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USING LIFE-CYCLE COSTING AND THE STRATEGIC PROFIT MODEL TO ENHANCE MOTOR CARRIER CAPITAL EQUIPMENT MANAGEMENT

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ABSTRACT

Participants in the increasingly competitive motor carrier industry are constantly trying to identify ways to enhance customer service levels and/or reduce costs. This research summarized case-based data from three large carriers to examine the use of life-cycle costing as a method to enhance motor carrier equipment management. The financial results of applying the technique are then examined by applying the Strategic Profit Model.

INTRODUCTION AND BACKGROUND

Over the last twenty years, the environment of the U.S. motor carrier industry has changed dramatically (Feitler, Corsi, and Grimm, 1997). Deregulation has been a troublesome event for many in the motor carrier industry as noted by an increase in the number of bankruptcies since deregulation was officially enacted in 1980 (Corsi, Grimm, Smith, and Smith, 1991; Feitler, Corsi, and Grimm, 1998). The free marketplace increased intramodal competition and placed downward pressure on prices, increasing failure rates and changing the strategic focus of many carriers (Silverman, Nickerson, and Freeman, 1997). Couple this with industry consolidation, rising insurance costs, driver turnover, large fluctuations in fuel prices, and a less than robust economy, and carriers are faced with a very difficult operating environment (Ellinger, Lynch and Hansen, 2003; Mejza, Barnard, Corsi, and Keane 2003).

Clearly the large company segment of the industry is under pressure. At the same time shippers are reducing supply bases and asking their remaining logistics providers for higher service levels at competitive prices. Studies confirm that carriers are increasing the variety of services they offer and are attempting to enhance service quality in order to either gain a competitive advantage or merely survive (Crum and Allen 1991; Stock 1988). In part, carriers are making major adjustments to their strategic orientation to counteract the impact the rapid growth of "integrated logistics service providers" has had on the marketplace.

While many motor carriers have made major adjustments to remain competitive in the challenging market environment (Corsi, Grimm, Smith, and Smith, 1991), one area where many continue to struggle is with the acquisition of new equipment. Asset based trucking companies depend on their tractors and trailers to move the freight that generates their revenue. Therefore, it is critical that these companies manage the acquisition, maintenance, and disposition of the equipment in an optimal manner. The entire life-cycle of the equipment must be managed in a way that maximizes reliability and minimizes cost. However, the effective management of capital assets has proven to be a difficult task for many in the highly competitive motor carriage industry.

One approach with promise as a tool designed to aid carriers in the effective management of capital equipment is life-cycle costing. Life-cycle costing is an analytical system that examines how much it actually costs an organization to acquire, use, maintain, and dispose of an asset over its lifetime (Ellram and Siferd, 1993). This method of cost analysis tends to focus primarily on capital or fixed assets (Fernandez, 1990; Jackson and Ostrom, 1980).

PURPOSE OF THE RESEARCH

Motor carriers can range from a one truck operation to an international corporation with thousands of tractors and drivers and millions of dollars tied up in assets. Furthermore, carriers operate in a wide range of diverse markets. However, all asset-based carriers have one challenge in common, how to best acquire and utilize their equipment. Therefore, the purpose of this article is to identify opportunities for motor carriers to improve their competitive position through better life-cycle management.

