved from the application of yield management systems and techniques in these two industries, a number of companies in other industries with common characteristics have recently considered the adoption of yield management systems, in an attempt to replicate the benefits attributable to yield management which airlines and hotel operators have accrued. This paper examines the implementation of yield management systems by companies in four different industries, and evaluates these applications in light of research which has been conducted regarding the theoretical extensions and limitations of yield management.

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[1] Darrow,R., J. Leimkuhler and B. Smith. "Yield Management at American Airlines", *Interfaces*. January-February 1992, p. 31.

This chapter begins by defining the concepts involved in yield management, and describes the types of environments which are the best candidates for the application of yield management systems. Following this overview, Chapter 2 briefly examines the results achieved in the airline industry attributable to the adoption of yield management systems. Chapter 3 next surveys recent yield management literature, specifically that research concerning i) the requirements for implementing a yield management system; ii) complicating issues related to the adoption of yield management practices, and iii) limitations of yield management. Chapter 4 profiles the adoption and use of yield management by four companies in different industries. Finally, Chapter 5 summarizes the observations and managerial implications gleaned from these case studies.

1.1 Yield Management Defined

In its 1987 annual report, American Airlines defined yield management as "selling the right seats to the right customers at the right prices." This broad characterization of yield management embodies many of the elements which are included in alternative definitions, including the underlying recognition that the value of any service or product is different for different customers. More precisely, yield management is the set of practices and policies that guides a company in the allocation of units of undifferentiated capacity in an attempt to maximize the yield, or revenue per available unit of inventory. As will be demonstrated below, because yield management systems have historically been associated with businesses facing relatively fixed capacity and low marginal sales costs, yield maximization is essentially equivalent to profit maximization.

Yield management integrates the functions of pricing and inventory management, in an attempt to determine what amount of capacity to offer at which

price, so as to maximize revenue or yield. As this definition implies, yield management involves segmenting the demand for a product or service, offering the product or service at multiple prices, and differentiating the price by some service or purchase characteristic at each price point.[2]

1.2 Common Characteristics of Yield Management Environments

The firms which may benefit most from the adoption of yield management typically face a set of common factors. These characteristics (adapted from Kimes[3]) include:

- *Fixed capacity:* Because capacity can always be expanded with a certain time lag or at a certain cost, this condition is more accurately represented as a high cost of adding an incremental unit of capacity.

- *Low marginal sales costs:* With a relatively low selling cost for the product or service, there exists a wide range of prices over which selling the product or service is preferable to letting it be wasted.[4]

- *Demand segmentation:* The firm must have the ability to segment price-sensitive customers based on specific attributes. The attribute used to segment customers must truly differentiate the product or service, since the perception of arbitrary price discrimination will undermine the system.[5]

- *Perishable inventory:* The product or service either ages or is unavailable on a date after which it becomes available.

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[2]Lieberman, W. "Debunking the Myths of Yield Management". *The Cornell Hotel and Restaurant Quarterly*. February 1993, p. 36

[3]Kimes, S. "The Basics of Yield Management". *The Cornell Hotel and Restaurant Quarterly*. November 1989, pp. 15-17.

[4]Bodily, S. and L. Weatherford. "A Taxonomy and Research Overview of Perishable-Asset Revenue Management: Yield Management, Overbooking and Pricing. *Operations Research*. September-October 1992, p. 832.

[5]IBID, p. 834.

- *Advanced sales/reservations:* Advanced sales create uncertainty for the firm, since it must decide how many discount rates to allow in advance and how much capacity to set aside for higher priced customers. Advanced reservations require a firm to have a defined overbooking policy in order to offset lost revenues resulting from no-shows and cancellations.

- *Fluctuating demand:* Yield management can help temper demand by increasing sales in times of low demand (through price decreases) and by increasing revenues during busy time (through price increases).

While all of these conditions must not necessarily exist for a company to benefit from yield management, the extent to which these characteristics are present may determine the magnitude of the incremental benefits which yield management is capable of providing. The degree to which these factors govern the effectiveness of yield management techniques will be considered in Chapter 4, as part of the profiles of companies which have adopted a form of yield management.

Chapter 2:

Yield Management Results in the Passenger Airline Industry

The motivation for companies to consider implementing policies and practices similar to those pioneered in the airline industry and adapted by the hospitality industry (and hence the motivation for this research) is due largely to the direct, measurable benefits achieved by firms in these two industries attributable to yield management practices. This chapter briefly summarizes the role of yield management in these industries, and the benefits which they have provided.

2.1 The Role of Yield Management in the Airline Industry

The impetus to the yield management movement in the airline industry was the Airline Deregulation Act of 1978. Deregulation opened the U.S. market to heightened competition i) by allowing free entry and exit on all domestic routes in the U.S., and ii) by permitting airlines to change fares as frequently as they wished. The yield management functions which were pioneered by American Airlines in response to these competitive challenges, and which were quickly adopted by other carriers, typically embodied the following functions[6]:

- *Discount allocation:* The process of determining the number of discount fares to offer on a flight in order to stimulate demand and fill seats that would otherwise have been empty; included in this process was the objective of minimizing revenue dilution, which resulted in selling discount fares to the relatively price-insensitive customer segments;[7]

[6]Darrow, Leimkuhler and Smith, p.28.
[7]Dhebar, A. and A. Brandenburger, "American Airlines, Inc.: Revenue Management." *Harvard Business School Case*. #9-190-129, 1989, p. 4.

- *Overbooking;* The practice of intentionally selling more reservations for a flight than the number of available seats to offset the effects of passenger cancellation;

- *Traffic management:* The process of controlling reservations by passenger origination and destination in order to provide the mix of markets that maximizes revenue. Central to this process was the development of the hub-and-spoke route structure which emerged subsequent to deregulation.

The ability of the large carriers to implement these functions was made possible by the access to data on air travel demand patterns, fare availability and seat inventory contained in sophisticated computer reservation systems (e.g. American Airlines SABRE system and United Airlines' APOLLO system) which were already established.

2.2 Results Attributable to Yield Management

The revenue enhancements attributable to yield management in the airline industry resulted from two benefits which the functions provided:

- *Effective Demand Segmentation:* Demand for air travel is clearly divisible into two distinct segments (business vs. leisure travelers) with significantly different price-sensitivities. Through selection devices such as advanced reservation restrictions and Saturday-night stay requirements, yield management has enabled carriers to dynamically manage demand and to minimize revenue dilution within a multiple-fare pricing structure.

- *Deterrence to Low-Fare Carriers:* In response to the proliferation of low fare start-up carriers, the established carriers were able to utilize yield management techniques to effectively deny the new low-cost entrants a foothold in the industry. This was achieved through selectively matching the discount fares offered by the new carriers i) on enough seats to match the low-fares,

but ii) on sufficiently few seats so as to protect the profitability of the higher-cost established carriers.[8]

As the industry consolidated late in the 1980's, yield management systems allowed the remaining carriers to again minimize the effects of occasional fare-wars (although some critics attributed the incidence of such fare-wars to the yield management systems themselves).

