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Safety Climate of Commercial Vehicle Operation

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Safety Climate of Commercial Vehicle Operation

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16. Abstract

Enhancing the safety culture within trucking and motor coach industries has become a key area of concern given the potential impact it has on crashes and overall safety. Many organizations recognize that safety is compromised if the culture within their organization does not promote safety. Unfortunately, the specifics of a good safety culture and the methods by which safety culture is fostered are relatively ambiguous. A key reason for this is the general lack of standardization of the highly qualitative term "safety climate" within the trucking and motor coach industries.

A survey was completed by 31 organizations within these industries as part of a Commercial Truck and Bus Safety Synthesis Program (CTBSSP) Synthesis #14. The results provide some insights into the safety beliefs and attitudes of these drivers and the organizational needs to maintain a stable workforce and positive safety climate. The report provides descriptions of the data collected but lack any derived inferences that can help shape the safety culture. The results of this research project are the development of a set of key factors that capture the essence of a safety climate within the truck and busing industries. This is achieved through factor analysis of the existing survey data that has been made available to the principal investigator. The result reveals a four-factor model that is grouped based on the overall safety culture in the industry, the financial impact, internal awareness, and demand for safety. This outcome suggests that there are both internal and external factors that may affect a safety manager's perception of safety and the safety climate within an organization, and provides insights for the trucking industry to communicate a safety culture to their employees. This, thereby, translates into a stable workforce, and reduces truck crashes. Future studies may need to consider how to both create and maintain a climate of safety.

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Abbreviations, Acronyms, and Symbols

CTBSSP	Commercial Truck and Bus Safety Synthesis Program
CMV	Commercial motor vehicle
ATRI	American Transportation Research Institute
ERG	Existence, Relatedness and Growth

Executive Summary

Enhancing the safety culture within trucking and motor coach industries has become a key area of concern given the potential impact it has on crashes and overall safety. Many organizations recognize that safety is compromised if the culture within their organization does not promote safety. Unfortunately, the specifics of a good safety culture and the methods by which safety culture is fostered are relatively ambiguous. A key reason for this uncertainty is the general lack of standardization of the highly qualitative term, "safety climate," within the trucking and motor coach industries.

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The results of this research project are the development of a set of key factors that capture the essence of a safety climate within the truck and busing industries. This is achieved using factor analytical techniques on the existing survey data as made available to the principal investigator. The result reveals a four-factor model that is grouped based on the overall safety culture in the industry, the financial impact, internal awareness, and demand for safety. This outcome suggests that there are both internal and external factors that may affect a safety manager's perception of safety and safety climate within an organization, and provides insights for the trucking industry to communicate a safety culture to their employees. This could then

translate into a stable workforce, and reduce truck crashes. Future studies may need to consider how to both create and maintain a climate of safety.

Chapter 1 Introduction

1.1 Background

The American Transportation Research Institute (ATRI) released the results of a CMV, "crash predictor model," study (Murray, Lantz, & Keppler, 2005) based on truck drivers' historical driving record data including specific violations discovered during roadside inspections, drivers' traffic conviction information, and past crash involvement. This study also identified effective enforcement actions to counteract issues related to driving behaviors and events. According to the states identified as having more traffic enforcement and lower crashes, successful enforcement strategies for addressing problem driver behaviors are those that exhibit one or more of the four components which follow. (1) Creating aggressive driving apprehension programs/initiatives; (2) focusing on both CMV and non-CMV driver behavior patterns; (3)conducting highly visible enforcement activities; using a performance-based approach to identifying specific crash types, driver behaviors and locations; and (4) conducting covert enforcement activities. Research such as this supports the premise that risky behaviors may be initiated by the drivers.

Knipling et al (2003) has indicated that some carriers have become havens for, and even attract, unsafe drivers. Both empirical and anecdotal evidence, however, support that "safe" carriers – as defined by numerous metrics including SafeStat scores, safety awards and industry safety statistics – produce, attract and retain safe drivers. While all major components that make up the "safety climate" of a motor carrier have not been adequately studied in past research, specific safety factors and correlations that contribute to safety culture do exist. These include compensation schema (ATA); non-financial reward programs (Transanalytics, ATRI); and ISO 9000 certification's nexus to safety (Naveh, Marcus, & Allen, 2003). Other industry sectors such

as aviation, mining and heavy equipment manufacturing also contain safety-sensitive positions and have researched the tangible and intangible mechanisms that contribute to a positive safety environment.