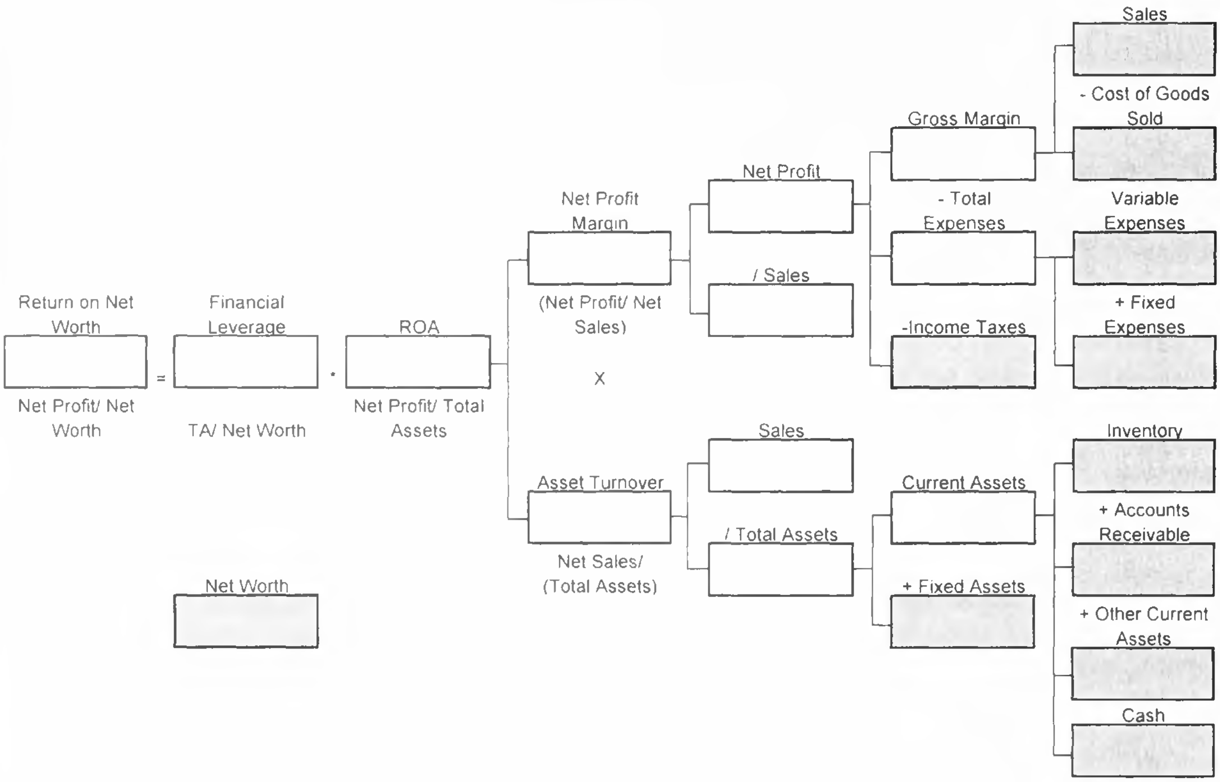
Data collected from public sources and personal interviews are analyzed to postulate strategies for improved carrier asset management. The first section provides information on study participants, research methodology, and introduces the strategic profit model. This model is used to provide support for the four strategies introduced in the research. Section two describes life-cycle management in general terms and how its concepts can be applied to managing equipment acquisitions. The third section addresses how asset assignment based on work configurations can impact the maintenance program and improve carrier performance and profitability. The last section provides managerial implications, strategies for carrier improvement under different work load scenarios, and suggestions for future research.

RESEARCH METHODOLOGY

The goal of every firm is to succeed. One component of success is to measure increases in shareholder value. A specific way to measure that increase (or decrease) is to calculate the return on net worth (RONW). Managers at DuPont Corporation created the DuPont chart to help them understand how changes in operations impact shareholder value (Shapiro and Kirpalani, 1984). Subsequent research (Lambert and Stock 1993, 2000) formalized the DuPont chart and introduced the strategic profit model (Figure 1). The strategic profit model shows how return on net worth is a function of three factors that can be controlled by management. These three factors are net profit, asset turnover, and financial leverage.

The strategic profit model uses net profit (sales-expenses) as a measure of how efficiently a firm

FIGURE 1
STRATEGIC PROFIT MODEL



Source: Lambert and Stock (2000), pp. 32-37.

manufactures and sells its products. Asset turnover (sales/total assets) is used as a measure of how efficiently a firm employs its assets. Financial leverage (net worth/total assets) is used as a measure of how effectively management uses outside sources of financing to increase the firm's RONW.

The strategic profit model employs a ratio analysis methodology to determine the return on assets (ROA) and RONW. The model employs two main equations:

ROA = Profit Margin x Asset Turnover (1)

RONW = ROA x Equity Muliplier =
Profit Margin x Asset Turnover x
Equity Multiplier (2)

Sample Firms

This research focused on three large, U.S.-based, cross country, full truckload carriers. The analysis includes: 1) case based observations from three major U.S. Truckload carriers: Swift, J.B. Hunt, and Schneider National, Inc. and 2) a financial based analysis of one of the carriers to illustrate the effectiveness of the methods suggested by the researchers.

The current research takes case-based interview and publicly available data and employs different life cycle costing strategies to the management of maintenance costs. Four strategies for improving maintenance procedures are presented based on a content analysis of the interviews and other information collected from the carriers. The impact of different strategies is then examined by using the strategic profit model to analyze the cost data of one firm in the sample.

Both Swift and J.B. Hunt are publicly held carriers who were selected in part because of the availability of financial and non-financial information. Schneider National was selected based on the research team's intimate knowledge of Schneider National and that Schneider is a privately held firm. The sample allows the researchers to do a case analysis of two publicly traded truckload carriers and one privately held corporation.

Throughout the presentation of the case study results, four strategies for enhanced management of maintenance costs are postulated. Then, the financial details of Swift are entered into the strategic profit model to illustrate the impact of strategic changes on the firms' ROA and RONW. By entering data into a spreadsheet built around the concepts of the strategic profit model, what-if analysis can be done quickly and effectively. The results can be used to help management shape a firm's strategic direction and highlight the possibilities for improvement from applying life-cycle techniques to a carrier's fleet.