The sophistication and refinement of yield management techniques is most notable at American Airlines, and the financial results are also the most dramatic. American estimates the quantifiable benefits to be $1.4 billion during the period 1989-1991; during this same period, parent AMR recorded net profits of $892 million. American expected an annual contribution to revenues of over $500 million to continue beyond 1992.[9]

[8]Kahan, Mark. "Airline Agony." *Across the Board.* May, 1992, p. 11.
[9]Darrow, Leimkuhler and Smith, p. 22.

Chapter 3: Literature Review

This chapter summarizes from the current literature i) the requirements necessary to implement yield management systems, ii) complicating factors which firms must consider when implementing yield management systems, and iii) some limitations of yield management, and suggestions of some alternative models of revenue management.

As noted earlier, most of the research conducted on yield management has been dedicated to the airline and hospitality industries. This chapter seeks to extract from this body of literature the lessons learned from these two industries which may be useful in predicting the ability of firms in other industries to implement yield management systems. Particularly useful contributions to this category of research include Kimes (1989), Kimes (1994), and Hamilton and Jones (1992) which consider yield management in the context of hotel operations; and Darrow, Leimkuhler and Smith (1992) which discusses yield management at American Airlines.

In addition, this chapter summarizes findings from the smaller body of research which has focused on generalized applications of yield management, as well as applications of yield management to environments other than the airline and hospitality industries. Notable contributions in these categories include the application of yield management to the health care industry by Carmel and Chapman (1992) and the discussion of perishable asset revenue management (PARM) by Bodily and Weatherford (1992).

3.1 Requirements for Implementing a Yield Management System

In order to effectively implement a yield management system, a firm must establish the proper infrastructure to support the yield management function. Kimes[10] and Carmel and Chapman[11] identify the following minimum requirements:

- *Determine booking patterns:* A firm must be able to predict how far in advance sales are typically made for each class of its service or product. The yield management system uses this information to help management determine how it is doing relative to how it should be doing at various intervals preceding the delivery of the service or product.

- *Determine demand patterns by market segments:* A firm must have access to historical demand patterns by market segment in order to build demand forecasts, which represent the foundation of a yield management system.

- *Determine demand elasticities for prices:* A firm must be able to identify how changes in its prices will affect demand for various classes of its services or products. This determination requires an awareness of competitors' prices, how competitors are likely to react to price changes, and the effect of competitors' prices on demand (cross-price elasticities).

- *Establish an overbooking policy:* A firm must clearly define at which level it is willing to overbook. This decision must consider historical patterns of cancellations and no-shows, as well as the trade-off between i) the costs of overbooking (e.g. loss of goodwill, loss of future business, required compensation to customers) and ii) the costs of cancellations (i.e. lost revenue opportunities from unutilized capacity).

- *Establish good information systems:* Fast and accurate availability of the types of data identified above are necessary for a yield management system to perform effectively. The complexity of pricing and inventory management out-

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[10]Kimes (1989), p. 17.

[11]Carmel, J. and S. Chapman. "Demand and Capacity Management in Health Care: An Application of Yield Management." *Health Care Management Review*. Fall 1992, p. 46.

comes for most firms utilizing yield management makes manual optimization decisions infeasible.

Hamilton and Jones warn, however, that although information systems are a necessary requirement for an effective yield management system, an over-reliance on the technology may prevent a yield management system from achieving its full potential. The authors instead emphasize the need to involve all of the *people* in the process who need to participate in order for yield management to be successful. Accordingly, their seven-step approach for implementing a yield management system (summarized in **Table 1**) , begins with the requirement of establishing a "yield culture". [12]

Table 1 Seven-Step Plan to for Implementing Yield Management (Adapted from Hamilton and Jones)

Step 1:	*Establish a yield culture*
Step 2:	*Analyze overall demand*
Step 3:	*Establish price-value relationships*
Step 4:	*Create Appropriate Market Segments*
Step 5:	*Analyze the pattern of demand*
Step 6:	*Track declines and denials*
Step 7:	*Evaluate and revise the system*

This process includes many of the requirements mentioned previously, but focuses on the human element of yield management, stressing that the technology and systems which comprise yield management are only as good as the people who are using them. The elevation of creating a "yield culture" to the first step in the implementation process emphasizes this focus. Some of the measures for

[12]Hamilton, D. and P. Jones. "Yield Management: Putting People in the Big Picture." *The Cornell Hotel and Restaurant Administration Quarterly*. February 1992, pp. 89-91.

creating a yield management culture within an organization advocated by this approach include:

- Using yield management performance criteria to evaluate business performance;

- Aligning employee compensation and incentive criteria to reflect the operating goals of yield management; and

- Demonstrating a high-level commitment to the concept within the organization.

3.2 Complicating Issues for Management

In addition to the infrastructure described above which must be established by a firm implementing a yield management system, there are a number of specific problems which may complicate the effective use of yield management techniques. Carmel and Chapman offer the following as potential complications which management should consider[13]:

- *Multiphase service:* Interactions between services (e.g. multiple legs on a flight, multiple-night stays in a hotel) makes the mathematical optimization problem more complex.

- *Multiplier effect:* Related products or services which also contribute to the profitability of a company (e.g. hotel restaurants) complicate the allocation of capacity based upon independently maximizing yield of the primary product or service.

  Similarly, inter-temporal relationships (i.e. long-term customer relationships) may diminish the utility of single-period yield-maximization.

[13]Carmel and Chapman, p. 47.

- *Loss of focus:* Yield management may encourage a firm to focus attention on short-term profits or revenue yield. Yield management systems should not be implemented without appropriate consideration of long-term strategy, and product or service quality.

  Indeed, Lieberman (1993) defines yield management as "maximizing profits from the sale of perishable assets by controlling price and inventory and *improving service.*" [14] (emphasis added); and Carmel and Chapman define yield management as the maximization of revenue "for a defined period"[15].

- *Employee morale:* If yield management techniques are used to dictate behavior, rather than as guidelines, employees may feel disempowered.

- *Reward systems:* As described in the discussion of a "yield culture", employee reward systems must be consistent with the objectives of yield management.

In addition to these concerns, Kimes (1994) discusses the possibility of alienating customers due to the perception of arbitrary price discrimination or unfair pricing practices resulting from yield management pricing structures. This argument is based upon the *principle of dual entitlement*, which holds that most customers believe that they are entitled to a reasonable price and that firms are entitled to a reasonable profit. If a customer believes that a service or product differs from his/her reference transaction (i.e. how a customer believes a transaction should be conducted, and how much it should cost) only in price, then it follows that the firm is receiving more than its reference profit and is therefore behaving unfairly.[16]

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[14]Lieberman, W. "Debunking the Myths of Yield Management". *The Cornell Hotel and Restaurant Administration Quarterly.* February 1993, p. 34.
[15]Carmel and Chapman, p. 46.
[16]Kimes (1994), p. 24.

Kimes suggests that firms can increase prices for various classes of its product or services in the following ways:

- *Increase the reference price:* By increasing the reference or full-price rate, the firm has greater flexibility in pricing its other levels of products or services as discounts off this new reference price.

