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Editorial Policy

The primary purpose of the JTM is to publish managerial and policy articles that are relevant to academics, policymakers, and practitioners in the transportation, logistics and supply chain fields. Acceptable articles could include conceptual, theoretical, legal, case, and applied research that contributes to better understanding and management of transportation and logistics. Saying that, our policy requires that articles be of interest to both academics and practitioners, and that they specifically address the managerial or policy implications of the subject matter. Articles that are strictly theoretical in nature, with no direct application to transportation and logistics activities, or to related policy matters, would be inappropriate for the *JTM*. Articles related to any and all types of organizations, and of local to global scope, will be considered for publication.

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

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

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Publishing Data

Manuscripts. Submit manuscripts to the editor by email attachment at taylorjohn@wayne.edu. Manuscripts should be no longer than 30 double-spaced pages and 7000 words. Guidelines for manuscript submission and publication can be found in the back of this issue.

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From the Editor…

Welcome to the Fall 2012/Winter, 2013 issue of the Journal of Transportation Management!

This issue of the *Journal* contains three articles on various aspects trucking safety and driver retention, an article on key factors in improving responsiveness in shipper/logistics service provider relationships, and finally an article on a decision support model for managing rental car businesses.

The first article investigates the behavioral aspects of the firm-logistics service provider (LSP) relationship in order to better understand the avenues through which LSP responsiveness to changing customer needs can be enhanced. The second article explores the perceptions of commercial motor vehicle operators and safety professionals regarding 35 commonly implemented practices used to improve operating safety. The third article examines Electronic On-Board Recorders (EOBR's), and the differing perspectives of management and drivers, while providing recommendations for reductions of conflicts. The fourth article studies the topic of long distance truck driver's intentions to leave their firm, and recommends managerial changes that could be made to retain professional drivers and owner operators. The fifth article examines the rental car business, and presents a multivariate decision-making model which can be used to improve operations decision-making.

At the *Journal*, we are continuing to make a number of changes that will improve the visibility of JTM, and improve its position in the supply chain publishing world. These include registering and updating journal information with several publishing guides, placing the journal content with the EBSCO, Gale and JSTOR databases faculty have access to, and placing abstracts of all past journal articles on an open area of the DNA Journal web page. Full journal article PDF's continue to be available to subscribers on the web page at www.deltanualpha.org

I look forward to hearing from you our readers with questions, comments and article submissions. The submission guidelines are included at the end of this issue's articles and I encourage both academics and practitioners to consider submitting an article to the Journal. Also included in this issue is a subscription form and I hope you will subscribe personally, and/or encourage your libraries to subscribe.

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INCREASING RESPONSIVENESS THROUGH THE FIRM-LSP RELATIONSHIP STRUCTURE: A BEHAVIORAL PERSPECTIVE

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ABSTRACT

This study investigates the behavioral aspects of the firm-logistics service provider (LSP) relationship in order to better understand the avenues through which LSP responsiveness to changing customer needs can be enhanced. Because the research examining the behavioral aspects of the firm-LSP relationship is sparse, a dyadic qualitative research approach was taken to explore the development of a relationship structure that will facilitate the level of responsiveness that the firm desires. This study revealed that the key to enhancing LSP responsiveness lays in the structure of the firm-LSP relationship. Specifically, it was found that the level of cooperation, coordination, communication, and bonding between the focal firm and the LSP have a direct effect on the LSP's level of responsiveness to the firm's needs.

INTRODUCTION

In the current business environment, firms are dealing with a myriad of challenges including constant change, shorter product life cycles, diverse customer requirements, and increased uncertainty of demand (Brown and Eisenhardt, 1998; Christopher, 2000; Agarwal, Shankar and Tiwari, 2007; Nachtmann, Waller and Rieske, 2010). While any of these issues alone are difficult to deal with, combining them makes it increasingly difficult for the firm to satisfy the demands of their customers in a timely and cost effective manner. Often the firm looks to external parties such as logistics service providers (LSPs) to assist them in achieving this objective. The result has been a significant growth in the outsourcing of logistics services in the last decade (Maltz and Ellram, 2000; Sanders et al., 2007). The organizational practice of contracting out part or all of the logistics activities that were previously performed in-house has proven to be beneficial to both parties in some but not all cases (Langley, Newton and Allen, 2000).

When successful, the firm-LSP relationship can provide both parties involved with a competitive advantage (Ellinger, Keller and Bas, 2010). A review of the LSP literature shows that successful relationships can provide a variety of benefits for the firm such as reduced logistics cost, improved access to and application of technology, end customer satisfaction, reduced capital investment in facilities, equipment, and manpower, increased flexibility and productivity, improved employee morale, increased access to wider markets and new competencies (Bowersox, 1990; Larson and Gammelgaard, 2001; Selviaridis and Spring 2007). Moreover, Zacharia, Sanders and Nix (2011) state that as the firm's competitive pressures rise, the LSP has in many instances been able to acquire specific assets and build a wide range of capabilities it can offer at a lower cost. In some cases the LSP takes on a more strategic role where it coordinates activities more broadly across the supply chain.

While successful relationships can provide a variety of benefits for LSPs as well, such as a long-term source of business volume, service

innovation and growth opportunities (Halldorsson and Skjoett-Larsen, 2004), there is a long history documenting the fact that every firm-LSP relationship is not successful. A testimony to the LSPs' failure to fully satisfy the firm's (their customer's) increasingly diverse and unexpected demands is the large number of firms reporting that logistics outsourcing has resulted in failure and disappointment (Boyson et al., 1999). Early research (Gulisano, 1997) revealed that 55% of logistics alliances were terminated after three to five years, while the Outsourcing Institute reported that more than half of third-party partnerships had failed (Foster, 1999).

A review of logistics outsourcing literature reveals that one of the problems causing the failure of logistics alliances is the inability of LSPs to deal with special product/service needs and emergency circumstances (Selviaridis and Spring, 2007). Furthermore, it is argued that success in the highly competitive LSP industry is largely dependent upon the LSP's responsiveness to the firm's needs and the ability to provide reliable service to achieve often complex and unplanned customer requirements (van Damme and Ploos Van Amstel, 1996; Ellinger, Keller and Bas, 2010).

This study investigates the behavioral aspects of the firm-LSP relationship that can impact the LSP's responsiveness to those needs. It is the premise of this paper that the key to increased success in firm-LSP relationships lays in the *development of specific firm-LSP relationship structures that facilitate the level of responsiveness that the firm requires to maintain or increase competitive advantage*. Specifically, the purpose of this study is to increase the understanding of how the behavioral aspects of the firm-LSP relationship impact the LSP's level of responsiveness.

In her recent comprehensive review of logistics service provider literature Marasco (2008) specified a need for this type of research, calling directly for studies that would lead to a "deeper understanding of the behavioral complexities that emerge through the interaction between the buyer and provider of logistics services" (p. 141). A dyadic qualitative research methodology with a focus on behavioral aspects of the firm-LSP relationship was designed to address the research question and develop mid-range theory. The dyadic method is used to pose theory from both parties' perspectives: the firm and its LSP.

The choice of a research method should flow directly from the nature and content of the phenomenon to be studied. Because research examining the behavioral aspects of the firm-LSP relationship that impact LSP responsiveness is sparse, qualitative methods are considered most appropriate. The research question addressed in this study deals with dynamic human behavior, therefore the grounded theory method was utilized following the Strauss and Corbin (1990) tradition. Furthermore, the use of this method responds to recent calls for increased use of qualitative methodologies within the logistics discipline when studying phenomena with complex behavioral dimensions (Mello and Flint, 2009).

RESEARCH DESIGN

Mentzer and Kahn (1995) suggest that future logistics research needs sufficient field observations to provide the underlying logic needed to justify the literature and theory used. While various aspects of the firm-LSP relationship have been explored in the literature, dyadic research to capture the behavioral complexities of such relationships is minimal. Developing a trustworthy interpretation and understanding of the type of relationship structure that the firm and its logistics service provider need to develop in order to increase the LSP's responsiveness does require such a dyadic perspective.

The purpose of this study is to take a first step toward additional theory development in this area. To execute this research a qualitative study

was conducted by integrating the literature bases relevant to the research question and the managerial perceptions gained from field interviews. In-depth interviews provide a powerful method because their revealing nature allows the researcher to delve into the respondents' mental world (McCracken, 1988). As such, they help achieve the purpose of qualitative research, that is, to accumulate sufficient knowledge to lead to understanding or explanation (Lincoln and Guba, 1985).

This research began with a review of the *logistics service provider literature* as well as the *agility literature*. Strauss and Corbin (1998) encourage a brief literature review at the beginning of the research project to facilitate theoretical sensitivity and help design the initial interview guide. As theory emerges through data analysis, additional literature can be reviewed and integrated with the findings of the study.

Existing literature suggests that *agility* helps firms overcome challenges brought about by constant change, shorter product life cycle, diverse customer requirements, and increased uncertainty of demand (Yusuf, Saradi and Gunasekaran 1999; Mason-Jones and Towill, 1999; Naylor, Naim and Berry, 1999; van Hoek, 2001). Although the concept originated in the manufacturing realm, agility principles can be adapted to other functional areas (Katayama and Bennett, 1999). Consequently, the concept has been extended to "agile competitor" (Goldman, Nagel and Preiss, 1995), "agile business relationships" (Preiss, Goldman and Nagel, 1996), "agile enterprises" (Goldman and Nagel, 1993), "agile decision support systems" (Huang, 1999), "agile workforce" (Van Oyen, Gel and Hopp, 2001), and "agile supply chains" (Christopher, 2000), to name a few.

Agility is a broad and multi-dimensional concept (Swafford, Goshm and Murthy, 2006) bridging many disciplines. Frequently suggested dimensions of agility are *responsiveness, flexibility* and *speed* (Sharp, Irani and Desai, 1999; Christopher, 2000; Giachetti et al., 2003; Jain, Benyoucef and Deshmukh, 2008). Following this logic, enablers of *agility* can also be considered direct enablers of *responsiveness*. The literature on *agility* was reviewed in an attempt to better understand the avenues through which LSP *responsiveness* to changing firm needs can be enhanced. (e.g., the firm is considered the LSP's customer). We explored managers' knowledge and experiences in a dyadic context; thus allowing increased focus on the phenomenon under investigation, trading generalizability for internal validity and contextual understanding.

Dyadic Data Sampling and Collection

Since buyer-seller relationships have been shown to develop differently based on their industrial context (Frazier, 1983), it was also considered important to include managers from multiple industries to facilitate theory building. The final sample consisted of six logistics service providers and six buyers of logistics services. The logistics service providers ranged from national trucking companies to international freight forwarders. The buyers of logistics services were manufacturers of consumer goods ranging across a variety of industries.

Following McCracken's (1988) guidelines for conducting in-depth interviews, we relied on the perspectives of logistics managers representing these companies to investigate and analyze the phenomenon. The interviews were conducted in the respondents' offices (18) and over the phone (4). While grounded theory practice traditionally recommends the use of theoretical sampling; in order to gain a dyadic perspective we employed purposive sampling, where particular settings, persons, or events are selected deliberately in order to provide important information that cannot be captured as well from other choices (Maxwell, 1996). However, we allowed the emerging theory to guide the interview processes for each dyad. Each manager was asked to identify his/her most critical supplier of logistics

services. It was not specified what "critical" meant in order not to impose any bias into the sample, so each manager used personal judgment to decide which supplier should be contacted.

A total of 22 individual manager interviews were conducted-11 buyers and 11 sellers of logistics services (Table 1). This is in line with qualitative research guidelines. McCracken (1988) states that eight respondents are sufficient for many research questions, therefore the number of participants for this research was sufficient to tap the domain of interest. The interviews were open-ended and discovery oriented, and typically lasted about one hour. Each interview was initiated with a grand tour technique (McCracken, 1988) and designed to be open-ended. Managers were asked to describe the relationship that they've developed with another manager, and then through laddering questions, we explored in more depth the specifics related to the constructs of interest. An example of the interview guide is provided in Appendix A. All interviews were audio-recorded and transcribed verbatim by the members of the research team.

Validating the Results: Analysis of Research Trustworthiness

In theory-testing studies that attempt to elicit generalizable findings the predominant criteria for evaluating research include assessment of internal validity, external validity, and reliability. However, these criteria are inappropriate or nonsensical in qualitative exploratory studies (Hirschman, 1986). While there are no standardized boilerplate criteria to apply in qualitative research (Pratt, 2008; 2009), certain guidelines analogous to that of the "theory generalizable" criteria described above have emerged. Specifically, earlier social sciences research focused primarily in marketing recommends that credibility, transferability, dependability, confirmability, and integrity should be the area of focus (e.g., Lincoln and Guba, 1985; Hirschman, 1986; Wallendorf and Belk, 1989) for such research. These criteria were evaluated holistically and thoroughly in this research project as follows:

1) *Credibility* (extent to which the results seem to be acceptable representations of the data) - provided a summary of initial interpretations to participants for feedback,
2) *Transferability* (extent to which the findings in a context have applicability in other contexts) – use of respondents from multiple industries,
3) *Dependability* (extent to which the findings would be the same if the study was repeated with similar subjects and context) - strictly followed guidelines for data collection and interpretation,
4) *Confirmability* (extent to which the findings are determined by the subjects and context and not by the researcher's

TABLE 1
DYADIC SAMPLE ILLUSTRATION

Buyers of Logistics Services			Sellers of Logistics Services	
Participant	Title		Participant	Title
James	Logistics Manager	———	John	Customer Service Manager
Brad	Operations Manager	———	Alison	Customer Sercie Supervisor
Richard	Supply Chain Manager	———	Dan	VP Operations
David	Purchasing Manager	———	Steve	Operations Manager
Robert	Import Manager	———	Tom	Customer Service Manager
Ethan	Import Manager	———	Mark	Account Manager
Glenda	Logistics Manager	———	Barbara	Logistics Broker
Paul	Logistics Manager	———	Peter	Operations Manager
Blake	Inventory Manager	———	Wayne	Transportation Manager
Tony	Operations Manager	———	Dwight	Sales Manager
Brian B	Global Accounts Manager	———	Jeff	President

bias and motives) - used auditor to confirm interpretations prior to journal submission, and
5) *Integrity* (extent to which the findings are influenced by participant misinformation) - assured participants of anonymity.

Data Analysis

Analyses were conducted after each interview using grounded theory procedures (Strauss 1987; Strauss and Corbin 1990). Three different types of coding are suggested in Strauss' coding paradigm and used in this study: open coding, axial coding, and selective coding. The interview transcripts were analyzed on a sentence by sentence basis and coded for conceptual content by the analysts. Initially, during open coding, the analysts independently broke down the data into discrete incidents, ideas, events, and acts, and assigned a name/code to represent these. A total of 126 open codes were initially generated from the data. These codes emerged through a process called the "comparative method" (Glaser and Strauss 1967; Strauss and Corbin 1998) where the researchers moved back and forth between transcripts and within transcripts to compare and contrast conceptual codes. The qualitative research computer software QDA Miner was used to facilitate this task. Throughout the data collection and analysis processes, theoretical memos (the researcher's record of analysis, thoughts, interpretations, questions, and directions for future data collections) were used to facilitate data interpretation and keep a trail record of the analysts' logical schema employed during interpretation.

As data analysis continued, when another object, event, act, or happening was identified through comparative analysis as sharing some common characteristics with an object or a happening, it was placed under the same code. Using this process, each incident was compared to other incidents at the property (general or specific characteristic of a category which allows a category to be defined and given meaning) or dimensional level (range along which properties of a category vary; used to provide parameters for the purpose of comparison between categories) for similarities and differences and placed into a category. Two types of theoretical comparisons were used: the "flip-flop technique" (looking at opposites or extremes to bring out significant properties) and the "systematic comparison" approach (comparing an incident in the data to one recalled from experience or the literature reviewed). Following this dynamic reiterative process we grouped concepts into categories (e.g., relationship integration, communication) for content analysis.

Once categories emerged through open coding, intense content analysis was done around each category, one at a time. This is known as axial coding. The purpose of axial coding is to begin the process of reassembling data that were fractured during open coding. During this stage relationships between categories are formed to provide more precise and complete explanations about phenomena focusing on how categories crosscut and link. When coding axially we looked for answers to questions such as "why" or "how come" (Strauss and Corbin 1998) in order to uncover potential relationships among categories. In axial coding, as in open coding, we continued to make constant comparisons and use of the analytic tools described previously. It is important to specify that while axial coding differs in purpose from open coding, these are not necessarily sequential analytical steps. Therefore, the analysts iterated between open and axial coding.

As the final type of coding performed, selective coding is the process of integrating and refining revealed categories. This was performed in order to delimit coding to only those variables that relate to the core variables of interest that have emerged from the study. Applying the coding steps suggested in the grounded theory methodology results in a variety of concepts and

categories; and as expected, some of these categories end up not being relevant to the core phenomenon studies. Therefore these categories are purposefully excluded in order to facilitate the emergence of theory regarding the phenomenon of interest. Although a variety of categories and relationships emerged during the previous two stages (open and axial coding), it was during axial coding that the major core categories were finally integrated to form a larger theoretical scheme.

To summarize, during open coding the analysts were concerned with generating categories and their properties and sought to determine how these concepts vary dimensionally. In axial coding categories were systematically developed and linked, and finally, during the selective coding stage the process of integrating core categories took place.

DISCUSSION OF FINDINGS

The data analysis of the dyadic interviews led to the emergence of several key themes/categories. This section provides detailed description of these themes. The additional literature reviewed during the analysis stage is integrated as well in order to provide further support for our interpretation of the findings.

Coordination and Cooperation

The first structural element of the firm-LSP relationship that emerged as a key enabler of LSP responsiveness was *coordination.* Coordination entails the alignment of actions between participating parties (Foss, 2001). Participants consistently emphasized throughout their interviews the role of firm-LSP coordination in enhancing the LSP's responsiveness. Consider James (buyer)' story,

> *"…when I see the bookings in there, that they're ready to be picked up from the facility, I immediately notify the truckers about the pick-up location, date and time and also coordinate with our export department to ensure the container is cleared to enter the port. This puts them (trucking company) in a position where they can respond to my work order in a timely manner and deliver the cargo before the port cut-off."*

John (seller) had a similar story that confirmed the importance of firm-LSP coordination in enhancing LSP agility,

> *"I have a customer that only calls us as a last resort. How can I successfully handle his emergency situations if I never know what he's got going on? He's setting us up for failure. With James on the other hand, he works closely with me, I know what's important to him, he proactively gives me all the information that I need, so of course I can better respond when he's got a rush delivery."*

Previous research confirms that coordination is often difficult due to a lack of shared and accurate knowledge about the decision rules that others are likely to use, and how one's own actions are interdependent with those of others (Geanakoplos, 1992).

Cooperation was the second structural element of the firm-LSP relationship that emerged as a key enabler of LSP responsiveness. Cooperation entails the alignment of interest between participating parties (Camerer and Knez, 1996). This is often difficult, because individuals/firms are often driven by the achievement of private benefits at the expense of collective benefits. Managers confirmed the importance of developing a cooperative relationship in order to enhance the LSP's responsiveness. Consider Brad (buyer)'s story,

> *"All truckers can deliver any container, that's the easy part. It's dealing with issues that come up with it that separates them. Some truckers are just so focused on their needs that they don't accommodate our customers' delivery needs. They call and say 'hey, we can only make it at this time, so hopefully your facility is open'. This is*

unacceptable because in our line of business it's all about the customer. If the customer's not happy it will have repercussion for all of us. That's why we try to have the right incentives in place to facilitate the responsiveness that we need from the trucker. We're all in business to make money."

This perspective was shared by managers representing logistics service providers (sellers) as well. Consider the following excerpts,

"*As a broker I only make $50 profit per load. So I'm up-front with customers, if you want this rate you need to have flexibility in moving it* (Alison), "*it needs to be a win-win for both parties. If I lose on a load I'm going to feel the pinch, I'm not going to meet my quota and my performance will suffer*" (Dan).

Coordination (aligned actions) problems can still arise even when cooperation is achieved (aligned interests). Incentives, sanctions, monitoring, rewards, and punishments can help to achieve cooperation but are not sufficient to achieve coordination (Gulati and Singh, 1998). This is due to the fact that cooperation problems are rooted in motivation; while coordination problems are due to cognitive limitations of parties, limitations that deny them comprehensive knowledge of how others will behave in situations of interdependence. Combined, *cooperation* and *coordination* encompass the multi-dimensional concept of *integration* (Camerer and Knez, 1996; Foss, 2001).

Support for considering *integration* (e.g., combination of *cooperation* and *coordination*) as an enabler of responsiveness can also be found in the literature on supply chain agility. It has been noted that a key to achieving supply chain agility is that all members (suppliers, manufacturers, distributors, and even customers) must work together to achieve an integrated supply chain (Christopher, 2000; Christopher and Towill, 2001). As a result of a comprehensive literature review, Lin et al. (2006) further identified integration as an essential enabler of agility. Based on the content analysis of the interview transcripts corroborated with support from the literature review, the following research propositions about the relationship between the firm-LSP structure and LSP responsiveness are put forth:

RP1: The higher the level of firm-LSP cooperation the higher the level of LSP responsiveness.

RP2: The higher the level of firm-LSP coordination the higher the level of LSP responsiveness.

Communication

Communication was the third structural element of the firm-LSP relationship that emerged as an enabler of LSP responsiveness. Communication, the formal as well as informal sharing of meaningful and timely information between firms (Anderson and Narus, 1990), is considered an important element in logistics alliances (Moore and Cunningham, 1999). Within an alliance, communication can create a shared interpretation of goals and can also facilitate the creation of trust and a closer working relationship among actors (Ring and Van de Ven, 1994). In fact, Bowersox, (1990) argue that complete and open exchange of operating and strategic information is the glue that holds logistics alliances together. As the earlier definition suggests, communication channels can be either formal or informal.

Formal communication refers to communication resulting from specified authority relationships and formal mechanisms for the coordination of work (Johnson et al., 1994). It includes agreed upon routines and schedules for presenting and reviewing data, operating status and analysis of current and past performance. Both, buyers and sellers of logistics services consistently emphasized the importance of formal communication in enhancing LSP

responsiveness. Consider some excerpts from buyers,

> "*It is great communication that's very important. Dwight is my primary contact. We keep each other informed, he lets me know if he's having any problems whatsoever, trying to be proactive with issues and just very open. As a result he can quickly respond to our needs because he's always up-to-date on our situation. When an emergency happens, he's more likely to handle it successfully" (Richard), "When I send out emails they return them pretty quickly, and they always pick up the phone and call if there's something urgent. For instance, they tell us upfront 'hey, the driver had a flat tire, just prepare for that, is there anything we need to change, to adjust or we're still good to deliver later today?' This type of communication allows us to contact the end customer in a timely manner, and in the end allows the trucker to recover from the incident"* (David).

Interviews with the LSPs managers' confirmed the importance of communication in facilitating quick response,

> "*We get daily reports from them with empty container inventory. When a work order comes in I don't have to call and ask where I can pull an empty from. I can just go ahead and send a driver to the right location, and this allows us to be proactive* (Steve/seller).