EQUIPMENT LIFE-CYCLE MANAGEMENT

Due to low barriers to entry and limited variation in service in the motor carrier industry, it is absolutely critical for carriers to be able to differentiate themselves in terms of price and service levels. Most cross country full truckload carriers operate on small margins. Therefore, they are naturally very cost conscious. However, many carriers often make cost decisions on a very tactical level without considering the overall life-cycle implications. Furthermore, different areas or even different departments have control over different stages of the life cycle, creating a fragmented approach when applying life-cycle cost analysis techniques to capital assets. The different departments often have conflicting priorities, especially if they operate from independent budgets. In some organizations, some departments are even viewed as their own entity and treated as a profit or cost center. This can require a departmental manager to focus more on cost or profit generated by their segment as opposed to examining the decision from the holistic view of what is best for the overall operation. For example, if maintenance costs are allocated equally across accounts, there is little incentive to practice preventive maintenance. As a result, life-cycle cost management needs to be a strategic approach ingrained throughout the organization by soliciting cross functional input.

The life cycle of a piece of equipment includes its purchase, operation, maintenance, and disposal (Ellram and Siferd, 1998). The purchase is the process of initial acquisition of the asset. Operation costs are those associated with the continued operation of the asset such as fuel. Operation costs can vary based on the work configuration with which the asset is assigned (e.g., solo vs. team driver configurations). Work configuration assignment and its impact on costs will be discussed in greater detail during the analysis section. Maintenance includes warranty, preventive, unplanned, and emergency maintenance. Disposal can include selling to a third party, returning the asset as part of a buy back program or scrapping the asset. Each of these steps presents challenges and opportunities for the carrier to reduce cost and improve service levels.

EQUIPMENT LIFE CYCLE: THE INITIAL STAGE

Equipment purchasing is an important and complicated decision. New equipment can be purchased to replace old equipment or to expand capacity. This type of purchasing decision is often made at the highest levels of the organization. For example, at least one of the carriers in this study has created an "asset team" of senior vice presidents to determine their purchasing strategy. The purchasing team considers price, quality, expected life, after sale service, maintenance, driver needs, and buy back opportunities when making purchasing decisions.

During the economic boom of the 1990's, trucking firms were locked in fierce competition for drivers (Keller, 2002). At the same time, the demand on trucking was growing with the expanding economy. Increased demands were placed on drivers, creating a demanding work environment which led many drivers to leave the industry for jobs with a different lifestyle. As a result, driver comfort became an increasingly important part of the asset specification process. Based upon discussions with individuals involved with purchasing strategy, one of the main reasons many carriers converted from less expensive Cab-Over-Engine (flat front trucks) to the long nosed conventional tractors was driver preference.

Purchasing assets based upon enhanced driver comfort meant more "creature comforts" in the cab, yielding a more complicated electrical system, and increased maintenance costs. Furthermore, in many cases, the purchase of new tractors requires mechanics to learn the maintenance procedures for a fleet built by an unfamiliar manufacturer. Clearly the strategy used by many carriers was not one of cost minimization but rather one of enhanced driver comfort to improve driver retention rates.

When selecting a supplier, large fleets also need to identify a manufacturer that can supply them with large equipment orders. Large fleets want to use their economies of scale and volume buying power to lower the price per unit. Large carriers seek to find truck manufacturers that can handle large orders of aesthetically pleasing, comfortable tractors, which include a strong warranty program, and a used tractor buy back plan.

Because purchasing is often an executive level decision, front line and mid level managers do not always have a lot of impact on the buying decision. However, once the purchasing decision is made, they have to analyze the entire life cycle of the asset and predict the potential short and long term impacts on their functional area. For example, managers must determine training needs as new and/or improved equipment is introduced. The training may include technical changes as well as warranty filing processes and altering maintenance scheduling and capacity levels. A vital part of the life cycle analysis performed by the managers of each functional unit is the maintenance costs associated with the asset and how those costs impact their functional unit.

Life Cycle-Management: Maintenance

Maintenance considerations play a large role in operations planning in part because maintenance costs make up a large percentage of total life cycle costs. In addition to the actual cost of repairing the equipment, there are opportunity costs whenever equipment is in maintenance. These costs include the impact on service, the under-utilization of the driver while waiting for maintenance, and the under-utilization of the equipment itself.

According to carrier representatives, the key is to minimize both maintenance dollars spent and the opportunity cost. Carriers, typically place maintenance events into one of three categories: planned, unplanned, and emergency. Planned maintenance includes scheduled inspections and preventive maintenance (e.g., changing the oil and filter). Unplanned maintenance occurs when a driver takes equipment to a shop in between scheduled maintenance but not when it will immediately affect service (e.g., getting the air conditioning fixed between loads). Emergency maintenance is categorized as a breakdown that threatens the successful on time delivery or scheduled pickup of a load (e.g., engine failure).