- *Attach additional services or products to the services sold at an increased price:* Additional amenities or incentives for future business may differentiate the product or service sold at the increased rate.

- *Sell the service as part of the package:* By bundling the service or product with other services or products (e.g. including ground and air transportation in the price of a cruise), the actual price of the service or product is obscured.

- *Attach restrictions to discounted prices:* Restrictions such as advanced booking or minimum stays for hotels may reduce the benefit to customers sufficiently such that the higher prices seem fair by comparison.

To summarize, if the criteria which is used to segment demand does not truly differentiate the product in the customer's mind (as mentioned in Chapter 1) , there is a greater potential for alienating customers. Kimes suggests that the resulting alienation presents the most significant threat to companies in industries in which customers face relatively low switching costs.

3.3 Limitations of Yield Management

As Chapter 2 illustrated, yield management systems have provided measurable financial benefits for airlines and hotel operators who have adopted these techniques. Nevertheless, the viability of yield management as an effective long-term management philosophy has been challenged in recent research on a number of bases. These challenges range from subtle modifications to the yield man-

agement definition by Bodily and Weatherford, to outright rejections of yield management techniques by Dunn and Brooks. The alternative approaches proposed by each of these challenges are described below as illustrative of the perceived theoretical limitations of yield management.

Alternative 1: Perishable-Asset Revenue Management (PARM):

Bodily and Weatherford challenge the ability of yield management as it is typically defined to capture the full range of activities involved in revenue management. By focusing on yield maximization, they do not feel that yield management i) gives adequate consideration to the tradeoff between average price paid and capacity utilization, and ii) is applicable to all industries.

Their alternative to yield management is termed Perishable-Asset Revenue Management (PARM), and is defined as "optimal revenue management of perishable assets through price segmentation".[17] Although the difference between this definition and the various descriptions of yield management is subtle, the authors provide a taxonomy consisting of fourteen elements which helps to characterize the maximization problem, and distinguishes it from the yield management approach which has evolved primarily in the context of the airline industry. The taxonomy is thus similar to the yield management approach, but is intended to move beyond the limitations of practices which are specific to one particular industry.

Alternative 2: Market-Segment Profit-Analysis:

Although stopping short of categorically dismissing the utility of yield management techniques, Dunn and Brooks propose that the "market-demand pricing

[17]Bodily and Weatherford, p. 833.

strategy" that is the basis of yield management is ineffective for long-term pricing decisions in "competitive markets".[18] The authors argue that the result of such a strategy is inevitably "deep discounting", which erodes the profit margins of companies employing yield management techniques; such a strategy is thus effective only for the low cost provider.

As an alternative to yield management, the authors propose an approach termed Market-Segment Profit Analysis (MSPA). This approach is heavily reliant on activity-based costing (ABC) to determine the costs incurred to support sales to each market segment; based upon such costs, a company should decide whether it can afford to compete on price, or whether it should consider another strategy. Included in the MSPA analysis is an evaluation of the trade-offs between various pricing alternatives, and the profitability of each alternative given the associated costs of serving demand in a particular segment.

Although, this section is not intended to be an exhaustive overview of the research which has identified the limitations of yield management pricing strategies, the examples cited illustrate i) the problems which have arisen, and ii) some of the alternative frameworks which have evolved from the application of yield management systems in the types of environments identified in Chapter 1

[18]Brooks D. and K. Dunn. "Profit Analysis: Beyond Yield Management." *The Cornell Hotel and Restaurant Administration Quarterly.* November 1990, p. 80

Chapter 4: Company Profiles

4.1 Research Methods and Limitations

Company Selection Criteria

The primary criteria for inclusion of companies in this survey was to represent, to the greatest extent possible, a diversity of industries in which yield management practices have been adopted. A secondary consideration was to choose organizations which had achieved a sufficient threshold of experience with yield management practices and technology, such that they would be able to effectively assess the implications of their experiences with yield management.

Regarding the first criteria, although diversity of industries was sought, the incidence of yield management practices is nevertheless predominant in transportation-related industries. Due to this fact, and due to the results which Ryder System and Sea-Land Services, Inc. have achieved in pioneering yield management practices in their respective industries, both companies were included in the study.

In contrast, radio broadcasting offers both industry diversity, as well as environmental characteristics which fit the text-book requirements for yield management applications. WBOS-FM in Boston is illustrative of the results which have been achieved in this industry, and it too has been a pioneer in its introduction of yield management to the Boston radio broadcasting market.

Finally, although the heavy-truck division of Ford Motor has not progressed to the adoption to *formal* yield management applications, the pricing policies and analyses which they utilize are indicative of the *potential* for yield management

philosophies in the management of manufacturing operations; while some literature has suggested that many manufacturing environments are ripe for the application of yield management[19], little evidence has been provided in practice.

Interview Selection and Methods

Each company included in the study agreed to speak about their experiences and, to the extent possible (given the proprietary nature of specific details) describe their practices. Interviews were conducted with those representatives of each company who were believed to be most familiar with the yield management systems and practices. Interview participants included:

- Ryder: Andy Anderson, *Director of North American Operations,* Steve Dixon, *Director of Pricing and Inventory Management ;*
- Sea-Land: Derek Smith , *Director of Yield Management;*
- Ford: John Fink, *Manager, Competitive Price Assistance;*
- WBOS-FM: Patricia Baker, *General Sales Manager*

Because the companies represented a diversity of operations with varying levels of complexity in their applications of yield management, the interview formats were essentially open-ended. The participants were encouraged to discuss the elements of their experiences which they deemed most significant to their organizations.

Limitations of Research

Due to a lack of strict uniformity in interview formats, the surveys are not intended to be scientific nor exhaustive. Rather they are intended as a means of evaluating the experiences of different organizations in light of the research and

[19]Dyson, Esther. "Airlines Could Teach Manufacturing a Thing or Two." *Computerworld*, May 17, 1993. p. 29.

literature which has been advanced on the topic of yield management - typically as it relates to the airline and hospitality industries. Observations which are qualitatively deemed most robust, or which are found in common for multiple cases will be presented in Chapter 5.

Finally, the trade-off in choosing the individuals most closely associated with the yield management function in each organization is a potential lack of objectivity of these individuals in assessing the strategic importance of yield management practices. The ownership which those responsible for yield management feel for the practices which they have implemented may deviate from the opinions of senior management or other organizational constituencies; this factor must thus be considered in evaluating the assessments of the study participants.

4.2 Case Studies

Case 1: Ryder System , Inc. - Consumer Truck Rental Division

Background

Ryder System, Inc., formed in 1933 as Ryder Truck Rental, is the largest full-service truck leasing and rental company in the U.S., with a nearly 50% market share. The company offers a range of commercial and consumer services through its 4,800 sales offices throughout the U.S. and Canada, and operates a fleet of more than 160,000 vehicles. The consumer truck rental division, which leased a fleet of approximately 31,000 trucks in 1993, holds the second largest share in the market for one-way and local self-move truck rentals behind market leader U-Haul, and accounts for approximately 25% of the parent company's revenues.

