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Effects of Transformational Leadership on Safety Performance in the United States Commercial Trucking Industry

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EFFECTS OF TRANSFORMATIONAL LEADERSHIP ON SAFETY PERFORMANCE IN THE UNITED STATES COMMERCIAL TRUCKING INDUSTRY

by

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ABSTRACT

The purpose of this study was to research whether the leadership styles of safety professionals, supervisory and management leaders of commercial trucking companies, were related to their companies' safety ratings. The theoretical framework employed in this study was based on the full range leadership model of Avolio and Bass (1991). Sixty-two long-haul commercial truck drivers participated in the study. This quantitative research was a quasi-experimental, correlational study comparing leadership styles with safety indices of trucking companies. The leadership styles were determined using the 45-question Multifactor Leadership Questionnaire (MLQ) Rater Form (Avolio & Bass, 1991) and compared them to the safety indices of the participants' trucking companies. The safety indices had two components, the companies' safety ratings and their safety climate scores. The safety ratings were derived from the U.S. Department of Transportation Federal Motor Carrier Safety Administration's Safety Measurement System (SMS) database. The safety climate score was a content-validated 10-question Likert-scale survey derived from the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50). Sixty-two truck drivers completed the MLQ Rater Forms and Safety Climate Scales. The study found that transformational leadership was negatively correlated to safety climates, and passive avoidant leadership had positive correlations to safety climates. These unexpected outcomes may be explained by the predisposition of long-haul truck drivers to share proactive, introverted personality types. These types

respond better to the autonomy and self-reliance that passive avoidant leaders provide than that of transformational leaders. Future employee selection, training, and professional development may benefit from testing for leadership and personality types. These processes may then be utilized to improve the safety outcomes of trucking companies and other remote workforces.

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ACKNOWLEDGMENTS

"Two roads diverged in a wood, and I - I took the one less traveled by, and that has made all the difference." - Robert Frost

This journey has been a challenge that I could not have completed alone. I referred to Luke 12:48 during many stressful periods, in addition to the weekly sermons of Bishop T. D. Jakes.

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CHAPTER 1

INTRODUCTION

This study examined the correlation of leadership styles to measurable safety outcomes, in the United States commercial trucking industry. According to the National Center for Statistics and Analysis & National Highway Transportation Safety Administration (2021a) annual fatal crashes involving large trucks and buses increased in the U.S. from 4,304 in 1975 to 5,096 in 2018 (Appendix E). More recently a total of 5,005 people died in large-truck crashes in 2019; an increase of 36% since 2010. In 2019, 118,000 large trucks were involved in crashes resulting in an injury, a 5% increase from 2018 (National Center for Statistics and Analysis & National Highway Transportation Safety Administration, 2021b). This upward trend was despite safer vehicle designs, better roads, equipment, and inspections. Over the last four decades, passenger vehicle accident fatalities have steadily decreased. One reason for this disparity may have been the number of miles driven by large trucks and buses annually nearly tripled over the same time period (Automotive Safety Council, 2021). Greater numbers of large commercial trucks, such as twin or tandem tractor-trailers, heavier loads, and driving longer distances, have contributed to the upward trend in fatal accidents (PR Newswire, 2011).

In addition to the human costs there are large monetary costs as well. Businesses spend $170 billion a year on costs associated with occupational illnesses and injuries (The American Society of Safety Engineers, 2014). Work-related injuries cost employer approximately $1 billion per week in direct and indirect costs (U.S. Bureau of Labor Statistics & U.S. Department of Labor, 2013). Direct costs consist of workers' compensation payments, medical expenses, and legal services. In contrast, indirect costs include replacement workers, absenteeism, accident investigations, corrective measures, repairing damages, decreased productivity, and lowered morale (Joyce, 2010). These statistics pointed to a need to solve these national safety problems. This study aimed to explore evidence-based, data-driven solutions for the rising large truck accident trends.

Statement of the Problem

Accident prevention has shown to be less successful in response to lagging, reactive indicators, such as accident and injury reports, than leading, proactive indicators of safety performance (Carillo, 2005; Hall, 2006; Wang, 2008). A behavior-based safety model is a proactive approach to accident prevention related to safety climate (Gyekye & Salminen, 2005). Its relationship between leadership and safety climate on safety behavior has been well-established (Clarke, 2010; Xuesheng & Wenbiao, 2012; Zohar, 2002). Safety climate was shown to be a strong predictor of safety behavior and accidents (Clarke, 2006, 2010; Milijic et al., 2013).