On average, planned maintenance is the lowest cost form of service because it can be scheduled and is predictable. Conversely, emergency maintenance tends to be the highest cost service effort because it is not scheduled and often requires overtime, emergency service, or expedited parts delivery. According to maintenance professionals interviewed, emergency maintenance is approximately three times as expensive as planned maintenance procedures.

A good maintenance program extends the life of the asset by conducting effective preventive maintenance. When there are unplanned or emergency breakdowns, maintenance determines the best value repair to maintain the highest level of revenue generation for each transportation asset. Maintenance planners must also make a decision as to whether the maintenance will be done internally or outsourced to a third party maintenance provider. These and other decisions contribute heavily to the cost per mile for a carrier and the pricing structure of a carrier.

While maintenance is a very broad subject and a vital component of carrier operations, the focus of this research is on how different work configuration strategies can be used to help optimize revenue generation for a carriers' fleet. While many companies generally do a good job of making maintenance decisions on a case by case basis, many do not focus on controlling the type or frequency of maintenance visits. Most carriers place their equipment in various work configurations to meet the immediate needs of their customers without a thorough knowledge of the impact on the asset or its maintenance requirements. While adhering to customer needs and providing a high level of customer service is essential to carrier success, an underlying maintenance cost minimization strategy could be simultaneously employed to yield a maximum profit level.

Life-Cycle Management: Operations

How a carrier utilizes an asset plays a large role in how costs will accumulate during the asset's life cycle. There are a number of different work configuration strategies a carrier can employ. Different carriers appear to use their own unique variations of the following basic models.

Line haul or system drivers are very common. The driver is dispatched and could travel to any location for any customer. Line haul drivers typically record 2500-3000 miles per week. Since their movements are more or less random, they drive in a number of different weather and terrain conditions.

Team Drivers are line haul drivers. However, there are two drivers which doubles the driving time without violating hours of service regulations. This configuration allows freight to travel very long distances, often coast to coast, in a very short amount of time. This is an ideal work configuration for time sensitive cross country loads. If the team is utilized correctly this can also be the lowest cost model because the carrier can get twice the miles in the same period of time, retaining a high level of asset utilization. From a life-cycle perspective, team drivers put a large number of miles on the tractor so they require different maintenance planning. Additionally, the cost of unplanned and emergency maintenance is much higher because a broken down tractor has two drivers being underutilized.

Dedicated drivers travel to and from the same shipper and consignee location. The weather and terrain conditions are much more predictable. It is also easier to plan maintenance because the location of the asset and the identity of the driver are known. Dedicated drivers often return to their home base at the conclusion of the workday, and no additional costs are incurred for accommodations when the asset requires maintenance.

Local driving is the final common category. Local drivers typically travel in a small radius around their home terminal. Local drivers are often used to shuttle trailers, make "milk runs" to enhance consolidation opportunities, or to serve as a drayage carrier to connect intermodal movements.

Work configuration is important to life-cycle management. Each work configuration places different demands on equipment. As a result, there are considerable opportunities to improve return on assets by closely managing the life cycle of a transportation asset by changing work configurations at predetermined mileage points. There is little evidence that carriers have a focused, cohesive, and systematic effort to enhance maintenance management through work configuration optimization.

Team Driver Assigned Shipments

Under normal circumstances team driving places the greatest strain on the tractor. Teams are often utilized on loads with stringent on-time requirements including Just-In-Time (JIT) logistics shipments. Therefore, a company cannot afford to have a team driven shipment suffer a breakdown. As such, management should consistently place team driven shipments in the most reliable equipment. Teams require living space and comfort features to meet the needs of multiple drivers working together to provide the carrier a significant number of continuous hours of service. These considerations often limit the options a carrier may have when assigning a tractor to a shipment.

Additional considerations must also be examined when using the life-cycle approach. Many manufacturer warranties are based upon age or mileage milestones. The warranty period often ends when either a time period expires or the asset exceeds a predetermined number of miles. Team trucks build up miles roughly twice as fast as a solo truck, greatly reducing the time the tractor is covered under warranty. This can be a costly disadvantage when considering components that are affected more by age than by miles, such as paint, interior components, radios, and some parts of the electrical system.

Retaining truckload line haul drivers has often proven difficult (Stephenson and Fox, 1996). The challenge is particularly apparent when dealing with team driving work configuration assignments designed to maximize continuous hours of service. In fact, turnover rates among all line haul drivers can average 70-80% with some estimates for team drivers as high as 100-300% (Ruriani, 1995).