Only three years earlier, however, at the end of 1990 the consumer truck rental division was near the completion of a downsizing effort which included a reduction of its consumer rental fleet. The decision to reduce the fleet was made, according to Ryder chairman M. Anthony Burns, "because of lesser demand and extreme price competition."[20] Having briefly surpassed U-Haul in market share in 1987, subsequent years saw Ryder experiencing lower revenues resulting from a declining share of a depressed consumer rental market, and by 1991 the unit was experiencing operating losses.

The eventual return to profitability and a fleet-size in excess of 30,000 vehicles in 1993 was the result of a corporate strategy which was designed to recapture market share, and which hinged on the capabilities provided by the completion of a

[20]Zisser, Melinda. "Ryder's Hopes Ride on the Whims of a Fragile National Economy." South Florida Business Journal. December 31, 1990, p. 13.

5-year project dubbed *Ryder First*. Ryder First, which cost more than $24 million to complete[21], included a network of personal computers linking the offices of all of Ryder's 4,800 independent sales agents with regional host computers and a mainframe at the company's headquarters in Miami. This system also provided the cornerstone for the division's newly developed yield management system.

Yield Management at Ryder

The implementation of yield management at Ryder was completed with the assistance of American Airlines Decision Technologies (AADT), a division of AMR. Although the development of the core system thus benefited from expertise gained in the airline industry, Ryder management stresses that the consumer truck rental industry creates a unique challenge which a yield management system must address. Specifically, rather than simply maximizing revenues by balancing the trade-off between fleet utilization and rental rates, Ryder must also track the movement of its fleet, and attempt to position the right equipment in the right locations at the right time. The task of determining this optimal location of trucks is complicated by continually changing demographic flows, which is the primary factor influencing the relative demand for the myriad combinations of origin and destination locations.

The yield management functions developed at Ryder to address the operational challenges associated with serving the self-move truck rental market include the following elements:

[21]LaPlante, Alice. "Ryder Redefines Business with Tracking System." InfoWorld. April 12, 1993, p.60.

Demand Segmentation: The market for consumer truck rentals can be segmented along a number of dimensions, including distance-moved (long-distance vs. short-haul) and calendar-date (mid-week, week-end, month-end, etc.). Through the use of yield management techniques, Ryder now understands customer behavior patterns much better than it previously did, and the rate structure reflects this knowledge. For example, Ryder has implemented a practice known as "calendarization", under which rates are set for each calendar date rather than for an entire month, to reflect the different behavior characteristics of customers moving at various times of the week and month.

Demand Forecasting: The primary determinants of demand patterns include demographic flows and calendar date (both discussed above), as well as the overall level of economic activity. Under yield management, reservation data "bubbles up" to demand forecasting systems in real time, improving the efficiency of demand forecasting techniques (previously based solely on historical data). Steve Dixon, Ryder's Director of Pricing and Inventory relates that forecasting efficiency has improved from "nothing to the 90th percentile".

Pricing: In addition to the calendarization of rates described above, Ryder establishes rental prices to optimize the position of its vehicles, based upon relative demand for rentals between different origin and destination locations . The primary components influencing pricing decisions include:

- Estimating the *cost* for every travel lane;
- Establishing *profit targets* based primarily on cost of capital requirements;

- Determining the "value" of each location, and biasing the rental rate up or down based upon the *difference between the profit contribution of the origin and destination locations* ;

- Calling the sales offices of competitor firms daily to survey between 5,000 and 7,000 different rental rates, and using extrapolation to estimate several million *competitive rates*. Ryder has become "infinitely better" at tracking rates since the development of yield management.

Implementation of Yield Management

Aside from the technological requirements of implementing Ryder First and the associated yield management systems, Ryder management was also concerned about i) reaction from competitors to Ryder's new rate structure, ii) acceptance and perceived fairness of the new rates by customers, and iii) acceptance of the new practices within the organization.

Competitive Response:

When its yield management system became fully functional in the summer of 1992, Ryder became the first company in the consumer truck rental industry to adopt such practices. Ryder management expressed considerable concern about the response of competitor firms to the resulting changes in its pricing policies.

Prior to Ryder's adoption of yield management, market-leader U-Haul typically served as price-leader for the industry. U-Haul generally changed prices on a monthly basis, and since these rates were not published publicly, other firms attempted to manually track U-Haul's rates and respond accordingly[22].

[22]The consumer truck rental industry is dominated by four large national firms (U-Haul, Ryder, Penske and Budget), in addition to the large number of local and regional competitors.

Because of Ryder's lack of a sophisticated tracking system prior to the implementation of Ryder First, management estimates that there was a 30-45 day lag between U-Haul's introduction of new prices and Ryder's ability to respond. Nevertheless, Ryder attempted to follow U-Haul's lead, and generated price lists monthly which contained roughly 2.5 million rates; however, by the time price lists were mailed to Ryder's sales offices, U-Haul would generally have already introduced a new schedule of rates.

Ryder's decision to abandon a policy of following U-Haul's price leadership was cause for concern because of U-Haul's much larger size (65,000 vehicles) and its motto that they "would not be undersold". Nevertheless, U-Haul has not responded by discounting rates or attempting to match Ryder's prices. Andy Anderson, Ryder's Director of Operations for the Consumer Truck Rental division speculates that the increased complexity of Ryder's rate structure has confused and frustrated U-Haul, and that in response U-Haul seems to have concentrated on pricing to their own needs rather than trying to match Ryder's rates. Thus, the competitive response to Ryder's initiative has been quite favorable.

Customer Reactions:

The other concern for Ryder management regarding the adoption of yield management pricing techniques was the perceived fairness and ultimate acceptance of a more complex rate structure by customers. Once again, Ryder has been pleased by the response.

Anderson feels that the airlines "bore the brunt of having to re-educate consumers", and that Ryder has benefited from this experience.[23] He believes that customers have become "smarter buyers", and when made aware of the alternative rates available under the new structure, many are willing to work within the constraints of the system to obtain an acceptable price and level of service. Indeed, to the extent that the new rate structure tempers demand fluctuations and is able to increase the availability of trucks during times of peak demand (albeit at a premium), some customers actually appear to favor the new arrangement.[24]

Organizational Acceptance:

Ryder management feels strongly that the key to the successful adoption of yield management has been the strong "buy-in" to the concept throughout the organization - from corporate management down to sales agents and dealers. Buy-in from this latter group was critical to the success of yield management for obvious reasons, and management expressed some concern about initial confusion in the field concerning the new practices.

Anderson relates that in addition to becoming technologically sophisticated, his group has also developed "excellent presentation capabilities", and the ability to communicate the benefits of the system to different constituencies within the organization; articulation of the benefits from the system was particularly important in securing the support of the dealers.

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[23]Bryant, Adam. "Travelers' Growing Irritation; Many Prices for One Product." *The New York Times*, January 24, 1994, p. D4.
[24]IBID, p. D4.

Noting that dealers are still able to negotiate rates on an individual basis, Anderson feels that one of the primary benefits of the system for dealers was the ability to become more "clever negotiators". Yield management provides guidelines or parameters for negotiating rates, as well as the ability to suggest alternative rental arrangements to customers; both of these capabilities can be used to maximize vehicle yield and to enhance customer satisfaction with the dealer's services.