Informal communication is a response to the social needs that underlie organizational communication and facilitates communication outside the formal communication channels. Both, buyers and sellers of logistics services emphasized the importance of informal communication. Consider the following excerpt,

> "*Tom is on vacation this week, but he gave me his cell phone number because we developed a relationship to where we call each other outside of work. Typically, I would not call him if he was on vacation, but if I have an emergency, I know how to get a hold of him*" (Robert/buyer).

Support for considering communication as a key enabler of responsiveness was also found in the review of agility literature across the domains of manufacturing and supply chain management (Burgess, 1994; Gunasekaran, 1998; Yusuf, Sarhadi and Gunasekaran, 1999; Tolone, 2000; Agarwal, Shankar and Tiwari, 2007). This leads to the following research proposition regarding the affect of formal and informal communication on LSP responsiveness:

> RP3: The higher the level of formal firm-LSP communication the higher the level of LSP responsiveness.
>
> RP4: The higher the level of informal firm-LSP communication the higher the level of LSP responsiveness.

Bonding

The fourth structural element of the firm-LSP relationship that emerged as an enabler of LSP responsiveness was bonding. Extensive and repeated contact between the concerned parties, combined with elements of affect and interpersonal liking lead to personal bonds (Granovetter, 1973). Bonds can be formed through a process of social integration wherein individuals become psychologically linked to each other in the pursuit of common goals (Harrison, Price and Bell, 1998). Building social bonds can take a lot of resources because social bonds evolve only gradually through repeated satisfying interactions (Ring and Van de Ven, 1994; Madhok, 1995).

The content analysis of the interviews revealed that bonding plays a key role in enhancing LSP responsiveness. The level of bonding between the parties involved was found to have a direct effect on the LSP's level of responsiveness to the firm's needs. Consider the following stories,

> "W*e've built such a relationship with the company at a team level that if any new*

business comes up we're probably the first get a shot at it. By the same token, if they have an emergency shipment we'll drop any other piece of business just to move their freight" (Dan/seller), "In the 90's I was a shipper here in X, and I knew the guys at the rail road. We have a good relationship, we share a lot in common, we both just had grandchildren. Now that I'm back they do so much for me. Let's say I have a hot shipment and the rail cut was today and they're low on flat cars. They'll take another container off the train and put my container on!" (Barbara/seller).

Support for the possibility of deriving business benefits from bonding abounds in the logistics literature (Folta, 1998; Marasco, 2008; Schreiner, Kale and Corsten, 2009). Strong bonds within an alliance can enhance the efficiency of the alliance by reducing the costs associated with safeguarding against opportunistic behavior and lead to informal transfer of customer-related knowledge and the acceptance of risks and uncertainties associated with a higher degree of joint action (Schreiner, Kale and Corsten, 2009). Consider Mark' story as an illustration; he is Ethan's logistics service provider and describes how because of the relationship he has with Ethan he can be more proactive,

"Because of our personal relationship he might be able to tell me something about his business that's not even for public consumption yet so that I can start digesting that information behind the scenes and already be thinking and planning with Ethan…it gets us off the starting block a lot sooner than it would otherwise. He doesn't have to wait until it's ready for public communication to share it with me."

Scholars argue that close personal relationships and bonds among individuals are responsible for establishing norms of trust and reciprocity in economic exchange (Granovetter, 1973; Gulati, 1995). Interpersonal bonds have also been shown to facilitate conflict resolution and foster continuity (Folta, 1998). Schreiner, Kale and Corsten (2009) assert that the absence of social bonds can lead to unstable relationships or even alliance dissolution. An extensive review of the logistics service provider literature by Marasco (2008) shows that the stability and overall performance of alliances is likely to be strongly influenced by the multiplicity of economic, technical, and social bonds that develop between the parties. Consequently, the following research proposition is put forth:

RP5: The higher the level of firm-LSP bonding the higher the level of LSP responsiveness.

Summary of Findings

The review of the relevant literature along with the results of the qualitative study led to the development of key emergent themes that are summarized in Table 2. The relational view (RV) paradigm provides additional support for our interpretation of how firms and their LSPs can achieve a competitive advantage (e.g., *responsiveness*) through the development of specific relationship structures. This is unlike the resource-based view of the firm (RBV), which proposes that a firm's superior performance originates in its resource-based advantages over its competitors and focuses on those resources housed within the firm (Wernerfelt, 1984; Barney, 1991; Rumelt, 1991). The relational view of the firm suggests that a firm's sources of competitive advantage may extend beyond firm boundaries (Dyer and Singh, 1998). Research suggests that partners who are willing to make relation-specific investments and combine resources in unique ways can achieve superior levels of performance (Asanuma, 1989). Furthermore, idiosyncratic inter-firm linkages can be a source of competitive advantage over firms who are unable or willing to form similar linkages (Dyer and Singh, 1998). The inter-firm *cooperation* and *coordination* which are elements of relationship integration, and the *communication*

TABLE 2
QUALITATIVE STUDY RESULTS ON FIRM-LSP RESPONSIVENESS

Resulting Themes		Mentioned by Percentage of Respondents	Sample Excerpts
Key Enablers of LSP Responsiveness	Coordination	Buyers: 95% Sellers: 98%	• "Capacity tends to be a problem so we try to coordinate with each other. If they know what I have going on they can better prepare for it. This reduces the number of service failures on their end"
	Cooperation	Buyers:82% Sellers:87%	• "You can catch someone on the front end, but it won't take too long for them to realize that they're just being used to achieve your own goals. You have to be able to understand what the other person is trying to accomplish, and find a way to provide that service and look up for their best interest as well. If you can do that, they'll do the same for you."
	Formal Communication	Buyers:100% Sellers:100%	• "Communication back and forth is crucial. If they pick up a hazardous load I call them to give them the heads up. They do the same if I miss it. As a result we can be more proactive with the end customer"
	Informal Communication	Buyers:93% Sellers: 100%	• "Sometimes we just call each other to talk 'hey how's the weather down there? Here it's raining cats and dogs'. I do believe my requests will be handled with a little bit more responsiveness as compared to someone who only calls when he needs something"
	Bonding	Buyers: 68% Sellers: 91%	• "The friendship pushes me to perform better. I'd be personally embarrassed to let Tony down. If he called me with a hot shipment I'd go out of my way to help"

process along with *bonding* can be considered such idiosyncratic inter-firm linkages that enable the relationship partners to achieve superior levels of performance, in this case, *responsiveness*.

CONTRIBUTIONS AND FUTURE RESEARCH

While logistics service providers (LSPs) have enabled firms to improve their operating efficiency and effectiveness, the ability to deal with unexpected or unplanned customer requirements remains a difficult challenge for LSPs (Selviaridis and Spring , 2007). This is an important capability for LSPs to possess considering that success in the highly competitive LSP industry is largely dependent upon a firm's responsiveness to customer needs and the ability to provide reliable service to achieve often complex and unplanned customer requirements (van Damme and Ploos Van Amstel, 1996; Ellinger, Keller and Bas, 2010). The qualitative dyadic study presented in this paper explores how the behavioral aspects of firm-LSP relationship structure affect the ability of the logistics service provider to sense and respond to their customer's needs. These findings, along with a review of the relevant logistics service provider and agility literature, led to the development of research propositions regarding the association between the relationship structure and LSP responsiveness. This research contributes to the existing body of knowledge by exploring the avenues through which the firm-LSP relationship can enhance the LSP's responsiveness to dynamic customer needs. The research confirmed the premise of this paper: the key to enhancing LSP responsiveness lies in the structure of the firm-LSP relationship. Specifically, it was found that the levels of cooperation, coordination, communication, and bonding between the focal firm and the LSP have a direct effect on the LSP's level of responsiveness to the firm's needs.

Managerial Implications

The research has several implications for managers. Firm managers can benefit from this research in a number ways. First, they are encouraged to examine the structure of the firm-LSP relationship before deciding that a LSP is not responsive enough. This lack of responsiveness would possibly lead to a loss of confidence in the LSP's ability and ultimately contracting services from another LSP. Secondly, the research findings suggest that accountability for LSP responsiveness does not rest with the LSP alone. If a specific LSP is not as responsive as the firm would expect, it could be because the firm has failed to invest the necessary resources in the relationship with the LSP. Firms need to proactively develop relationship structures with their LSPs that allow for the desired level of LSP responsiveness. Third, managers can also use the propositions introduced in this paper to identify what structural elements of the firm-LSP relationship to primarily focus on (e.g., coordination, cooperation, communication, and bonding) in order to increase the LSP's level of responsiveness.

Theoretical Implications and Future Research

As an important step in theory building, the research presented in this paper has attempted to provide direction for future research on the antecedents of LSP responsiveness. The elements of the relationship structure offer a framework for further theory building on the firm-LSP relationship using the relational view. While the findings from this qualitative research contribute to the understanding of the behavioral aspects of the relationship structure, they are based on the perceptions and opinions of a limited number of participants. Although the inductive method leads to theory development through the development of theoretical propositions, it is not generalizable to a broader population.

The next phase of this research is to test the generalizability of the proposed relationships empirically. After operationalizing selected constructs specific measures should be developed. In addition, future research could examine the firm-LSP relationship structure through other theoretical frameworks such as social network theory. Social network analysis techniques could be used to analyze power, cooperation, flows of information, and conflict resolution and the management of expectations (Phillips and Phillips, 1998). Future research should also empirically examine the propositions developed in this study in failed and successful firm-LSP relationships. Comparing successful relationships to failed ones on the proposed dimensions can reveal additional insights into the complexities of firm-LSP relationships.

Just as important, future research should also explore additional behavioral dimensions of the process of logistics outsourcing as these "soft" aspects of the partnership are largely unexplored. To conclude, the following quote by one of the LSP managers summarizes the message of this paper:

> "*The relationship itself drives the success of the partnership-we can't do it alone. From a business perspective, you can anticipate their approach to a certain initiative, or perhaps their approach to the resolution of specific problems. The structure of the relationship facilitates that. As a result we can be more proactive and more responsive to their needs*".

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APPENDIX A
INTERVIEW PROTOCOL

Interview Questions

• Could you please tell me about your position here at (name firm) and what your responsibilities include? (Probe as needed to fully understand the person's role, background and orientation)
• Can you think of your most critical supplier of logistics services? (assuming yes) Please place your interactions with them clearly in your mind first.
• Now, what is it like to work with them?
• Can you tell me about that relationship?

Floating Prompts

• Can you tell me more about that?
• Can you explain that in more detail?
• That's interesting. Please go on
• Can you give me an example?
• What do you mean by that?
• What happened next?
• How did you deal with that?

Wrap up

Thank you very much for taking time out of your busy schedule to meet with me. You have been very helpful. You will receive a copy of our report when we're done collecting and analyzing the data. This should be towards the end of this year. Where would you like this report sent? If you have any questions, or if you can think of anything else you'd like to share with us, please feel free to contact me.

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DRIVER vs. MANAGER PERCEPTIONS OF COMMONLY USED SAFETY PRACTICES IN COMMERCIAL MOTOR VEHICLE OPERATIONS

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ABSTRACT

This research investigated the perceptions of Commercial Motor Vehicle Operators and Safety Professionals regarding 35 commonly implemented practices used to improve operating safety. Several differences were found in how drivers of different backgrounds rated various practices, and between the drivers and safety managers. These differences were found to be persistent even when combined with measures of safety performance and experience. Managers tended to overvalue (relative to drivers) practices related to hiring, while drivers tended to overvalue (relative to managers) practices related to company support and reward systems. Motor Carriers, insurers, and regulators could consider areas of agreement with respect to high value practices as actionable for increased investment of resources. At the same time, resources allocated toward areas of low perceived value could be reduced.

INTRODUCTION

Motor Carriers spend a significant amount of resources on activities and programs designed to improve the safety of their operations. Large truck accidents have a tremendous impact on society (US Department of Transportation, 2006). Motor vehicle accidents directly affect and disrupt the lives of the victims as well as their families and friends, especially when injuries or fatalities occur.

Accidents have declined quite significantly since the 1980's, however accidents continue to claim lives and to have serious consequences for individuals and society, along with negative economic consequences for the economy. One estimate of the average cost of an accident involving a truck with one trailer is $97,574 with the cost of a fatal accident estimated to be $3,833,721 (Pacific Institute for Research and Evaluation, 2006). Indirect costs such as the disruption of the supply chain and delays in shippers' cargo further increase the costs associated with an accident. These costs affect the motor carriers involved. Higher insurance rates, lawsuits, environmental cleanup costs, and loss of corporate and consumer trust result when trucking firms fail to operate safely (Cantor, Corsi, and Grimm, 2006). Carriers that incur these costs will find it difficult to succeed in a highly competitive environment. Consequently, motor carriers must enact practices that have a direct and positive impact on the safety performance of their firm (Corsi and Fanara, 1988; Corsi, Fanara, and Jarrell, 1988; Mejza and Corsi, 1999; Monaco and Williams, 2000; Crum and Morrow, 2002; Baxter, 2003; Mejza et al., 2003; Melton and Van Dyne, 2004).

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With respect to assessments of the effectiveness of safety practices, most of those efforts have concentrated on the firm or the firm's safety manager (Brock et. al., 2007; Corsi and Fanara, 1988; Knipling, Hickman and Bergoffen 2003; Mejza and Corsi, 1999; Mejza et. al., 2003; Short et. al., 2007). This is not surprising, as the safety program manager would be presumed to be the subject matter expert on the practices used. Many of these studies have found a high degree of agreement between safety managers and other safety professionals on two dimensions: first, what programs they are using; and second, their confidence in those programs (Knipling, Hickman and Bergoffen 2003, 2004.

While previous studies have focused on the perceptions of safety program managers as the unit of analysis, it could also be posited that the driver of the commercial motor vehicle may be equally- if not more- capable of assessing the value of safety practices. The purpose of this research was to explore the perceptions of value related to safety practices in common use by North American motor carriers from the perspective of the drivers, and to compare these perceptions to those of the safety program managers. Three related hypotheses follow from the overall research question:

H1: Perceptions of value of safety practices differ between drivers and safety professionals.

H2: Perceptions of value of safety practices differ between types of drivers:

a. based on driving experience.
b. based on type of driving performed.

H3: Perceptions of value of safety practices differ among drivers and managers, based on safety competence.

METHODOLOGY

The first phase of the study (building the instrument) sought to identify some of the most common safety practices in current use. A parallel effort consisting of both a review of the literature and open-ended surveys was conducted.

The literature review included the cataloguing of the results of other national level surveys (mentioned above). An initial list of common practices was developed (Corsi and Fanara, 1988; Baxter, 2003; Mejza et. al., 2003; Knipling, Hickman and Bergoffen 2003, 2004). This list of practices was then reviewed by a panel of subject matter experts (small groups of safety professionals and "million miler" professional drivers; 3-5 in each cohort; about 20 total).

The open ended survey of practices in use was sent to members of the state transportation association listed as "safety managers" or with a "safety" related job title. This survey asked respondents to list and describe the practices they were currently using at their firms by both "importance" and "value."

The results of the open ended survey (49 responses out of 287 total) were then combined with the results of the literature review to come up with a combined list. A second round of development took place in an attempt to validate and refine the list. Two groups (drivers and managers) were surveyed for their opinions on the "Importance" and "Value" of the programs. The first group consisted of professional drivers (independent owner-operators) under contract with a large general freight carrier. The second group included a subset of the safety professionals who were members of the state motor transportation association. While small numbers of safety professionals (fewer than 30) limited the results of this phase, the programs list was modified once again to capture the most common practices. Also, the results allowed the practices to be classified in logical categories that seemed to be consistent across the different types of motor carriers represented. As a result of this pilot testing, the research identified a total of 35 specific practices; and the practices fell

TABLE 1
INDIVIDUAL PRACTICES WITH CATEGORY AND VARIABLE CODES

Code	Safety Practice
AW1	Safety awareness posters/bulletin boards
AW2	Regularly scheduled driver safety meetings
AW3	Post-accident/incident information to drivers
AW4	Safety awareness newsletters
AW5	Safety messages (e-mail, Qualcomm, etc.)
CS1	Operations/safety alignment (safety mgr is a supervisor)
CS2	Certification of company safety professionals
CS3	Fatigue management programs
CS4	Coordination/cooperation between operations & safety
CS5	Improve driver/fleet manager communication
CS6	Training of safety professionals
H1	Pre-hire criminal background checks
H2	Minimum driver qualification requirements
H3	Pre-hire employment history checks
H4	Pre-hire Moving Violations Reports – analyzing reports of tickets from law enforcement
H5	Pre-hire experience requirements (e.g., 1 year) vs. hiring brand new drivers
MA1	SAFER/SafeStat analysis (federal database of company safety performance)
MA2	Periodic driver safety reviews/evaluations
MA3	Log audits & analysis
MA4	Post-accident/incident review boards
MA5	Random alcohol/drug testing
R1	Cash incentives for driver safety performance
R2	Public recognition for driver safety performance
R3	Driving competitions
R4	Individual driver safety awards (i.e., monthly, yearly)
R5	Million Mile Program
TC1	Global Positioning System GPS data (i.e., Qualcomm)
TC2	Electronic logs
TC3	On-board data recording devices
TC4	Vehicle speed governors
TR1	Driver safety training, prevention, during initial hiring or orientation
TR2	Driver check rides, recurring
TR3	Driver check rides, initial hiring
TR4	Driver safety training, prevention, after hiring (recurring)
TR5	Driver safety training, post-accident/violation

into seven categories (see Table 1). The seven overall practice categories included:

- Training (TR)
- Monitoring and Analysis (MA)
- Hiring (H)
- Company-Wide Support (CS)
- Rewards (R)
- Technology (TC)
- Awareness (A)

Categories and items within categories were randomly sorted for the final instrument, to prevent bias as a result of "block responding" leading to an overestimate of internal validity in the analysis phase. The items were presented in a "Likert Scale" format, with respondent choices ranging from 1 "Lower Value" to 7 "Very High" value. Blank lines were included for respondents to add any practice they felt was missing from the list. See Table 1 for a list of all practices, with their variable identifiers by category.

The next phase of the study (data collection) included three different types of drivers in addition to the safety professionals. The driver types surveyed included:
NOTR: New Over the Road drivers, at the conclusion of a 10-wk training program
EOTR: Experienced Over the Road drivers, rotating through the major operations center
LOCL: Generally experienced short-haul (waste disposal) local drivers
The investigators chose to administer the survey instrument to the drivers in a face to face setting, based on previous experience. It is believed that the ability to explain the research, answer questions, and build trust with the respondents improves the reliability of the data collected. Random sampling was therefore not possible. A small cohort of participating firms were identified to serve as the basis for a sampling proxy. Firms were chosen to represent each of the three categories NOTR, EOTR, and LOCL. Drivers were then asked to participate in the survey as they rotated through the operations centers for training or administrative reasons. Based on the high career mobility of the drivers, and the pseudo-random nature of their arrivals at the operations center, it is proposed that the drivers captured could represent a proxy for random sampling. Under this protocol, the participation rate of the drivers exceeded 95%.

Safety program managers (MGRS) were surveyed from among members of the state motor transportation association mailing list as described in the pilot testing phase. The list was examined for members identified as having safety related job titles or duties. An effort was made to validate the list by making email or telephone contact with each individual. The frame resulted in 309 total safety managers identified for survey administration. An iterative process of respondent contact was used, consisting of an initial postcard notification, a letter of support from the state motor transportation association asking for participation in the research project, the survey itself, a reminder postcard, and follow up email or phone reminders (Dillman, 2007). A total of 68 surveys were returned, for a 22% response rate.

During the follow-up contact, the non-respondents were asked to identify a reason for not responding. Anecdotally, the two most popular answers given (exact counts were not recorded) were either "Too Busy" or a response indicating they felt participating in the research would expose their firms to litigation risk. In depth discussion of this concern with non-respondents found this belief to be very strong, and the perception to be widely held among safety professionals. In general, it was believed that participation in safety research involving the use and value of safety practices would be "discoverable" during litigation and could reflect poorly upon the firm. The researchers found this perception to be interesting in and of itself; perhaps meriting further investigation under a more rigorous process. Early vs. late responses were compared, and no significant differences were found beyond a potential bias for larger companies to respond earlier than smaller

companies. It could be suggested therefore that a non-respondent bias may favor the larger (generally better performing; Corsi and Fanara, 1988, among others) firms. However, the final respondent list showed only 9 out of the 68 firms could be considered "large" (over 100 power units) with the remainder being much smaller.

Two surveys were unusable due to incomplete information provided. The final usable sample of drivers included 531 NOTR, 102 EOTR, and 93 LOCL. The final sample of safety professionals (MGRS) included 66 responses, for a total data set of 792 respondents.

ANALYSIS AND RESULTS

In an attempt to simplify the analysis, Exploratory Factor Analysis (with and without rotation) was performed on the 35 variables (SPSS v. 15.0). While the practices were organized rationally according to categories, as validated by the pilot testing, the response data provided by the drivers did not support the use of categories as an empirical proxy for individual practices. Cross-loadings were significant; the variance between individual practices was larger than the variance shared among practices within a category. We can infer from the analysis that the perceived importance of individual practices is at least statistically more significant than the perceived importance of logical categories of practice.

For the purpose of illustration, factors were created representing the categories using the mean values of the variables within the category. Reliability assessment was performed on the pseudo-factors (categories) and the results are presented in Table 2. Using the benchmark of Cronbach's Alphas of 0.7 or greater as an acceptable level of reliability (Nunnally, 1978; Hinkin, 1998 among others), items within the categories of Awareness (AW), Company Support (CS), Monitoring and Analysis (M & A), and Rewards (R) all displayed acceptable reliability without remediation. Items were dropped from factors Hiring (H), Technology (TC), and Training (TR) based on an examination of the individual practices in each group for semantic consistency and loading/ cross loading scores. The final constructs included the following items within each category of Hiring (H 1, 3, 4), Technology (TC 1, 3, 4), and Training (TR 1, 3, 4, 5).
Next, biserial correlations were performed between each of the seven pseudo-factors (Table 2). Significant correlations were found among all seven categories (all statistically significant at $p < 0.01$ or better). Correlation R^2 values range from highs of 0.766 (AW-CS) and 0.765 (MA-TR) to lows of 0.381 (R-H) and 0.449 (TC-R). These results suggest that while caution must be used in presuming that the categorical pseudo-factors represent the underlying practices, they capture enough of the variance between the practices to serve as proxies for the specific individual practices. However, due to the cross-loadings detected during EFA and the correlations between categories, differences in value perceived by the respondents will be very difficult to detect. An argument could be made that any analysis would be biased against the detection of contrasts. Any statistically significant contrasts that do appear in spite of these difficulties would need to be interpreted in context.

Comparisons Between Categories of Practice

As previous research has generally focused on the assessments of the safety managers, the research looked at the opinions of drivers vs. the opinions of managers (see Tables 3-5). Multiple pairwise comparisons were performed, with a significance threshold of 0.05 (two-tailed). Categories of practices were listed from "Most Valuable" to "Least Valuable," and designators (A, B, etc.) assigned based on whether they could or could not be separated at this level of confidence.