The financial costs associated with losing drivers and then hiring and training new drivers is considerable. New drivers are also more expensive because their inexperience can lead to more accidents and service failures. However, financial cost is not the only consideration. It is not rare for a driver to simply resign his/her position in route, causing service disruptions and potentially causing a negative impact on customer service levels. Not only is customer service impacted by the specific event, but the event reduces the asset utilization rate and can add to the cost of providing a replacement driver to transport the shipment to its final destination.

Strategy #1. Carriers may wish to assign team drivers a new tractor and upgrade their equipment relatively early in the warranty period. Based upon the three carriers in this study, this strategy would result in an upgrade to a new tractor by team drivers approximately every eight months. Use of this strategy would simultaneously extend the length of time the tractor is under warranty and reduce the time the tractor is in the shop for maintenance. Furthermore, receiving a new tractor every eight months could be used as a good recruiting incentive for team drivers. This is important because team drivers typically carry relatively high profit margin per load items, but tend to be difficult to recruit and retain because of lifestyle issues.

Solo Line Haul Driven Shipments

Solo line haul drivers and their equipment face many of the same conditions as team driven equipment. However, solo line haul equipment incurs fewer miles per week and drivers tend to be somewhat easier to recruit when compared to a team driving configuration assignment.

Based upon the interviews conducted, it appears to be common for a carrier to place their more experienced drivers in newer equipment. This is in spite of the fact that, from the perspective of a maintenance cost strategy, it would make more sense to place seasoned drivers in older equipment. Experienced drivers tend to have more of an appreciation for their equipment, have fewer service emergencies, and are better equipped to handle a breakdown in the most cost effective manner. Solo line haul drivers require reliable and comfortable tractors. They are similar to team drivers except that there is only one driver responsible for delivering the shipment to its destination.

Strategy #2. Solo line haul drivers should receive tractors less than one year old and could include the tractors from which team drivers are upgrading. Unfortunately, most large fleets do not have the luxury of having as many team driven units as solo driven units. Therefore, this strategy would leave some solo line haul drivers without relatively new and reliable replacement equipment.

Dedicated Shipments

Dedicated tractors present a challenge to managers implementing life cycle planning strategies. Given that a dedicated asset is often assigned to a particular customer, the demands placed on the asset can vary greatly. Different dedicated customers have varying service expectations and requirements. To generalize all dedicated accounts into a single configuration model is not possible. Some dedicated accounts require precise on time delivery for Just-In-Time shipments and, therefore, require highly reliable equipment. Other customers are more flexible and have less rigid demands.

Regarding dedicated tractors, the consensus of those interviewed is that the original haul and back haul freight often have different service requirements. For example, a company may move finished product to a customer with Just-in-Time requirements at a premium price, then return with a load of scrap for recycling or send empty packing crates and pallets back to the manufacturer.

Dedicated freight is often considered more desirable by drivers because the drivers on dedicated accounts have consistent schedules and spend less time away from their home base. Therefore, it is easier for the company to assign older, less "comfortable" equipment to these drivers in exchange for the better life style.

Strategy #3. Dedicated account tractor assignments must be made on an account by account basis. The account manager should play a major role in requesting equipment that fulfills the customer service level requirements at the lowest possible cost. If an account manager is going to be judged on his/her profit and loss (P&L) statement for each account, he/she should have some input into how equipment is assigned to the account.

However, account managers should avoid making the mistake of trying to improve their P&L by exchanging newer equipment for older equipment that has a lower annual depreciation charge. Managers do this because maintenance costs are arbitrarily allocated as opposed to being assigned by activity based costing techniques which try to match the cost with the activity driving the cost. Depreciation is a non-cash cost to the company, so it represents only an estimate of the reduction in the value of the asset. When making decisions based upon depreciation figures, the account manager's incremental increase in maintenance costs more than offsets any gain achieved by changing equipment to reduce the depreciation expense. Furthermore, this negatively impacts cash flow since depreciation is a non-cash expense while maintenance is a cash expense and increased maintenance time reduces the utilization rate of the asset. Therefore, a tactical decision at the account manager level results in a negative impact on the overall organization.

Decision-making based upon this type of cost strategy can result in an account being priced incorrectly and not properly reflecting the underlying costs of servicing the account. All of the major carriers studied are involved in projects to evaluate dedicated accounts for profitability. Each is seeking to expand business in their most profitable accounts and eliminate accounts with the lowest profit potential.

However, if the right equipment mix is not used to service each account, managers could be making bad decisions as a result of a failure to fully appreciate the true cost picture. Manipulating equipment to change the amount of non-cash depreciation charges reflected on the income statement of a particular customer account can lead to poor decision making. The income and expense numbers provided for each customer account may actually distort true profit per account and lead managers to drop a more profitable customer for a less profitable customer.

