Work Climate, Organizational Commitment, and Highway Safety in the Trucking Industry: Toward Causal Modeling of Large Truck Crashes

Carroll M. Graham and Aaron J. Scott
University of Arkansas

Frederick M. Nafukho
Texas A&M University

While theoretical models aimed at explaining or predicting employee turnover outcomes have been developed, minimal consideration has been given to the same task regarding safety, often measured as the probability of a crash in a given time frame. The present literature review identifies four constructs from turnover literature, which are believed to be relevant to safety research. A theoretical model of safety built upon these constructs, as they apply to the trucking industry, is presented.

Key words: Safety, Organizational Commitment, Work Climate

Research on safety has included numerous variables, all meant to clarify reasons for unsafe driving behaviors and their consequences. This historically includes variables that can be measured *directly*, most often limited to individual characteristics (human factors), vehicle characteristics, organizational safety policies, and physical environment conditions (Rodriguez, Targa, & Belzer, 2006). Causal studies from government agencies, annual reports from research organizations focused on transportation safety, and human resource development (HRD) periodicals consistently discuss factors in these four categories. Many of these types of variables are invaluable to our understanding of crashes, especially those that have clear causes, such as vehicle malfunction or hazardous road conditions. This often leads to collecting data on literally thousands of variables (Staplin, Gish, Decina, and Brewster, 2003), making it possible to generate seemingly unlimited hypotheses. However, building theory requires understanding and articulating processes and mechanisms that generalize across contexts and environments. This is difficult to accomplish with *only* these types of variables.

There are more complex variables that have successfully led to understanding and addressing turnover behavior over the past two decades. A few of these variables have been applied to safety research, but often done so in isolated conditions and without the aim of building theory. This paper examines prevalent factors employed in turnover research and introduces additional factors identified elsewhere that are believed to be applicable to safety in the trucking industry, in particular truck load (TL) carriers. We postulate that the combination of these two activities will greatly advance the generation of theoretical models of safety and influence positive HRD outcomes.

Defining and Measuring Safety

The concept of safety in the trucking industry is primarily discussed in terms of driver practices, environmental conditions, and individual behaviors as they relate to accidents. Mejza, Barnard, Corsi, & Keane (2003) recently expanded a well-known definition of safety, stating that "transportation safety can be defined as the degree of protection from physical risk to life or property present during carrier movements of freight and passengers" (p. 16). This is an important contribution to the measurement of safety and its consequences. Indeed, viewing safety in this manner allows the consideration and investigation of the degree of presence of identified *mechanisms* of protection from risks as well as how *effective* these mechanisms are at reducing risk of harm.

Safety training ranges from education about road conditions, speeding, braking, weight distribution, to discussion of driver distraction, fatigue, and physical, mental, and emotional health (Staplin, L., Gish, K., Decina, L., & Brewster, 2003). Studies of safety, then, typically focus on harm by estimating the effects of these variables on crash rates in order to measure the degree of safety present within a specific carrier (Nafukho & Hinton, 2003; Nafukho, Hinton, & Graham, 2007). Given that crashes and their associated costs are the most relevant outcome regarding transportation safety, the number of crashes or the probability of a crash over a given distance or within a specified timeframe is the most common method of quantifying safety. More refined measures have taken into consideration the differences in likelihood of different crash rate contrasts, namely 0 vs. 1 crash, 1 vs. 2 crashes, and

2 vs. 3 crashes. Additionally, crashes are often further divided and analyzed by their severity, typically dichotomized as fatal and non-fatal crashes.

Need for Theoretical Models in Explaining Large Truck Crashes

Two primary factors justify the need for better identifying, and more importantly, integrating explanations and predictors of driver crashes: (1) an increasing rate of crash injuries and fatalities and, (2) their associated rising costs. These factors continue to be critical issues that trucking organizations must face, and understanding the causes behind them can be catalyzed by proposing and testing theoretical models.

Large truck crash injuries and fatalities. Large truck registrations, those with gross vehicle weight ratings greater than 10,000 pounds, have increased for the years 2003-2005. During this same period, total fatalities have ranged from 5,036 to 5,235 but remain approximately the same when calculated as a ratio of fatalities per million vehicle miles driven. Figure 1 shows the number of large truck crashes involved in fatal crashes and reveals a steady and slightly upward trend from 2002 through 2005 (Federal Motor Carrier Safety Administration, 2007b, 2007c).