First, the perceptions of the managers were compared to the perceptions of drivers based on the 3 categories of drivers (NOTR, EOTR, LOCL; see Table 3). It was interesting that the

TABLE 2
PRACTICE CATEGORIES AS FACTORS

	Aware	CoSup	Hiring	M & A	Reward	Techno	Trng
Aware	**0.838**						
CoSup	0.766	**0.843**					
Hiring	0.546	0.523	**0.722**				
M & A	0.735	0.692	0.655	**0.768**			
Reward	0.653	0.672	0.381	0.551	**0.784**		
Techno	0.596	0.534	0.506	0.644	0.449	**0.698**	
Trng	0.747	0.753	0.615	0.765	0.533	0.563	**0.808**
All correlations are significant at the <0.01 level (2-tailed).Factor reliability scores (Cronbach's alpha) given on diagonal							

range of perceived values (difference between highest and lowest) was much greater for the managers than the drivers. Both groups scored "Hiring" as most valuable (5.638 vs. 5.8611); the local drivers scored Technology lowest (4.7616) while the managers scored Rewards lowest (3.8393).

It was also noted that the order of value for LOCL drivers vs MGRS was very similar; differing only in the preferred ordering of the bottom three categories (R, AW, TC for drivers vs. AW, TC, R for managers). The LOCL drivers rated the top practice categories lower in general, and were unable to distinguish between the top four. Overall, there was substantive agreement in relative value between the local drivers and the safety program managers. This differs from the "Over the Road" (long distance) drivers. The over the road drivers tended to rate Company Support slightly higher than the local drivers and managers. Another interesting split is found between the emphasis placed on "Hiring" practices. Due to the independent nature of long-distance drivers, perhaps they see less value in the screening function; local drivers and more experienced over the road drivers may appreciate the impact that hiring practices have. The effect of experience level in perceived usefulness of the seven categories of safety practices required further investigation.

Next, the drivers were grouped according to their level of experience for comparison to the safety managers (see Table 4). For this analysis, drivers were coded as "Experienced" if they had either more than one year or over 100,000 miles of professional driving experience (218 drivers) and "Inexperienced" if they had less time or miles behind the wheel (466 drivers). While this classification criteria is somewhat arbitrary, it is in line with the judgment of the senior safety managers with the firms involved in the study based on informal discussions.
This contrast provides more noticeable differences. For example, as experience increases for drivers, the value placed on Hiring increases (while value of Rewards decreases); compared with the absolute highest (Hiring) and Lowest (Rewards) value ranks. The value placed on Company Support decreases with experience, falling from highest value for inexperienced drivers to second rank for experienced, and 4th for managers.

The third set of pairwise comparisons was conducted between managers and drivers based on the safety record of the drivers (see Table 5). Drivers reporting "None" for involvement in Safety Events (moving violation, preventable or non preventable accident, near miss, etc.; a total of 507 drivers) were compared against those drivers experiencing at least one safety event in the last year (219 drivers).

TABLE 3
MEAN PRACTICE CATEGORIES BY SOURCE

Notr			Eotr			Locl			Mgrs		
CoSup	5.9474	A	Trng	5.9069	A	Hiring	5.6380	A	Hiring	5.8611	A
Trng	5.9333	A	CoSup	5.8779	A	Trng	5.6308	A	Trng	5.7121	AB
M & A	5.7997	B	Hiring	5.7958	AB	M & A	5.4783	A	M & A	5.4992	B
Reward	5.6818	C	M & A	5.6373	BC	CoSup	5.4774	A	CoSup	5.0674	C
Aware	5.5899	D	Aware	5.5176	CD	Reward	5.1901	B	Aware	4.5553	D
Hiring	5.5794	D	Reward	5.3725	D	Aware	5.1582	B	Techno	3.9596	E
Techno	5.3402	E	Techno	5.0065	E	Techno	4.7616	C	Reward	3.8393	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

When grouped by safety event, the relative value assessments are almost identical to the assessments when grouped by experience. It could be expected that there would be significant overlap between "experience" and involvement in a safety event within the last year. Therefore, a second analysis was performed, sorting by involvement in safety event, after filtering out the responses of inexperienced drivers (see Table 6).

The relative assessments of value of categories of safety practices for experienced, safer (134 respondents) and experienced, less safe (86) drivers can now be compared against those of the managers. When the inexperienced drivers are filtered from the analysis, no additional contrast between "more safe" (no safety events) and "less safe" (some safety events) can be detected. The relative category values differ only within the ability of the pairwise comparison test to detect differences. The original differences noted between drivers and managers are not contradicted by this comparison.

Summary of Comparisons Between Categories of Practice

Pair-wise comparisons of means of the assessed values of the categories of practice were performed within various groups of respondents. The assessments of drivers were categorized

TABLE 4
MEAN PRACTICE CATEGORIES BY EXPERIENCE

< 1yr and 100k			>1yr or 100k			Mgrs		
CoSup	5.9740	A	Trng	5.7320	A	Hiring	5.8781	A
Trng	5.9649	A	CoSup	5.6886	AB	Trng	5.7313	AB
M & A	5.8147	B	Hiring	5.6208	AB	M & A	5.4679	B
Reward	5.6618	C	M & A	5.5630	B	CoSup	5.0664	C
Hiring	5.6198	C	Reward	5.4137	C	Aware	4.5261	D
Aware	5.5978	C	Aware	5.3571	C	Techno	3.9141	E
Techno	5.3348	D	Techno	4.9106	D	Reward	3.8058	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05								

according to type of driving, experience level, and involvement in safety events. Driver opinions from within these groups were compared to the opinions of safety professionals. In general, Training practices are rated very highly by all driver and manager groups. The relative importance of Hiring practices increases from NOTR through EOTR, LOCL, and MGRS groups, while the perceived value of Company Support decreases over the same groups. The relative value of Rewards decreases with experience through driver groups and ends up valued least for managers. The relative value of Technology is consistently low across all groups. The values of Monitoring and Analysis, and Awareness, fall in the middle/lower middle range for all respondent groups.

Comparisons Between Individual Practices

Similar comparisons were made for assessments of value for individual practices. Many differences were detected; some contrasts are reported here. Three sets of contrasts will be reported here: the most highly valued quartile of practices, the least valued quartile of practices, and the practices with the greatest degree of disagreement between groups.

Mean value assessments were calculated for all practices by source of respondent. The eight

TABLE 5
MEAN PRACTICE CATEGORIES BY SAFETY PERFORMANCE

No Events			Some Events			Mgrs		
CoSup	5.9193	A	Trng	5.8813	A	Hiring	5.8611	A
Trng	5.8950	A	CoSup	5.7806	AB	Trng	5.7121	AB
M & A	5.7637	B	M & A	5.6707	BC	M & A	5.4992	B
Reward	5.6796	BC	Hiring	5.5556	C	CoSup	5.0674	C
Hiring	5.6440	C	Aware	5.3456	D	Aware	4.5553	D
Aware	5.6020	C	Reward	5.3342	D	Techno	3.9596	E
Techno	5.2860	D	Techno	5.0647	E	Reward	3.8393	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05								

TABLE 6
MEAN PRACTICE CATEGORIES BY SAFETY PERFORMANCE, EXPERIENCED DRIVERS

Exp, No Events			Exp, Some Events			Mgrs		
CoSup	5.7296	A	Trng	5.7711	A	Hiring	5.8611	A
Trng	5.7034	A	CoSup	5.6187	AB	Trng	5.7121	AB
Hiring	5.6144	AB	Hiring	5.6145	AB	M & A	5.4992	B
M & A	5.5678	AB	M & A	5.5380	B	CoSup	5.0674	C
Reward	5.5476	B	Aware	5.2428	C	Aware	4.5553	D
Aware	5.4280	B	Reward	5.1904	C	Techno	3.9596	E
Techno	4.9104	C	Techno	4.8855	D	Reward	3.8393	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05								

most highly valued practices are listed for each respondent source category in Table 7. All driver sources rated TR1 (Driver safety training, prevention, during initial hiring or orientation) as the most valuable individual safety practice, while the managers rated MA5 (Random alcohol/drug testing) as the most valuable practice. MA2 (Periodic driver safety reviews/ evaluations) shows up in the top eight for all respondent categories. R1 (Cash incentives for driver safety performance), shows up in the driver top eight practices, but not the managers.

A similar comparison can be made at the opposite end of the perceived value scale. The eight least valued practices are listed for each respondent source category in Table 8. Some similarities and differences exist in the ratings of the least valued practices between respondent categories here as well. TC2 (Electronic logs) are rated at or near the bottom for all respondent classes. R3 (Driving competitions) is also listed in the bottom eight for all respondents. MA3 (Log audits & analysis) and TC4 (Vehicle speed governors) are listed in the bottom eight for all drivers, but not managers. CS3 (Fatigue management programs) and TC1 (Global Positioning System GPS data i.e., Qualcomm) are listed in the managers bottom eight, but do not appear in any of the driver respondent categories bottom eight practices. It should also be noted that there is more agreement between the "Local" driver respondent category and the managers than between the managers and any other driver category.

The next phase of assessment involved looking for the practices that displayed the greatest amount of disagreement between all categories of drivers against the safety program managers (see Tables 9 and 10). For this analysis, practices were ranked by mean value. Differences in ranks between drivers and managers were calculated. The greatest 10 differences were calculated for both cases where drivers ranked the practice higher, and where managers ranked the practices higher.

The ranks and mean values for those practices where managers valued the practice much higher than drivers are shown in Table 9. Rank differences as well as the results of the one-way ANOVA test for significant differences between the means are also shown. The previously noted contrast between Hiring practices in general is affirmed here. With the exception of H1 (Pre-hire criminal background checks), drivers and managers disagree strongly about the relative value of hiring related practices. Two of the Monitoring and Analysis (MA3 Log audits & analysis, and MA5 Random alcohol/drug testing) practices resulted in disagreement. Two of the Training (TR2 Driver check rides, recurring, and TR4 Driver safety training, prevention, after hiring recurring) practices resulted in disagreement as well. Disagreement was also strong on the individual practices AW2 Regularly scheduled driver safety meetings and TC4 Vehicle speed governors.

The ranks and mean values for those practices where drivers valued the practice much higher than managers are shown in Table 10. Rank differences as well as the results of the one-way ANOVA test for significant differences between the means are also shown. The results shown appear less "mixed" across the practice categories; more consistent within categories than the disagreements where managers rated the practices more highly than drivers. The greatest disagreement was over R1 Cash incentives for driver safety performance. Also, Rewards R4 Individual driver safety awards (i.e., monthly, yearly) and R5 Million Mile Program exhibit great disagreement between drivers and managers. This could be ascribed to the drivers preferring cash incentives personally, aside from their honestly reported perception of value.

The drivers also rated Company Support practices (CS2, CS3, CS4, CS5, CS6) much higher than managers. Oddly, they did not disagree on CS1 Operations/safety alignment (safety mgr is a supervisor), which recognizes the implicit conflict between "safe operations"

TABLE 7
TOP 8 PRACTICES BY SOURCE

Notr			Eotr			Locl			Mgrs		
TR1	6.260	A	TR1	6.320	A	TR1	5.980	A	MA5	6.270	A
R1	6.210	AB	CS4	6.110	AB	MA5	5.930	A	H4	6.220	AB
CS6	6.160	AB	CS6	6.040	B	MA2	5.790	A	H3	6.140	AB
CS5	6.130	B	MA2	5.990	B	AW2	5.760	A	TR1	6.140	B
MA5	6.060	BC	CS5	5.950	B	H3	5.750	A	H5	5.910	BC
MA2	6.000	C	H1	5.950	B	CS2	5.720	A	CS4	5.770	C
CS4	5.960	C	TR5	5.950	B	R1	5.700	A	H2	5.720	C
TR5	5.930	C	R1	5.910	B	H4	5.670	A	MA2	5.720	C
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

TABLE 8
BOTTOM 8 PRACTICES BY SOURCE

Notr			Eotr			Locl			Mgrs		
MA3	5.350	A	AW4	5.150	A	R3	4.950	A	CS3	4.010	A
H2	5.260	AB	TR2	5.010	AB	MA3	4.920	A	TC1	3.950	A
TR2	5.250	B	MA3	4.960	AB	AW4	4.910	A	AW5	3.840	A
TC4	5.070	B	TC3	4.680	ABC	TC4	4.620	AB	AW4	3.760	A
TC3	5.050	B	TC4	4.630	BC	TC1	4.580	AB	R5	3.340	AB
R3	4.740	C	H5	4.550	BC	R5	4.440	AB	TC3	3.310	AB
TC2	4.480	D	R3	4.320	C	AW5	4.350	B	TC2	2.690	BC
H5	4.440	D	TC2	3.080	D	TC2	4.140	B	R3	2.490	C
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

and “productive operations” anecdotally noted by many respondents. Safety managers rated this higher (relative to driver preferences) than the other Company Support practices.

Individual disagreements also were discovered. Drivers rated TC1 Global Positioning System GPS data (i.e., Qualcomm), MA4 Post-accident/ incident review boards, and TR5 Driver safety training, post-accident/violation practices much higher than the safety managers. Overall, an argument could be made that drivers tended to rate those safety practices that involved them personally, or were “closest” to their actual job duties, were rated as more valuable. Unsurprisingly, they did not seem to value practices that they would not personally or directly participate in.

Summary of Comparisons Between Individual Practices

As with the practice categories, significant disagreements were noted between classes of respondent for perceived value of individual safety program practices. When considering the most valued practices by driver sub-group, all

TABLE 9
MAXIMUM DRIVER VS. MANAGER DISAGREEMENT, MANAGER PREFERRED

Pract	Drivers Mean	Drivers Rank	Mgrs Mean	Mgrs Rank	Rank Diff	Sig
H5	4.536	34	5.906	5	29	0.000
H2	5.330	27	5.720	7	20	0.099
H3	5.552	24	6.136	4	20	0.006
H4	5.645	20	6.220	2	18	0.003
MA3	5.238	29	5.577	11	18	0.112
AW2	5.521	25	5.348	16	9	0.382
TC4	4.953	32	4.323	23	9	0.017
TR2	5.229	30	4.197	25	5	0.000
MA5	6.021	5	6.273	1	4	0.199
TR4	5.747	13	5.646	9	4	0.581

TABLE 10
MAXIMUM DRIVER VS. MANAGER DISAGREEMENT, DRIVER PREFERRED

Pract	Drivers Mean	Drivers Rank	Mgrs Mean	Mgrs Rank	Rank Diff	Sig
R1	6.103	2	4.023	27	-25	0.000
CS2	5.810	10	4.286	24	-14	0.000
CS3	5.735	15	4.008	28	-13	0.000
R4	5.815	9	4.555	22	-13	0.000
TC1	5.688	17	3.946	29	-12	0.000
CS6	6.066	3	5.455	14	-11	0.000
R5	5.631	22	3.345	32	-10	0.000
MA4	5.800	11	4.766	20	-9	0.000
CS5	6.039	4	5.532	12	-8	0.004
TR5	5.880	8	5.453	15	-7	0.014

driver sources rated TR1 (Driver safety training, prevention, during initial hiring or orientation) as the most valuable individual safety program practice. Managers rated MA5 (Random alcohol/drug testing) as the most valuable practice. MA2 (Periodic driver safety reviews/ evaluations) shows up in the top eight for both drivers and managers. R1 (Cash incentives for driver safety performance), shows up in the driver top eight practices, but not the managers.

When considering the least valued practices by driver sub-group, TC2 (Electronic logs) and R3 (Driving competitions) are rated at or near the bottom for all respondent classes. MA3 (Log audits & analysis) and TC4 (Vehicle speed governors) are listed in the bottom eight for all drivers, but not managers. CS3 (Fatigue management programs) and TC1 (Global Positioning System GPS data i.e., Qualcomm) are listed in the managers bottom eight, but do not appear in any of the driver respondent categories bottom eight practices.

When considering the practices exhibiting the greatest relative disagreement between managers and drivers, additional notable patterns emerged. For those practices highly valued by managers and less valued by drivers, managers value hiring related practices much higher than drivers do. Also rated more highly by managers were

two practices within the Monitoring and Analysis and Training categories.

For those practices highly valued by drivers and less valued by managers, specific practices within the Rewards category (R1, R4 and R5) were rated very highly by drivers when compared against managers. Also, five out of six practices within the Company Support category (CS2, CS3, CS4, CS5, CS6) were highly valued by drivers.

Safety Performance Weighted Perceptions of Value

Additional investigation was performed exploring the role of safety performance (competence) in altering the relative perception of safety practice value (see Tables 5 and 6). For these comparisons, safety competence was constructed as a "weighting factor" to be multiplied by the value scale for each respondent and category/practice variable.

The drivers were asked to self-assess their own safety competence relative to "The average commercial driver on the road" using 5 questions on a 7-point Likert scale addressing:

- Safety record
- Adherence to company safety policies and recommendations
- Setting the example for other drivers to follow in terms of safety practices
- Adherence to all Federal, State and Local safety regulations
- Track record of compliance for inspections and enforcement

Drivers were also asked to self-report any involvement in "safety events" during the previous year. Safety Events included "near miss" situations not resulting in accidents, preventable accidents, non-preventable accidents, moving violations, inspections resulting in "out of service" determinations, and a write-in "Other" category. If the driver chose "none" a value of 0 was assigned. If no events were checked (including "none") then the response was counted as a missing value and the weight was not calculated. The aggregate safety competence score or weight was calculated as the average of the 5 Likert scale questions (value 1-7) minus the number of Safety Events (value 0-6). Actual values for the weights ranged from a low of 0 to a high of 7, with a mean of 5.29.

The safety performance/competence weight for the safety managers was calculated on the firm level. Federal Motor Carrier Safety Administration safety statistics (the "SAFESTAT" database; FMCSA 2009) were used. It must be noted that the "SAFER/ SafeStat" system has been replaced by the CSA 2010 system. At the time this research was conducted, stability and reliability problems in the newer CSA 2010 system prevented the use of the newer metrics. Statistics used to evaluate firm safety performance on a relative (to other firms) percentile basis include the Driver and Vehicle Safety Evaluation Area Scores (SEAS). SEAS statistics take on values between zero (the highest rated firm; better than 100% of all other firms) and 100 (the worst performing firm; better than 0% of all other firms). This research created a composite SEAS safety performance value using the following formula:

(1) Firm SFac = [(200 - DSEAS + VSEAS)/ 200]*7 (from FMCSA SafeStat database)

The composite weighting factor added the driver and vehicle SEAS and inverted the scale by subtracting from the maximum possible value of 200. A relative value between 0-1 was created by dividing by the maximum score, and this relative value was centered to take on final values between 0-7 in an effort to make it at least comparable to the driver calculated safety performance weights. The final firm level weighting factor took on values between 1.20 and 6.94, with a mean of 3.85. Firms for which SEAS data were incomplete were not assigned a safety performance score. The final safety performance weighted subsample included 380 NOTR, 101 EOTR, 91 LOCL, and 52 MGRS respondents.

Comparisons were now run using the safety performance weight multiplied by the perceived value for each category of practice (Tables 11 and 12) and individual practice (Tables 13 and 14).

Table 11 represents the same analysis as Table 3, except that the categories of practice used were the "safety weighted" categories. For the NOTR and EOTR classes of driver, the order of perceived values are identical to those found in Table 3. For LOCL drivers, the order of mean values are slightly different, but the order changes do not exceed the statistically significant grouping indicators. For the MGRS, the order is identical to the unweighted order, with minor differences in grouping indicator boundaries. Overall, the safety performance weighted safety practice category perceived values differ, and differ between the driver and manager groups. The way these perceived values differ is quite similar to the way the non-safety performance weighted values differ.

The analysis was continued for the practice categories by experience level. Table 12 is analogous to Table 4, except that in Table 12 we use the safety performance weighted categories. The MGRS group is unchanged from Table 11, but the driver groups are now divided into two groups based on miles/year driven. For the more experienced drivers, the order of perceived value is identical to that found on Table 4 (unweighted). The order changes slightly for the less experienced drivers, but the order changes again do not exceed the statistically significant grouping indicators. As in the previous analysis, the way these perceived values differ is quite similar to the way the non-safety performance weighted values differ.

Next, the top eight (Table 13; analogous to Table 7) and bottom eight (Table 14; analogous to Table 8) individual practices were examined. In Table 13, we see that significant differences in perceived value exist for all classes of drivers and managers. However, these differences are quite similar to those shown on Table 7 for the unweighted values. For driver cohort NOTR, the top eight practices are identical, differing only in the individual order of CS6-R1 and TR5-CS4. Results are similar for group EOTR. For groups LOCL and MGRS, the unweighted vs. weighted perceived values are again similar; however, two other differences exist. For LOCL drivers, the practice R1 leaves the list of top eight and AW3 enters. For the MGRS, MA2 leaves the list and AW3 enters. This would suggest that as safety performance increases, the perceived value of AW3 "Post-accident/incident information to drivers" increases in perceived value.

Similar results were found for the perceived value of individual practices at the lower end of the value order (Table 14). For the NOTR and EOTR classes of drivers, the bottom eight practices are the same, with only minor differences in order for the NOTR group. The same is true for the LOCL drivers and managers, with two individual exceptions. For the LOCL drivers, the practice H5 fell into the bottom eight practices, and R3 rose in value out of the bottom eight. For the MGRS, AW1 dropped into the lower eight, and AW5 rose out of the bottom. We conclude that differences in relative rankings of safety-weighted safety practices exist and are significant; and differ only slightly from those differences shown for the unweighted practices.

Safety Performance vs. Perceived Value

A final investigation of the relationship between safety performance and perceived value of safety practices was conducted. For this analysis, bivariate correlations were conducted between the individual respondent "safety performance score" and their rating of perceived value for safety practices and categories of practice. The effort was to assess if levels of safety performance covaried with the value placed on practices. Sample size becomes an issue here, as the final safety performance weighted subsample included 380 NOTR, 101 EOTR, 91 LOCL, and only 52 MGRS respondents.

The first analysis (Table 15) captured the relationship between safety performance and the value of categories of safety practices. Due to the small number of datapoints, none of the correlations were statistically significant for the MGRS. For the driver groups, all correlations between safety performance and categories of practice were statistically significant for NOTR, and most were significant for EOTR and LOCL. Sample size may have been an issue with the two smaller driver groups as well. A positive relationship indicates that as safety performance increases, the relative perceived value increases as well. While this might not be practically significant in an absolute sense (safer drivers tend to rate all safety programs as being more valuable in general), the relative magnitude of association may suggest a means of comparison between programs (higher R^2 means a closer tie between performance and perceived value). A higher correlation would suggest increased perceived value by respondents with higher safety performance scores. For this data, correlation coefficients ranged between 0.2-0.3. When compared to the mean perceived values and safety weighted mean perceived values, the correlation strength metric suggests a different order. For example, the NOTR drivers rank "Awareness" as being fairly low with respect to the other categories, while it is the highest rated using a correlation measure.