As part of a Commercial Truck and Bus Safety Synthesis Program (CTBSSP), Short, Boyle et al, (2007) synthesized the current available research and literature relating to safety culture. The study showed that there were specific ties between the available body of knowledge and the motor carrier industries. The effort included a data collection component, consisting of responses to surveys and interviews from motor carrier safety managers and commercial motor vehicle (CMV) drivers, as well as case study data collected onsite, directly from motor carriers. This report culminated in suggested steps for increasing safety culture through a series of best practices.

The report made a first attempt at identifying and analyzing significant safety and non-safety programs and initiatives across relevant sectors that currently has, or could create and support, a positive safety culture within the trucking and motor coach industries. Some of the gaps identified in the report included (1) the possibility of a disconnect between expectations from a safety culture and those that exist within other professional cultures within the organization they operate in; or, alternatively, (2) the driver identifies strictly with the professional culture they within which they operate. These programs and initiatives resulted in a list of best practices with factors that are most likely to offer the greatest influence on developing and enhancing a culture of safety.

The report consists of summarized information on best hiring practices, and communication among employees as reported by individuals within various organizations. However, no attempt was made to infer the reasons why these organizations consider various

factors optimum. These insights can only be gained with inferential statistics conducted to examine the responses across all participants. The lack of inferential statistics has hindered a quantifiable hypothesis that can be used to identify programs that will contribute to a better safety climate and demonstrate that the likelihood of success is not due to chance. The analysis proposed as part of this project will help identify non-programmatic factors that help cultivate or improve an overall culture of safety, such as leadership roles within management and among CMV drivers.

1.2 Relevance to the MATC Theme and Thematic Thrust Areas

The MATC theme is "*improving safety and minimizing risk associated with increasing multi-modal freight movement on the U.S. surface transportation system.*"

Movement of freight by trucks has increased tremendously in the US. It is not surprising that crashes involving trucks are still proportionately high and problematic. Studies have shown that a stronger safety culture can provide more positive attitudes among the drivers and thereby help reduce the number of crashes (Arboleda, Morrow, Crum, & Shelly, 2003). By gaining insights in the perception of the safety managers, we can better design a complementary study on drivers' perception of the safety climate related to their organizations and the profession as a whole.

This project therefore relates to the MATC theme by improving safety related to multimodal freight movement and can therefore improve overall safety across ground transportation systems.

As part of this project, data that was collected as part of CTSSP #14 will be available. The data analysis was completed at the University of Iowa and in coordination with Jeffrey Short, Senior Research Associate with the American Transportation Research Institute (ATRI).

His areas of expertise include policy analysis and program evaluation; qualitative and quantitative analysis; and policy tool development and assessment.

Chapter 2 Literature Review

Commercial vehicle related crashes can result in costs related to property damage, injury and even fatalities. Based on US crash data, the annual number of crashes for the period 2001-2003 involving medium to heavy trucks exceeded 430,000, and the average cost per crash was about $90,000 (Zaloshnja & Miller, 2006). Though more recent statistics show a decline in both the number of crash-related injuries and fatalities per 100 million vehicle miles traveled, truck involved crashes continue to cost the industry millions of dollars per year (FMCSA, 2008).

Several studies have examined factors (e.g., fatigue and circadian rhythms, driving experience, crash history, etc.) related to crashes involving large trucks (Elisa R. Braver et al., 1992; E.R. Braver, Preusser, & Ulmer, 1999; Hanowski, Wierwille, & Dingus, 2003; Lin, Jovanis, & Yang, 1994; Murray et al., 2005). Among those factors that are less examined yet still critical, are the psychological and sociological factors within organizations (e.g., motivations, incentives, as well as human capital characteristics) that are related to safety issues (Rodrigues, Rocha, Khattak, & Belzer, 2003; Rodrigues, Targa, & Belzer, 2006). Based on the current body of knowledge, there appears to be an increasing awareness of organizational and individual attitudes and beliefs that may influence the likelihoods of a crash even before a driver enters a vehicle (Clarke, 1999; Short et al., 2007; Wills, Watson, & Biggs, 2006). Therefore, qualities associated with the safety climate can be viewed as predictive in nature, and may be highly useful when examining and assessing safety management within organizations (Flin, 1998).