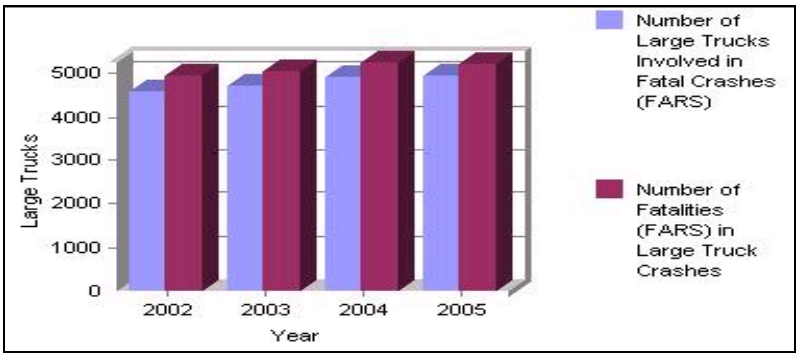

Figure 1. Number of Large Trucks Involved in Fatal Crashes
Data Source: FARS & MCMIS (March 2007 data snapshot)

As Figure 2 shows, approximately 145,000 large trucks were involved in fatal and non-fatal crashes for the year of 2005. As indicated in the table an upward trend exists and reflects a 24 percent increase since 2002 (Federal Motor Carrier Safety Administration, 2007c).

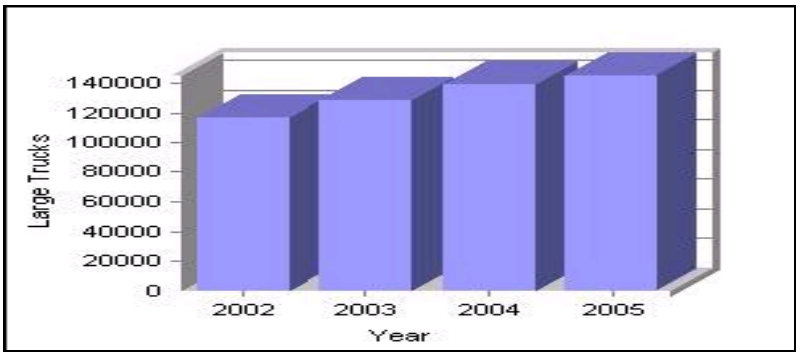

Figure 2. Number of Large Trucks Involved in Fatal and Non-Fatal Crashes
Data Source: FARS & MCMIS (March 2007 data snapshot)

Also, 91,993 injuries in crashes involving large trucks were recorded in 2005. Injuries in large truck crashes represent 4 percent of all injuries and fatalities in large trucks represent 12 percent of all fatalities in motor vehicle crashes for 2005. Failure to keep in proper lane, driving too fast for conditions or in excess of posted speed limit, inattentiveness (talking, eating, etc.) and failure to yield the right-of-way made up approximately three-fourths of the driver-related factors recorded for large trucks in fatal crashes and violations recorded. It should be noted that driver-related factors(s) recorded made up 38.5 percent and no driver-related factors recorded made up 61.4 percent of the total data on drivers of large trucks in fatal crashes by driver-related factors and violations recorded. Finally, 354,000 large trucks were involved in property damage only crashes and hazardous materials placards were present on 4 percent of the large trucks involved in fatal crashes (Federal Motor Carrier Safety Administration, 2007b).

Accident costs. The U. S. Department's of Transportation's administrative branch, FMCSA, estimates that a $25,000 accident may cost a carrier with a 2 percent profit margin an additional $1,250,000 in revenues. Correspondingly, (with a 3% profit margin), if an accident costs $150,000 the revenue required to cover the losses for carrier will increase to $5,000,000 (Federal Motor Carrier Safety Administration, 2007a).

According to FMCSA the expense due to a truck crash covers direct and indirect costs:

> *Direct costs* cover the cargo damage, vehicle damage, injury(s), medical, and loss of revenue, administrative, police report, possible effect on cost of insurance and workmen's compensation insurance, towing costs, storage of damaged vehicle. The *indirect* or *hidden costs* include lost clients/customers, lost sales, meetings missed, salaries paid to employees in accidents, lost time at work, cost to hire/train replacement employees, supervisor's time, loss of personal property, replacement vehicle rental, damaged equipment downtime, accelerated depreciation of equipment, accident reporting, medical costs paid by company, poor public relations/publicity, increased public relations costs, and government agency costs. (Federal Motor Carrier Safety Administration, 2007a, p. 1)

Large truck injuries and fatalities, and the elevated costs of accidents in large truckload carriers justify the need for development of a theoretical model. The overriding constructs of such a model should reflect the relationships of relevant variables in a unified manner and ultimately provide a basis for HRD initiatives that lead to increased safety. However, there are no studies in the literature reflecting that a model of this description is currently being utilized.