Alignment of Yield Management Objectives with Corporate Goals:

Ryder System has articulated the goals of gaining market share in the consumer truck rental division, in part by making technology and automation "signatures" of the services which they provide. However, technological innovations such as Ryder First and yield management are not valuable, in Anderson's opinion, simply as marketing tools. Rather, the value of yield management is derived from its ability to free up human resources by allowing the technology to determine prices, thus allowing management to use their "minds and hands to touch customers". Utilized in this fashion, the objectives of yield management are thus consistent with Ryder's larger goals of enhancing service through the use of technology in its effort to build market share.

Case 2 : Sea-Land Service, Inc.

Background

Sea-Land Service, Inc., a unit of CSX Corporation is a world leader in inter-modal freight transportation and related trade services. The company operates more than 70 container ships and over 160,000 dry cargo containers, and serves more than 80 ports in 70 countries and territories worldwide[25]; in 1991, Sea-Land's three divisions (Pacific, Atlantic/Middle East, Americas) accounted for a 6 percent share of worldwide container shipping traffic.[26]

Despite steady growth in containerized cargo volumes, Sea-Land and other shipping concerns have had difficulties remaining profitable in recent years. The combination of escalating costs, depressed shipping rates (due primarily to overcapacity), and the large capital investments required for asset replacement have contributed to the industry's financial difficulties. The response of the industry has been to voluntarily restrict capacity and establish collective pricing mechanisms through conference agreements established by firms operating on common routes (e.g. Trans-Atlantic Agreement, Transpacific Stabilization Agreement). While these agreements have served to temporarily boost rates in many cases, long-term profitability has continued to elude most carriers.

Under pressure from its parent company to earn its cost of capital (about 12.5% after taxes)[27], and limited by conference agreements to aggressively pursue new business by discounting rates, Sea-Land began exploring the possibility of realizing operating efficiencies and improving profitability through the use of yield

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[25]PR Newswire, March 22, 1991.

[26]Containerized shipping accounts for approximately 52 percent of general cargo transportation, and this level is expected to increase to a maximum of 70 percent - generally believed to be the maximum amount of cargo that is suited for containerization.

[27]Canna, Elizabeth, "Cut Costs," *American Shipper*, September 1992, p. 43.

management techniques. In 1989, John Clancey (then Pacific Division Vice President, and now President and CEO of Sea-Land) initiated a pilot program to evaluate the viability of yield management techniques in the division's refrigerated cargo shipping operations. To support the yield management functions, Sea-Land and Decision Focus , Inc. (DFI) began developing the component subsystems of the Dynamic Yield Management System (DYM$), a computerized system which analyzes vessel deployments, cargo flows and routes, and demand forecasts and margin costs.[28]

Yield Management at Sea-Land

Sea-Land management describes yield management as a decision-making process which improves profitability by "looking at the big picture". The essence of yield maximization under this approach consists of:

- *Optimizing equipment deployment:* Imbalances in equipment deployment and allocation result in the shipment of sub-optimal cargo loads and frequently the movement of empty containers, and represents perhaps the largest source of operational inefficiencies in the industry.[29]

- *Determining the profit-maximizing cargo mix:* Each type of cargo has different revenue implications due to varying equipment requirements, wide ranging variable costs and routing alternatives.

Derek Smith, Director of Yield Management at Sea-Land distills the optimization problem into two questions: *"What segments should we serve?"* ; and, *"To what ex-*

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[28]"DYM$", CSX Internal Publication, 1994, p. 6.

[29] A report by Drewry Shipping Consultants Ltd. of London estimated that 18% of container moves worldwide involve empties, at an annual cost in excess of $3.5 billion annually.

tent can we be imbalanced and still be profitable?" The process of answering these questions with yield management and DYM$ at Sea-Land consists of the integration of numerous activities, including:

Forecasting: Through DYM$, Sea-Land is attempting to integrate the wide range of logistical and financial forecasts which were previously developed independently throughout the organization. The resulting process consists of *short-term forecasts*, which are used to drive short-term allocation decisions (e.g. how much capacity of particular ships and equipment types to allocate to each sales office); and *intermediate-term forecasts*, which are used to feed DYM$ to test the effects of market changes and to develop optimization plans.

Equipment Planning: Sea-Land aggregates its different types of equipment into eight classes, and attempts to develop a "coherent plan" for each type of equipment. This process is limited, however, by the fact that within these eight classes, each vessel and piece of equipment frequently possesses unique features (e.g. cargo profile, capacity, etc.), which complicates optimization decisions.

Cost Analysis: Sea-Land utilizes an activity-based costing system to perform a "cycle-flow" analysis to determine the cost of each shipping lane, and feeds this information to an Alternate Routing System within DYM$. In addition, the wide-ranging variable costs associated with different origin and destination combinations (O/D) and different types of cargo must be considered. The factors driving these variable costs include inter-modal or inland transport requirements for O/D combinations, equipment requirements for different cargo types, and brokerage commissions when applicable. A Margin System which existed prior to the adoption of yield management has been integrated into DYM$, to help an-

alyze the different revenue and cost implications associated with the endless combination of cargo types and routing requirements.

Vessel Network and Routing: Because of the essentially infinite O/D combinations involved in point-to-point transportation, Smith stressed that it is impossible to optimize operations on a point-to-point basis. Instead, Sea-Land has developed a hub configuration utilized by its Alternate Routing and Vessel Network Systems.

Implementation of Yield Management

As noted earlier, yield management at Sea Land began in 1989 with a pilot program in its Pacific Division, designed specifically to improve utilization of its refrigerated cargo equipment (a capacity constrained operation, and typically Sea-Land's most profitable business). By 1992, the subsystems which comprise DYM$ were in place, and Sea-Land began testing the newly developed practices, including the development of model cargo flows, identification of unmet cargo demands, and the ranking of refrigerated cargo by profitability .

In the first nine months of 1993, the division realized "impressive earnings improvements" attributable to the new system. Achievements included a 15% improvement in equipment turnaround times which allowed the division to carry 14,000 more cargo loads leading to the improved earnings.[30]

Following the success of the Pacific Division, Sea-Land began the process of implementing similar practices in its other two divisions. The yield management effort has been guided in each division by Smith and the corporate Yield

[30]"DYM$", p. 7.

Management Implementation Team (YMIT), although ownership of the new systems has been vested in divisional managers who have been assigned the dual responsibility for logistics management and yield management. Smith stressed that there has been no "blueprint" for implementing the systems, although he notes that there has been significant organizational learning which has benefited each successive implementation.

This learning is evidenced by the accelerated rates of implementation across the divisions. In each case, DYM$ has been used to prepare quarterly optimizations to guide a division's operational decision-making. Initially, *retrospective optimizations* are prepared to assess a division's quarterly performance relative to the performance of the DYM$ optimization decisions. Once the division has refined and accepted the retrospective optimizations, it begins to utilize DYM$ to prepare *prospective optimizations* consisting of three one-month optimizations, used to guide planning for the approaching quarter. The time required to progress from initial implementation to the development of the first prospective optimization has collapsed from three years (in the case of the Pacific Division) to a few months (in the Atlantic/Middle East division, which is currently in the process of preparing its first prospective optimization for the 3rd quarter of 1994).