Investigation of the effectiveness of leadership styles on the safety performance of employees was conducted based on the conceptual framework of the full range leadership model (Avolio & Bass, 1991). The goal of the research was to identify the relationships between leadership styles, safety climate, and safety outcomes. The significance of the

research was to contribute to the knowledge and understanding of leadership styles' correlations to safety climates and safety measures. The outcomes of this study will help organizations improve safety performance by the application of the full range leadership model on its leaders and followers.

Companies often invest large amounts of resources in their safety programs. A corporate climate conducive to cultivating an effective safety program may be thwarted by misconceptions of executives about ROI (return on investments). Reactive management immediately responds following a serious incident only to wane until the next injury (Carillo, 2005). Assessing safety performance solely through measuring the accident and injury reports gives a false impression of overall safety performance. Just as businesses rely on KPIs (key performance indicators), organizations can use PSPIs (process safety performance indicators) to give early warnings, allowing time for corrective actions before it is too late (Azizi, 2013).

Being proactive and preventing accidents is more effective than merely responding to them. However, this is dependent upon the ethical reporting of such indicators. Employees must be empowered and not fear retaliation for reporting safety concerns and incidents, including near misses. According to Steve Niswander, the American Trucking Association's (ATA) 2006 Safety Director of the Year, building a winning safety program requires total buy-in from the company president, or owner, on down. The importance of a safety program outweighs the very expensive alternatives (Niswander, 2007). "Without a strong leadership commitment to achieving safe results, safety takes a backseat to potential profits" (Johnston, 2011, p. 28). In other words, the development of a corporate safety culture is an essential part of an effective safety

program. These statements by safety experts reflect the importance of organizational culture and climate on safety behavior (Freiwald, 2013; Gyekye, 2006; Yahyagil, 2006).

In the past, transactional leadership was the primary approach to corporate productivity and safety (Fulwiler, 2014). Paul Meshanko, president and CEO of Legacy Business Cultures, reported that the employee productivity is reduced by domineering, aggressive and intimidating leadership characteristics. He determined that condescending, one-way communication with subordinates is outdated (Meshanko, 2013).

Transformational leadership has been correlated to positive safety outcomes (Barling et al., 2002; Kelloway et al., 2006; Lu & Yang, 2010; Mullen & Kelloway, 2009; Sivanathan et al., 2005; Zohar, 2002; Zohar & Luria, 2004). Safety professionals are in the position to be transformational leaders, not only of workers but of management as well. Robert Pater, managing director of Strategic Safety Associates, stated, "There is an art to positively influencing high-level, control-oriented leaders…you can create a realistic strategy to more effectively influence your previously resistant executives to actively lead organizational safety" (Pater, 2005, p. 26). The effect of transformational leadership on emotions, values, ethics, standards, and long-term goals covers many of the issues faced by safety professionals.

Purpose of the Study

This study aimed to determine the effects of transformational leadership on safety in the United States commercial trucking industry within the framework of the full range leadership model. The purpose of this study was to determine whether correlations existed among leadership styles of safety professionals, supervisors, and managers, and safety in the United States trucking industry. If so, then these correlations between

leadership styles (transformational, transactional, and passive avoidant) and safety indices would be measured as to the strength of their relationship. The significance of this study was to contribute to the knowledge and understanding of leadership styles correlated to safety climates and safety outcomes. If successful in determining whether particular leadership styles or combinations, were correlated to the overall safety ratings of commercial trucking companies, then the gap between theories and applications would be closed.

In the trucking industry leadership techniques or qualities may be applied in the following ways:

- be taught to safety, supervisory, and managerial leaders through professional development workshops,
- open two-way communication between truck drivers and leaders regularly, and
- prospective employees may also be screened for desirable leadership styles or traits.

The need for interventions may also have a good cost-benefit ratio due to the recent increases in the number of freight trucks on the road (PR Newswire, 2011). If found to be effective in reducing trucking safety violations and accidents, these initiatives may be adopted on a large scale and to be applied to other remote workplaces.