The Purpose of the Research

The present paper proposes that there is a relationship between organizational commitment, work climate, and driver safety in the trucking industry. Further, the study proposes *processes* and *practices*, as illustrated in a model and their connection to often-identified antecedents and costly consequences may explain variances in safety within truck load carriers. A number of constructs from turnover research have begun to make their way into safety literature. The four most prominent found were job satisfaction, intent to leave, organizational commitment, and work climate. The authors were unable, however, to detect a pattern of the reasons these constructs are introduced, when discussed in safety literature. More importantly, it was often unclear or unaddressed how the constructs might be related to one another as well as to other relevant safety variables. In order to bring structure to what appears to be a fragmented process, the literature review that follows provides the beginning of a discussion meant to bring these ideas together under a common theoretical umbrella.

Methodology

The review of literature was conducted using the academic literature databases ProQuest Direct, ProQuest Dissertations and Theses (Digital Dissertations) Ebsco Academic Search Premier, Social Sciences Citation Index, also known as Web of Science, and the National Transportation Library (Transportation Research Information Service). Initially, the search terms crashes, and trucking, commitment, and turnover were utilized to search for relevant peer-reviewed journal articles. An analysis of literature beginning in 1980 revealed there were only a few empirically-based studies related to the issues of safety and/or intention to leave and safety in the trucking industry. A third term, safety, was added and few additional relevant empirical articles were revealed. The WorldCat database was searched for relevant empirical studies authored in books and once again, a limited amount of relevant literature was located. Also, the Federal Motor Carrier Safety Administration's (FMCSA) research publications link was searched for updates on large truck crashes, injuries, fatalities, and property damage information. Finally, the American Trucking Associations (ATA) online website was searched for white papers and information related to ATA authorized research studies for the topics of turnover, job satisfaction, dispatcher/fleet manager relationships with truckers, intention to leave and the impact on safety. As a result, the latter revealed no empirical studies relating to these topics were available to the public via the ATA website.

Job Satisfaction

Understanding drivers' levels of job satisfaction is beneficial in the highly competitive environment of trucking where net profit margins are two percent or less (Swain, 2006). The degree to which drivers are satisfied with their attainment of job related values is linked to their perception of job satisfaction. Many elements within the culture of an organization impact a workers job satisfaction. Herzberg's (1966) Motivator-Hygiene Theory of job satisfaction assumes that workers have two sets of needs: *motivator needs* and *hygiene needs*. Motivator needs can be described

as those job facets such as interesting work or autonomy. Hygiene needs relate to the physical and psychological contexts in which the work takes place, such as working conditions, interactions with supervisors and other key people, pay, and job security (George & Jones, 1999). In the transportation industry, points of interaction, or those persons with whom the driver interacts, often play a critical role in establishing mutually beneficial relationships that result in job satisfaction. Should a driver's intention to leave culminate in a turnover then job dissatisfaction of the driver may also be correlated to customer dissatisfaction (Schlesinger & Heskitt, 1991). Thus, improving job satisfaction and reducing turnover helps maintain, customers, revenues, drivers, and employer relationships, and avoids associated costs when employees leave. Further, due to the ever-present changes in the transportation industry, monitoring and analyzing driver job satisfaction with key personnel is important and should be initiated periodically to avoid unforeseen problems.

Intention to Leave

The concept of *intention to leave* has not been adequately explored in the trucking literature when compared to the construct of *turnover*. Yet, most dissatisfied employees allocate time to contemplate (Mobley, 1977) the consequences of leaving their present employer and many have guiding principles that trigger thought processes and the increased probability of quitting the job (George & Jones, 1999). Often, socialization processes (Klenke-Hamel, & Mathieu, 1990), including adjustment issues, and a perceived lack of supportive working relationships, increases a driver's *intention to leave*. Thus, intention to leave may be defined as a precursor or antecedent to turnover that occurs in conjunction with increased levels of job dissatisfaction and thought processes and/or plans of leaving the job.