Locally Driven Shipments

Equipment driven by local drivers is generally exposed to harsher treatment than any of the other three categories discussed. Local drivers are constantly in slow moving, congested traffic requiring heavy loads on the engine, transmission, and braking systems. Furthermore, poor yard conditions at railroad loading/unloading locations and ports and/or trailer drop off locations can be punishing to tractors. Therefore, it generally does not pay to assign good equipment to shipments requiring a local shipment configuration. Furthermore, local drivers tend to spend less time in the tractor and spend virtually every night at their home base. As such, it is relatively easy to schedule a tractor for overnight maintenance to be repaired and ready for use the next morning. If a breakdown prevents a local tractor from completing its workday, it is comparatively easy to find a substitute asset to complete the job.

Strategy #4. Utilize old equipment near the end of its life cycle for local shipments. Local fleet managers serve the organization well by using old, fully depreciated equipment for local shipments. However, caution must be exercised to ensure the maintenance costs and related idle-time of the asset do not exceed the value of having the equipment. One drawback to this strategy is that using a tractor for local shipments will often diminish its resale value. The carriers involved in this research indicated that trucks assigned to local shipments often end their life cycles by being scrapped for salvage value versus being sold in the used truck market.

One alternative to running former line haul tractors in a local configuration is to purchase tractors specifically designed for this type of work. These tractors are lower cost because they do not need the sleeper berth and storage space. The local tractors also do not need the weight and engine power of a larger tractor. In fact, many local drivers prefer the smaller and more maneuverable truck.

The decision to run former line haul tractors in a local configuration or to buy specialty equipment depends largely upon the used truck market, truck manufacturer buy back plans, and the company's capital budget. Since the decision to buy specialty equipment is usually a five to seven year commitment, many companies choose to run a majority of their local fleet using former line haul tractors, and occasionally buy specialty equipment when they perceive conditions are favorable. Favorable conditions often occur when a company frequently running local shipment equipment experiences a liquidation of assets. The individual or team that makes the decision to add equipment must fully understand the cost structure of the account the equipment will be assigned to, the long term projections of the business, the reaction of drivers, pricing of the business, and how the local business relates to the overall portfolio of services offered by the company.

Life-Cycle Management: Disposal

Disposal is an important part of the life cycle strategy. There are four disposal options: trade in, trade out, salvage, and scrap. Trade in involves selling the truck to a new tractor manufacturer. Trade in terms and conditions are set at the time of purchase of a new truck. There is often cost associated with trade in. This can include mileage penalties and the cost of bringing the tractor to an acceptable standard to be traded. When conducting life cycle planning, if a trade in option exists, it is important to select tractors for the trade in process that will recoup the maximum amount of money. The goal is to trade the tractor at a higher cost than it could be sold for on the wholesale used truck market. A hidden cost to be aware of is the opportunity cost of having maintenance resources dedicated to preparing trucks for trade in when they could be servicing active equipment.

Trade out is selling the truck on the used truck market. Most large trucking companies do not have the time or expertise to sell individual trucks retail, therefore they sell to wholesale buyers. The advantage of trade out is that it is quick, and does not require a lot of preparation time. The disadvantage is that the wholesale price is usually lower than a trade in price. Furthermore, the used truck market fluctuates whereas the trade in price is contractually set at the time of new truck purchase.

Salvage of a tractor is cutting it up for parts. The parts are then sold or put into maintenance inventory. This is a good option when a newer tractor is involved in an accident, such as a roll-over, that destroys the cab and frame of the truck, but the engine, tires and drive train remain in good shape.

The fourth option is to scrap the asset. Scrapping a truck is simple, management either sells the tractor to a scrap yard or strips the parts it desires to keep and then sells the remaining portion of the asset to a scrap yard. This obviously has the lowest return and is only used when the truck is so badly worn or damaged is has little or no value.

The ideal scenario is to get the maximum amount of use of a tractor with acceptable maintenance costs, then sell it at a competitive price. This involves making sound predictions of when major components like the engine, transmission, and frame will fail. A strategy of avoiding the position of having to rebuild an engine or other significant components shortly before the sale date is essential since the sales price of the asset will not make up for the recently incurred maintenance and repair costs. According to one of the interviewees, one of the keys to effective disposal planning is being able to "predict failures that can be predicted, prevent failures that can be prevented, run to failure when safe and economical to do so, and to recognize the difference." In some configurations (e.g., local shipments) it makes sense to run the tractor to failure, and when the failures become too expensive to repair, scrap or salvage the unit (see Figure 2).