The theoretical framework employed in this study was the full range leadership model of Avolio and Bass (1991). This quasi-experimental research study investigated the effects of transformational, transactional, and passive avoidant safety leadership styles on commercial trucking companies' safety indices. Commercial trucking

companies selected for the study were all listed in the FMCSA database. MLQs(MLQ) were purchased from Mind Garden, Inc. They were answered by commercial truck drivers using paper and pencil or online Likert scales. These assessment rater and survey questionnaires were provided to participants to determine whether the leadership styles of their safety managers, supervisors, and administrators are transformational, transactional, or passive avoidant.

A 10-question safety climate questionnaire was administered the participants as well. The safety climate questionnaire was modeled after the fifty question Nordic Occupational Safety Climate Questionnaire (Kines et al., 2011, 2012). The safety climate questionnaire was validated for content by subject matter experts in the trucking industry. They rated the safety climate of their company. The safety climate scores were grouped as either low, fairly low, fairly good, or good. They provided another source of quantitative safety data to correlate to the leadership scores.

The trucking industry in the United States is heavily regulated by the government. The U.S. Department of Transportation Federal Motor Carrier Safety Administration (FMCSA) requires the industry to comply with strict safety protocols, including training and record keeping. The Safety Measurement System (SMS) methodology assesses noncompliance by analyzing on-road performance data collected from inspections, crash reports, acute and critical violations.

The SMS safety data is utilized to assess carriers in the seven Behavior Analysis and Safety Improvement Categories (BASICs). The BASICs are unsafe driving, crash indicator, hours-of-service (HOS) compliance, vehicle maintenance, controlled substances/alcohol, hazardous materials (HM) compliance, and driver

> fitness. A carrier's annual Department of Transportation (DOT) rating comprises vehicle out of service ratios, driver out of service ratios, and hazmat out of service ratios. (U.S. Department of Transportation, 2019)

In addition, accident records, equipment inspections, operator violations, and other safety indicators are available to the public. For these reasons, there is a great deal of data available to researchers.

Each company's quantitative safety score was derived from their DOT rating. These were composed of company snapshots which consisted of VSR (Vehicle out of Service Ratios), DSR (Driver out of Service Ratios) and, HSR (Hazmat out of Service Ratios). These safety ratings were compared to safety leadership scores derived from the MLQs. The full range leadership model ratings of transformational, transactional, and passive avoidant styles were determined.

Correlational studies and multiple regression analyses were performed using the Excel Statistical Analysis ToolPak. Ordinal variables collected from Likert scales were converted to interval data to fit the safety climate scores for analysis. Multiple regressions were calculated to determine the magnitude of relationships between leadership styles and safety ratings and leadership styles and safety climate ratings.

The Pearson product-moment correlation coefficients (R), coefficients of determination (R^2), and probabilities were calculated and illustrated on scatterplots. Significant correlations between safety leadership styles and the safety indices, consisting of safety scores and safety climate scores, of their trucking companies were analyzed.

Research Questions

The following 12 research questions were explored.

1. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies positively correlate with their companies' safety ratings?
2. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies positively correlate with their companies' safety ratings?
3. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies positively correlate with their companies' safety ratings?
4. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
5. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
6. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
7. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores?

8. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies positively correlate with their companies' safety climate scores?
9. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies positively correlate with their companies' safety ratings?
10. Do the transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
11. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
12. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?

Limitations of Study

There was a great deal of secondary quantitative data supplied by the FMCSA. These included safety fitness determination (SFD) methodologies and BASICS. These tools were useful in evaluating carriers' safety performance with drivers and identifying behavior patterns that precede unsafe operations. The FMSCA scores documented infractions, maintenance records, and other safety data such as crash statistics. Safety scoring is based on ordinal scales (U.S. Department of Transportation Federal Motor Carrier Safety Administration, 2016).

There may have been discrepancies in the quantitative safety scores of trucking companies since carrier and driver data were not compiled annually. Carrier and driver safety data are not aligned in that driver reports were every three years, and carrier reports every two years. Truck drivers' abilities to contest negative information might not have been entered into their rating. It was unclear whether the FMSCA had a mechanism for actually correcting the score or if it is just notated (Owner-Operator Independent Drivers Association, 2017). Negative information such as warnings, contested violations, unpaid tickets may not always be standardized nationally.