The second analysis captured the relationship between safety performance and the value of individual practices (Table 16). The reduced sample size creates greater problems here. None of the MGRS relationships were statistically significant. Fewer than half of the EOTR and LOCL relationships were statistically significant, and three of the practices were not statistically significant for the NOTR group. Three findings are worth noting. First, the order based on strength of association does differ substantively from the order based on perceived value. This is similar to the finding for categories of practice. Second, most of the practices are positively related to safety performance, again suggesting that drivers with higher safety performance tend to rate safety practices higher than drivers with low safety performance scores. Third, there is a statistically significant exception to this: for LOCL drivers, practice R1 "Cash Incentives for Driver Safety Performance" is negatively related to safety performance. This suggests that the worse performing drivers value cash incentives higher than safer drivers, and safer drivers value cash incentives lower than worse performing drivers. This was the only statistically significant negative relationship between safety performance and safety practice found in this data set. While this is an interesting result, it may be an artifact of the problems with sample size in this category.

TABLE 11
MEAN SAFETY WEIGHTED PRACTICE CATEGORIES BY SOURCE

Notr			Eotr			Locl			Mgrs		
CoSup	33.0150	A	Trng	28.7187	A	Trng	29.4536	A	Hiring	22.7112	A
Trng	32.9225	A	CoSup	28.6501	A	Hiring	29.2648	A	Trng	22.1290	A
M & A	32.2947	B	Hiring	28.4528	A	CoSup	28.6694	A	M & A	21.1538	B
Reward	31.5312	C	M & A	27.5408	B	M & A	28.5728	A	CoSup	19.4299	C
Aware	31.2677	C	Aware	27.1009	BC	Aware	27.0940	B	Aware	17.7273	D
Hiring	31.1567	C	Reward	26.4064	C	Reward	27.0172	B	Techno	14.9632	E
Techno	29.5341	D	Techno	24.3993	D	Techno	24.9678	C	Reward	14.6096	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

TABLE 12
MEAN SAFETY WEIGHTED PRACTICE CATEGORIES BY EXPERIENCE

< 1yr and 100k			>1yr or 100k			Mgrs		
CoSup	32.8900	A	Trng	29.2957	A	Hiring	22.7112	A
Trng	32.7886	A	CoSup	28.9805	AB	Trng	22.1290	A
M & A	32.1136	B	Hiring	28.7110	AB	M & A	21.1538	B
Hiring	31.2057	C	M & A	28.5402	B	CoSup	19.4299	C
Reward	31.1103	C	Reward	27.6950	C	Aware	17.7273	D
Aware	31.1083	C	Aware	27.5083	C	Techno	14.9632	E
Techno	29.4220	D	Techno	25.0753	D	Reward	14.6096	E
Mean groups organized by failure to reject pairwise diff of means test at 0.05								

TABLE 13
TOP 8 SAFETY WEIGHTED PRACTICES BY SOURCE

Notr			Eotr			Locl			Mgrs		
TR1	34.6299	A	TR1	30.7059	A	TR1	31.4764	A	H4	24.1426	A
CS6	34.2228	AB	CS4	29.8455	AB	MA5	30.8852	AB	MA5	23.7762	AB
R1	34.0928	ABC	CS6	29.5558	BC	AW2	30.5676	AB	H3	23.7537	AB
CS5	33.8107	BC	TR5	29.1357	BC	CS2	30.3862	AB	TR1	23.7224	AB
MA5	33.7861	BCD	MA2	29.1158	BC	MA2	30.1546	AB	H5	22.8915	BC
MA2	33.2200	CD	H1	28.9889	BC	H3	29.9283	B	H2	22.3748	BC
TR5	33.0718	D	CS5	28.9646	BC	AW3	29.5415	B	AW3	22.3358	C
CS4	32.9825	D	R1	28.7701	C	H4	29.4572	B	CS4	22.1059	C
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

SUMMARY OF FINDINGS

The purpose of the research was to explore the perceived value of a set of popular practices used by commercial motor carriers to improve the safety performance of their operations. Three hypotheses were investigated, and can now be addressed directly.

> (H1) Perceptions of value of safety practices differ between drivers and safety professionals.

This hypothesis is strongly supported by the data. The hypothesis was supported across all types of contrasts investigated. The difference between drivers and safety managers is lowest between managers and local drivers, and greatest between managers and over the road drivers. Tables 9 and 10 summarize the "degree of disagreement" between drivers and managers. This was supported for both categories of practices and individual practices.

> (H2a) Perceptions of value of safety practices differ between types of drivers based on driving expertise

This hypothesis is only weakly supported by the data. While the data show clear preference differences based on experience, the relative preference between less and more experienced

TABLE 14
BOTTOM 8 SAFETY WEIGHTED PRACTICES BY SOURCE

Notr			Eotr			Locl			Mgrs		
MA3	29.8318	A	AW4	25.6062	A	H5	26.0636	A	CS3	15.1836	A
H2	29.0015	AB	TR2	24.3229	AB	MA3	25.8275	A	TC1	15.1747	A
TR2	28.8496	B	MA3	24.1323	AB	AW4	25.4710	A	AW1	15.0659	A
TC4	27.8836	B	TC3	22.9520	ABC	TC4	24.0725	AB	AW4	14.8617	A
TC3	27.8519	BC	TC4	22.4616	BC	TC1	24.0644	AB	R5	13.3353	AB
R3	26.2714	C	H5	21.9574	BC	R5	23.9716	AB	TC3	12.6627	AB
H5	23.9809	D	R3	21.2796	C	AW5	23.0933	B	TC2	10.3289	BC
TC2	23.7535	D	TC2	15.1208	D	TC2	21.4151	B	R3	9.6457	C
Mean groups organized by failure to reject pairwise diff of means test at 0.05											

drivers were similar. Differences were discovered between "new" and "experienced" over the road drivers, but experience was not a discriminator by itself.

> (H2b) Perceptions of value of safety practices differ between types of drivers based on type of driving performed.

This hypothesis was strongly supported by the data. Contrasts were revealed between newer and more experienced over the road drivers, and between both classes of over the road drivers and local drivers. The differences were apparent for both categories of safety practices and individual practices.

> (H3) Perceptions of value of safety practices differ among drivers and managers, based on safety competence.

This hypothesis was investigated using three different approaches. The first approach (Tables 5 and 6) used a binary discriminator for drivers, based on involvement in "safety events." Significant differences were found between categories of practice; however, these differences were not sensitive to involvement in safety events. The second approach created continuous variables representing safety performance or competence, and looked for differences in safety performance weighted perceived value (Tables 11-14). Contrasts were found between safety weighted practices for all driver and manager cohorts. These differences were only slightly divergent from the unweighted perceived value scores, lending only weak support to the hypothesis. The third type of contrast was to correlate the perceived value of safety practices against the safety performance score (Tables 15 and 16). Data were insufficient to directly address the hypothesis. The evidence showed that safety performance was correlated to the perceived value of safety programs in general (safer drivers place higher value on safety practices). In addition, the strength of the correlation (as a ranking metric) provided different results from using the perceived value directly. We conclude that the hypothesis is weakly supported, and merits additional investigation.

MANAGERIAL IMPLICATIONS

Different classes of drivers and safety program managers share perceptions of the value of some safety practices and categories of practice. In general, practices falling within the Training category were highly rated by all categories of drivers and safety program managers. In particular, the practice TR1 Driver Safety Training, Prevention during Initial Hiring or

TABLE 15
CORRELATIONS; SAFETY PERFORMANCE AND CATEGORIES OF PRACTICE

Notr			Eotr			Locl			Mgrs		
Aware	0.3425	0.0000	Reward	0.3163	0.0013	Aware	0.2844	0.0063	Techno	0.1377	0.3404
M & A	0.2990	0.0000	Aware	0.3152	0.0013	Techno	0.2681	0.0102	Trng	0.1055	0.4566
Techno	0.2679	0.0000	Hiring	0.2746	0.0054	M & A	0.2669	0.0105	Hiring	0.0360	0.8000
CoSup	0.2661	0.0000	CoSup	0.2251	0.0236	Trng	0.2616	0.0122	Reward	0.0114	0.9359
Hiring	0.2524	0.0000	M & A	0.2068	0.0380	CoSup	0.2500	0.0169	Aware	-0.0227	0.8728
Trng	0.2480	0.0000	Trng	0.1247	0.2140	Reward	0.1676	0.1123	CoSup	-0.0583	0.6814
Reward	0.2197	0.0000	Techno	0.0835	0.4063	Hiring	0.1227	0.2467	M & A	-0.0806	0.5702

Correlations organized by variable, Pearson's moment, and significance
$p > 0.05$ shaded

Orientation was identified as being valuable. At the other end of the assessment scale, the Technology category was uniformly rated as being less valuable. This applied to most of the technology practices (TC2, TC4 showed up on bottom eight list for all; TC3 showed up on the bottom eight list for all but LOCL drivers). These areas of agreement suggest that firms and safety program managers align resources and attention accordingly. In addition, risk management firms and regulatory agencies should incentivize firms to spend significant emphasis in developing and improving training activities, and provide less incentive for technology based practices.

Different classes of drivers and safety program managers disagree on their perceptions of the value of some safety practices and categories of practice. These areas of disagreement suggest that safety program managers may not have considered the opinions of drivers in organizing their safety efforts. Particularly in the categories of practices associated with Company Support and Rewards, drivers perceive a much higher value than safety professionals. R1, R4, and R5 are particularly valued by drivers (and not managers) in the Rewards category. CS2, CS3, CS5, and CS6 were similarly valued by drivers under Company Support.

The areas of agreement and disagreement could be considered "actionable" by firms, regulators, and risk managers. As already mentioned, the areas of "high value" agreement could be recognized for increased emphasis, incentives and support. The areas of "low value" agreement could be recognized for decreased attention. The areas of disagreement may not be immediately actionable; additional investigation should be performed. However, where warranted, those practices valued highly by drivers should be given consideration for increased attention or effort. The Company Support practices may not fall under the organizational purview of safety program managers alone; and therefore an integrated effort within the firm may be needed to support the safe operating decisions of the drivers. The same would be true for the practices involving rewards for safe driving behavior. Attention from regulatory or risk management organizations could perhaps provide incentive in this regard.

SUMMARY AND FUTURE RESEARCH

This research investigated the perceptions of commercial motor vehicle drivers and the managers of company safety programs regarding 35 commonly implemented practices used to improve operating safety. The discrete practices fell into seven categories, including Hiring, Safety Awareness, Training, Monitoring and

TABLE 16
CORRELATIONS, SAFETY PERFORMANCE AND PRACTICES

Notr			Eotr			Locl			Mgrs		
AW1	0.3085	0.0000	R4	0.4396	0.0000	CS2	0.3852	0.0002	TR3	0.2383	0.0921
H3	0.2884	0.0000	MA1	0.4274	0.0000	AW2	0.3773	0.0003	TC4	0.1997	0.1735
MA1	0.2854	0.0000	AW1	0.3546	0.0003	TR1	0.3009	0.0044	TC3	0.1512	0.3272
AW4	0.2647	0.0000	AW5	0.3488	0.0005	R5	0.2941	0.0073	R5	0.1456	0.3344
AW2	0.2531	0.0000	R2	0.3477	0.0005	TR5	0.2927	0.0054	R3	0.1251	0.3919
AW5	0.2503	0.0000	H3	0.2706	0.0062	TC1	0.2585	0.0150	TC2	0.0989	0.5231
AW3	0.2439	0.0000	AW4	0.2536	0.0122	MA3	0.2542	0.0156	R1	0.0951	0.5068
CS2	0.2376	0.0000	CS2	0.2480	0.0138	CS4	0.2466	0.0191	TR2	0.0895	0.5451
MA3	0.2360	0.0000	R5	0.2437	0.0173	AW5	0.2363	0.0249	TR4	0.0825	0.5647
TC4	0.2341	0.0000	CS1	0.2153	0.0323	R2	0.2360	0.0260	CS1	0.0776	0.5883
MA4	0.2325	0.0000	CS3	0.1947	0.0547	CS1	0.2341	0.0310	H1	0.0710	0.6168
TR5	0.2304	0.0000	H4	0.1944	0.0538	R3	0.2235	0.0353	AW3	0.0643	0.6504
CS1	0.2296	0.0000	H1	0.1930	0.0556	CS6	0.2209	0.0375	H3	0.0488	0.7313
H4	0.2230	0.0000	TR5	0.1504	0.1395	AW1	0.2163	0.0395	AW5	0.0297	0.8431
TC1	0.2146	0.0000	AW2	0.1451	0.1539	TR4	0.1988	0.0589	MA2	0.0246	0.8627
R4	0.2103	0.0000	AW3	0.1361	0.1770	MA2	0.1968	0.0660	H2	0.0179	0.8998
TR1	0.1990	0.0001	CS4	0.1319	0.1930	AW3	0.1885	0.0769	AW1	0.0051	0.9711
R2	0.1978	0.0001	CS6	0.1225	0.2371	TC3	0.1660	0.1245	TR5	-0.0069	0.9621
CS3	0.1963	0.0001	TR4	0.1178	0.2431	TC4	0.1573	0.1387	CS5	-0.0070	0.9617
TR3	0.1855	0.0003	TR1	0.1178	0.2408	TR2	0.1565	0.1455	TC1	-0.0115	0.9400
CS6	0.1851	0.0003	R1	0.1162	0.2571	MA5	0.1357	0.2047	R2	-0.0154	0.9156
CS4	0.1806	0.0004	MA4	0.1129	0.2659	MA4	0.1280	0.2372	MA4	-0.0187	0.8975
MA5	0.1768	0.0005	TR2	0.1102	0.2853	MA1	0.1276	0.2474	CS2	-0.0215	0.8834
TC3	0.1722	0.0009	MA5	0.1079	0.2827	H3	0.1271	0.2300	H5	-0.0412	0.7762
MA2	0.1661	0.0012	R3	0.1043	0.3066	H4	0.1182	0.2644	TR1	-0.0500	0.7251
TR4	0.1652	0.0013	MA2	0.0841	0.4031	H2	0.1057	0.3270	AW4	-0.0518	0.7237
R3	0.1446	0.0050	TC3	0.0716	0.4834	CS3	0.0850	0.4286	H4	-0.0584	0.6811
CS5	0.1395	0.0066	TC1	0.0635	0.5279	CS5	0.0836	0.4388	R4	-0.0665	0.6463
R5	0.1375	0.0079	TC4	0.0625	0.5386	AW4	0.0570	0.5956	MA1	-0.0769	0.5958
H5	0.1282	0.0134	CS5	0.0582	0.5674	H1	0.0538	0.6143	CS6	-0.0858	0.5452
H1	0.1132	0.0277	TR3	0.0362	0.7238	R4	0.0531	0.6191	MA3	-0.0910	0.5253
TR2	0.1043	0.0462	TC2	0.0308	0.7655	TR3	0.0281	0.7948	CS3	-0.1045	0.4749
R1	0.0751	0.1458	MA3	0.0064	0.9497	TC2	-0.0079	0.9427	AW2	-0.1074	0.4487
H2	0.0731	0.1575	H5	-0.0187	0.8582	H5	-0.1155	0.2810	MA5	-0.1470	0.2984
TC2	0.0333	0.5204	H2	-0.0609	0.5537	R1	-0.2214	0.0349	CS4	-0.1768	0.2100

Correlations organized by variable, Pearson's moment, and significance
p > 0.05 shaded

Analysis, Company-Wide Support, Rewards, and Technology. Almost 800 surveys were analyzed from subgroups including both new and experienced over the road and local drivers, and safety program managers. Comparisons were made between subgroups on the individual practices and categories of practice. While much agreement was found on the importance and usefulness of practices in general, notable differences were found in how drivers of different backgrounds rated various practices, and between the drivers and safety managers.

The logical next step must certainly include an attempt to explain and resolve the differences. For practices and categories of practice where drivers and managers disagree, the potential exists for program managers to achieve better safety program results by realigning their resource allocations in accordance with the drivers' assessments. Of course, the drivers' assessments could be inaccurate; in which case, such a reallocation would decrease safety program performance. Given this reason these findings must be approached with caution. The effectiveness of these practices and categories of practice must be measured in some objective way. Obviously, the effectiveness of motor carrier safety practices has already been investigated (for some related summaries see Corsi and Fanara 1988, Knipling, Hickman and Bergoffen 2003, Mejza et. al. 2003, Brock et. al. 2007, among others). However, none of the previous studies have explicitly surveyed the drivers themselves for their opinions on the effectiveness of safety practices. Using the firm as the unit of analysis for these assessments of practice effectiveness limits the inference that can be drawn, due to confounds that are inherent in studies of these types. It is suggested that only by reviewing the effect of these practices on the individual driver can an appropriate assessment be made. For example, in order to assess the effectiveness of a certain type of training, one should investigate before-after attitudes and behaviors of individuals undergoing the training treatment- in lieu of comparing the performance of firms using that type of training vs. firms that don't.

This approach is obviously not possible for all practices evaluated here. The effects of mandatory drug testing are moot- the testing is required regardless of effectiveness. "Hiring Practices" are also not tractable to an analysis based on an experimental design evaluation of treatments at the individual level. However, an evaluation of hiring practices could be conducted as a pseudo experiment, where safety event involvement is correlated with the various pre-hiring practices in use. For example, a screening process that would deselect a driver above a certain threshold of past failed vehicle inspections could be correlated with future behavior based on driving records. No single approach to evaluating the various practices should be used; however, this research suggests that using the individual driver as the unit of analysis may yield stronger inference and value to practitioners than the more traditional approaches.

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CONFLICTING PERSPECTIVES ON THE GOVERNMENT MANDATE FOR THE USE OF ELECTRONIC ON-BOARD RECORDING DEVICES IN COMMERCIAL MOTOR VEHICLES: A CASE STUDY

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ABSTRACT

In July of 2012, the President signed into law the bill, "Moving Ahead for Progress in the 21st Century" or MAP21, also known as the Surface Transportation Act. The Act instructs the Secretary of Transportation to promulgate regulations requiring the use of electronic on-board recording devices (EOBRs) to verify hours of service compliance by commercial motor vehicle drivers. The mandate has drawn opposition from many drivers and trade organizations, while simultaneously drawing support from government, union organizations and other trade organizations. Consequently, it appears that the EOBR mandate will continue to be a source of potential conflict for management and commercial motor vehicle drivers in some transportation organizations. This case study analyzes some of the factors involved and proposes recommendations for the mitigation of potential workplace conflict.

INTRODUCTION

The National Transportation Safety Board estimates that 34% of all fatal-to-the-driver heavy truck crashes are due to driver fatigue (Rosekind, 2011). Heavy trucks or Commercial Motor Vehicles (CMVs) are defined as those having a gross vehicle weight rating of more than 10,000 pounds (DOT, 2010a). A study of 46 CMV drivers over 16 months indicated that 26.4 percent of them included an observed rating of a drowsiness (ORD) score above the fatigue threshold (Wiegand, et al., 2008). Examining the most severe safety-critical events (i.e., crashes/near-crashes), 22.3 percent were above the fatigue threshold. Dingus et al. (2006) found that fatigue was a contributing factor in 20 per cent of 82 crashes and 16 per cent of 761 near-crashes captured in a "100-Car" study (Wiegand, et al., 2008).

Currently, CMV drivers are limited by FMCSA's hours of service (HOS) regulations, which outline how much time a driver can spend behind the wheel and how much time off is required between driving sessions. In an effort to track driving time, drivers of CMVs are required by FMCSA to keep detailed self-completed paper logs, known as hours of service (HOS) logs. The National Transportation Safety Board (NTSB) indicates that these written logs are susceptible to tampering, driver oversight and are often inaccurate (Kotowski, 2007).

In 1997, the NTSB began advocating studies of the use of electronic on-board recording devices (EOBRs) which would gather driving information electronically, eliminating the need for paper logs (Kotowski, 2007). The EOBRs track driver duty status, location of the vehicle (via GPS), and distance travelled.

The DOT then proposed a mandate that self-completed paper logs be eliminated and replaced with EOBRs by companies with a driver log violation rate greater than 10 per cent, and for passenger carriers, hazardous materials transporters, and new motor carriers seeking authority to conduct interstate operations in the United States (FMCSA, 2012). On April 5, 2010, FMCSA published a final rule entitled "Electronic On- Board Recorders for Hours-of-Service Compliance" (EOBRs) requiring that certain carriers use EOBRs for a 2-year period. They also modified supporting document requirements and compliance review procedures

for those carriers that voluntarily chose to use EOBRs (FMCSA, 2012). The final rule took effect on June 4, 2010.

On June 3, 2010, OOIDA filed a petition in the United States Court of Appeals challenging the final rule (FMCSA, 2012). The case is known as *Owner-Operator Independent Drivers Ass'n v. Federal Motor Carrier Safety Admin.*, 656 F.3d 580 (7th Cir. 2011). The court found that FMCSA's failure to address the issue of harassment as part of the rulemaking rendered it arbitrary and capricious. As a result, the court vacated the entire rule. Then in in July of 2012, the President signed into law the bill dubbed "Moving Ahead for Progress in the 21st Century" or MAP2, also known as the Surface Transportation Bill (CVSA, 2012). The bill instructs the Secretary of Transportation to offer regulations requiring the use of EOBRs to verify HOS compliance by CMV drivers and both defines and sets requirements and performance standards for EOBRs (CVSA, 2012). The requirement for installation of EOBRs on CMVs is expected to be phased in over the next few years. However, Todd Spencer, OOIDA executive vice-president, says "the issue is far from settled" (OOIDA, 2012a). Rep. Jeff Landry (R-La.)said he is prepared to do whatever he can to stop the federal government from mandating such devices and said he will continue working to make sure the devices are not required on trucks. Landry indicated that "the potential impact it has on small businesses is catastrophic (Cama, 2012)."

Consequently, it appears that the EOBR mandate will continue to be a source of conflict for those involved. These organizations will include governmental agencies, special interest groups, management and drivers; each with their own interests, opinions, power, and authority.

THE CASE STUDY

A case study approach was chosen in an effort to gain a better understanding of the perceptions of inequity regarding the EOBR mandate from the perspective of management, employees, and contractors of a small transportation organization. The organization chosen for the case study is a family-owned and operated transportation company located in the southeastern United States. The information gained may be applicable to other small transportation organizations facing this or a similar conflict.

In addition to administrative and management personnel, the organization currently employs approximately 15 company drivers and utilizes some 60 owner-operators or individuals who own their trucks and contract their services to the organization. Data was collected using a combination of face-to-face and telephone interviews using open-ended questions. All of the participants have a stake in the conflict and participated voluntarily in the survey.

PERSPECTIVES

The reported underlying reason for the EOBR mandate is an attempt by governmental agencies to reduce or eliminate intentionally or unintentionally falsified HOS driver logs in the hopes of decreasing the incidence of tired driving and ultimately decreasing the number of accidents involving CMVs. "We are committed to cracking down on carriers and drivers who put people on our roads and highways at risk," said Secretary Ray LaHood. "This rule gives us another tool to enforce hours of service restrictions on drivers who attempt to get around the rules (DOT, 2010)."