The concept of safety climate is defined through a synthesis of previous work (Guldenmund, 2000). Generally, safety climate refers to employee perceptions of how safety is managed and how safety policies are implemented in an organization. Another related concept is safety culture. Within the commercial driving environment, a company's safety culture can be

identified through the attitudes, values and beliefs related to safety and risk. These are values held by individuals and manifested in the organization's safety practices, procedures and outcomes (Short et al., 2007). Though some individuals have used climate and culture interchangeably, there are certain distinctions: while culture refers to underlying beliefs, climate can be described as a "check on whether the behavior of the people within the company, especially management and supervisors, matches the [company's] rhetoric" (Shannon & Norman, 2008). This indicates that safety climate within an organization is more likely to change than the safety culture as a result of managerial actions.

Studies suggest a direct relationship between safety climate and safe behavior (Johnson, 2007; Tharaldsen, Olsen, & Rundmo, 2008; Wu, Chen, & Li, 2008). Thus, understanding the factors that influence a good safety climate can have a positive impact on employee's overall safety performance. In research related to occupational safety, there is an increased focus on understanding safety climate given its potential impact in reducing fatalities and injuries (Wills et al., 2006).

It is less difficult to quantify the safety climate experienced by individuals within organizations through the use of survey tools than it is to quantify safety culture. Although many researchers have sought to find a common model of safety climate, there is little consensus on the dimensions that should be incorporated into such a model (Williamson, Feyer, Cairns, & Biancotti, 1997). Reasons for this may be due to differences in the nations and industries that organizations operate within (Shannon & Norman, 2008). There are, however, areas that have consistently been part of the safety climate discussion and the first of these is related to management (Flin, Mearns, O'Connor, & Bryden, 2000). The structure of safety climate has been examined from two different but related aspects of management: managers' attitudes toward

safety (Clarke, 1999; Zohar, 1980) and management practice, such as safety rules, management commitment, and safety policies (Isla & Díaz, 1997; Johnson, 2007; Williamson et al., 1997; Wills et al., 2006; Wu et al., 2008). These two aspects are intertwined because good managerial attitudes are most likely needed to reinforce good managerial practices (Zohar, 1980).

Therefore, one step in understanding safety climate within organizations is to understand the relationship of this concept to safety management. The *OSHA Compliance and Management Handbook* (1993) suggests that Alderfer's ERG (Existence, Relatedness and Growth) theory can provide insight into the organizational motivation for safety. In this theory, "existence" refers to the need for basic material and physiological desires, "relatedness" refers to the need for positive feedback and respect from others, and "growth" refers to the need for self development (Alderfer, 1969). Although this model is used to explain motivations on an individual level, it can be applied to explain motivations on organizational levels as well.

Neal, Griffin & Hart (2000) stated that changing employees' awareness of and motivation for safety is necessary before the improvements in safety climate can have impact on overall safety. In addition, safety attitudes has been shown to be a predictor of safety climate (Isla & Díaz, 1997). Therefore, it can be argued that understanding safety attitudes and motivation is an essential step to improve the safety climate in organizations.

This study focuses on management attitudes and considers factors that are largely related to the safety climate within commercial vehicle operations. Although other factors such as worker involvement and communication can have a strong influence on the safety climate (Williamson et al., 1997; Wills et al., 2006), managers' attitudes (especially safety manager attitudes) toward safety can also have a strong influence how safety is managed and perceived by employees, as is depicted in figure 2.1. In such an environment, employees may exhibit behavior

that supports more urgent non-safety related goals—such as getting products out quickly and making a profit—rather than focusing primarily on safety-related priorities (Johnson, 2007).