To illustrate the potential gains associated with employing a life cycle maintenance strategy, Figure 2 illustrates the estimated annual maintenance cost by age of tractor in each configuration. Team trucks have a higher annual cost and steeper slope as the age increases because they run roughly twice the miles. This results in more maintenance and the rapid expiration of the warrant period. As previously discussed, the opportunity cost for a team truck in any kind of maintenance is also considerably higher than the other configurations. Not only are maintenance occurrences more likely as a team truck ages, but breakdowns are more costly when compared to other configurations.

FIGURE 2
ANNUAL MAINTENANCE COSTS FOR VARIOUS WORK CONFIGURATIONS

According to the data, for an asset utilized by a team driver configuration, the annual maintenance cost difference for a new truck versus a two-year-old truck is about $5,200. This cost difference expands to approximately $6,750 when comparing a new piece of equipment to a three-year-old asset. If the same truck was moved to a solo configuration after one year, the total maintenance cost would be approximately $3,200. This is a significant annual savings per tractor which could result in savings into the millions if assets were more appropriately assigned to a particular work configuration. Hopefully, life cycle cost analysis will aid carriers in their pursuit of enhanced asset scheduling and reduced maintenance costs.

Use of the strategic profit model to estimate cost savings for Swift Transportation illustrates the potential impact possible by employing such a strategy. The researchers used 2001 annual report data, estimated the potential cost savings of optimizing work configurations and applied the savings across the total number of assets owned by Swift. The profit model (See Figures 3 and 4) yielded an estimated savings of roughly $6 million in maintenance costs. As illustrated by the model, the reduction in total operating costs will lead to a significant increase in the company's return on assets measure. The results obtained by using the strategic profit model illustrate how the cumulative affect of closely managing work configuration can dramatically impact maintenance costs.

FIGURE 3
SWIFT TRANSPORTATION MODEL RESULTS BEFORE WORK CONFIGURATION OPTIMIZATION

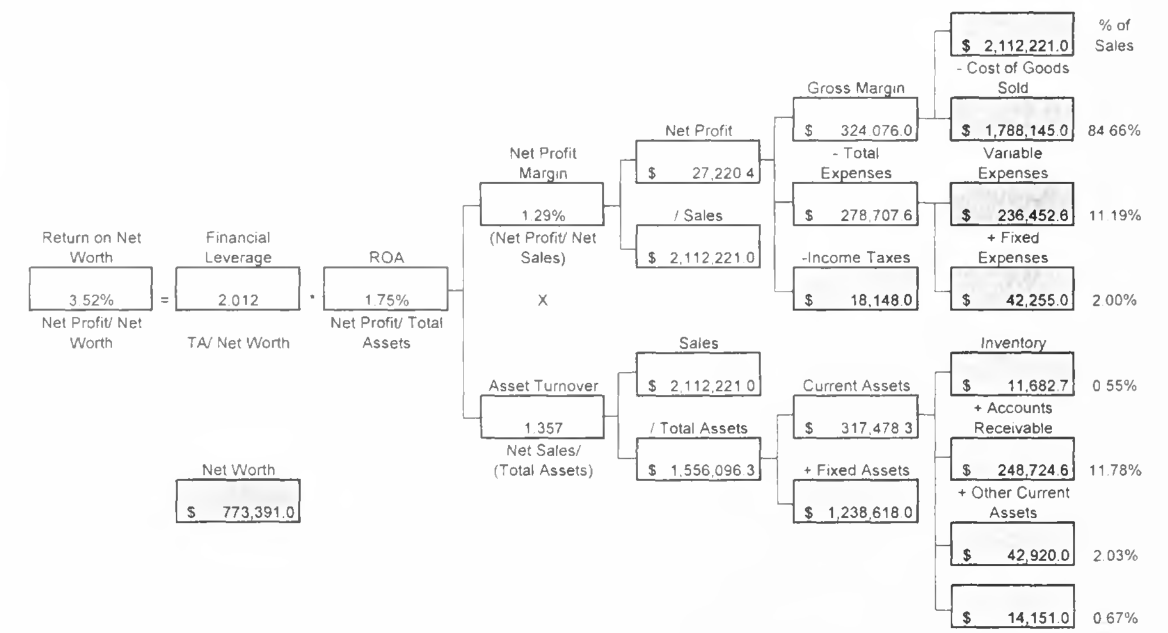
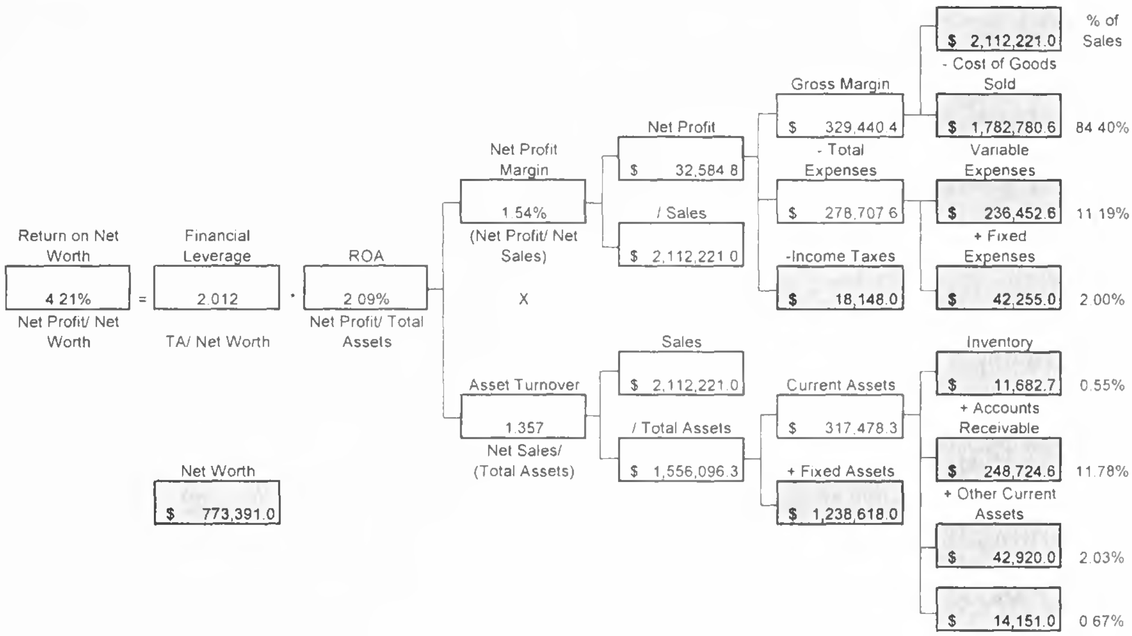