The trade organization, OOIDA, representing small business and independent truck drivers, continues to oppose the mandate on the grounds that the EOBR technology has not been proven to improve safety. "This is being done under the guise of compliance with federal hours-of-service regulations, but it is actually a way for large motor carrier companies to squeeze more 'productivity' out of drivers and increase costs for the small trucking companies they compete

with," said OOIDA Executive Vice President Todd Spencer (Szakonyi, 2012).

An opposing view of the mandate is held by the American Trucking Associations (ATA) organization, whose website indicates that its mission is "to serve and represent the interests of the trucking industry with one united voice (ATA, 2012)." "Clearly, these devices lead to greater compliance with maximum driving limits, which is very good for the trucking industry as a whole and highway safety [in particular]," said ATA President and CEO Bill Graves, who adds that the EOBRs could also help drivers better manage fuel use, routes and other fleet operations (Szakonyi, 2012).

While management, employees and owner-operators all agree with the importance of safety-related measures, all expressed a dislike of the requirement being mandated by government. According to John Stuart Mill, there are two states of inclination: the desire to exercise power over others and the disinclination to have power exercised over themselves (Lukes, 1986). There are, however, differing perceptions of the fairness of this mandate. Equity theory explains that individuals can perceive certain arrangements as being unjust. Like the mandate for use of EOBRs, there are conditions in which individuals fail to achieve outcomes that they consider to be fair or equitable, which are likely to be marked by social conflict (Schellenberg, 1996).

Management indicates that they have strict policies and procedures in place to handle issues of HOS log errors. They indicate that while there isn't a high incidence of intentional falsification of HOS logs, driver oversights and/or a lack of understanding have created some issues for the organization.

> "Because we are not OTR (over the road), there is no need for a driver to intentionally falsify their logs. There are some minor issues, but each driver violation carries a score. That score goes on the company's overall score too. When our score goes over a certain threshold, DOT is alerted and we are signed up for an audit. With the EOBRs, the HOS violations basically disappear."

Conversely, owner-operators for the company express views different from those of management with regard to the problem of falsified HOS logs. A general feeling of inequity was expressed by the drivers.

> "I'm sure it happens, but I've never been guilty of falsifying my logs. The main reason some drivers do it is because they get held up and need to get their loads delivered, but why should everyone get punished? Why not just make the violators pay?"

The EOBR mandate would impose a very significant financial cost on the transportation industry. This is based on the Agency's Regulatory Impact Analysis (RIA) for the 2011 notice of proposed rulemaking (NPRM), which estimated total costs of the program at $2.377 billion per year (FMCSA, 2012a).

While management agrees that there are significant financial costs to businesses required to implement the mandate, their view is that the potential benefits outweigh the cost, which, in their opinion, justifies the expense. Karl Marx presumes that individuals in different classes, in this case, the management and the drivers, have different economic interests, regardless of their awareness of them (Schellenberg, 1996). The financial expense appears to be of little concern to management, who indicated:

> "It's expensive, but we want them. We would spend the money and although I don't like anything to be mandated, our ultimate goal is safety."

In stark contrast to management, a common theme among the owner-operators was the idea that the mandate would result in an expense, which represents a tremendous financial burden. Additionally, a common sentiment expressed was that the EOBR mandate was ultimately unfair and particularly hurtful to independent drivers and small businesses. One of the owner-operators expressed his opinion:

> "A lot of us can't afford it. It's just another way for the government and big companies to squeeze out competition from independent drivers and small companies."

Table 1 below summarizes the comments made by the various parties.

POWER RELATIONSHIPS

In an attempt to understand conflict situations, it is useful to understand power relationships. Goldman (1972) posits that relative power, in certain situations, depends on other assets, including other relationships. He further posits that in attempting to achieve an end in opposition to others, one frequently performs certain acts intended to elicit aid from other persons. When individuals with common interests or goals join together, mutually supportive acts can create a collective ability to exercise power or influence (Lukes, 1986). Goldman (1972) adds that a collective power results when members of a group have greater confidence in the reliability of their partners and consequently more confidence in their own acts as part of the larger group, giving the group more power together than members have individually.

The above discussion of "power relationships" provides some insights into the behavior of the actors in the situation under study here. For instance the references to the increased confidence that can result from "collective power" play out in our case study as described below. While management indicated that they had little interest in participating in any "political activist groups," several owner-operator drivers indicated that they were members of the OOIDA organization because of its support of such issues, [and presumably because of the resulting collective power]. In the words of one owner-operator:

> "I joined OOIDA because they keep up with things like this. They stand up for us, which is what the Teamsters used to do before all of the corruption. Now they're just in it for themselves."

TABLE 1
ANTICIPATED CONSEQUENCES OF THE MANDATE IDENTIFIED IN THE CASE STUDY

Management	Employees	Owner-Operators
Reduction of liability	Increased loss of control to management	Increased financial burden
Increased control of employees	Increased loss of productivity	Increased invasion of privacy
Reduction of paperwork	Inequitable penalties	Inequitable penalties
Increased reliability of Information	Reduction of paperwork	Increased loss of control to government
Increased driver safety		

Several groups have joined forces to either support or oppose the EOBR mandate. The American Trucking Association (ATA), American Automobile Association (AAA), the National Transportation Safety Board (NTSB), the National School Transportation Association (NSTA), and the Teamsters Union have joined together to create a collective power in support of the mandate. However, it has been met with opposition from the collective power of the Owner-Operators Independent Driver's Association (OOIDA), the largest national trade organization representing the interests of professional and small business truckers, and from small business groups such as the National Federation of Independent Business, National Ready Mixed Concrete Association, National Association of Small Trucking Companies, Portland Cement Association, American Concrete Pavement Association, National Precast Concrete Association, Agricultural Retailers Association and the Petroleum Marketers Association of America (OOIDA, 2012).

PROPOSED SOLUTION TO CONFLICTING INTERESTS OF DRIVERS AND MANAGEMENT

In this case, management is cognizant of the likelihood that the mandate will result in a financial burden for the owner-operators working for their organization. Additionally, management indicated that there would certainly be a backlash from the drivers, particularly the owner-operators. Consequently, in an effort to mitigate potential conflict, management has proposed taking financial responsibility for the purchase of all necessary EOBR equipment and developing a programwhich will allow drivers to utilize the equipment at no cost to them. The drivers in this case were in agreement that eliminating the requirement for purchasing the EOBR equipment would certainly reduce the financial burden for them.

Certainly, management has different economic interests than those of the drivers. Marx indicated that managers may attempt to gloss over differences in economic interests in order to avoid conflict with their workforce (Schellenberg, 1996). In this particular case, management did express the desire to avoid any conflict with the owner-operators that contract with their organization. However, management has elected not to attempt to avoid the issue of financial impact to the owner-operators, but to put the economic interests of those drivers in front of those of the organization.

ANALYSIS OF ISSUE

An understanding of power is important to understanding and managing conflict. Galbraith indicates that power is the possibility of imposing one's will on the behavior of other individuals (Lukes, 1986). In this case, there are many groups involved with differing interests and wills; and consequently, many different power relationships. With differing interests and viewpoints also come many different potentially adversarial relationships, in which power becomes a critical tool. For example, those relationships include the power of government versus the power of organizational management, the power of government versus the power of the workforce, the power of management versus the power of the workforce, the power of government versus the power of trade organizations and even the power of one trade organization versus another.

As seen in this case, the government, a source of great power, can utilize its authority to dictate or mandate certain behaviors of organizations and of the workforce, particularly when pertaining to matters that concern the welfare of the general public. While, in this case, there was a dislike of the EOBR mandate by management and the workforce, there exists a certain amount of acceptance of the power of the government and of the final decision as binding. Consequently, there is a shared attitude by both management and the workforce that conceding to the power of the law is inevitable.

However, the same attitude was not shared by the trade organization OOIDA, which has more economic and collective power than does management or individuals within this organization. Arendt, in 1970, indicated that power corresponds to the human ability to act in concert (Lukes, 1986). Consequently, members of management and individual members of the workforce may join groups, such as trade organizations in an attempt to increase the power they have. Simmel, in 1966, posits that where the rule of law prevails, there is always a two-way flow of influence between the more powerful and the less powerful, but one should not ignore the secondary flow, the factors responsible for it, and the consequences of it (Lukes, 1986).

While management has the authority to mandate the use of EOBRs for their employees, regardless of the government mandate, they have not done so. Management has done a good job of mitigating potential conflict with the owner-operators by putting the financial interests of the drivers before their own. Although management agreed that the use of EOBRs would reduce organizational liability and reduce workload, it has not mandated their use in an effort to avoid placing additional burdens on the drivers. Although the owner-operators will be required to have the equipment in their CMVs, management's proposal to bear the burden of the expense, which will result from the mandate, should prove successful for several reasons. First, for the owner-operators, it eliminates the major source of contention regarding this issue. Second, it may indicate to the drivers that management recognizes the legitimacy of their concerns. Finally, it may serve to strengthen the relationship between management and owner-operators.

RECOMMENDATIONS

Certainly, the EOBR mandate will not disappear in the foreseeable future and the government appears to have prevailed on this issue. However, in anticipation of the impacts of the mandate and the potential for backlash from employees and drivers, management should begin to take pro-active steps to mitigate potential conflicts. There are several suggestions that are drawn from the literature on social interaction, an understanding of which is critical in the management of workplace conflict:

- **Separate Fact from Fiction.**

Care should be taken by management to ensure that all of the facts, both negative and positive, are openly communicated. Drivers and employees should also understand that the mandate and resulting consequences were a result of the power of government and not of the organization. Effectively communicating all of the facts about the issue should help employees/drivers understand the intended benefits of the mandate and the idea that the mandate should not be viewed as a "victory" for the organization.

- **Acknowledge the Impact on Employees.**

Management should address the legitimacy of the major concerns of both the company drivers and the owner-operators. When dealing with issues that affect the employees/drivers, often the key is not so much in trying to solve their problems, but in simply being a good listener. By being truly listened to, employees are often empowered to solve many challenges on their own (Billikopf, 2006).

- **Create a Sense of Community.**

For the company drivers, fear of increased control by management was a critical concern. Honest and open two-way communication between management and company drivers regarding the issue will be helpful in attempting to decrease an "us" against "them" mentality. Additionally, the collective power of the trade organizations

should not be discounted. Management, drivers and any other employees who are opposed to the mandate should consider becoming involved in and supporting the trade organizations, which continue to challenge the mandate.

- **Shift Focus to the Overall Organizational Goal.**

Create and communicate a shared vision. The intent is to clarify why the team is here and where they are heading. Many "visions" are one-sided and reflect one individual's (or one group's) vision imposed on an organization, which calls for compliance-not commitment (Senge, 1990). A shared vision is a vision created with the input of the team, changing the need for compliance with the organization into a desire for commitment to the organization.

- **Create Written Policies and Procedures.**

All employees/drivers should understand which aspects of the issue are inflexible and the consequences of failing to comply. Putting the rules and resulting penalties for non-compliance in writing removes any ambiguity and potential for misunderstandings. Additionally, having written policies and procedures is important to ensure consistent and fair application of the rules and avoid conflicts caused by perceptions of inequity from the employees/drivers.

CONCLUSION

Certainly, there will always be conflict in the workplace, particularly when faced with governmental restrictions and controls. However, there are steps that management can take to both mitigate potential conflict situations resulting from the mandate, and to help diffuse existing ones. There are no ready-made conflict prevention plans which are applicable to every situation. These are merely recommendations based on this particular case, which consequently, may be applicable to other industries and situations. The suggestions are intended to increase employee/driver personal power and feelings of importance within the organization, decrease feelings of inequity, and increase the collective power of everyone within the organization, which should result in a decreased incidence of conflict.

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REDUCING LONG DISTANCE TRUCK DRIVER'S INTENTION TO LEAVE: AN ANALYSIS OF PROFESSIONAL DRIVERS AND OWNER OPERATORS USING IMPORTANCE/PERFORMANCE METHODS

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ABSTRACT

Since it is widely known that turnover is highest among unsatisfied employees, the authors argue that long haul professional drivers (PDs) and owner operators (OOs) can be retained by using a yearly importance/performance analysis of company drivers. Because qualified drivers are becoming more scarce and difficult to recruit/retain, carriers need to focus on increasing driver retention. In this article, we suggest an Importance/Performance (IP) model which uses an "if then" perspective, relating intention to leave as a function of the PD/OO: IP structure. This model is used to explain the managerial changes that could be made to retain professional drivers and owner operators.

INTRODUCTION AND LITERATURE REVIEW

Research into the nature and causes of truck driver turnover and retention in the United States has been ongoing for much of the last twenty-five years. Reasons for interest from both researchers and practitioners in this area abound and continue to increase in importance for a number of reasons. The following subsections discuss the industry and the driver retention issue, and highlight some of the reasons for this interest from researchers and practitioners.

Growth in Demand

First, even after accounting for the prolonged recession in the U.S., the volume of truckload freight movements has declined in some product categories, increased in others, but has shown more strength of demand and even growth than in other areas of the economy. The strength and stability of demand for truck transportation is in part due to growth in international trade. According to Meixell and Norbis (2008), growth in imports and exports in this country have outpaced growth in the economy as a whole and they expect this trend to continue. As the economy continues to improve over the next few years, this will lead to a significant rise in the demand for truck transportation. Of course, as the demand for truck freight transportation increases, the demand for drivers mirrors this change.

In fact, the demand for drivers in the U.S. has been growing more rapidly than the supply for a number of years. The increasing gap has implications for all sectors of the economy, not just transportation and logistics. In a 2005 study, it was reported that the supply of truck

drivers is expected to grow at an annual rate of 1.6 percent over the next 10 years, while the demand is expected to grow by 2.2 percent annually (Global Insight, 2005). Exacerbating this growth gap, the Council of Supply Chain Management Professionals (CSCMP) reported in 2010 that nearly 143,000 drivers have left the industry (changed occupations) since 2007, creating an anticipated shortage of 400,000 drivers by the end of 2011 (2010). In 2013, the CSCMP reported that the trucking industry was short 30,000 drivers. Although not as severe as predicted for 2011, the shortfall of drivers will likely be further impacted by the new hours of service regulations, pushing this number back up to 130,000 (2013). Further, the Bureau of Labor statistics considers commercial trucking a "high demand" job and expects 300,000 jobs to open by 2020, a growth rate of 21% (Henderson, 2012).

Driver Turnover Rates

The attrition rate for drivers in the U.S. motor carrier industry has climbed significantly in the past quarter century. According to the American Trucking Association (ATA), the industry average turnover rate for large truckload carrier line-haul drivers has risen to 97 percent in the first quarter of 2013 – the sixth such consecutive increase (2013). This same source predicts additional consecutive increases in the turnover rate in this industry category due to competition for drivers in the improving economy. It should be noted that there is a great deal of variability in the published estimates of driver turnover rates which may, in part, be ascribed to variance in the composition of the sampling data. For instance, turnover rates are not the same for large truckload carriers compared to large less-than-truckload carriers. Rates will also vary by size of carrier, average length of haul, variations in compensation and benefits, equipment type, etc. As an example of variation by type of carrier, one study reported a turnover rate as high as 130 percent in the irregular route truckload sector (CSCMP, 2006). In the not too distant past, driver turnover rates in excess of 100 percent have been reported for the truckload sector as a whole (Transport Topics, 2007; McElroy, Rodriguez, and Griffin, 1993).

Low Switching Cost

There is little cost for drivers to switch from one carrier to another. This low cost of switching contributes to the turnover and retention issues with truck drivers. The driver skill set is consistent from carrier to carrier and from market segment to market segment. It is even common practice to pay "commissions" to drivers for each new driver they recruit for their company. Virtually every truck stop in the country has magazines, posters, flyers and in some cases "headhunters", all touting the advantages of working for a specific carrier. The reasons associated with switching carriers range from better pay and benefits to newer and better equipment. This low switching cost has been referred to in some studies as a "natural tendency" to migrate from carrier to carrier (Keller, 2002: Suzuki, Crum and Pautsch, 2009). It has also been estimated that almost 50 percent of truck drivers in the U.S. change jobs within the first three months of employment (HRM International Digest, 2003). The average driver has been in his/her current job for between nine and twelve months (Suzuki, 2007).

Cost of Turnover/Retention

Employee turnover is costly to organizations, regardless of the occupation and/or industry segment involved. In the domestic motor carrier industry, the costs associated with turnover, recruiting, training, retention, motivation, etc. are significant. There are also significant costs associated with lower productivity of less experienced drivers, loss of revenue from driver service failures (late or missed pickups and/or deliveries), and lack of market coverage due to shortages in available drivers (Dobie, Rakowski, and Southern, 1998).

While the breadth and magnitude of the cost of driver turnover is very difficult to estimate accurately, there is some evidence in the literature that the total cost to the industry and to the economy is highly significant. According to an article by Suzuki, Crum and Pautsch (2009), cost estimates for the replacement of a single driver range between $2,200 and $21,000, with the range being accounted for by factors such as tractor repositioning costs, drug screening costs, road testing and driver training for new drivers, and various types of opportunity cost such as lost freight revenue (see also, Joe White, 2012). As a rough measure of the impact of these figures, consider the following example. In a study by Harrison and Pierce (2009), it was estimated that truck drivers numbered 2.9 million in the U.S. in 2006. Applying a conservative overall annual turnover rate of 75 percent yields an estimate of 2,175,000 drivers changing jobs annually. On the low side ($2,200 per driver), the total annual cost to the industry would be $4.79 billion. On the high side ($21,000 per driver), the total annual cost to the industry would be $47.85 billion.

Turnover and Intention to Leave

In today's highly dynamic economy, especially in times of a qualified truck driver shortage, it is very difficult to find employees that match their expectations with the organization's values and culture. Therefore turnover is inevitable. Turnover is defined as the loss of a driver for any particular reason. There are two types of turnover, voluntary and involuntary. Voluntary turnover occurs when drivers leaves the organization deliberately (i.e. quitting); this can be contrasted with involuntary turnover, which occurs when drivers leave the organization without choosing to do so (i.e. fired or laid off) (Lee et al, 2008). The focus of this research is on the driver who might leave through his/her own volition.

Turnover intention is described as the cognitive process of thinking, planning, and desiring to leave a job (Mobley, 1977). It occurs just before individuals actually leave their jobs. Intention to leave is linked with actual turnover. In practice, employers would rather know their driver's intention to quit, prior to them actually leaving, so management can take preventive measures and encourage them to stay (Wong and Tay, 2010). When the employee has decided to leave, it is too late for human resource managers to do anything. Therefore, there is not a lot that can be done other than to hire a very costly replacement.

In addition to the dollar costs of turnover, drivers incur other costs when they leave a job. Negative consequences to drivers include losing seniority, and the disruption of social life (Mobley and Fisk, 1982; Roseman, 1981). Also, transitioning to another job or situation can take a personal toll. In addition, a new job can be stressful and cause considerable uncertainty and ambiguity (Brooks et al, 2005).

Job Shifting

Organizations must distinguish between controllable and uncontrollable turnover, and not spend resources trying to retain drivers who leave for reasons outside the carrier's control. Such efforts are highly unlikely to yield positive results.

Some workers have the natural impulse to move from one job to another for sometimes no apparent or rational reason, that is, irrespective of whether they have better alternative job offers or not. Ghiselli (1974) describes this as hobo syndrome behavior, "...the periodic itch to move from a job in one place to some other job in some other place." Wong and Tay (2010) suggest that job hoppers like the mobility and freedom to be able to frequently change jobs because they know exactly what they want to do with their lives and career. The random nature of the job hopper makes their identification and profiling very difficult.

Summary

The above subsections identified a number of the issues relative to driver turnover. Some of

the reasons for turnover are controllable by management and some are not. This research focuses on the controllable aspects of turnover. Identifying possible turnover candidates, and managerially dealing with their issues, can possibly encourage these drivers to stay with the company. From an analysis standpoint, these possible turnover candidates form the basis of our study.

RESEARCH QUESTIONS

The importance of driver retention in the trucking industry is both relevant and important to the economics of the US trucking industry. Thus, this research attempts to take a snapshot in time of what is important to both professional and owner operator long distance truck drivers and how they feel companies are dealing with these needs. The following research questions (1-3) deal with examining these issues.

- Research Question 1: What is the Importance/ Performance (IP) structure for professional drivers (PDs)?
- Research Question 2: What is the IP structure for owner operators (OOs)?
- Research Question 3: What are the differences in IP structure between PDs and OOs?

In addition, this research establishes a managerial structure for enhancing driver satisfaction and a suggestive structure for reduction of intention to leave, hence turnover reduction. Therefore we propose the following research questions (4-5).

- Research Question 4: What can managers do to reduce intention to leave for PDs?
- Research Question 5: What can managers do to reduce intention to leave for OOs?

METHODOLOGY AND ANALYTICS

The use of Importance – Performance analysis in research is not an exact science. It follows more or less a process of identifying the important issues, namely professional driver (PD) and owner operator (OO) human resource/ employment and company retention issues and then developing a suitable sampling and data collection mechanism. The IP structure is developed from the data collected about the importance of an issue to the PD or OO and then how the company performs (serves) on the issue. What makes this research unique is the addition of an "intention to leave" scale, which addresses the likelihood of a PD or OO leaving the company. This intention to leave data can be used in an "if-then" model to predict what issues might lead to a PD or OO leaving the company. The enhancement of information on these issues might enable the company to create a predictive type model of retention for the PD or OO driver. To develop the model, five research questions are addressed in this research. The following methodology was used to answer the research questions and develop the if-then model.

Questionnaire Development

An original set of important long distance truck driver employment issues (items) were chosen from the literature, discussions with various trucking management groups, and a focus group of 10 regional drivers from large fleet managed trucking companies. This list was further reduced by asking the ten (10 - 5 PD and 5 OO) regional drivers to rank order the items as to how important these issues were to them. Eighteen items remained to ascertain perceptions of critical issues to drivers while working as a PD or OO for a fleet trucking company.

The intention to leave (IL) measure was developed using a composite three item (question) scale (5 point Likert scaling), adapted from Tett and Meyer (1993) to measure the intention to leave an organization. It has an alpha reliability of .89. A set of additional questions were asked to assess the drivers' experience level.

The questionnaire was tested on a set of professional drivers, owner operators, and managers to determine if any changes should be

made to the questions. This established content validity for the data collection.

Survey Methods

Two separate samples were developed for data collection. This seemed to be the best sampling approach given the differences between professional drivers and owner operators in the long haul trucking industry. Two sets of differing size carriers were asked to participate. They were also asked to implement the online data collection by using their email systems to encourage drivers to participate. The data collection was kept open for twelve months, ending December, 2012. These carriers have asked to remain anonymous. However, they represent a typical fleet carrier on average with about an 80 % "PDs" to 20 % "OOs" ratio. The questionnaire was sent by the carriers to the bulk of drivers within the two strata. The only requirement for the stratification besides the driver split was to have the drivers vary in experience levels for current and previous companies. The online survey was conducted using Questionpro (www.questionpro.com) software. Due to the sampling procedures and the carriers' participation, the completion ratio for the sampling was on average approximately 70% while the "view to start" ratio was approximately 60%. Thus the sampling seemed efficient and representative of the sampling stratification requirements. The analytical sample represented 862 PDs and 292 OOs. Eighty-five percent of the PDs had at least 4 years of driving experience, while 10% had between 5 and 12 years of experience. Approximately 90% of the OOs had at least 4 years of driving experience while 5% had between 5-8 years of experience.

