APS1013 Applying Innovation in Engineering – Final Team Projects, Fall 2012

Assessing the Efficacy of a Metrics-based Transport Vehicle Fleet Safety Solution

The client's business is based in Ontario, has 4 employees, was incorporated in early 2010 and serves the trucking industry. They offer trucking fleet companies consultation services and software products geared towards improving client safety and performance. Their first product, a safety monitoring system, is a web-based information dashboard for fleets of commercial trucks that helps customers address recently implemented compliance, safety and accountability (CSA) regulations. The client is targeting 6% of heavy trucks within North America (250,000 trucks) with a subscription-based service charging $14 per truck/month with the goal of $40M in annual revenue. The safety monitoring product simplifies the process of monitoring fleet safety by manipulating and displaying data collected from recorders installed on board the trucks, which are in fact a requirement of new CSA legislation. The system uses this information to prioritize CSA performance areas that require attention by the fleet operator, provides users tools to set targets, track company progress, and has been shown to improve performance (e.g. 60% reduction in hard braking). Our client is working with a local college to complete development of this safety monitoring system for commercialization. To complement the launch of their maiden product, the client is delivering safety and CSA workshops across a number of regions in Canada and the United States. They also offer a CSA and performance reporting service based on data from on-board recorders. The information delivered to clients is a great deal more in-depth and regular than monthly government-issued CSA scores. The client is now working to improve their branding and web presence, as well as to develop their marketing, growth and financing strategies.

Problem Statement

The client is introducing a new product into the market that has the potential of substantially reducing the risk of crashes within fleets of heavy commercial trucks which currently results in over 3,500 deaths a year in the US alone. The product, a web-based service, uses information that is drawn from electronic on-board recorders (EOBRs) which are installed in trucks and continually collect data on driver and truck activity along with GPS information, and these data are analyzed using the company's proprietary algorithm which flags opportunities for follow-up action.

The problem the company has is establishing an effective methodology for assessing the efficacy of their product on fleet safety and the related cost saving associated with using their product. They are also interested in determining the product's impact on fuel reduction given that many of the intended changes in driver behavior for safety purposes also leads to better fuel efficiency such as reducing over-speeding which reduces both the risk of accidents and the amount of fuel consumed. Ideally, the company would benefit from a framework with guidelines for measuring product efficacy during its beta phase testing.

Executive Summary

The objective of the study was to determine the key safety and fuel efficiency parameters that are monitored by the safety monitoring product in terms of their impact on cost savings, and to determine an estimate on the Return of Investment (ROI) for any client wishing to utilize the product. The methodology involved in reaching our conclusions spanned:

1. Studying the product's software package
2. Performing literature and market research, including prior studies done on the subject, information on insurance pertaining to trucking fleets and finding similar products in the market
3. Interacting with the client's trucking fleet clients, board members, and Natural Resources Canada to get in-depth industry perspectives on the problem

4. Utilizing the skills acquired in the APS1013 course to brainstorm the various factors and to come up with a way forward that can benefit the client in successfully rolling-out its flagship product to an expansive list of potential customers.

Based on our study, we have determined that the key Safety parameters impacting cost savings for trucking clients are hard braking and speeding, while those for fuel efficiency are idling time, engine speed (low/high RPM) and speeding. Based on our research, we have determined that a decrease in hard braking by 20% can result in maintenance cost savings of approximately 1 cent per mile per truck, while a 50% reduction in idling time results in maintenance cost savings of ~$1.13 per day per truck. A reduction in low engine RPM can result in as much as 14% improvement in fuel savings, a 10mph reduction in speed (from 75 to 65mph) can result in fuel savings of ~30%, and idling accounts for about 15 to 30% of the total fuel consumption. In addition, we have determined that maintaining tire pressure within ±5% of the nominal value can result in an increase in fuel efficiency by as much as 1% by improving tire traction and reducing friction based heating on roads. Apart from an improvement in fuel efficiency, tire pressure can also have a bearing on safety as it has been suggested to be a contributor to roll-over based accidents.