Cammann, Fichman, Jenkins, and Klesh (1983) noted that individual level assessment partially fulfills the requirements of evaluating an organizational program. Thus, requesting timely feedback from truckers regarding their perceived level of intention to leave informs management of the possibility that truckers may resign from the job. An elevated level of *intention to leave* may serve as an antecedent forecasting not only turnover rates, but other issues as well. For example, if a trucker has frequently considered leaving the company he or she may demonstrate a reckless indifference toward a company's safety policies, fellow employees, equipment, and public relations with customers. Researchers in healthcare, another industry with very high rates of intention to leave and turnover, noted, "a departing person [one who intends or may intend to leave], cuts corners, compromises quality and safety, risks malpractice claims, or exemplifies any number of adverse traits, behaviors, and attitudes that staff find offensive" (Waldman, Kelly, Arora, & Smith, 2005, p. 2).

Organizational Commitment

As of this writing, organizational commitment has yet to be applied in safety research. The degree of commitment and the *components* of commitment demonstrated by employees both have been extensively researched and shown to be strongly related to turnover. The development of this construct has made the most progress in the past decade. Meyer and Allen have been greatly responsible for this progress, producing a great deal of research exploring the depth and breadth of organizational commitment (Meyer & Allen, 1991, 1997; Meyer & Herscovitch, 2001; & Meyer, Stanley, Herscovitch, & Topolnytsky, 2002). Meyer and Allen have argued that organizational commitment can be generally defined as "…a psychological state that (a) characterizes the employees' relationship with the organization, and (b) has implications for the decision to continue membership in the organization". Additionally, they have found that it is best understood as consisting of three strands or, as they prefer to call them, "components". These are *affective* commitment, *continuance* commitment, and *normative* commitment. A great deal of research preceded this view of commitment in the workplace, and has been reviewed elsewhere (Meyer & Allen, 1997). However, it has been shown that other models of commitment can be incorporated into and measured more fully under these three components.

Each of the three components contributes to the overall understanding of how commitment operates and how it influences workplace behavior. According to Meyer and Allen (1991) affective commitment is defined as "employees' emotional attachment to, identification with, and involvement in the organization". Continuance commitment "refers to an awareness of the costs associated with leaving the organization." Normative commitment "reflects a feeling of obligation to continue employment" (p. 67). Yet, they have demonstrated on a limited basis in the past that each component works differently in different contexts and for different purposes. In a recent meta-analysis, they confirmed this with greater confidence, concluding that by investigating these components relationships to antecedents, correlates, and consequences in the workplace, they were able to better differentiate the unique qualities of each component. For instance, among the three components, affective commitment was most strongly associated with the correlates of job satisfaction, job involvement, and occupational commitment (Meyer, et al., 2002). However, when investigating antecedents, namely demographic variables, no single component was affected more than another in its development. Finally, regarding the consequences of commitment, all three components were found to consistently correlate negatively with withdrawal cognition, turnover intention, and

turnover. At the same time, all three correlated positively with other work behaviors including attendance, job performance, and organizational citizenship behavior (Meyer, et al., 2002).

Work Climate

Work climate is described in the transportation industry as a result or end-product of driver's perceptions of key support personnel. These include, but are not limited to, the fleet manager (dispatcher), orientation personnel, equipment maintenance personnel, safety, compliance, compensation and benefits, and customer service personnel that may influence a driver's intention to leave, and thus safe driving practices. How these individuals are perceived by a driver over time establishes the type of work climate that he or she experiences. The work climate can be influenced by the dependability of individuals with whom the driver is most frequently in contact. It can further be influenced by the degree of trust established between the driver and such personnel.

Michael, Guo, Wiedenbeck, and Ray (2006) investigated the relationship between leader-member relationships (leader-member exchange), safety communication, and safety-related events in five manufacturing businesses. Based upon survey results of nearly six-hundred carriers and selection of OSHA recordables, the authors found that the relationships between leaders and members was the strongest predictor of safety-related events, but not of OSHA recordables. It was also discovered that after controlling for gender, age, job satisfaction, and leader-member relations, safety communication was not a significant predictor of safety-related events. The authors concluded, however, that leader-member exchanges independently explained additional variation in safety outcomes, beyond safety communication, indicating that the climate at work can influence safety-related events. Explaining the discrepancy between the significant relationship between leader-member relations and their own measure of safety-related events and the non-significant relationship with OSHA recordables, the authors argue that how safety is measured is key. OSHA recordables, while objective measures, are typically related to events that are often beyond the control of the employee.