Analytics and Importance-Performance Analysis (IPA)

IPA, along with its many derivative forms, is a well-developed, simple to understand, managerially useful marketing research technique. IPA, in its original conception, was developed to measure attribute importance and performance to develop effective marketing programs (Martilla and James 1977). Although often criticized and creatively modified (Deng and Huo 2008), it is a very useful tool to organize important service attributes relative to provider (in this case a trucking company) performance. After the IPA analysis is completed, a manager can set priorities for changing how the company deals with the issues that the drivers feel are important but underserved (Tyrrell and Okrant 2004). Essentially, the method begins with the specification of how important an issue is to a professional driver (PD) or owner operator (OO) while driving for a particular company (their expectations). The PD or OO then evaluates how well the company is serving each issue (performing). The PD or OO evaluates the relative importance (scaling from extreme importance to not important), and then evaluates whether the company is dealing positively or negatively with an issue (scaling from excellent to poor). The relationship between the sample's (PD sample, and OO sample) importance mean ratings and the performance ratings form a grid analysis with the structure found in Tables 1 and 2.

After examining the structure in Tables 1 and 2, where the IP column reflects the IP relationship (HH HL, LH, LL (high importance, high performance to low importance, low performance)), managers can use this model in Table 3 as a guide to allocate/reallocate resources to enhance the driver's feelings that an important issue is served. In the case of this research, we are also examining the IP feelings of drivers who report an intention to leave. Managers could also use the guidelines in Table 3 to provide better managerial matches with driver expectations to suggest ways and means to serve the drivers' needs and therefore decrease their intention to leave.

DISCUSSION OF RESULTS

Research Question 1

The IP results for the professional drivers (PDs) are shown in Table 1. The highest ranked items in the structure that are important to the PDs reflect the themes of honesty, competency, problem solving, compensation, home time,

and loyalty. The (PDs) drivers' perceptions of how their respective companies perform on these items are shown as HLs (high in performance but underserved) in the table. Generally, the PDs perceive that the companies perform poorly on these issues and they are important to them. Of interest in the table is the – "Providing Advancement Opportunities" item – which the PDs believe their companies are not responding to. Using the guidelines in Table 3, it would seem that management for the respective carriers would do well to improve these items to affect positive PDs perceptions and suggestively – their job satisfaction.

Research Question 2

The IP results for the OOs, owner operators' stratum are shown in Table 2. The highest ranked items, important to the OOs, seem to reflect the themes of honesty, respect, competency, compensation, prompt problem solving, loyalty, and communication (issues/ change, rules). Generally the OOs perceive that the companies are also performing poorly on these issues. Of greatest concern to the OOs are loyalty, honesty, and compensation.

Research Question 3

The comparison of IP results of the PPs and the OOs in the sample (Tables 1, 2) seem to indicate a similar pattern of IP with the exception of honesty, respect, problem solving, and dispatch. Although both strata believe these are important and that management performs poorly on these concerns, the OOs seem to perceive that management performs more poorly on these items.

Research Questions 4, 5

The basis of retention is a combination of good recruiting, confirmation of initial and ongoing expectations of drivers, and continuous company management of the issues/concerns that drivers have. The analysis of the PDs and OOs intention based upon their perceptions of their IP structures may give company management a snapshot of what they are doing correctly, or not, to keep the drivers in the fold. Obviously, management might not have the resources to affect all of the changes suggested by the IP structure, nor can we be sure that these changes will result in higher retention. This will have to be monitored by companies on a long term basis. Our intent is to give a carrier a model prognosis (using Table 3) and a plan of change to retain drivers.

Ninety seven of the eight hundred and sixty two (97/862) of the PD sample indicated a high probability of leaving the company (Table 4). This estimate is based upon the composite (IL) "Intention to Leave" scale. Generally, this would indicate that if the sample was a true reflection of a PD, then companies would have to deal with a possible twelve (11%) per cent leave rate. If one examines the IP data for PDs (Table 4), one can conclude that certain IP items might have an impact on driver retention. For the PD stratus, these would be compensation, loyalty and honesty. Obviously, this is not a slam dunk, if - then model. But, it makes intuitive sense, from the literature, that higher perceptions of job satisfaction can be an indicator of retention (Rust, Stewart, Miller, and Pielack 1996). Similarly, if one examines the IP data (Table 5) for the OOs stratum, one can conclude that management might be able to reduce intention to leave, thus enhancing retention, (52/292 or ~18% for OOs) by positively changing driver perceptions of honesty, compensation, respect, and loyalty.

DISCUSSION OF MANAGERIAL IMPLICATIONS

Although, it might seem trivial to some, this is the first attempt to examine retention using a somewhat sophisticated managerial tool. The "if – then" model, although easily criticized as with all IP approaches, seems to provide useful insights into PD/OO intentions to leave and what actions might be taken to avoid the turnover.

TABLE 1

SURVEY OF IMPORTANCE/PERFORMANCE

PROFESSIONAL DRIVERS

(All Participants, n = 862)

Offering (Attribute)	Importance Mean (1-5)	Performance Mean (1-5)	IP
Adequate Driver Compensation	4.71	3.12	HL
Informed About Issues/ Changes	4.44	3.63	
Solving Drivers Problems Promptly	4.72	3.20	HL
Providing Competent Dispatchers	4.75	3.36	HL
Treating Me With Respect	4.76	3.42	HL
Honest With Me	4.83	3.27	HL
Providing Adequate Training	4.67	3.75	
Providing Newer Equipment	4.50	3.46	
Providing Adequate Home Time	4.71	3.27	HL
Strong Supervisor Communication	4.53	3.42	
Providing ContinuousTraining	4.37	3.77	
Indicating Clear And FairWork Rules	4.57	3.58	
Providing Advancement Opportunities	4.49	3.25	HL
Let Me Make Some Critical CRM Decisions	3.95	3.19	
Indicating Clear Hiring Expectations	4.38	3.49	
Providing Respectful Dispatchers	4.70	3.43	
Company Shows Me Loyalty	4.71	2.92	HL
Provide Stress Relief Workshops	3.90	2.82	

Notes: Scales range from 1-5, where attribute is more important to the professional driver (PD) as the value approaches 5. In addition, the driver perceives that the company is doing the best job they can in providing for the attribute as the value approaches 5. IP reflects the Importance Performance relationship. HL indicates than a PD sees this issue as important but underserved by the company.

TABLE 2

SURVEY OF IMPORTANCE/PERFORMANCE

OWNER OPERATORS

(All Participants, n = 292)

Offering (Attribute)	Importance Mean (1-5)	Performance Mean (1-5)	IP
Adequate Compensation	4.76	2.83	HL
Informed About Issues/ Changes	4.71	3.24	HL
Solving Owner Operator (OO) Problems Promptly	4.75	3.04	HL
Providing Competent Dispatchers	4.79	3.22	HL
Treating Me With Respect	4.80	3.20	HL
Honest With Me	4.85	2.85	HL
If applicable, providing Adequate Training	4.53	3.70	
Providing Newer Equipment	4.38	3.96	
Providing Adequate Home Time	4.63	3.66	
Strong Supervisor Communication	4.45	3.38	
If applicable, providing Continuous Training	4.23	3.86	
Indicating Clear And FairWork Rules	4.63	3.12	HL
Providing Advancement Opportunities	4.32	2.82	HL
Let Me Make Some Critical CRM Decisions	4.05	2.80	
Indicating Clear OO Expectations	4.50	3.05	HL
Providing RespectfulDispatchers	4.74	3.16	HL
Company Shows OO Loyalty	4.74	2.64	HL
Provide Stress Relief Workshops	3.63	2.37	

Notes: Scales range from 1-5, where attribute is more important to the owner operator (OO) as the value approaches 5. In addition, the OO perceives that the company is doing the best job they can in providing for the attribute as the value approaches 5. IP reflects the Importance Performance relationship. HL indicates than an OO sees this issue as important but underserved by the company.

TABLE 3
I/P STRUCTURE AND RESULTANT MANAGERIAL PRIORITY FOR CHANGE AND AFFECTING INTENTION TO LEAVE

Importance (I) **Mean Score**	**Performance (P)** **Mean Score**	**Priority** **(Possible Resource Allocation)**	**Change**
High	Low	High	Attributes to Improve
Low	Low	Possible Reallocate	Attributes to Question
Low	High	Possible Reallocate	Attributes toDeemphasize
High	High	Continue	Attributes to Maintain (examine effect)

The results from this study show the research provides some interesting perspectives for the industry. The first perspective is that companies seem to use a self-fulfilling prophecy as to what motivates drivers. These results indicate management does a poor job of understanding the expectations and motivations of the PDs and the OOs in their fleets and a somewhat poorer job of actually performing up to drivers' expectations concerning very critical issues. The second perspective seems to indicate that companies do not understand retention from the drivers' perspective and throw resources at the wrong issues to try to retain them. In many instances, companies believe that their retention rates are better than the competitors, so they are somewhat shocked when they find out otherwise. The third perspective is the value to perform this simple quizzical approach to maintain driver satisfaction-a sort of Driver/ Management audit approach. Used on a periodic basis and coupled with a longitudinal data base of results, the resultant retention data could enable a company to develop their own –if then- model. The simplicity of the modeling makes the technique both driver and managerial friendly. In addition, the quickness of data collection, using Internet, tablet, and even smart phone data collection coupled with the simplicity of the analysis make this technique invaluable in a time of driver shortage and difficulty of PD/OO replacement.

Although Table 3 illustrates the direction of resource allocation, it does not spell out how many resources would be needed to induce PD or OO change of perception about an issue. The guidelines are more suggestive that a change in resources would affect perception and enhance retention. Since the guidelines are suggestive, it is important that an individual company continually monitor their PDs and OOs and experiment with allocations based upon their philosophy of management. Resources available from the LL and LH conditions should be allocated to the critical HL category and the maintenance of the HH categories. If there is an impact, then management could develop a more predictive model using actual retention data resulting from the IP changes.

TABLE 4

IP of PROFESSIONAL DRIVERS WITH A HIGH INTENTION TO LEAVE

(High Intent to Leave, n = 97)

Offering (Attribute)	Importance Mean (1-5)	Performance Mean (1-5)	IP
Adequate Driver Compensation	4.72	2.59	HL
Informed About Issues/ Changes	4.29	3.45	
Solving Drivers Problems Promptly	4.60	2.85	HL
Providing Competent Dispatchers	4.69	2.87	
Treating Me With Respect	4.63	2.86	HL
Honest With Me	4.77	2.79	HL
Providing Adequate Training	4.44	3.51	
Providing Newer Equipment	4.46	3.33	
Providing Adequate Home Time	4.69	2.88	HL
Strong Supervisor Communication	4.41	3.13	
Providing Continuous Training	4.14	3.49	
Indicating Clear And Fair Work Rules	4.47	2.99	
Providing Advancement Opportunities	4.42	2.68	HL
Let Me Make Some Critical CRM Decisions	3.95	2.76	
Indicating Clear Hiring Expectations	4.31	3.49	
Providing Respectful Dispatchers	4.58	2.88	
Company Shows Me Loyalty	4.64	2.40	HL
Provide Stress ReliefWorkshops	3.95	2.50	

Notes: Scales range from 1-5, where attribute is more important to the professional driver (PD) as the value approaches 5. In addition the driver perceives that the company is doing the best job they can in providing for the attribute as the value approaches 5. IP reflects the Importance Performance relationship. HL indicates than a PD sees this issue as important but underserved by the company.

TABLE 5

IP of OWNER OPERATORS WITH A HIGH INTENTION TO LEAVE

(High Intent to Leave), n = 52

Offering (Attribute)	Importance Mean (1-5)	Performance Mean (1-5)	IP
Adequate Compensation	4.82	2.19	HL
Informed About Issues/ Changes	4.74	2.57	HL
Solving Owner Operator (OO) Problems Promptly	4.68	2.21	HL
Providing Competent Dispatchers	4.76	2.41	HL
Treating Me With Respect	4.84	2.45	HL
Honest With Me	4.92	2.30	HL
If applicable, providing Adequate Training	4.64	3.30	
Providing Newer Equipment	4.29	3.65	
Providing Adequate Home Time	4.76	2.95	
Strong Supervisor Communication	4.54	2.76	
If applicable, providing Continuous Training	4.39	3.73	
Indicating Clear And Fair Work Rules	4.67	2.86	
Providing Advancement Opportunities	4.23	2.05	HL
Let Me Make Some Critical CRM Decisions	4.18	2.35	
Indicating Clear OO Expectations	4.46	2.43	
Providing Respectful Dispatchers	4.77	2.44	
Company Shows OO Loyalty	4.69	2.03	HL
Provide Stress Relief Workshops	3.72	2.00	

Notes: Scales range from 1-5, where attribute is more important to the owner operator (OO) as the value approaches 5. In addition the OO perceives that the company is doing the best job they can in providing for the attribute as the value approaches 5. IP reflects the Importance Performance relationship. HL indicates than an OO sees this issue as important but underserved by the company.

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MANAGING RENTAL CAR BUSINESSES IN THE NEW ECONOMY: USING A MULTIVARIATE DECISION MODEL APPROACH

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ABSTRACT

U.S. rental car organizations are having to modify their business models to adapt to the new economy, which includes increased fuel costs, reduced business and leisure travel, and reduced resale of low mileage rental units. Revenue is negatively impacted due to increased maintenance as a result of higher mileage requirements placed on the rental inventory. Changes in the depreciation allowance on the rental car fleet reduced the potential value of vehicles by requiring fleet operations managers to maintain the fleets for longer periods of time. This article presents a multivariate decision-making model, which used in conjunction with in-house performance indicators, will assist operations managers in understanding specific variables likely to impact rental car revenues and optimize their decisions regarding available assets.

INTRODUCTION

The rental car industry flourished for many years through relationships forged with the so-called big three automotive manufacturers. Deep discounts enjoyed by rental car companies allowed them to replenish fleets and sell low-mileage vehicles for high profits in the consumer marketplace. Unfortunately this scenario has changed with the new economy. Increasing costs of fuel, replacement parts and tires; are adversely affecting many segments of the automotive market, but especially rental car companies purchasing and maintaining rental car fleets.

Several key factors are impacting revenue in this industry segment. During the period of fall 2008 through fall of 2012 the price of gasoline increased from an average of $2.50 per gallon to an average of $3.73 in today's market. Some states experienced increases as high as $5.99 per gallon during this time period (Gas Buddy.com, 2012). This trend is reflected in decreases in business and leisure travel, reductions in the numbers and prices of rental units and increased maintenance costs.

The airline and hotel industries along with leisure travel are declining, which puts additional pressure on car rental companies to further modify or change their existing revenue models. Airlines increased their profit margins from 5.3% to 6% during the 12 months from the 2nd quarter 2011 to the 2nd quarter of 2012. However, this increase includes $991 million in baggage fees and $661 million in reservation change fees and the total of $1.6 billion represents 70% of the profit for quarter 2 of 2012. Total passenger loads for the first 6 months of 2012 indicate virtually no increase over 2011, an early indication that flat passenger

loads won't provide expected revenues for the rental car market from airline passengers (BTS.Gov, 2012).

Fuel costs have negatively impacted both business and leisure travel from 2007-2011. The hotel occupancy rate for 2009 was the worst on record during those five years with an average occupancy rate of 66%. The average hotel occupancy rate has increased since 2009 to nearly pre-recession levels. For example, occupancy rates rebounded to 74% for 2011 and are keeping pace so far in 2012. Unfortunately, hotel occupancy projections are lower again for the remainder of 2012 and 2013 due to the volatile fuel market (Smith Travel Research, 2012).

According to *Auto Rental News.com*, the overall inventory for rental car companies decreased from a high of 1.861 million units in 2007 to a low of 1.629 million units in 2010. The total car rental fleet increased to 1.76 million units during 2011, an increase of 8%. Revenue increased from $20.5 billion in 2010 to $22.4 billion during 2011. The revenue figures had not been released for 2012 when this article was completed and will reflect the Federal government's attempt to ease losses with the bonus depreciation program when they are released. This program allows rental car companies to write off the entire cost of a new rental unit in year one resulting with little or no tax liability. Once this ends, the depreciation decreases to 50% in 2012 and 0% in 2013.

The decrease in numbers of rentals per year forced rental car companies to hold on to inventory longer than usual during 2010 which resulted in an increase in maintenance costs. For example, the overall repair cost per mile per unit increased from $0.014 in 2009 to $0.015 in 2010 and dipped slightly in 2011 to $0.013. The reduction in repair cost per mile is a result of replacing older vehicles with newer cars in order to take advantage of the accelerated 100% depreciation for the year of 2011. Average maintenance costs per month increased in 2009 and 2010, at $32 per unit and increased to $34 per unit in 2011. These changes were due primarily to the increase in oil prices and the requirement that newer vehicles use expensive synthetic oil for scheduled oil changes. Maintenance on tires increased from $101 per tire during 2009 to $103 during 2010 and $108 during 2011. This is an increase of 7% during the past three years due primarily to higher petroleum costs (Antich, 2012).

The discussion above suggests that rental car company managers face ongoing changes in a variety of key variables. Properly responding to these changes in the environment is critical to rental car company profitability. This article presents a multivariate decision-making model, which used in conjunction with in-house performance indicators, will greatly assist operations mangers in understanding specific variables likely to impact rental car revenues, and allow them to optimize their decisions regarding available assets.

LITERATURE REVIEW

The research literature identifies a number of deterministic models, which are designed to address revenue management in varying industries. More specifically, the authors focused on those which centered their attention on the rental car industry. Some of the issues which these models attempt to address are highlighted below followed by a brief commentary about their shortcomings.

Twenty years ago United States automobile manufacturers purchased the majority of major car rental companies and flooded them with their vehicles. As the economy improved, changes in the price structure forced the rental car business to follow the airline paradigm of applying revenue management. Revenue management, the practice of using booking policies, together with data information systems, aims to increase revenues by intelligently matching capacity with demand (Belobaba, 1987; Weatherford and Bodily, 1992; Gallego and Van Ryzin, 1997).

Unfortunately, this approach presented difficulties within the car rental industry. It failed to address specific issues surrounding asset management for businesses operating in a downturn economy. Rental car companies found themselves holding on to their assets (i.e. rental units) longer than usual. As a result, this practice gave rise to increased maintenance and liability issues, which many of the deterministic models failed to address or explain when discussing revenue management. Most of these models are static in nature, and thus cannot fully account for dynamic changes.

Researchers agree that all rental car companies face an uphill battle in their dynamic pricing practices, because there are an increasing number of variables to take into account. Altman and Helms (1995) noted that competitive pricing is one of the most critical attributes that a rental car company must possess in order to attract customers. In addition to pricing, there are other factors to consider, such as different car classes, arrival dates, rates which can change daily, and time of rental. Most deterministic models simply identify these variables, but fail to fully explain their interaction, or significance in explaining variation in revenue.

A common theme in the revenue management literature is to focus on profit maximization by matching capacity with demand. One particular method in dealing with this complexity involves risk pooling, where rental locations can be grouped in pools to gain access to each other's vehicles. In the rental car industry, revenue management models can be designed to allocate resources to the products, allocate resources to the customer, set prices, and allocate resources to the market.

Predictive models typically developed for this industry include unit pricing, allocating resources to markets and dynamic reallocation. The unit pricing model is used consistently in the rental car industry; it includes data such as location, car type, anticipated demand, duration of rental, and competitor pricing. Once bookings begin, demand forecasts are updated. Then demand is considered relative to available resources, given customer preference of car type. The model which allocates resources to markets considers production capacity, which can be optimized across and within markets. A variation of the preceding model involves dynamic reallocation, which targets short-term adjustments in the allocation of resources across markets.

RESEARCH SETTING AND ISSUE

A typical rental car company aggregates and compiles its operational and financial data monthly. Internal reports are generated from these databases and disseminated to both district and branch managers who review indicators such as utilization, and any identifiable trending associated with travel. Short-term revenue implications are assessed based on current market conditions, and adjustments are often initiated to align with long-term corporate strategic goals.

A nation-wide rental car company provided a subset of its operational and financial databases for one of its small markets covering a three-year period from 2009 to 2011 to assist with this research project on the condition that their identity remained anonymous given the sensitivity and priority nature of the information. There are four rental locations within 50 miles of one another included in this database. Two of its largest centers are within 25 miles of each other, which allows for access to its fleet to meet specific customer demand. One of these two locations is situated near a military base, while the other is strategically positioned in an industrial dominated sector. The other two locations service smaller geographical regions with a focus on serving rural customer needs. During this three-year period and well into 2012, the rental car agency recognized that its revenues were plummeting, as demand fluctuated affecting both fleet capacity and utilization. It recognized the need to institute changes to its current business plan given the volatility within

the market-place. According to the operations manager, the decline in profits was linked to increases in fuel prices, inadequate depreciation, reduced discounts on new acquisitions from automobile manufacturers, and a softened used car market place. In 2012 the used car re-sale market improved because manufacturers reduced their fleet allocations and eliminated "deep" discounts.

In the past, rental car agencies depended less on rental revenue for profitability. Significant profits were realized from the re-sale of rental units, which were leveraged against the "deeply" discounted purchase price. In fact, rental revenues were used to service each unit's operational costs until it was time to dispose of the inventory. While there is no industry standard, it was common practice in the rental car agency in this study to dispose of a rental unit when it reached about 21,000 miles, according to the operations manager. Unfortunately, with all of the changes discussed above, this practice was quickly abandoned as they were now faced with keeping their units much longer in their fleets.

Given the need for change, the rental car operations manager was keenly interested in the deterministic multivariate model proposed in this research. More specifically, he is interested in determining how the information derived from the model can be effectively implemented within their decision-making process. This allows the rental agency to achieve its long-term strategic goals and to maximize fleet revenue. A methodology for the multivariate decision model is proposed in the next section.

METHODOLOGY

The following sections address variable definition, model formulation, and model building approaches.

Defining Variables

This section defines both the predictor and indicator variables for the multivariate decision model. The rental car company's database captures vital information about the company's operations for all four of its market locations. Some of the predictor variables extracted from the rental car database are shown in Table 1. These fields include: revenue (REV), number of rentals (NUMREN), number of rental days (RENDAYS), fleet size (FLTSIZE), revenue per day (REVPDAY), revenue per rental unit (REVUNIT), average number of rentals per month (AVEREN) and utilization (UTIL).

Based on interviews with the operations manager, it was determined that interest in additional predictor variables needed further investigation to determine potential impact on revenues. An expanded database was created to provide these predictor variables: nationwide monthly gasoline prices (GASOL), consumer price index (CPI), regional population data (POPDAT), and regional monthly unemployment data (UNEMP).

Three dummy variables were added to reflect potential effects due to location, seasonality or quarterly periods. These variables include: Location (REGION1, REGION2, REGION3, and REGION4), Season (FAL, WIN, SPR, SUM), and fiscal year Quarter (QUAR1, QUAR2, QUAR3, and QUAR4).