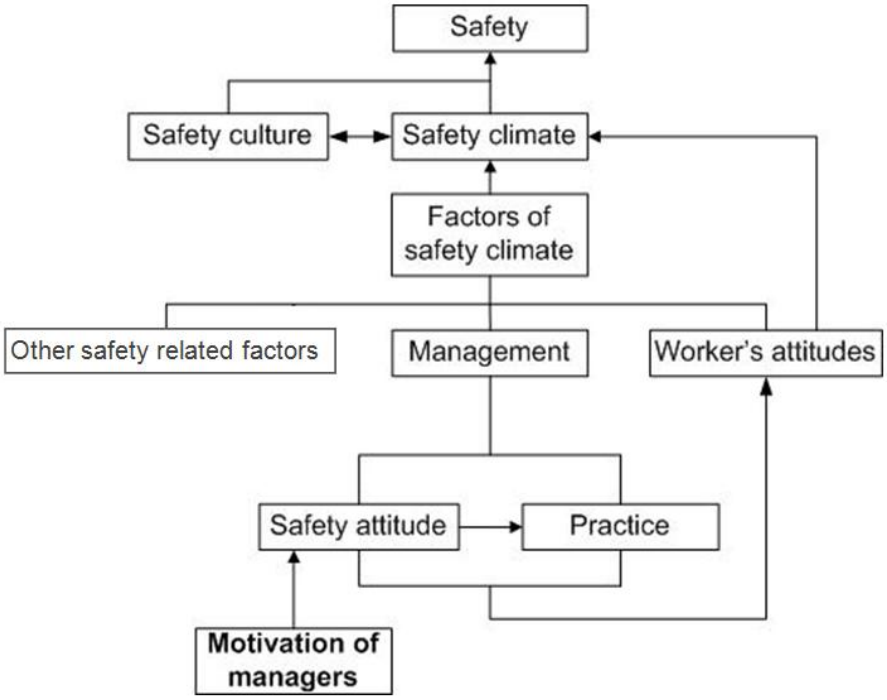

Fig. 2.1 Interaction of factors Related to Safety Climate and Culture as shown in the Literature

The goal of this study is to develop a set of latent, or hidden, variables that capture the essence of safety manager attitudes. Thus, this study will investigate the structure of motivations that affect a safety manager's perception of safety. It is hypothesized that these key factors may not be easily quantified, but do have substantial impacts on the safety climate within transportation organizations.

Chapter 3 Data Analysis

3.1 Method

Data from a survey distributed to safety managers as part of a research project sponsored by the National Academies Transportation Research Board, Commercial Truck and Bus Safety Synthesis Program (CTBSSP) was analyzed for this study. The survey was administered to 25 safety managers at trucking companies and 5 safety managers at motor coach companies. The survey questions were designed to assess manager's perceptions of safety and included questions on available incentive programs, investments in technology and safety certificate programs, as well as demographics of the safety department and the company as a whole (including crash records).

A factor analysis was conducted on the survey questions related to the concept of safety climate. Questions that were not related to perception were omitted (e.g., "How many power units does your company operate?", "How many employees (excluding drivers) does your company employ?"). A total of 17 variables were used in the analysis including questions regarding the safety manager's perceptions of the motivations for improving company safety, the relationship between safety culture and driver turnover, other factors related to safety, and manager perceptions of others' attitudes regarding their company's safety practices. Responses to these questions were based on a Likert-scale. One question included 7 separate items related to the motivations for improving company safety ranked in order of importance. Respondents were asked to rank the topics with 1 as "the most important" and 7 as "the least important," and they were instructed to use each number only once when answering the survey. Additionally, 7 items about attitudes related to company-wide and industry-wide safety practices was scaled from 1 as

"strongly agree" to 5 as "strongly disagree," with 3 indicating "uncertain." The remaining questions were scaled from 1 as a positive to 3 as a negative answer.

There were three different Likert-scales used in the survey. Therefore, prior to conducting the factor analysis, all responses were recoded to be of the same weight. The values ranged from -3 for least important or strongly disagree [negative response] to +3 for strongly disagree or most important [positive response], with 0 for uncertain [neutral].