The MLQ data also presented challenges on their validity and applicability. MLQs are the most widely used measure of transformational leadership (Batista-Foguet et al., 2021; Edwards et al., 2010; Northouse, 2013). However, self-report studies inherently have validity problems. MLQs, being self-reported by safety professionals, supervisory, and management leaders, can produce bias. The typical biases prevalent in self-report studies are exaggeration, deception, central tendency, and social desirability (Rothstein & Goffin, 2006). Left-sided bias is a particular risk of the MLQs. Due to the design of the questions, it is difficult to compensate for them by rephrasing them from favorable to unfavorable ways (Friedman et al., 1994).

The length of the MLQ-5x was another obstacle, being 45 questions long. The safety climate questionnaire addressed this by being reduced to only 10-questions, from the 50-question Nordic Occupational Climate Questionnaire. It was only content-validated by subject matter experts. It was not construct validated or criterion validated.

Depending on the corporate culture, employees may be reluctant to report perceived negative responses to the questionnaire (Rentsch, 1990). Reaction to culture

may also skew the data collected by the drivers as raters of managers. For this reason, online administration of the questionnaires was preferable to paper and pencil. To allow a greater collection of data, both methods were available.

The three million truck drivers, and two million bus drivers, are not a homogeneous group, according to the largest association of truck drivers in the U.S., the Owner-Operator Independent Driver Association (OOIDA). The population sampled in the study, employees of commercial trucking companies, may not have represented the majority of them.

> Owner-operators are small business people who own, maintain, and drive their commercial motor vehicles. Ninety percent of the trucking industry comprises small-business trucking companies with 10 or fewer trucks…Owner-operators are involved in fewer and less severe accidents than any other segment of the truck driving population. (Owner-Operator Independent Drivers Association, 2017, para.1)

Another limitation of the study may have been the predisposition of professional, commercial truck drivers to have a common personality type. For example, long-haul truck drivers' solitary workplaces and self-motivation to follow mandatory daily inspections, may be prone to certain personality types. The standard measurement tool for determining this, the Meyers-Briggs Type Indicator (MBTI), measures 16 different personality types. People with distinct personality types may have responded to rating or responding to leaders in predictable ways.

Definition of Key Concepts

1. *Basic Unsafe Driving (BUD).* A safety indicator rate is reported every six months by the U.S. Department of Transportation (DOT) on the commercial trucking companies (U.S. Department of Transportation Federal Motor Carrier Safety Administration, 2016).
2. *Driver out of Service Ratio (DSR).* A safety indicator is calculated by dividing the number of drivers prohibited from driving due to a safety infraction by the number of active drivers of a company (U.S. Department of Transportation Federal Motor Carrier Safety Administration, 2016).
3. *Hazmat (Hazardous Material).* A substance or material posing an unreasonable risk to health, safety, or property when transported in commerce (Pipeline and Hazardous Material Safety Administration, 2016).
4. *Hazmat out of Service Ration (HSR).* A safety indicator is calculated by dividing the number of vehicles prohibited from moving due to a Hazmat safety infraction by the number of active vehicles of a company (U.S. Department of Transportation Federal Motor Carrier Safety Administration, 2016).
5. *Institutional Review Board (IRB).* Office of Sponsored Projects Institutional Review Board, whose Human Use Committee must approve all student research involving human subjects for ethical protections.
6. *Leadership.* The process of influencing an organized group toward accomplishing its goals (Northouse, 2013).

7. *Mediator variable.* A mediator variable explains the relationship between the two other variables (Baron & Kenny, 1986).
8. *Moderator variable.* A moderator variable influences the strength of a relationship between the predictor and the criterion (Baron & Kenny, 1986).
9. *Motor Carrier Safety Rating (MCSR).* An annual numerical evaluative safety score between one and 100, given to each interstate commercial motor carrier by the FMCSA (U.S. Department of Transportation Federal Motor Carrier Safety Administration, 2016).
10. *Multifactor Leadership Questionnaire (MLQ).* A psychological inventory consisting of 36 items, with 5-point Likert scale answers, related to leadership styles and nine items related to leadership outcomes (Avolio & Bass, 2004).
11. *Nordic Occupational Safety Climate Questionnaire (NOSACQ).* A 50 question, 4-point Likert scale survey designed for a wide variety of occupations to measure their perceptions of management and workgroup safety-related policies, procedures, and practices. It is available free of charge in 23 languages (Kines et al. 2001, 2012).
12. *Passive-Avoidant leadership.* Leaders that employ management by exception (passive), after the fact, or Laissez-faire avoidance of using their authority (Humphrey, 2012).