FIGURE 4
SWIFT TRANSPORTATION MODEL RESULTS AFTER WORK CONFIGURATION OPTIMIZATION



MANAGERIAL IMPLICATIONS AND CONCLUSIONS

Transportation providers have many decisions to make. Several of those decisions are based upon asset investment. Carriers must address what level of asset investment will be required to supply the customer's needs. Furthermore, once an asset is acquired, there are strategic decisions to be made on how to best maintain or dispose of an asset.

Shippers are shrinking their carrier bases and asking for more integrated services. Carriers must attempt to balance the need to remain price competitive in the marketplace with their asset acquisition and maintenance strategies. Acqui-ring too many assets too often can increase capital equipment acquisition costs, forcing the carrier to raise the price charged to customers. Conversely, carriers failing to acquire new or updated equipment frequently enough may experience low asset utilization rates, high maintenance costs, and frequent service failures.

Life-cycle costing techniques provide some unique opportunities for carriers to effectively manage maintenance costs by assigning assets to various work configurations in a systematic method. Life-cycle costing provides its best results when both art and science are merged with good judgement. There are many aspects of life-cycle management that provide opportunities to reduce cost. One under-appreciated cost saving opportunity is better assignment of assets to particular work configurations. Placing the right trucks in the right configurations will enhance the efforts of carriers to make the right purchasing, maintenance, and disposal decisions.

Cutting costs without sacrificing service is critical to competing in the trucking industry.

Work configuration life-cycle management is an untapped source of cost reduction for many companies. The result of such an implementation could yield positive results and provide a carrier with an inherent advantage in a highly competitive industry.

Managers wishing to apply life-cycle management to the maintenance function must get accurate maintenance costs for various ages and configurations. The data used in this research are based upon relatively small samples and approximations from three truckload carriers. Each carrier will have slightly different data on configurations and maintenance costs. Once obtained, a detailed analysis should be done to determine the optimum mileage or timing of when to shift an asset from one work configuration to another.

Furthermore, to create a highly precise, predictive model, better information on the predictable failure time of the asset needs to be incorporated. Managers must also undertake an analysis of warranty recovery to determine the amount of the disadvantage of reaching the mileage warranty target before the age warranty target. Accurate weekly mileage estimates for the organization implementing the suggested strategies must also be made for each work configuration in order to verify significant differences.

Finally, the manager must also examine cost-per-repair on similar repairs for assets assigned to different configurations in order to confirm that there is a significant difference. Once these variables are examined, a good mathematical model for the organization's work configurations and related maintenance costs can be created. The results of the model can be utilized to aid management in the planning for effective asset rotation between workforce configurations for large and complex fleets.

Life-cycle management has been introduced as a way to effectively manage the asset acquisition, assignment, and disposal process. The researchers applied life-cycle techniques to maintenance costs and examined the impact of various work configurations on the total maintenance costs of a carrier. While additional research needs to be conducted, this technique shows promise as a tool to assist carriers in reducing maintenance costs through efficient asset work configuration assignments.

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