A principal factor analysis was conducted in SAS 9.1 using the factor procedure, for more information refer to Der & Everitt (2002). It should be additionally noted that factor analytic techniques have been used to generate a better understanding of safety culture and safety climate in past research (Clarke, 1999; Cooper, 2000; Flin et al., 2000; F.W. Guldenmund, 2000; F.W. Guldenmund, 2007; Singer et al., 2003; Tharaldsen et al., 2008). The squared multiple correlations were used to estimate the prior communality estimates. Both orthogonal and oblique rotation methods were used. The number of factors retained was based on an assessment both of eigenvalues and 'elbow' in the scree plot (Kachigan, 1991), Several 'nfactor' of factor analysis were conducted to determine different combinations of factors that can be best interpreted.

3.2 Result

The survey results showed that safety managers viewed safety as a top priority or at least equal to other major priorities, such as customer and operational concerns). About two-thirds of the survey respondents reported that safety is integrated into driver screening, hiring, discipline, firing and also into compensation, benefits, and incentives.

Before conducting factor analysis, one item—"how does your company's safety culture relate to driver turnover?"—was omitted due to its highly skewed distributions: more than 75 percent of responses were the same for this question.

Four factors were extracted based on eigenvalues (>1). One item—the importance of setting a high industry safety standard as a motivation for improving company safety—failed to load significantly (<0.3) on any factors. Thus, this question was removed and no longer considered in the analysis. A factor analysis was then conducted without this variable, resulting in 15 total items, and, despite these alterations, a four-factor solution was still obtained and accounted for 81.8% of the total variance. The factor loading results of orthogonal and oblique rotations were similar and therefore the outcome of the former are presented here.

A 0.4 cutoff point (Williamson et al., 1997) was used in the final solution. For this reason, one item failed to load on any factors and thus was moved to the "not included" category. Other items loaded well on one of the four factors, but some also had similar high loadings on other factors. The cross-loadings were addressed based on conceptual as well as internal consistency of factors using Cronbach's alpha (Pett, Lackey, & Sullivan, 2003). The bolded loading scores shown in table 3.1 are the final solution after addressing overlapped variables. The final Cronbach's alpha ranged from 0.59 to 0.69 which is relatively close to the standard of 0.7 (Litwin, 1995).

Table 3.1 Factor Loadings for the Four Latent Variables of the Safety Attitudes of Managers

Survey items	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1: The financial impact of safety (27.3% of variance, α=0.68)				
importance of avoiding enforcement issues as a motivation for improving co. safety	0.74			
importance of avoiding costly lawsuits as a motivation for improving co. safety	0.68			
importance of attracting customers as a motivation for improving co. safety	0.62			
importance of attracting drivers as a motivation for improving co. safety	0.54		-0.53*	
importance of decreasing insurance costs as a motivation for improving co. safety	0.44			0.50*
Factor 2: Internal awareness of safety (19.4% of variance, α=0.62)				
importance of reducing crashes as a motivation for improving co. safety		0.53		
perception of whether our customers value safety		0.82		
perception of whether the general public sees our co. safe		0.60	0.57*	
perception of whether the general public sees our industry safe		0.41		
Factor 3: Demand for safety (17.6% of variance, α=0.59)				
perception of whether drivers from other companies see our co. safe			0.62	
perception of how other drivers outside the co. influence our drivers			0.61	
Factor 4: Overall safety culture in the industry (17.5% of variance, α=0.69)				
perception that whether general CMV drivers operate in a culture of safety				0.73
perception of how the overall culture among drivers within the industry impact safety efforts				0.66
Not Included				
perception of whether enforcement sees our company as one that is safe			0.31	-0.32
perception of whether our insurers help make us a safer company	-0.43			

*Note: These loadings were observed to load high on 2 factors but were not included in this factor because they lowered the Cronbach's alpha value

The first factor explained 27.3% of the variance and is labeled as "the financial impact of safety." This factor is related more to the financial implications when safety is not considered, and includes enforcement issues, civil litigation, attracting customers and drivers, and insurance costs. The initial Cronbach's alpha of this factor was 0.47 which is relatively low. Further investigation of the variables indicated that one of the items, "perception of whether our insurers help make us a safer company," should be dropped since it was not consistent with the others by lowering the alpha score. When this variable was dropped, a significantly higher alpha score resulted (α=0.68) and this final structure was retained.