Another important area which the safety monitoring product will affect is productivity, the savings coming from reduced supervisory man-hours spent on trouble shooting. Data provided from the system can enable remote monitoring of multiple trucks with automatic flagging of process abnormalities. Based on our calculations, as an example, for a truck running 800 miles and 303 days a year (detailed information provided in report), estimated savings from using this product can be as high as $84,145 per truck per year with 90% of savings being fuel related. Even with a 50% uncertainty, the cost saving is about $42,000 per truck per year.

Based on our study, we did not find any direct correlation in relating improved CSA scores directly to decreased rate of accidents. Moreover, insurance rates can go down by consistently good CSA scores, but the relationship seems to be very subjective and not readily quantifiable. Our research and interaction with industry experts also suggest that increased fleet safety in terms of the ratio of preventable to non-preventable accidents can result in lower insurance premiums for companies. The implementation of a system by trucking fleets in which corrective actions for any abnormality are actively recorded online can also aid in reducing insurance premiums. Various intangible economic benefits such as building up a better company image and attracting new trucking company clients may also be possible. Lastly, key recommendations we would like to provide to our client are:

1. Measure and incorporate tire pressure as an additional parameter for both safety and fuel efficiency
2. For trucks with high idling time, the software should recommend installation of Auxiliary Power Units (APUs)
3. Idling percentage should be included in the periodic reports given to clients
4. In the upcoming statistical analysis, perform a thorough statistical analysis to discover any interaction effects between cost savings from multiple parameters so that any overestimation of cost savings can be addressed
5. We would also recommend the client assesses the strength of competitor products in terms of technology and pricing strategies, and also evaluates the competitors online ROI calculators
6. The addition of tire pressure to the list of measured and monitored variables for cost and safety benefits.

Abstract

This study is a part of APS1013, Applying Innovation in Engineering course's industrial consultancy project. Our client is an Ontario based company which is set to launch its trucking and fleet monitoring software product, and our project involved studying key aspects of the trucking industry, both via literature research and interaction with the client's trucking partners to determine which key safety and

fuel efficiency parameters monitored by the product would translate into tangible Return on Investments (ROI) for trucking companies.

We performed an in-depth literature research, and interacted with representatives of the client's trucking and pilot study partner, the client's board of advisors, as well as government fuel study partner, Natural Resources Canada. Process analysis techniques (Perspective chart and Fishbone analysis) were used to determine these key parameters.

Based on our study, we determined that hard braking and speeding are key safety parameters. Idling time, engine speed (low/high RPM) and speeding are key fuel efficiency parameters that have a direct bearing on costs for trucking companies. Maintenance cost savings determined include 1 cent per mile per truck for a 20% decrease in hard braking, $1.13 per day per truck for a 50% reduction in idling time. Fuel cost savings include as much as 14% for reduction in engine speed (low/high RPM), 30% for reduction in truck speed from 75mph to 65mph, and 15 to 30% of overall fuel consumption if idling is addressed. In addition, maintaining tire pressure within ±5% of the nominal value can enable improvements in fuel efficiency as high as 1% of the total consumption.

Improvement in CSA scores were not found to have any discernible impact on prevention of accidents perhaps owing to a lack of adequate information present in literature, and because of the feedback from trucking company partners that they traditionally maintain good CSA scores. Incorporation of the client's software product may also enable lowering of the ratio of preventable to non-preventable accidents and hence help bring lower insurance premiums, and also help bring both tangible and non-tangible associated cost returns for clients.

Key recommendations to the company include

1. The addition of tire pressure to list of safety and fuel efficiency parameters owing to potential cost savings, and prevention of roll-over type accidents
2. Suggestion of incorporation of auxiliary power units (APUs) for customers with high idling rates
3. The study of any potential linear and two factor interaction effects between the various parameters suggested by our team to get the precise impact of the individual variables on the cost savings.