The final step in the adoption of yield management at Sea-Land is the development of "Global DYM$", which is being lead by Smith and the corporate Yield Management group. As described above, DYM$ has been implemented on a divisional basis, with optimization decisions made strictly within each division. The goal of Global DYM$ is to eventually produce optimization plans *across divisions* and shipping theaters, taking into consideration the linkages between the operations of different divisions and the resulting global deployment of re-

sources. Smith feels that this type of global perspective is critical to Sea-Land's long-term success, as it strives to meet the needs of its customers which are increasingly driven by global sourcing practices.

Challenges and Limitations of Yield Management at Sea Land

Organizational Challenges:

The implementation of yield management at Sea-Land represents the involvement of more decision-makers in an integrated optimization process through the use of "the two T's" : teamwork and technology. According to Smith, the easy part of this process has been the technology; the more challenging task has been determining how to involve people in the process and how to get them to buy in to the new system. Smith stressed the importance of creating "systems of value" to people in order to gain acceptance and enthusiasm for the system, and the need to properly define roles. To address these challenges, the implementations of DYM$ at the divisional level and now on a global scale have stressed teamwork, and the use of multi-functional steering committees. Ultimately, these activities define the larger task facing Sea-Land of defining "how we make decisions as a company."

Environmental Constraints:

As described above, the yield management system embodied in DYM$ does not contain an explicit pricing function. Although the system may enable yield maximization by optimizing cargo mix, equipment utilization and routing alternatives, the operating environment in the ocean shipping industry precludes Sea-Land from explicitly using shipping rates to influence revenues.

Although rate adjustments are allowed under most conference agreements, because all rates are published in a tariff schedule, the consequences of stimulating demand through pricing would likely be severe. Smith described the relationship between shippers and shipping companies as essentially a zero-sum arrangement, in which any attempt to attract additional business from a competitor through rate reductions would result in a retaliatory competitive response. Additionally, relationships with existing customers would be jeopardized if other customers (particularly competitors) were granted more favorable rates.

Even in the absence of these external constraints, Smith indicated that using yield management techniques to focus on pricing decisions is still a dangerous practice. By focusing on pricing as a primary mechanism to maximize revenues, he feels that managers are lead to make decisions which ultimately jeopardize the company's revenue base. As the implementation of DYM$ illustrates, Sea-Land's management feels that the ultimate value of yield management is in its ability to integrate all aspects of the enterprise's operations in defining global optimization decisions.

Case 3 : Ford Motor Company - Heavy Truck Division

Background

The Ford Motor Company has historically held between 9 to 12 percent of the market for heavy trucks, which consists of vehicles weighing more than eight tons (categorized as Class 6, Class 7 and Class 8)[31]. Class 8 trucks are the largest of the vehicles which Ford produces at its Kentucky Truck plant in Louisville (which also produces medium-trucks), and represent over 90% of the units produced by the division; these trucks range in price from $60,000 - 130,000 depending on the combination of options and trim which are included.

In January 1994, the Kentucky plant averaged a backlog of 12 to 14 weeks for medium- and heavy-truck orders, and for some models, the backlog extended to as much as 20 weeks. In an attempt to meet production demands, the plant was working one hour of overtime daily and frequently adding Saturday shifts throughout the second half of 1993.[32]

As recently as 1991, however, the Kentucky plant was being shut down approximately one out of every four weeks because the division could not fill its production line and was thus forced to halt operations.

Such wide fluctuations in demand are illustrative of the sensitivity of the market for heavy-trucks to the level of overall economic activity. Because Ford (the seventh largest competitor in the market for Class 8 trucks) receives such a large percentage of its business from trucking fleet operators (traditionally the most

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[31]Trucks in Class 6 weigh between 16,001 - 19,500 lbs; trucks in Class 7 trucks range from 19,501-31,000 lbs; and trucks in Class 8 exceed 31,000 lbs.

[32]Bohn, Joseph. "Medium-Duty Truck Sales on Upward Climb." *Automotive News*, January 3, 1994, p.28.

conservative buyers), the recessionary effects on its operations were particularly severe.

In an attempt to optimize the performance of the heavy-truck division in this context, the Competitive Price Assistance group has begun to adopt some techniques which resemble yield management. John Fink, manager of this group, concedes, however, that his the division's practices are "light years" behind those of the airlines.

Yield Management in the Heavy Truck Division

The yield management practices which the Competitive Price Assistance group has developed consist primarily of i) analyses used to arrive at manually-intensive, negotiated prices; and ii) retrospective evaluation of performance to encourage revenue maximization through pricing policies. The components of this process include the following:

Published List Price:

Based upon forecast demand, variable production costs and a target contribution margin, the division establishes published list prices for its line of heavy-trucks. Because negotiated concessions and promotions are frequently offered (described below), the published list price is typically a starting point in determining the actual price.

Demand Segmentation and Pricing:

Customers in the heavy-truck market are generally divided into retail and fleet customers, and the pricing practices at Ford are designed to capitalize on the behavior characteristics of these two segments. Dealers typically offer retail cus-

tomers a published list price, but depending upon production needs Ford will occasionally institute incentive programs to stimulate demand in this segment to help fill its production line.

Pricing in the fleet segment embodies significantly different considerations. Fink characterizes this segment as "extremely astute" buyers, and indicates that relationships are an important consideration in fleet negotiations. Dealers provide the specifications for fleet bids, and the Competitive Price Assistance group evaluates the bid based upon production needs, share targets, customer relationships, and customer prestige[33]; the result is a bid which is inevitably below the published list price.

Retrospective Evaluation:

The Competitive Price Assistance group produces reports weekly, monthly and quarterly to evaluate the division's performance in discounting and negotiating bids to maximize revenue opportunities. These reports track *external measures*, such as share of industry order receipts and share of industry sales revenues vs. target shares; and *internal measures*, such as percentage of bids won, average profit margin and average discount off list. Detailed analyses by product line is also performed.

Limitations of Yield Management

The attempts by the Competitive Price Assistance group to maximize revenues by balancing the trade-off between i) pricing and ii) capacity on Ford's heavy truck production line resembles yield management on certain dimensions; how-

[33]Fink cited certain customers (such as Steelcase) who provide value by their ability to "showcase" fleet trucks. Manufacturers are often willing to lose money on the most prestigious customers as a result.

ever, the degree to which manual processes and negotiations predominate the decision making process clearly indicate that the division's practices do not fully utilize the optimization capabilities of pure yield management systems. Some of the factors which limit the Heavy Truck Division from further utilizing prospective optimization techniques include the following:

Buyer Influence:

Years of over-capacity in the heavy-truck industry have created an enduring legacy of a "buyer's market" in Fink's estimation, particularly for large fleet customers. As evidence, he points to the relative stability of prices in recent years despite an industry-wide production back-log. Although Ford currently has an average 12- to 14-week backlog on its medium and heavy-truck orders, it has been unable to raise its prices significantly.[34]

Ford's necessity to completely fill out its heavy-truck production line provides substantial leverage to the fleet buyers which contribute significantly to the division's heavy-truck sales. Because of the cyclicality of heavy-truck sales, Fink estimates that the industry will again experience over-capacity in coming years; thus, attempts to extract maximum revenues from large customers now may damage Ford's ability to meet its production needs in times of reduced demand.