The objective of the database analysis was to identify a representative subset from the variables shown in Table 1 for the purpose of fitting the multivariate deterministic model. The model's predictive capability along with the rental car agency's in-house performance indicators would be used to enhance to decision making to maximize rental car fleet revenues.

Several endogenous variables are identified to help explain variation in revenue. Some variables were intuitively identified based on their ability to globally impact the economy such

TABLE 1
DEFINITION OF PREDICTOR VARIABLES

Definition of Variable	*Short Variable Name*
Y =Monthly Rental Car Revenue (thousands of dollars)	*REV*
X_1=Seasonal Segmentation (fall, winter, spring and summer)~Dummy Variable	*FAL, WIN, SPR, SUM*
X_2=Quarterly Segmentation (Q_1, Q_2, Q_3, and Q_4)~Dummy Variable	*QUAR1, QUAR2, QUAR3, QUAR4*
X_3=Regional Location (four locations within a 50 mile radius)~ Dummy Variable	*Region1, Region2, Region3, Region4*
X_4=Regional Population Data (thousands of people)	*PopDat*
X_5=Regional Monthly Unemployment Data (%)	*UnEmp*
X_6=Nationwide Monthly Price for Regular Gasoline ($ per gallon)	*Gasol*
X_7=Number of Rentals per month (expressed in hundreds)	*NumRen*
X_8=Total Number of Days Cars were Rented Monthly	*RenDay*
X_9=Average Number of Rentals per Month (days)	*AveRen*
X_{10}=Revenue per Unit ($ per unit)	*RevpDay*
X_{11}=Fleet Size(number of units)per month at each location	*FltSize*
X_{12}=Fleet Utilization (%)	*Util*
X_{13}=Average Number of Days per Rental Unit ('000)	*RevUnit*
X_{14}=Advertising Expense ('000)	*AdvExp*
X_{15}=Consumer Price Index (CPI) ('00)	

as gasoline price, consumer price index, and unemployment rate, which influences spending. As fuel prices increase, both consumers and businesses tend to alter their consumption levels.

Exogenous variables help to capture this effect, but these are difficult to accurately quantify. For instance, businesses often ask their employees to use public transportation or taxis, rather than incur the cost of a rental car. Rental car companies have no way to counteract such practices, except to offer further rate reduction, which undermines revenue in the short term. As the general price levels for goods and services rise, both consumers and businesses adjust consumption levels to meet existing and future demand. Families are likely to defer travel, while businesses enact policies whereby employees are compensated for the use of their own vehicles. Rental car companies can do little to alter consumer and business practices. Instead, they are motivated to seek cost reduction through efficient allocation and maintenance of an optimal mix of units and size (Cook and Weisberg, 1985).

Model Formulation

The basic structure for building the multivariate decision model is derived from using the general linear regression methodology, which utilizes multiple explanatory variables. This model is commonly referred to as a multivariate regression model in the statistical literature (Rousseeuw, 1984). Equation 1 provides the generalized form, whereas equation (2) presents the formal structure. The dependent variable, *Y* defines *Revenue*, while the variables denoted by X_i represent the list of predictor and indicator variables (i.e. dummy variables). As shown in equation (1) the two components include a deterministic and a random error.

Y-values | X-values = deterministic + random error……..……(1)

$$Y = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_k X_k + \varepsilon \quad \text{……...(2)}$$

The deterministic component represents the explained variation about the response variable, whereas the random error accounts for the unexplained variation. Unexplained variation is the result of occurrences which often the user does not have control over, such as a customer's decision to use public transportation or carpooling in lieu of renting a car.

The multivariate regression equation shown in (3) must be expressed in its algebraic form before data processing can be facilitated.

$$E(Y \mid (X_1 i, X_2 i, \ldots, X_n i)) = bo + b_1 X_1 i + b_2 X_2 i + b_3 X_3 i + ,\ldots, + bnXni \text{……..(3)}$$

Equation (3) is re-written in (4) to include the random error component, ei which helps to capture unexplained variation as described above.

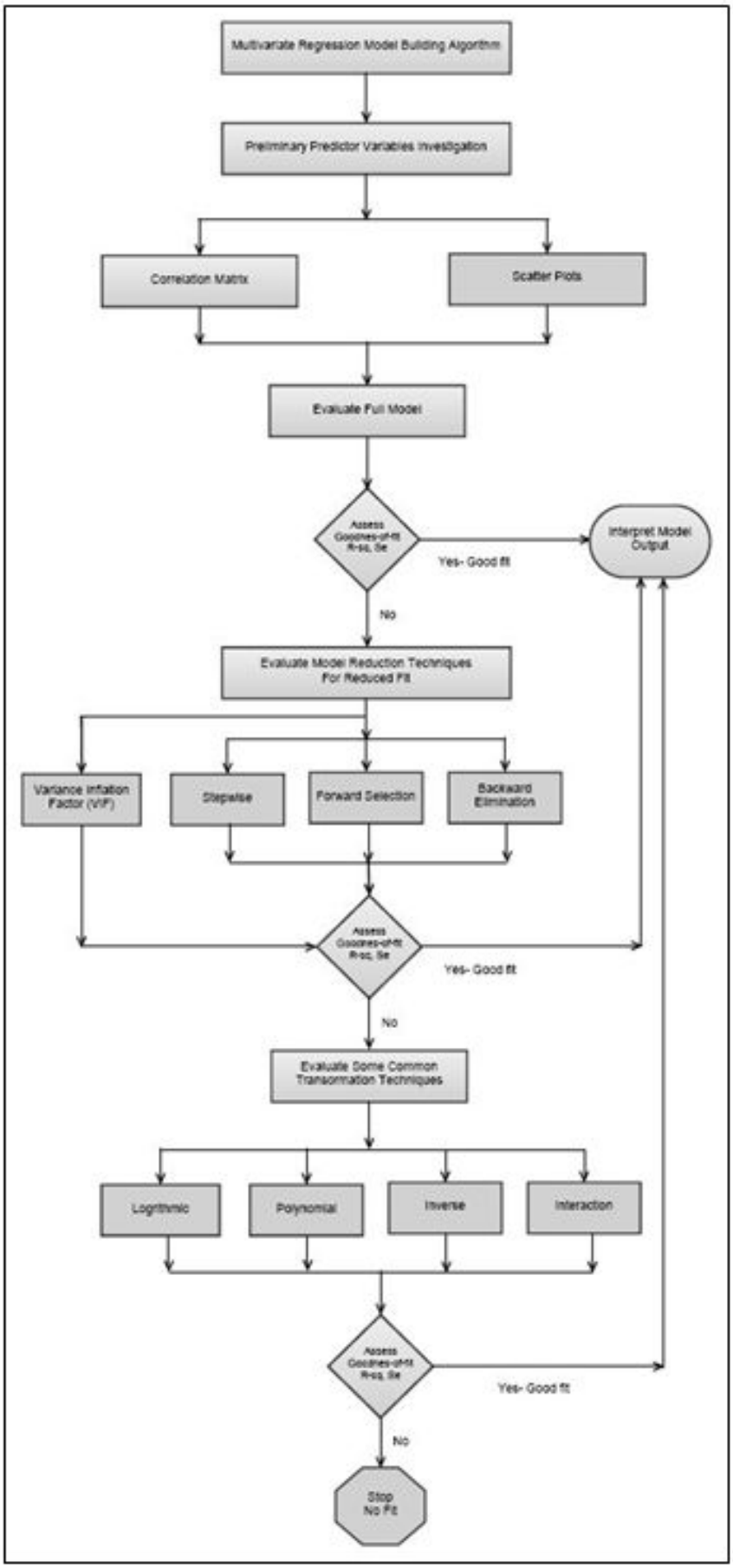
$$E(Y \mid (X_1 i, X_2 i, \ldots, X_n i)) = bo + b_1 X_1 i + b_2 X_2 i + b_3 X_3 i + ,\ldots, + bnXni + \varepsilon i \text{ ….…..(4)}$$

Eliminating the *I* indices from (4) produces the form in (5), which will be used to display the output from Minitab.

$$Y \mid (X_1, X_2, \ldots, X_n) = E(Y \mid (X_1, X_2, \ldots, X_n)) + \varepsilon = bo + b_1 X_1 + b_2 X_2 + b_3 X_3 + ,..,+ bnXn + \varepsilon \text{ ….(5)}$$

In summary, the basis for developing the multivariate decision model in the next section will be based on fitting the model using the statistical structure defined above in (5). The Minitab outputs will be discussed in the results section of this article.

FIGURE 1
MODEL BUILDING ALGORITHM



Model Building

The model building algorithm is illustrated in the flowchart in Figure 1. There are four stages.

Stage 1 involves conducting a preliminary investigation of the predictor variables. Stage 2 requires assessing the model's goodness-of-fit using the complete set of variables, while stage 3 uses several predictor variable reduction techniques to identify a suitable subset. Stage 4 completes the model building algorithm using transformation methods to fit a model to the data.

If a model can't be identified after stage 4, then the process of fitting the model to the data ends. The researcher must decide if added investigation is warranted by re-examining its experimental design for possible improvements or design changes.

In stage 1, a preliminary analysis using a correlation matrix and scatter plots is carried out. This is a necessary first step in identifying any spurious correlation effects, or relationships which exhibit unusually high degrees of correlation, which can ultimately give rise to the existence of multicollinearity in the model. Such conditions can adversely affect the integrity of the model's behavior and performance.

Scatter plots are particularly useful for revealing specific relations, which can assume either a linear or non-linear form. Linear forms when identified can be adapted into the model without much difficulty. Non-linear relations present challenges, but non-linear forms such as exponential or even polynomial relationships (i.e. quadratics) can be easily detected using simple scatter plots. The key to using these two basic statistical tools at the beginning of the model building process is minimizing any noise through early detection associated with specific predictor variable behavior. In summary, the completion of stage 1 allows for identifying probable relations among predictor variables; however, there is no insight about which variables will be included in the model.

Stage 2 represents the first attempt to fit the model by using the complete set of predictor and indicator variables. If a reasonably good fit is achieved, the model building process stops and moves towards discussion of results. If a fit is undesirable, the process continues to stage 3 in the algorithm. The decision to stop or proceed further to the next stage in the model building process is based on assessing the model's goodness-of-fit. In this research, two parameters are available for assessing goodness-of-fit in regression analysis. The use of R-square and Se, the standard error of the regression, are both appropriate and acceptable statistical parameters. However, it is generally accepted by researchers to report R-square, because it has a defined range (i.e. 0 d" R-square d" 1) and is also intuitive to convey. Sometimes, there is a preference and tendency to report the adjusted R-square, if the researcher suspects an over-fitting associated with the model. Over-fitting simply implies that the model includes an unusual number of variables, which have no explanatory power.

If a fit cannot be identified from stage 2, then the process shifts to stage 3. During this stage, predictor variable reduction technique methodologies (i.e. includes stepwise, forward selection, backward elimination and Variance Inflation Factor) are used to identify a fit. Predictor variable reduction techniques are quite powerful when faced with a large set of variables (i.e. >100). The data set used in this research is limited to 22 predictor variables, almost half of which are dummy variables. In other words, caution must be exercised with this methodology because it could lead to an oversimplification of the model. Essentially, the model could result in a less than desirable fit, and with very little explanatory power.

A researcher doesn't have the luxury of using a larger set of predictor variables because the rental car operator's focus is on profits, and not

on collecting data to build statistical models. Another alternative to using these three variable reduction techniques is to use the variance inflation factor (VIF) methodology, which is particularly useful when given a smaller set of predictor variables. Stage three results can be used to compare to those found in stage 2. That is, comparing the full model in stage 2 with the reduced model in stage 3.

When variable reduction techniques don't allow for an adequate fit to the model, researchers are afforded with transformation techniques such as logarithmic, polynomial, inverse ones in hopes of providing an improved fit. It is best for transformation to be identified prior to fitting the model. This information can sometimes be detected when discussing the data set with the end user, where intuitive insights can help identify potential relationships.

For example, the operations manager indicated that increases in fuel prices resulted in declined rental units. In this case, it would be useful to use an inverse relation when fitting the "GASOL" variable. A researcher's objective is to fit the data to the best predictive model. Use of transformation techniques can serve to over-fit and complicate the multivariate regression model. However, use of logarithmic or quadratic transformations can be difficult to interpret for the end user, the rental car operator. In general, while transformations can lead to an improved fit with the model, a major setback lies in its interpretation within the model.
If a satisfactory model can't be found using the model building algorithm, the only recourse is to stop and revisit the nature of the data. Researchers are often confronted with this problem and must weigh the cost versus the benefits of devoting added resources to derive a predictive multivariate model. The rental car operator must decide if it is willing to invest resources into building a database where the information collected will lead to effective predictive modeling, and, more importantly to disseminate this information in its decision-making process.

RESULTS

Stage 1 of the model building algorithm (i.e. preliminary investigation) produced several notable relationships among predictor variables when using both a correlation matrix and scatter plots. The correlation matrix displayed in Table 2 produced several intuitive relationships. The Pearson correlation coefficient (i.e. -1 d" r d" +1) captured in Table 2, helped to assess both the strength and direction of the association between Revenue and its host independent variables. The numerical value quantified the strength of the association, whereby direction was noted by either a positive or negative sign.

Of particular concern in this study was the condition associated with multicollinearity, because it created instability and produced inflated standard errors in the regression model. The advertising (ADVEXP) variable exhibited this condition and was dropped from further consideration. Other observed relationships were noted below.

In general, seasonal variables (i.e. Fall, Win, Spring, Sum) exhibited a poor relationship with revenue. Summer (r=0.104) was the only period to produce a positive relationship; however, its overall association with revenue was rather weak. Fluctuating fuel prices throughout the year adversely affected travel plans, which could partially explain the weak relationship. If fuel prices remained consistently low during summer months, travel would have increased resulting in increased revenue for the rental car company. A strong positive correlation coefficient would have revealed this effect.

Overall, fiscal quarterly periods (QUAR1, QUAR2, QUAR3 and QUAR4) provided weak relationships. The second quarter relative to the others had the highest correlation (r=0.128) albeit weak. According to the rental company's operations manager, the trend had always been for increased budgeted planned travel by business travelers during this quarter. In addition, it was not a coincidence that

TABLE 2
CORRELATIONS: REV, FAL, WIN, SUM, QUAR1, QUAR2, QUAR3, REGION1, ...

	REV	FAL	WIN	SUM	QUAR1	QUAR2	QUAR3
FAL	-0.128						
	0.125						
WIN	-0.120	-0.333					
	0.151	0.000					
SUM	0.104	-0.333	-0.333				
	0.216	0.000	0.000				
QUAR1	-0.083	-0.333	0.556	0.111			
	0.321	0.000	0.000	0.185			
QUAR2	0.128	-0.333	-0.333	0.556	-0.333		
	0.128	0.000	0.000	0.000	0.000		
QUAR3	0.050	0.111	-0.333	-0.333	-0.333	-0.333	
	0.551	0.185	0.000	0.000	0.000	0.000	
Region1	-0.235	0.000	-0.000	-0.000	0.000	0.000	0.000
	0.005	1.000	1.000	1.000	1.000	1.000	1.000
Region2	-0.242	-0.000	-0.000	-0.000	0.000	0.000	-0.000
	0.004	1.000	1.000	1.000	1.000	1.000	1.000
Region3	0.921	-0.000	0.000	0.000	-0.000	-0.000	0.000
	0.000	1.000	1.000	1.000	1.000	1.000	1.000
POPDAT	0.018	-0.000	-0.000	-0.000	0.000	0.000	-0.000
	0.832	1.000	1.000	1.000	1.000	1.000	1.000
UNEMP	0.498	0.094	0.018	-0.217	-0.074	-0.138	0.108
	0.000	0.264	0.832	0.009	0.379	0.100	0.199
GASOL	0.032	0.099	-0.176	-0.016	-0.281	0.070	0.073
	0.704	0.236	0.035	0.848	0.001	0.407	0.384
NUMREN	0.929	-0.078	-0.128	0.075	-0.073	0.080	0.054
	0.000	0.355	0.125	0.371	0.386	0.338	0.518
RENDAY	0.986	-0.138	-0.083	0.107	-0.031	0.088	0.033
	0.000	0.100	0.321	0.202	0.714	0.294	0.697
AVEREN	-0.014	-0.106	0.116	0.055	0.111	0.009	-0.056
	0.871	0.208	0.165	0.516	0.184	0.916	0.506
REVPDAY	0.794	-0.097	-0.244	0.140	-0.256	0.283	0.078
	0.000	0.249	0.003	0.095	0.002	0.001	0.355
FLTSIZE	0.969	-0.155	-0.043	0.119	-0.023	0.135	-0.012
	0.000	0.063	0.608	0.155	0.785	0.106	0.886
UTLIZ	0.181	0.074	-0.039	-0.087	0.064	-0.161	0.088
	0.030	0.380	0.639	0.298	0.448	0.054	0.292
REVPUNIT	0.756	-0.025	-0.266	0.055	-0.195	0.064	0.170
	0.000	0.767	0.001	0.515	0.019	0.449	0.041
ADVEXP	1.000	-0.128	-0.120	0.104	-0.083	0.128	0.050
	*	0.125	0.151	0.216	0.321	0.128	0.551
CPI	0.023	0.154	-0.175	-0.068	-0.286	0.009	0.116
	0.787	0.066	0.036	0.420	0.001	0.914	0.167

consumers who received their tax returns frequently booked leisurely travel during this same period.

Region 3 (0.921) revealed a strong positive relationship. This result was expected because the rental car operator catered to numerous businesses. It helped that its office was located in an industrial region, where Region 3 served a population of almost 100,000.

The correlation matrix above provided numerical values to help with interpreting relationships. Alternatively, scatterplots proved to be effective graphical tools for identifying non-linear relationships. Some common non-linear relationships include curvilinear (i.e.

FIGURE 2
UNEMPLOYMENT VS. REVENUE

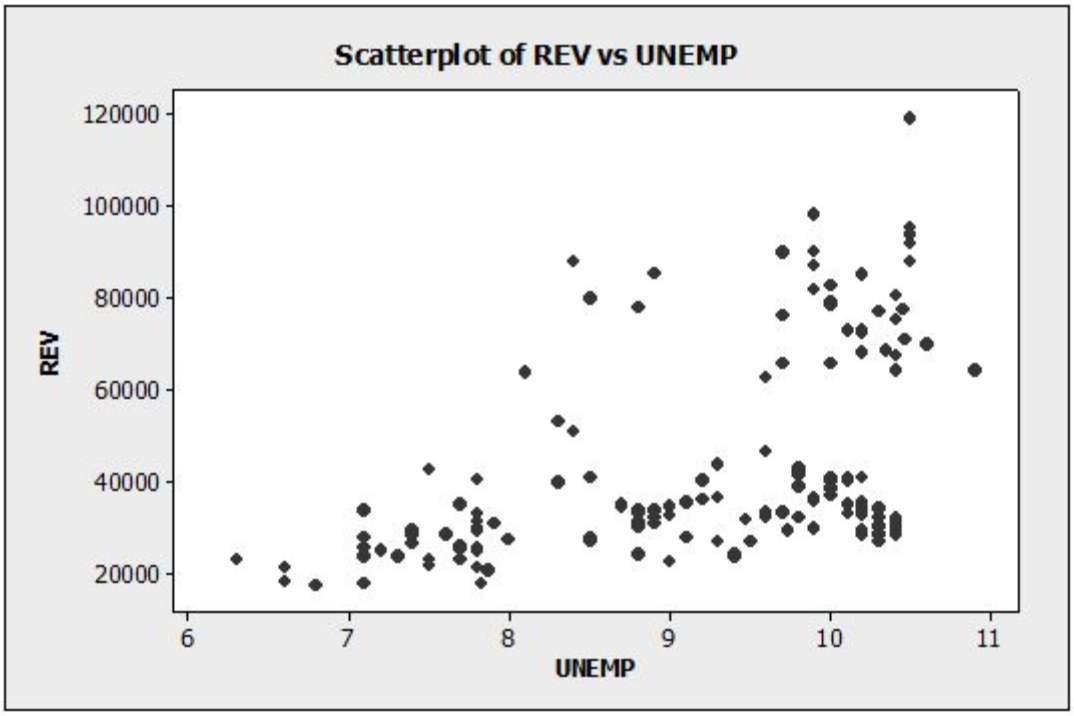
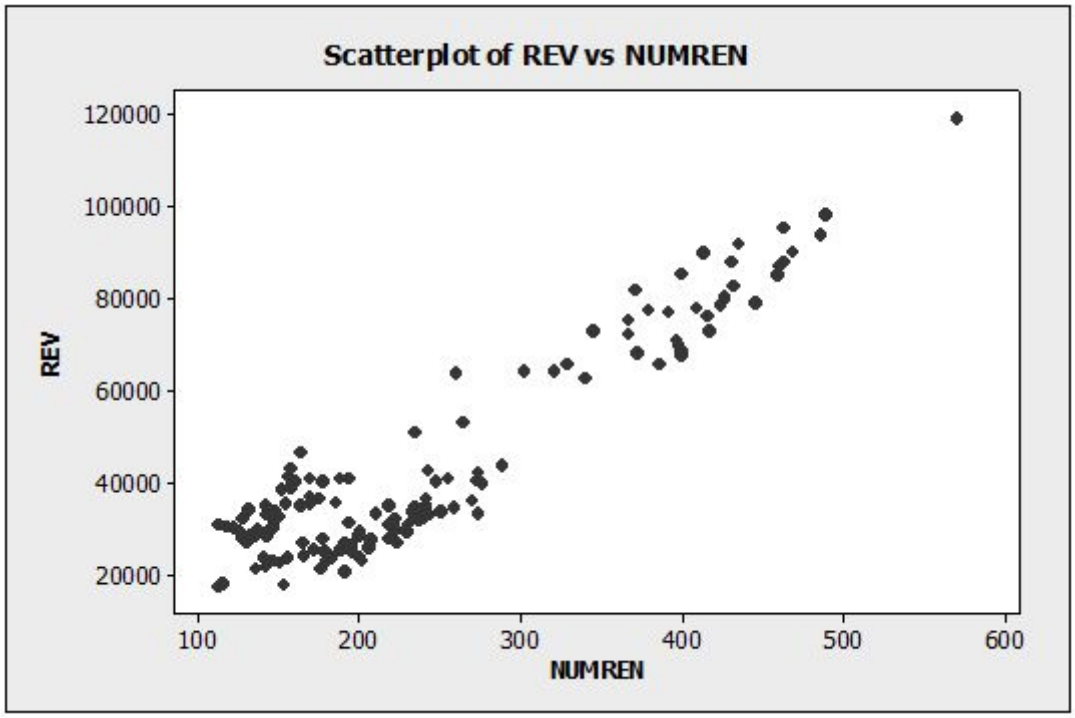


FIGURE 3
NUMBER OF RENTALS VS. REVENUE



quadratic) and exponential forms. Several scatterplots presented below highlight the relationship between revenue and some of its predictor variables.