Mejza et al. (2003), surveying 148 motor carriers (freight and passenger) deemed to be safest in the industry nationwide (based on FMCSA's SafeStat 2000 data), investigated safety performance and its relationship to *driver management practices*. These practices were defined as "activities a carrier performs to enable its drivers to detect and avoid potentially dangerous driving situations" (p.17). The activities studied included driver selectivity, instructional intensity, supportive intensity, and motivational intensity. It was found that among the safest motor carriers, hiring practices were based on strict criteria regarding drug abuse and driving history, training practices very often included both pre-service *and* in-service training programs, and practices of driver reinforcement and support, such as verbal praise, congratulatory letters, and merit certificates, were an integral part of the carrier's culture. While the study is solely descriptive in nature, the authors concluded that the aforementioned management practices were pivotal in initiating and maintaining superior safety outcomes.

Theoretical Framework for Developing A Model of Trucking Safety

In light of reviewed literature on important constructs, the second purpose of the present paper is fulfilled here by utilizing Meyer and Allen's (1991) model of organizational commitment. This model illustrates the relationships among antecedents, correlates, and consequences of commitment. Instead of focusing upon commitment, however, a revised model (Figure 3) is suggested in order to accommodate the inclusion of additional or alternative antecedents and correlates as well as to incorporate safety as a primary consequence variable. This proposed model emphasizes the *processes* and *practices* and their connection to often-identified antecedents and costly consequences. It is meant to offer a different lens through which to view safety as a much larger and more complex process. It should be noted, the model incorporates more information than was reviewed in previously discussed literature. The proposed theoretical model finds support in the performance improvement (PI) and systems theory literature. Further, these theories are integral to performance because performance issues occur in systems within organizations operating within subsystems of the workplace environment (Gradous, 1989; Swanson, 1999). Accordingly, PI theories found in the literature are relevant to the truck drivers' performance in numerous ways. For example, transportation companies are highly motivated to increase return on their investments and often focus on factors, such as safety issues, which impact overall performance of the organization.

Holton (1999) developed an integrated taxonomy of performance system domains with four main domains of performance (1) mission, (2) process (3) critical performance subsystem, and (4) individual. The system's mission, and the goals derived from it, specifies the expected outcomes of that system. As noted "every purposefully organized system operates either explicitly or implicitly with a mission and the role of the mission is to reflect the system's relationship with the external environment" (Holton, 1999, p. 29). Further, the primary mission of a large truck load transportation company is to maximize profit while providing quality service to customers. However, Dirkx (1997) suggested measurement of performance by focusing solely on economic returns is flawed. Process, the

second domain of PI, is defined as a "series of steps designed to produce a product or service" (Rummler & Brache, 1995, p. 45). To show the complex nature of the process domain, Rummler and Brache (1995) noted:

> Process is the least understood and least managed domain of performance; it should be seen as a value chain, with each step adding value to the proceeding steps; an organization is only as effective as its processes; enhancing organizational and individual effectiveness will only improve performance as much as the processes allow, and strong people cannot compensate for a weak process. (p. 45)

According to Holton (1999) the third domain of performance, critical performance subsystem, is "an internal subsystem for which performance goals have been set that are derived from and contribute to the mission of the overall system" (p. 31). Unlike the mission domain, which focuses on the performance outcome relative to the external environment, the subsystem domain is more concerned with the internal performance subsystems that relate to the internal environment of the organization. The subsystems are part of the processes that take place in an organization. The fourth domain of performance, the individual, focuses on the need to improve individual performance This can be done through "optimizing learning and expertise, incentives and consequences, feedback, information, resources, and working conditions required for the individual to function in the system" (Holton, 1999, p. 32). Relative to the fourth domain, the individual, performance is manipulated with rewards, incentives, recognition, individual capacity, evaluative feedback, and motives and expectations of the employee (Gilbert, 1978; Gilbert, 1988; Gilbert, 1996; Rummler & Brache, 1995; Swanson & Arnold, 1997; Weinberger, 1998). Robinson and Robinson (1996) observe that the work environment governs whether or not the employees utilize the skills learned, a theory relevant to the current study. Robinson and Robinson (1996, p.180) developed a formula that is also relevant to the study. It is expressed as: "Learning Experience *X* Work Environment = Performance Results." In the formula, to achieve desired performance results, employees must focus on the skills required for job success. This, combined with a supportive work environment, should ensure good performance. The multiplication symbol indicates that deficiency in either factor impacts the performance directly. According to Robinson and Robinson (1996), all significant causes of performance deficiencies must be resolved if performance improvement is to be achieved. To do this, research on possible deficiencies is important.