Multiplier Effects:

Ultimately, the profitability of Ford's heavy-truck division is derived not from the sales of its trucks, but from the sale of parts for these trucks. This situation results from the higher margins commanded for and less-cyclical demand of its truck parts. As a consequence, optimization decisions which establish heavy-

[34]Bohn, p. 28.

truck prices must be made with this linkage in mind. While a yield management system could certainly include this consideration, the combination of this effect with other complicating factors has lead Ford to limit its adoption of automated yield management techniques.

Case 4: Granum Communications - WBOS FM Radio

Background

WBOS-FM is one of two FM radio stations in the Boston area owned by Granum Communications, Inc. of New York. With an "album-oriented" music format, WBOS ranked among the top-ten rated stations in the Boston market in 1993. Like many radio broadcasters in the region, WBOS has benefited from brisk demand for radio advertising spots in the past year, and its inventory of ten advertising segments per hour has consistently been sold-out five weeks in advance.

Although an over-sold market clearly delivers sales opportunities for broadcasters, it also highlights an important challenge facing sales managers. Specifically, *how far in advance should advertising spot inventory be sold out, and at what price?*

Although much of the industry remains bound by a "cost-per-point" mentality which ties advertising rates to rating points, this arrangement clearly does not represent a revenue maximization opportunity for broadcasters. As a result, broadcasters are increasingly moving away from static rates cards[35] to the adoption of dynamic "mega rate" electronically generated rate cards, which operate on the principles of yield management.[36]

In late 1992, when Patricia Baker joined WBOS as General Sales Manager, parent Granum Communications announced that she would be responsible for imple-

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[35]Although there are many variations, rate cards (also called grid cards) typically refer to matrices which price inventory based on day, daypart, advertising frequency, date of purchase and other factors which are included in pricing decisions.

[36]Mega Rates was a study commissioned by the National Association of Broadcaster (NAB) in 1986 to determine how broadcasters could sell a maximum number of spots at optimal prices.

menting a yield management system using ProRate, a software product of Radio Computing Services (RCS), to guide the efforts of her seven-member sales team.

Baker initially resisted the adoption of ProRate and yield management techniques, on the grounds that a computer system could not outperform her eighteen years of experience in radio advertising sales. Today, however, she extols the benefits of yield management as a valuable tool which enhances her management of sales at WBOS. Although her inventory is currently in a sold-out position, Baker emphasized that without ProRate, she would have been sold out "much earlier" - and clearly with lower revenues.

Yield Management at WBOS

The elements of the yield management system at WBOS which are used to guide advertising sales decisions for Baker and her sales team include the following functions:

Demand Forecasting:

The behavior of advertisers which is of interest to sales management includes purchasing patterns for programs, dayparts and demographics, as well as customer booking patterns (i.e. how far in advance advertisers book orders). With a minimum of 4-6 weeks of historical sales information, ProRate can forecast demand for each day and daypart up to 53 weeks in advance.

Inventory Management:

ProRate produces a Daily Rate Card which reports on the current amount of available segments remaining ("avails") and the sell-out percentage, which is used by sales management to decide whether to sell particular spots at discounts

or to hold the inventory for future buyers willing to pay premium prices. A "bottom-line" rate is supplied for each daypart to guide the negotiations of salespeople.

Pricing:

As noted above, the Daily Rate Card is based upon demand forecasts and inventory availability, and provides WBOS's sales team with "clear and defined limits" in their negotiations of advertising rates. The prices in the system are based upon a Master Rate structure which is determined by Baker, and is adjusted based on the following considerations:

- *Competitive Prices*: Baker noted that the top two or three stations in the region dictate prices for the market based upon the rates that they set. While not explicitly bound by a cost-per-point schedule, WBOS's Master Rate structure must yield an average cost-per-point which is "in line" with the rates prevailing in the market.

- *Seasonality*: Although Baker notes that seasonal fluctuations in demand have been somewhat mitigated in recent years, there are still identifiable trends which affect WBOS's rate structure. For example, whereas the first quarter has traditionally been a period of slow demand, the cycle has been shortened such that the month of January is now the slow period; broadcasters typically adjust their rate schedules downward for this month.

<u>Benefits and Limitations of Yield Management at WBOS</u>

Customer Response:

Because advertisers were already accustomed to the relatively complex rate structure embodied by rate cards, WBOS's adoption of yield management and daily rate cards did not represent a dramatic change in rates as perceived by customers. However, Baker explained that her sales team nevertheless undertook

the initiative to educate advertisers about the dynamics of yield management pricing, citing the following reasons:

- *to help customers achieve the desired level of service* by understanding how to package segments, and how far in advance to book spots; and

- *to gain leverage over customers in negotiations*, by intimating that the "computer" generates advertising rates, and thus the ability to negotiate lower rates is "out of my hands". This practice has been effective presumably because of WBOS's position as a top-tier station in a capacity constrained market for advertising spots, and would be less useful when attempting to stimulate demand during slower periods.

Competitive Response:

Although WBOS feels that the adoption of yield management pricing techniques have helped to enhance their revenue opportunities, the station remains (in Baker's estimation) as one of the only broadcasters in the market to utilize such a system. The implication of this condition is that WBOS is still constrained in its efforts by the top-rated stations which act as price setters for the market. When these stations set their rates too low for given demand conditions, the ability of all other broadcasters to deviate from comparable cost-per-point rate structures is drastically limited. If all broadcasters were to adopt yield management systems to determine advertising rates, Baker feels that all stations in the market would benefit.

Chapter 5: Observations and Managerial Implications

As indicated in the discussion of research methods in Chapter 4, the company profiles offered in this paper are not designed to yield any exhaustive conclusions, but are rather intended to promote a discussion of the theoretical extensions of yield management practices in different industry settings. This chapter summarizes the observations gleaned from the four case studies for the purpose of i) suggesting further directions for research on the application of yield management, and ii) to broaden the traditional view of yield management by management, thereby broadening the appeal of the practice for more diverse industries.

Observation: Pre-existing pricing practices and market structure limit the ability of firms to fully utilize yield management pricing techniques.

The ability of Ryder, WBOS and Sea-Land to maximize yield by modifying their price structures varied considerably, due in large part to structural constraints imposed by pre-existing pricing practices.

In both the consumer truck rental market and the Boston radio broadcasting market, prices were effectively dictated by one or more dominant market leaders; however, Ryder has used yield management techniques to extricate itself from the role of price-taker, while WBOS has been limited in its ability to do the same. This difference may be explained by the fact that the truck rental market already had a complex rate structure, which consisted of several million rate combinations for widely differentiated services (based upon O/D combinations, calendar date, etc.); radio-broadcasting, in contrast, utilized a less complex grid structure

and an underlying cost-per-point metric which could be used to easily compare rates for different segments and across broadcasters.