13. *Transactional leadership.* Leaders who focus their leadership on motivating followers through a system of rewards and punishments (Bass, 1985).
14. *Transformational leadership.* Leaders who challenge and inspire their followers with a sense of purpose and excitement to achieve goals (Bass, 1985).
15. *Vehicle out of Service Ratio (VSR).* A safety indicator is calculated by dividing the number of vehicles prohibited from moving due to a safety infraction by the number of active vehicles of a company (U.S. Department of Transportation Federal Motor Carrier Safety Administration, 2016).

CHAPTER 2

LITERATURE REVIEW

Introduction

Chapter 2 includes a review of literature relevant to (a) full range leadership model, (b) transformational leadership, (c) transactional leadership, (d) passive-avoidant leadership, (e) the MLQ, (f) organizational culture and climate, (g) safety culture and climate, (h) safety leadership, and (i) safety climate scale. The scholarly papers included several meta-analyses that were reviewed as well as journal articles, books, and dissertations. The substantive findings of individual studies were reported and critiqued. The chapter attempted to correlate leadership styles with safety climate and safe work practices

The theoretical framework of this study was based upon the full range leadership model. This study explored whether certain leadership styles were associated with better safety indices of trucking companies. The literature review explored the evolution of the full range leadership model over two decades. Each of the three main leadership styles; transformational, transactional, and passive-avoidant; were discussed in the sections that followed. The effectiveness and validity of the transformational and transactional styles were confirmed in the review of multiple meta-analyses. Passive-avoidant leadership, the least effective style, was examined in descriptive studies. These three sections provided a comprehensive understanding of the full range leadership model.

The MLQ section completed the study of the full range leadership model. A description of the MLQ was followed by a critique of several studies. Issues of research ethics, sample size, coding, biases, and the measurement scale were discussed.

It was followed by the review of research studies on organizational culture and organizational climate. A direct relationship between the influence of organizational culture and climates on the psychological climates of employees and their safety climates was supported in this section. This was followed by the safety leadership section. Active transformational leadership was shown to have a positive influence on positive safety climates. Meta-analyses of safety leadership concerning safety climate, safety culture, and safety performance were reviewed. The final section of the literature review explored the relevance of safety climate scales in measuring and predicting safety outcomes.

Full Range Leadership Model

James MacGregor Burns introduced the transformational-transactional model of leadership in his book, *Leadership*, in 1978 (Bass, 1985). Burns viewed transformational and transactional leadership to be on opposite ends of the leadership continuum (Bass, 1985; Burns, 1978, Tejada et al. 2001). Burns related charismatic factors to transformational leadership. Transformational leadership was described by Burns as a mutualistic process in which leaders and followers raise each other to higher levels of morality and motivation. (Burns, 1978). He asserted that it is more effective than transactional leadership, which he attributed to mostly selfish motives (Burns, 1978; Northouse, 2013).

Several years later, Bernard M. Bass expanded on Burn's theory by defining four elements of transformational leadership and explaining how it may be measured based on

motivation and performance. Bass also defined three elements of transactional leadership and postulated that successful leaders utilize both behaviors. His study compared transformational leadership with contingent reward, transactional leadership, and laissez-faire leadership (Bass, 1985; Northouse, 2013).