The second factor can be called the "internal awareness of safety," and it explains 19.4% of the variance with alpha score of 0.62. This factor was highly loaded by respondents' perception of the customer's value of safety, the general public's opinion of an individual company and industry safety efforts and the importance of reducing crashes as a motivation for

improving safety within an organization. All of the variables explain some aspect related to the reasons a company may value safety within the organization.

The third factor, which explained 17.6% of variance with alpha of 0.59, can be identified as “demand for safety” and is derived from the factor based on attracting drivers as a reason for safety. It can be considered as one aspect of competition among different companies, as it is associated with the two central questions: whether drivers from other companies see the manager’s company as a safe one, and how other drivers outside the company influence drivers within the company.

The last factor can be interpreted as ‘overall safety culture in the industry,’ because it incorporates safety manager concerns of whether general commercial motor vehicle drivers operate in a culture of safety, and of how the overall culture in the industry impacts company safety efforts. The variance explained by this factor is 17.5% with alpha of 0.69.

Table 3.2 shows the small inter-correlation scores between factors extracted from original variables. The Pearson Correlation Coefficients, shown in table 3.3, also shows that there was no obvious linear dependence between any two factors. Therefore, all four factors are relatively independent and can be considered as four different aspects that influence the motivation for maintaining a good safety climate.

Table 3.2 Inter-Correlation of Factors Extracted

	Factor1	Factor2	Factor3	Factor4
Factor1	1.00	-0.04	0.04	-0.05
Factor2		1.00	0.04	0.01
Factor3			1.00	0.04
Factor4				1.00

Table 3.3 Pearson Correlation Coefficients (PCC) of Extracted Factors

	Factor1	Factor2	Factor3	Factor4
Factor1	1.00	0.04	0.12	-0.16
Factor2		1.00	-0.04	0.20
Factor3			1.00	-0.11
Factor4				1.00

Chapter 4 Findings and Conclusion

This study expands on the results presented in Short et al. (2007) and suggests that a four-factor model accounting for 81.8% of the total variance was best to explain motivations of safety manager attitudes towards safety. The four factors include different aspects of safety managers' perceptions and considerations related to safety: the financial impact of safety, internal awareness of safety, demand for safety, and overall safety culture in the industry. These four factors can be considered as influences of safety managers' attitudes toward safety both internally, the financial cost of safety, internal awareness of safety and demand for safety; and externally, or the overall safety culture in the industry. This indicates that future investigations into creating and maintaining a positive safety climate and attitude may need to examine both the internal functioning of organizations as well as the industry as a whole.

Although there is no factor structure in former safety climate studies that are similar to this study, due to the focus on different aspects of safety consciousness, the internal factors can be supported by the Alderfer's ERG (Existence, Relatedness, and Growth) theory of motivation, which was mentioned earlier. To explain this theory at an organizational level, existence needs can be considered as needs involving organizations' financial interests—namely, investment in safety practices and technologies can have a clear investment return. On the other hand, related needs can be classifiedas needs involving external feedback, such as that from customers, regulators and safety audits. Finally, growth needs can be considered as needs involving organizations' self development, which are determined through the measurement of safety performance. This study shows that it is several aspects of organization's needs that affect safety managers' perception of safety and act as motivations to maintain a good safety attitude.

The strongest factor in the model which accounted for the highest level of variability is the financial implications if safety is not met. The outcomes of the factor analysis show that financial considerations are a critical factor for organizations, and may have a larger influence on safety managers than expected. Safety managers' primary concern is the overall safety of their organization, but they may also realize the financial implications of not having high safety standards. Trucking organizations do apprehend the benefits from good safety performance since accident-related costs can be avoided. It is also possible that insurance costs will decrease as good safety performance is maintained, and safe companies may have a better ability to attract safer drivers. These factors show basic needs for organizations to survive in a highly-competitive industry. Therefore, safety managers' concerns for such factors, as well as the concerns of company owners and/or top executives (which greatly influence the actions of safety managers), can be considered as motivated by existence needs: the basic need to survive in ERG theory.