As shown in Figure 2, unemployment (UNEMP, r=0.498) yielded a curvilinear pattern. An inverse relationship was expected.

Higher unemployment should have resulted in fewer rentals thereby inversely influencing revenue. Unfortunately, this was not the case. The operations manager explained that rates were kept low to encourage increased rentals and to recognize that higher fuel rates would only serve to compound declining rental revenue. In fact, those who were unemployed could still make use of rentals to seek continued employment opportunities by taking advantage of lower rental rates.
Figure 3 depicted the number of rental units (NUMREN, r=0.929) which yielded a strong positive linear relationship with revenue.

Intuitively this behavioral pattern was expected. The rental operator indicated that it had aggressively focused on quicker turnaround times for getting its rental units back in service. This was particularly true during peak periods such as Thanksgiving. The rental car company also targeted businesses for repeat rentals by providing attractive reduced rates to secure long-term rental contracts.

Figure 4 illustrated a strong and positive linear association between revenue and the number of days rented (RENDAY, r=0.986).

The rental car operations manager indicated a preference to secure long-term rental contracts by providing attractive corporate discounts, which boosted rental revenues and increased utilization. For instance, businesses would often rent minivans to accommodate group travel to events such as conferences for their employees. These types of events can last for several days. The rental van would reduce group travel expenses by eliminating the need for taxi or any other shuttle service.

FIGURE 4
NUMBER OF RENTAL DAYS AND REVENUE

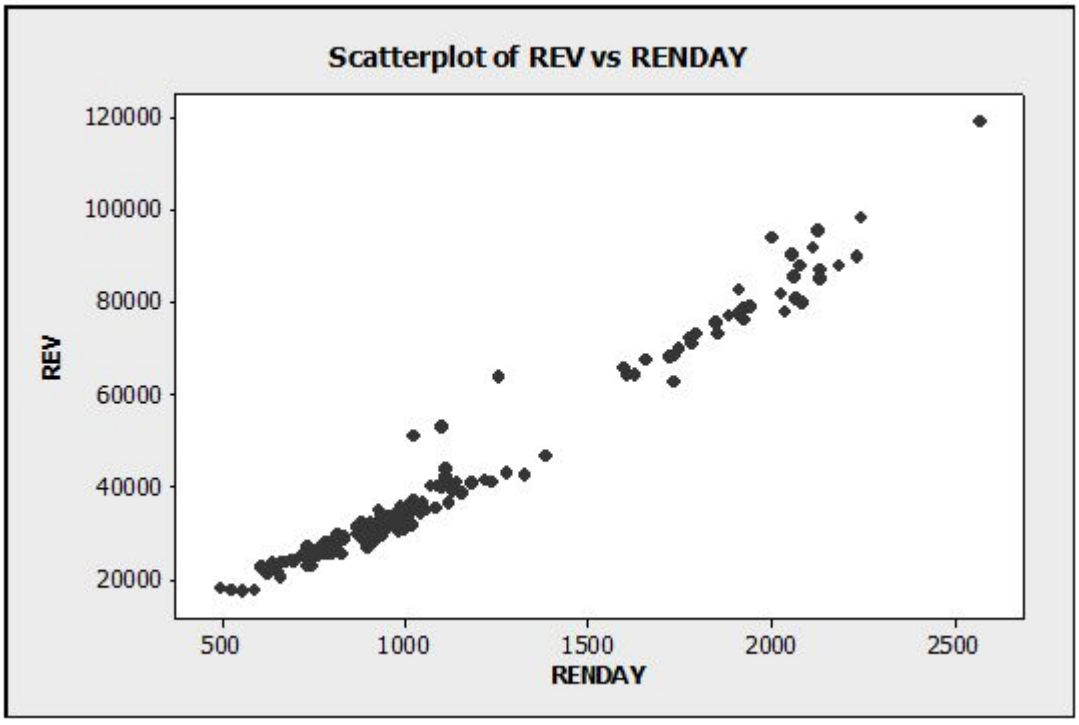
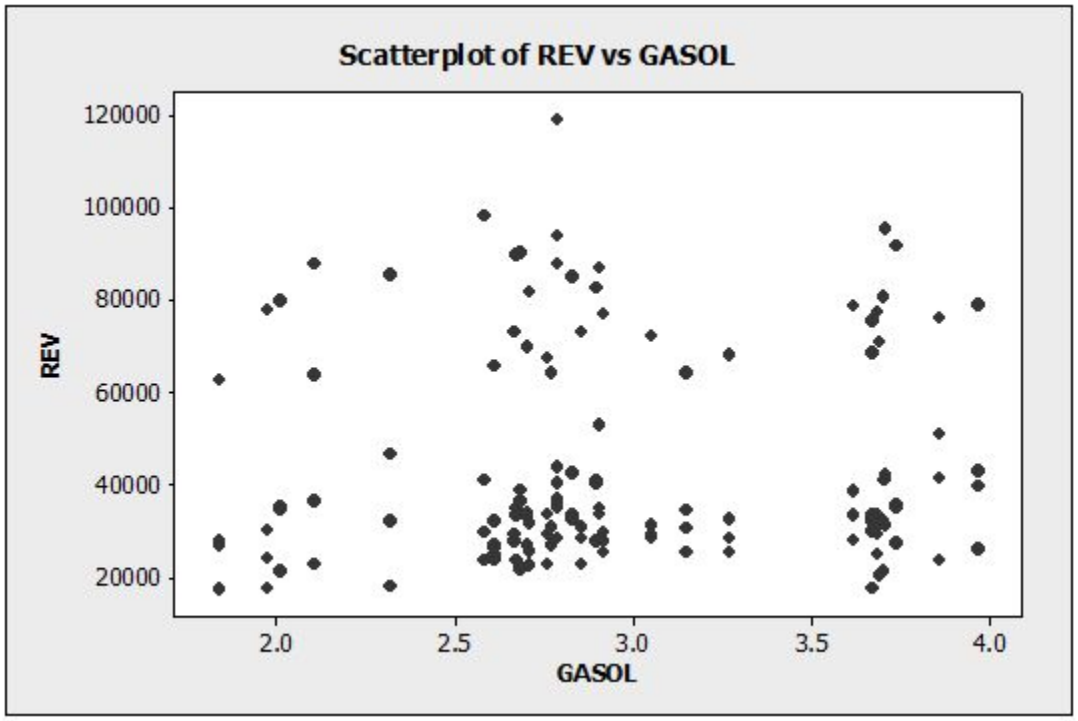


FIGURE 5
GASOL VS. REVENUE



The predictor variable, GASOL, illustrated in Figure 5, produced a random association when correlated with revenue (r=0.032).

An inverse relationship was expected, however, fluctuating prices in fuel did not influence revenue. In essence, it demonstrated that consumers and businesses acted randomly with regards to consumption of fuel. Businesses and consumers adjusted their travel plans to reflect changes in the price of fuel.

The model's four assumptions, 1) Zero mean, 2) Constant variance, 3) Normality and 4) Independence, were verified and validated using the residual plots from Minitab as shown in Figure 6.

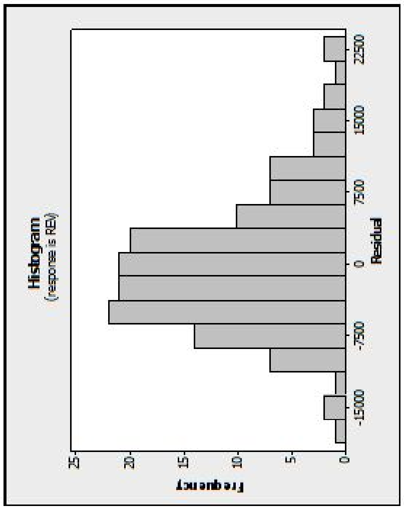
The first residual plot (residual vs. fits) validated the zero mean and constant variance assumptions. In this plot, it can be seen that the zero mean condition was satisfied because the residuals were randomly scattered about the mean zero residual line. The constant variance condition was also satisfied because an estimated equal number of the residuals were randomly situated above and below the mean zero residual line. The constant variance condition would have been violated if a cone shape or fan-like pattern had been detected. Both the normal probability and histogram plots satisfied the assumption of normality (Kutner, 2005 and Brandimarti, 2011).

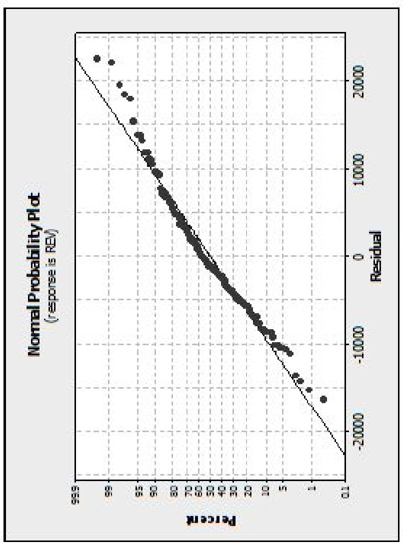
The multivariate model shown in Table 3 was fitted during stage 3 of the model building algorithm.

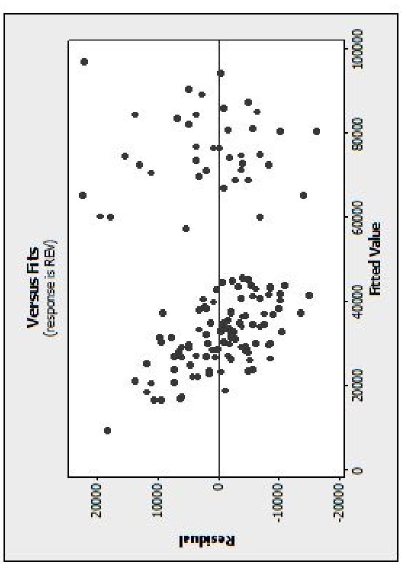
The variance inflation factor (VIF) variable reduction methodology produced the best fit. The results for the final iteration were displayed by Minitab. These results were achieved after reaching two iterations where the resulting VIFs were all less than 3.0. A fitted model with independent variables displaying VIFs<3.0 is highly acceptable in statistical modeling.

An F-test was conducted for the hypothesis shown in equation (6). The results were significant (p=0.00) at á=0.05, which supported the existence of a relationship between revenue and its set of predictor variables.

FIGURE 6
PLOT







$$Ho: \beta_o = \beta_1 = \beta_2 = \cdots = \beta_{10} \quad (6)$$

According to the goodness-of-fit measure, with an R-sq =89.3%, the model provided an excellent fit to the data as shown in Figure 7. An estimated 10.7% of the total variation in monthly revenues remained unexplained. This can be attributed to the exogenous variables previously discussed, which described situations whereby businesses required their employees to car pool or encouraged them to use public transportation. Individual t-tests were conducted for each predictor variable with the results shown below (Rousseeuw and Van Zomeren, 1990).

The fall and winter seasonal variables were not favorable for the rental car business. Monthly revenues during fall declined by $5,277 and $625, respectively. Even though both periods observed a decline in monthly revenues, more individuals were prone to rent during the winter period relative to fall. Christmas may explain higher travel during this time. Revenues increased by $6,869 during summer, which can be explained by increased vacation travel trips. Both fall and summer seasonal periods were significant at á=0.05.

Region1 and Region 2 locations were significant at á=0.05. Monthly revenues declined by $25,655 and $18,580, respectively. Region1 represented a smaller market for the rental car company. The rental car operations manager indicated that the company had to negotiate longer term rental contracts in order to remain profitable for small market locations, like Region1, which has a population of about 25,000. The location in Region2 was represented by a population of 195,000. A decline in revenue for Region2 was attributed to several business closures and relocation to another state.

The unemployment variable *UnEmp* was significant at á=0.05. The sign on its coefficient was positive rather than negative indicating a positive relationship, which was not expected. It

TABLE 3
MULTIPLE REGRESSION ANALYSIS: REV VERSUS FAL, WIN, ...
(Output from Minitab)

```
The regression equation is
REV = - 166222 - 5277 FAL - 625 WIN + 6869 SUM + 1005 QUAR1 - 595 QUAR2
    - 25655 Region1 - 18580 Region2 + 10163 UNEMP + 2634 REVPDAY + 46395 UTLIZ
```

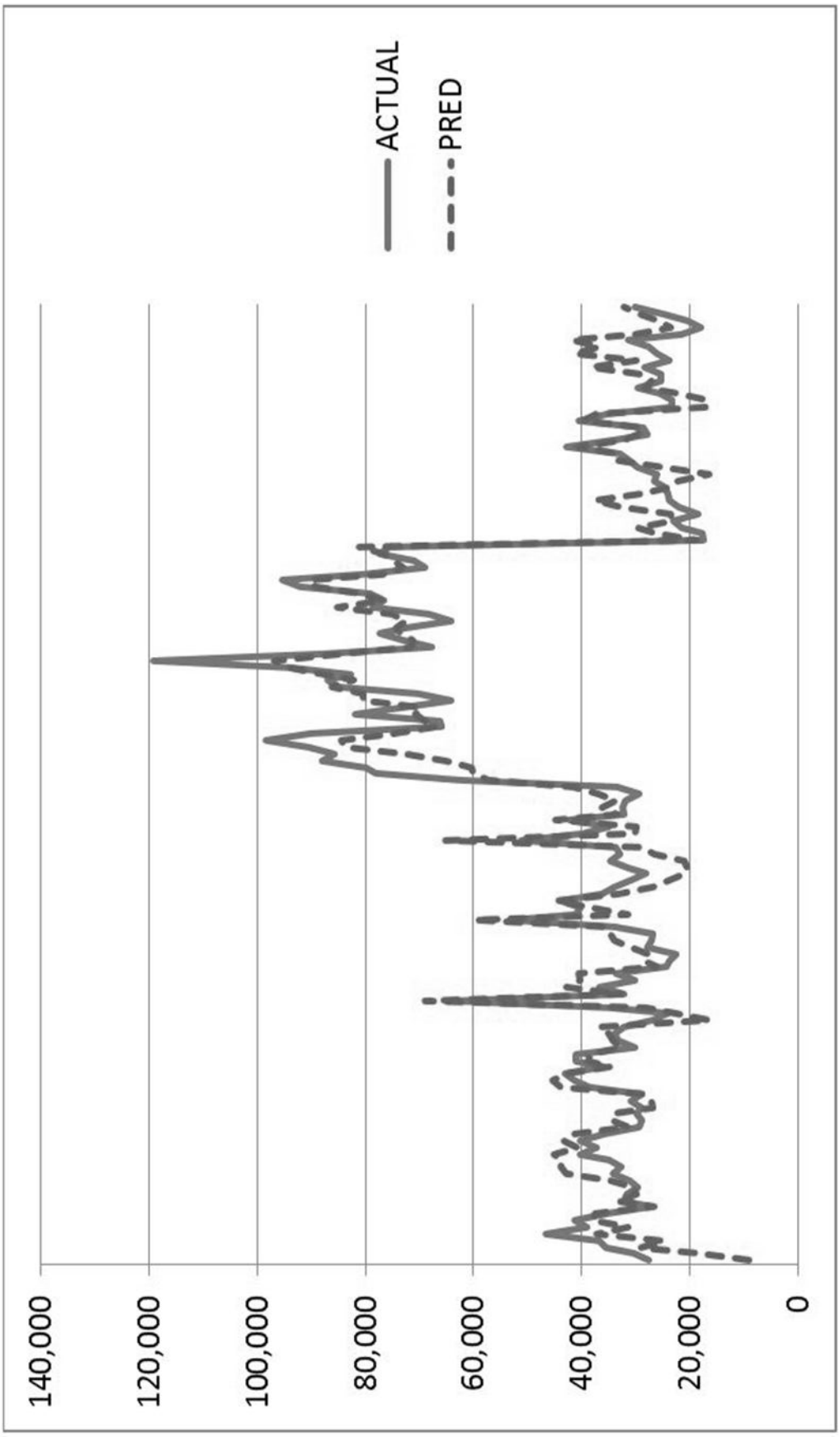
Predictor	Coef	SE Coef	T	P	VIF
Constant	-166222	9578	-17.35	0.000	
FAL	-5277	1990	-2.65	0.009	1.823
WIN	-625	2276	-0.27	0.784	2.385
SUM	6869	2252	3.05	0.003	2.334
QUAR1	1005	2247	0.45	0.656	2.324
QUAR2	-595	2259	-0.26	0.792	2.348
Region1	-25655	2446	-10.49	0.000	2.753
Region2	-18580	1728	-10.75	0.000	1.374
UNEMP	10162.9	926.5	10.97	0.000	2.810
REVPDAY	2634.0	259.3	10.16	0.000	2.684
UTLIZ	46395	9754	4.76	0.000	1.603

```
S = 7659.70   R-Sq = 89.3%   R-Sq(adj) = 88.5%
```

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	10	651544455491	65154445549	111.05	0.000
Residual Error	133	78032370004	58670955		
Total	143	729576924 95			

FIGURE 7
ACTUAL VS. PREDICTED MONTHLY REVENUES (2009-2011)



was possible that even those unemployed were still able to rent cars, because the rental car operator kept its rental rates affordable. With recessionary conditions and higher fuel prices, the rental car operator could ill afford to ground its fleet keeping higher rental rates and subsequently adversely affecting its utilization. Lower rental rates positively impact monthly revenues because it is affordable even for those seeking transportation means as they are job hunting.

Revenue per day (RevDay) and utilization (Util) were both significant at á=0.05. Each day adds $2,634 in revenue across its four locations. Increasing utilization from its fleet by one percent increased monthly revenue by $46,395.

LIMITATIONS, RECOMMENDATIONS AND FUTURE WORK

This study would have benefited from a database encompassing more than three years to establish a stronger foundation for building a deterministic model, where, for example, trends could have been identified.

The database did not capture information about its mix of rental vehicles. The inclusion of vehicle mix (i.e. compact, midsize, full size, SUV and minivan) in the model building process would have enhanced the results. Rental revenues would have been impacted by both fleet size and mix of vehicles.

Customer demographics would have been helpful in identifying not only the impact on revenue, but also to target specific groups in their marketing campaign. For instance, identifying local vs. non local residents, age of customer, business vs. leisure travel needs, male vs. female, preferences in rental vehicle and so forth, would provide added benefits to further explain variation in rental revenues.

Profitability is impacted by both revenue and cost. Maintenance cost was captured in the database. This component would be vital particularly because the rental companies were keeping their units in inventory longer. Increased maintenance costs would adversely impact revenue. For instance, units which required frequent repairs presented both business and safety risks.

CONCLUSION

Although the United States has been officially declared out of the recession, rental car companies still face significant changes in their business model in order to maintain expected profit margins. The recession's negative impact on the airline and travel industries also negatively impacted the rental car industry. After suffering large reductions in revenue during 2009 and 2010, the results from 2011 show slight increases in revenue, and flat to negative increases in repair and replacement costs for vehicles. The depreciation bonus was reduced to one half in 2012 and potentially required additional attention to maintaining rental fleets for longer periods of mileage and number of months held in the fleet.

The multivariate decision model developed in this article provides a tool with which decision-makers at rental car companies can optimize the use of their assets in order to maximize revenue. With this model, they will be able to perform "what-if" scenarios with predictor variables, which are significant to their monthly revenue streams. As with any statistical model, there will always be factors which cannot be quantified, such as policies adopted by businesses to promote public transportation or taxis in lieu of renting a vehicle.

The results from this model reveal significant findings which impact rental revenues. For instance, summer and fall seasonal periods had opposite effects on revenues. As expected, monthly revenues increased during the summer; however, sharp decreases were observed in the fall, which is likely the result of decreased travel. Management use information like that produced in the model to adjust marketing

strategies during periods like fall season when travel declines.

As with many businesses, location plays an important role in determining yield. The monthly revenues of two of the four car rental locations used in this study were adversely impacted by the predictor variables Region1 and Region2. Management can use this information to decide the degree to which it must implement changes to improve yield at these locations.

Survival in the "new economy" will continue to present challenges for U.S. rental car companies. The deterministic model presented in this article provided promising results in terms of helping decision-makers maximize revenue. Improvements to rental car companies' databases will enhance the model's predictive capability and provide management with a powerful supplemental decision-making tool.

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Journal of Transportation Management

Guidelines for Submission/Publication

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1. Editor Contact Information – Dr. John C. Taylor, Associate Professor of Supply Chain Management, Department of Marketing and Supply Chain Management, School of Business, Wayne State University, Detroit, MI 48202. Office Phone: 313 577-4525. Cell Phone: 517 719-075. Fax: 313 577-5486. Email: taylorjohn@wayne.edu

2. Articles should be submitted electronically to Dr. Taylor at taylorjohn@wayne.edu.

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Manrodt, Karl (2003), "Drivers of Logistics Excellence: Implications for Carriers," In J. W. Wilson (Ed.), *Logistics and Transportation Research Yearbook 2003* (pp. 126-154) Englewood Cliffs, NJ: Prentice-Hall, Inc.

Book:
Coyle, John J., Bardi, Edward J., and Novack, RobertA. (2004), *Transportation*, 6th ed., Cincinnati, OH: South-Western College Publishing.

Website:
Wilson, J. W. (2003), "Adapting to the Threat of Global Terrorism: Reinventing Your Supply Chain," [On-line]. Available: http//:georgiasouthern.edu/coba/centers/lit/threat.doc. Created: 11/01/02, Accessed: 11/12/03.

MANUSCRIPT SAMPLE

A FRAMEWORK FOR EVALUATING SUPPLY CHAIN PERFORMANCE

Terrance L. Pohlen, University of North Texas

ABSTRACT

Managers require measures spanning multiple enterprises to increase supply chain competitiveness and to increase the value delivered to the end-customer. Despite the need for supply chain metrics, there is little evidence that any firms are successfully measuring and evaluating inter-firm performance. Existing measures continue to capture intrafirm performance and focus on traditional measures. The lack of a framework to simultaneously measure and translate inter-firm performance into value creation has largely contributed to this situation. This article presents a framework that overcomes these shortcomings by measuring performance across multiple firms and translating supply chain performance into shareholder value.

INTRODUCTION

The ability to measure supply chain performance remains an elusive goal for managers in most companies. Few have implemented supply chain management or have visibility of performance across multiple companies (Supply Chain Solutions, 1998; Keeler et al., 1999; Simatupang and

Sridharan, 2002). Supply chain management itself lacks a widely accepted definition (Akkermans, 1999), and many managers substitute the term for logistics or supplier management (Lambert and Pohlen, 2001). As a result, performance measurement tends to be functionally or internally focused and does not capture supply chain performance (Gilmour, 1999; *Supply Chain Management*, 200 I) . At best, existing measures only capture how immediate upstream suppliers and downstream customers drive performance within a single firm.

Table 1 about here

Developing and Costing Performance Measures

ABC is a technique for assigning the direct and indirect resources of a firm to the activities consuming the resources and subsequently tracing the cost of performing these activities to the products, customers, or supply chains consuming the activities (La Londe and Pohlen, 1996). An activity-based approach increases costing accuracy by using multiple drivers to assign costs whereas traditional cost accounting frequently relies on a very limited number of allocation bases.

$$y = a^2 - 2ax + x^2$$

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