The full range leadership model evolved further over two decades due to the work of Bruce Avolio and Bernard Bass. Laissez-faire leadership was combined with passive management by exception to form the passive avoidant style. Nine components, or scales, were incorporated into the earlier model of the three leadership styles (transformational, transactional, and passive-avoidant) as follows:

- Transformational leadership
    - Builds trust through idealized Influence and attributes
    - Acts with integrity through idealized influence and behaviors
    - Encourages others through inspirational motivation
    - Encourages innovation by thinking through intellectual stimulation
    - Coaches and develops people through individualized consideration
- Transactional Leadership
    - Rewards achievement through contingent rewards
    - Monitors deviations and mistakes through active management-by-exception
- Passive–Avoidant (or Laissez-Faire) Leadership
    - Fights fires through passive management-by-exception
    - Avoids involvement through lack of involvement (Antonakis, 2001; Antonakis et al., 2003; Bass & Avolio, 2004; Munaf, 2011).

Besides measuring these nine scales and the three leadership styles, the full range leadership model also measures three leader outcomes:

- satisfaction with the leader,
- exerting extra effort for the leader, and
- leader effectiveness (Bass, 1985; Bass & Avolio, 2004).

Transformational Leadership

Transformational leadership is one of the most widely studied leadership theories (Humphrey, 2012; Meuser et al., 2016; Tejada et al., 2001). In their meta-analysis, Judge and Piccolo (2004) looked for data supporting or rejecting this theory based on leadership behaviors that predict organizational criteria relevant to leadership. Judge and Piccolo conducted a thorough literature search of keywords in the PsycINFO database from 1887 to 2003, which produced articles that were reviewed for evidence of follower job satisfaction, follower leader satisfaction, follower motivation, leader job performance, group effectiveness, and leader effectiveness and resulted in five hypotheses that they tested.

Their research aimed to determine the overall validity of the data on the popular theory of transformational leadership; and a comparison to contingent reward and laissez-faire styles. They also sought out to determine whether strong correlations existed amongst the theories.

One strength of the study was the much larger scope reviewing double that of the next highest study by Lowe et al. (1996). Another strength of the study was that it was the first meta-analysis of all the dimensions in the full leadership model. The study has set a standard and laid the groundwork for future research.

One of the weaknesses of the meta-analysis study was the huge variation between the validity of Lowe et al. (1996) being 65.9% higher than Judge and Piccolo (2004). This was due to a greater number of multi-source studies, which confounded making comparisons. Another weakness was that the differentiation between transformational and transactional leadership was difficult due to their commonalities. In other words, they are not mutually exclusive (Frooman et al. 2012). This made comparisons difficult since they may both contain overlapping elements.

Beus and Whitman (2012) conducted a meta-analysis of employees reaching maximum performance compared to typical performance. They found that in addition to ability; motivation and personality also were moderators of better performance. The association between transformational leadership and motivation (Burns, 1978), to better outcomes, was supported by their research.

Meuser et al. (2016) performed a manual search for leadership, published between 2000 and September 2012, from 10 academic journals known for leadership studies. This search yielded 989 articles. They were then refined as being original works and leadership being the primary focus of the article. Of the remaining 752 articles, transformational leadership was the most studied, at 154. Charismatic leadership followed with 78 articles. In all, they identified 66 different leadership theories, many of which have emerged since the turn of the century.

Eisenbeiss et al. (2008) performed an important study on the validity of transformational leadership. This study was necessary due to the lack of empirical evidence on transformational leadership sparking innovation. The importance of innovation is clear in that without it, organizations would stagnate and fail to compete

(Eisenbeiss et al., 2008). An analysis of 33 research and development teams confirmed their theory. One condition that was disclosed as necessary for success was that the corporate culture has a high climate for excellence. This was considered to have a mediating role in supporting innovation.

A strength of the study was that the sampling of 33 research and development teams, while not large, was sufficient for reasonable power. Another strength was using a seven-item Likert scale since it is more descriptive than a five-item Likert scale. The need and justification for the study were clearly shown. A weakness of the study was that the groups were not homogeneous. Another weakness was their failure to get longitudinal data to make cross-references and prove causality.

Mullen and Kelloway (2009) conducted a longitudinal study that constituted the first assessment of transformational leadership-based intervention on safety climate outcomes. A sample of 54 leaders from 21 long-term health care organizations in Eastern Canada was randomly assigned either two training classes or no training as a control group. One of the training classes was on general transformational leadership, and the other was on safety-specific transformational leadership. Employee ratings of the leaders' safety-specific transformational leadership qualities were done by using pre-tests and post-tests. A seven-point response Likert scale was used. Out of 1,822 health care workers given the pre-tests and post-tests, 115 were retained for evaluation due to incompleteness or errors. The 115 employee raters evaluated pre-training and post-training safety climates. Other data evaluated in this manner were safety participation, safety compliance, safety-related events, and injuries.