The result also suggests that internal awareness of safety can be reflective of the safety attitudes of managers. Different from the first factor, this awareness is not caused by the direct relationship between safety and financial interests, but caused by how the manager values the overall safety beliefs within society, including the perception of the organization itself. As the value of safety increases among society, the pressure and awareness of enhance safety within the organization should increase as well. However, if organizations fail to value and account for societal concerns, the organization's attitude may not change. This factor therefore is greatly pertinent to the "relatedness" needs of the organization: that is, the "feedback from peers" (Charleston, 1993).

The last two factors in the result are relatively weak compared with the former two, since they contain only two variables each and explain less variance. However, it is still worthwhile to

consider the possible impacts on a manager's safety attitude. The demand for safety has to do with the safety manager's concerns about competing levels of safety between organizations—safety acts as an attractive quality to potential employees, which helps in hiring and retaining good drivers. Accordingly, this is also derived from the relatedness needs of company. The overall safety culture in the industry can influence individual organizations safety attitudes and values. That is, if the whole industry holds a poor safety value, it is not surprising that companies within the industry do as well. Subsequently, safety managers may not have a high safety value as they may not have the pressure to consider safety issues important.

There are several limitations to this study. The dataset analyzed included 30 survey respondents and was collected during original study conducted by Short, Boyle, Shackelford, Inderbitzen and Bergoffen (2007). Factor analyses are typically conducted with sample sizes much larger than this. This may have caused the lower Cronbach's Alpha scores compared to other factor analysis studies when measuring the internal consistency. Thus, further investigation should be conducted on the reliability of this structure by adopting a larger sample size. Additionally, due to the small sample size, few variables could be included in the analysis.

Regardless of these limitations, this study provides an initial indication of some of the constructs that relate to the safety climate perceived by safety managers in commercial vehicle operations. More specifically, this study indicates that safety manager attitudes toward safety are motivated by certain relationships between safety performance and the consequences of unsafe performance. Enhancing safety attitudes by emphasizing this relationship will help establish a high safety culture within the industry.

Chapter 5 Recommendations for Future Projects

For future studies, it would be valuable to examine the constructs not captured in this survey but still of great importance, including managers' understanding of drivers and customers' priority for safety versus other competing demands, and the competition related to safety among companies. Therefore, a survey specifically designed to assess managers' safety attitudes is warranted to improve the current factor structure obtained from this study. It would have been useful to have a similar questionnaire with responses on a 7-points Likert-scale to obtain more precise feedback from managers. In addition, adopting a larger sample size is essential to verify the reliability of the factor structure. A sample size around 250 is recommended for future studies.

It may also be interesting to see whether the priorities and factor structure of safety attitudes is different among different management levels. Previous studies have shown that differences in the safety culture attitudes and perceptions of individuals at different levels of management exists in large organizations (Singer et al., 2003). Therefore, comparing the safety attitude using the same questionnaire may provide greater insights about how the safety climate can be improved.

In manufacturing, differences in attitudes among managers can relate to number of incidents (Nielsen, Rasmussen, Glasscock, & Spangenberg, 2008). Hence, it would be valuable to gather data related to the attitudes of managers and compare that to different crash rates per miles driven in each organization.

It is recognized that manager's attitude toward safety is just one aspect of a good safety climate. As shown earlier in figure 2, there are other safety-related factors not addressed in this

study including worker involvement, attitudes toward safety (Williamson et al., 1997), and communication between managers and workers (Flin R., 2000; Wills et al., 2006). Therefore, additional studies based on commercial vehicle driver perceptions about safety and the communication effectiveness within organization may provide additional insight on how to achieve a "good" safety climate. To achieve this goal, similar questionnaires can be designed for commercial drivers. Based on previous safety climate studies of Zohar (1980) and Wills et al.(2006), an example question that can be asked in the survey includes: "How important is safety training?"Rank the priority of following items from most important to least important (safety, on-time delivery, customer, etc.) ";"How do safety managers value safety?"; "How do the company safety rules influence your safety performance while driving?". Similar to the manager questionnaires, a 7-points Likert-scale would be preferred in order to attain more precise responses.

In general, the culture set forth by a company greatly impacts the driver's attitudes and their overall perception of safety. Further research in this area can help provide insights that help foster a good safety culture and mitigate the impacts of risky driving performance.

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