As a result, Ryder's change in its price structure was less apparent to customers, and was immensely difficult for competitors to respond to (the number of prices in Ryder's rate system increased from roughly 2.5 million to more than 100 million); consequently, Ryder has effectively discontinued its practice of following U-Haul's pricing lead, and can seek instead to maximize vehicle yield by optimizing its pricing structure.

Conversely, WBOS remains constrained by pricing decisions of the market leaders (although it can now maximize its revenue potential subject to this constraint). Nevertheless, when the top-rated broadcasters set their rate schedules too low for given demand conditions (as often occurs, in WBOS General Sales Manager Baker's opinion), WBOS must adjust its Master Schedule downward, which mitigates the full potential of yield management pricing optimizations.

An interesting result of this condition is the consequence that Ryder has benefited from being the only firm in its industry to adopt yield management pricing techniques, while WBOS is constrained by the failure of its competitors to adopt such practices.

Finally, as described earlier, Sea-Land is essentially precluded from using yield management based pricing decisions, since conference agreements effectively determine prices, and all shipping rates are published in tariff schedules. This practice is analogous to an extreme case of price-leadership (by a conference,

rather than by a single dominant firm), with an explicit vehicle for monitoring rates across firms.

Observation: Buyer influence is a limiting factor in the ability of a firm to utilize yield management pricing decisions.

Two of the cases - Ford's Heavy Truck division and Sea-Land Service - were illustrative of relationships in which buyers wielded significant influence, and this advantage appears to have diminished the ability of Ford and Sea-Land to effectively utilize the pricing component of yield management techniques.

In the heavy truck market, a disproportionately large portion of Ford's business was derived from fleet owners, who derived power from i) the large amount of sales which they contributed to Ford's production line, and ii) the ability to delay fleet-replacement decisions. These factors differentiated the fleet segment from retail customers not simply in terms of price-elasticities, but in more substantive behavior characteristics which affected the relationship between supplier and buyer. The result is the perceived necessity to negotiate all fleet bids based upon these relationships rather than determining prices based upon discrete optimization functions.

Sea-Land faces similar challenges from the portion of its business which is derived from large, influential shippers. The power of these buyers is derived from an absence of significant switching costs in point-to-point transportation, and perfect knowledge of price structures through published tariff schedules. Based upon these constraints, Sea-Land is not able to effectively optimize rates for these customers, but instead has to rely upon service provisions and customer relationships in attracting such business. With shipping rates essentially

established by conferences, Sea-Land ultimately attempts to maximize yield by choosing which segments to serve in order to obtain optimal cargo mixes.

Observation: The presence of multi-phase services complicates yield maximization decisions substantially; this encourages the adoption of yield management techniques.

Literature on the topic of yield management cites the existence of multiple phases of service as a potentially complicating factor in implementing yield management practices[37] (examples include multiple night stays in a hotel or multiple legs on a flight). While these considerations create complex optimization decisions under any pricing schematic, two of the cases profiled in this study indicate that this complexity is not a barrier to the implementation of yield management, but rather encourages an enterprise to consider such techniques. Yield management systems may be designed to account for such interactions in services, and to optimize decisions subject to these constraints.

Both Ryder and Sea-Land provide examples in which there exist strong temporal linkages between phases of service provided. That is, the services provided today have direct implications for the deployment of assets, and the ability to provide similar services in the future. Ryder has integrated this constraint into its optimization decisions by assigning a profit contribution value to each O/D point, and using the spread between the O/D combination to establish a rental rate. Similarly, Sea-Land's DYM$ includes Alternate Routing and Vessel Network Systems to optimize cargo planning and equipment deployment for an infinite set of point-to-point O/D combinations.

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[37]Carmel and Chapman, p. 46.

In both of these cases, yield management provides the capabilities to consider the implications of multiple phases of service in operational decisions, which less integrated decision making frameworks are incapable of doing.

Observation: Information technology is a critical element of a yield management system, but it is typically not the biggest challenge of the implementation.

In the three cases in which yield management systems were effectively implemented, an information technology infrastructure was prerequisite to the adoption of the attendant techniques. However, these cases represent an interesting contrast in the level of effort which was needed to attain the required technological threshold. For example, a "turn-key" solution is available to WBOS-FM and all other radio broadcasters with only a modest investment and limited hardware requirements (personal computers). In comparison, Ryder System embarked on an aggressive 5-year project of deploying a vast communications network and developing the component subsystems to support a yield management system. Finally, Sea-Land was able to integrate many of their previously "stand-alone" systems into a comprehensive decision-support system, although significant time and resources were required to develop complementary subsystems.

Representatives from each company indicated, however, that the development of the IT infrastructure was not the most challenging aspect of the implementation. Although a significant investment was required in at least two of the cases, the expertise embodied in the services of firms such as AADT and DFI provide the expertise (gained typically in the airline and hospitality industries) for developing the core technology and optimization models.

The more challenging aspect of adopting yield management articulated by these companies was gaining acceptance for the new practices throughout the organization, and ultimately changing the way a company makes decisions. The efforts of Ryder management in "selling" the concept to the network of dealers as well as to upper-management was a critical success factor in the division's ability to fundamentally change the way it conducted business. Similarly, the emphasis of Sea-Land's corporate Yield Management group on promoting a team approach to implementation, and its view of yield management as an integrated, global perspective for decision making has effectively guided the company in embracing the new processes, which has been characterized by a significant amount of organizational learning. This learning will be further challenged as the company moves to the final phase of its undertaking - Global DYM$.

Conclusion

Much of the literature on the topic of yield management, particularly as it relates to pricing decisions, has focused on i) the structural requirements which must exist to implement yield management systems, ii) technical discussions of optimization models and techniques, and the iii) complicating factors and limitations of utilizing yield management. However, as decision-support technologies improve, the optimization techniques no longer present a barrier to the adoption of yield management techniques by even the most complex operations (as the Sea-Land case illustrates). Similarly, as both customers and service providers become more familiar with the pricing structures which result from yield management optimization techniques, the process of overcoming resistance to these structures (and the perception of unfair price discrimination) is becoming more manageable.

Ultimately, if practitioners come to view yield management more as an adaptive, integrative process of decision-making and as a tool to promote other strategic objectives, the component techniques of yield management may be more applicable to a wide range of industries. The four cases profiled in this study represent four different definitions of yield management, and widely varying degrees to which the techniques have been engrained in each company's decision-making process.

Sea-Land's Director of Yield Management Derek Smith offers advice on how to *fail* with yield management techniques: stick the yield management responsibility in the marketing department, and let that group attempt to use the techniques to maximize revenues. This prediction dictates that companies considering the adoption of yield management should not view the practice with the myopic definitions which are often advanced, but rather consider yield management more broadly, as companies such as Sea-Land Services and Ryder System have. Such a broad perspective will likely lead more companies to consider adopting yield management systems, and will help to extend the boundaries typically attributed to the use of such techniques.

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