In the case of transportation, numerous processes, often involving dozens of support personnel must interface with various systems and subsystems in a harmonious manner to accomplish the organization's mission. Often, people and systems are performing within their own functions and are unaware of the deficiencies that occur on a systems-wide basis that impact performance and ultimately safety.

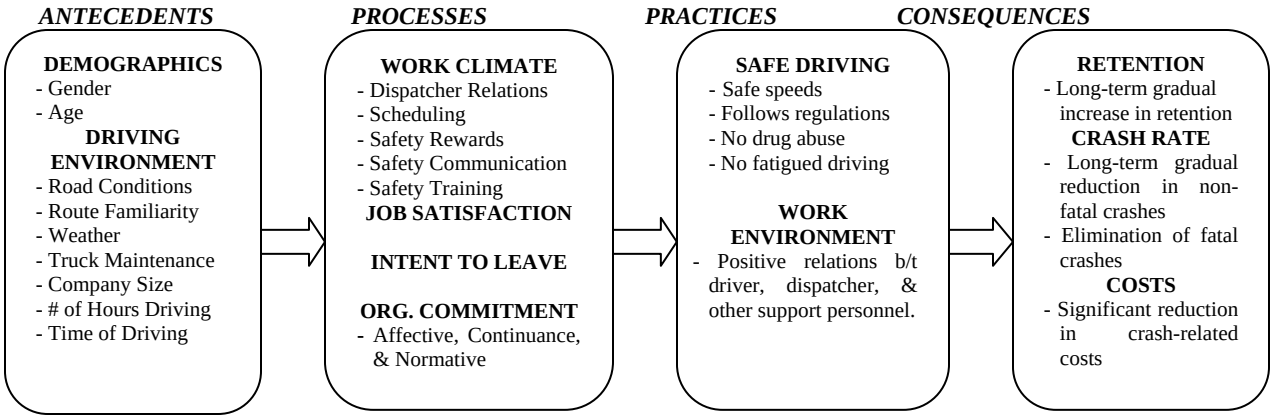

Figure 3. Model of safe driving dynamics in trucking. Based upon Meyer & Allen's (1991) multidimensional organizational commitment model.

The aforementioned literature review supports the view that a conceptual model is needed to account for and illustrate variances in retention, crash rates, and related costs. Thus, the researchers suggest the following should be included: *Proposition 1:* The model should determine the estimated relationships among processes including, worker job satisfaction, intention to leave, organizational commitment, and work climate. *Proposition 2:* The model should determine the estimated relationship among antecedents, including demographic and environmental variables. *Proposition 3:* The model should determine the estimated strength and direction of relationships among processes, practices, and consequences, while controlling for antecedent variables.

Discussion

The purpose of this paper was to propose a theoretical framework that describes relationships of under-researched variables found in turnover literature, and to discuss their potential impact on safety in the trucking industry. Though extensive research has been conducted in an attempt to curb the effects of turnover, this has been done to a lesser degree in safety research. The literature revealed safety issues are extensive in this industry, costly, and are influenced by numerous variables. However, there are considerable deficiencies in the literature that prevent exploration of linkages between safety-related processes, practices, and outcomes. This paper provides a conceptual model of safety to address these gaps in the literature.

The literature, while supported by limited empirical data, suggests the concept that support personnel relationships, job satisfaction, intention to leave, and organizational commitment may impact safety. Thus, the researchers suggest that verification of the proposed model with an empirical study may influence human resource development initiatives that prevent costly disasters affecting numerous stakeholders.

Conclusions, Implications, Suggestions for Future Research

The present paper is beneficial from a practical and theoretical perspective for the following reasons: (1) HRD practitioners may develop interventions to address issues related to safety and support personnel relationship deficiencies; (2) supportive personnel excel in their areas of expertise, but lack education related to soft skills that may enhance relationships and increase drivers' organizational commitment. Unfortunately, relationships often evolve into unmanageable sources of conflict and render relationships irretrievable, inducing intention to leave. With knowledge of an empirically-tested model, HRD practitioners could assess their local cultures for deficiencies of this nature and provide appropriate initiatives; and, (3) various theoretical perspectives can be tested utilizing this model as a foundation to determine the strength and nature of the relationships among the constructs investigated.

New knowledge on this conceived model could assist HRD practitioners in designing initiatives to curtail the costly effects of truck drivers who are most likely to be involved in a crash. Also, further investigation could offer new knowledge that may be utilized to help reduce driver crash rates throughout the world and avoid losses due to injury and death.

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