A multivariate analysis of covariance (MANCOVA) was performed on the data. Interpreting these results, Mullen and Kelloway (2009) "showed that leadership training resulted in significant effects on the safety-specific transformational leadership and safety climate outcomes" (p. 253). Safety-specific transformational leadership training resulted in significantly better post-test scores in leader safety attitudes, self-efficacy, and intent to promote safety. The authors concluded that it is a very cost-effective intervention. Their study supported the findings of Ruchlin et al. (2004), who demonstrated the positive role of leadership on safety culture.

As compelling as it was, the Mullen and Kelloway (2009) study did have several limitations that should be mentioned:

- a small percentage of usable pre-and post-surveys, 115 of a total of 1,822, is notable;
- seven-point response Likert scale, being an odd number, allows for neutral answers and can lead to respondents not making a more thoughtful choice that might have been done on an even number scale; and
- demographics of the study in Eastern Canadian health care facilities may have presented cultural bias.

Transactional Leadership

The transactional management style of leadership has been referred to as the carrot and stick approach (Bass, 1985). Bass characterized this social exchange as a cost-benefit exchange process. Transactional leadership often fails to develop the long-term potential of followers by focusing on short-term rewards, corrections, and punishments (Bass, 1985; Lievens et al., 1997).

The commercial trucking industry often uses a transactional, military-like, chain of command style of leadership and supervision (Fernandez, 2011; Garver et al., 2008). The transactional climate in the trucking industry was associated with employee dissatisfaction and low morale, resulting in high employee turnover (Fernandez, 2011; Garver et al., 2008). Low morale and high employee turnover both contribute economic and human costs to businesses (Fink, 2014).

Bass (1985) identified the elements of (a) contingent reward leadership and (b) management-by-exception leadership as both belonging to the transactional leadership category. Contingent reward leadership involved conditioning employees to perform in certain ways for positive short-term rewards. The contingent reward leader may also give reinforcing feedback for such good work with promotions. Management-by-exception leaders generally transact with followers only when they fail to perform to standards, with negative feedback (Frooman et al., 2012).

Teo et al. (2005) suggested that there are negative safety consequences of punitive or transactional leadership. They hypothesized a framework for fostering safe work behaviors. The main reasons for unsafe behaviors identified in their framework were ignorance, lack of knowledge, and apathy. The first reason, ignorance, was addressed through safety training. The second reason, apathy, was addressed through transactional leadership consequences. The transactional leadership methods examined included punitive measures and other forms of operant conditioning.

Teo et al. (2005) conducted a quasi-experimental study on safe work behavior of construction workers in Singapore. A random selection was made in which 420 participants were drawn from a population of 1,469 general contractors. Questionnaires

were mailed to 420 of them. Data were analyzed on the 60 acceptable, completed questionnaires. Statistical analyses using SPSS were done. They used t-tests with a significance level of .05 to compare safety, training, and supervision variables on productivity. Ten of the 13 variables studied were linked to safe work behavior. The three ineffective variables were all punitive. The meta-analysis of Beus and Whitman (2012) supported the results of Teo et al. (2005) in that both linked safety performance to leadership variables.

Passive Avoidant Leadership

In leadership studies, laissez-faire was coined to describe leaders who avoid taking any action. The French term laissez-faire, translated to English as "let do," is often interpreted more broadly as a doctrine of non-interference. Avolio et al. (1999) revised the multifactor leadership model, combining laissez-faire leadership with passive management by exception into the passive avoidant leadership category and made the category much broader than merely non-leadership.

Passive management by exception applies to leaders waiting for problems to occur and taking punitive action on unacceptable performance (Bass, 1999; Lievens et al., 1997). Conversely, active management by exception punitively corrects unacceptable performances of employees while they are occurring. Therefore, it falls under the transactional leadership style.

Frooman et al. (2012) contended that it is not logical for a leader to be passive, avoidant, and transformational. Transformational leaders engage followers by actively formulating, sharing visions and goals, encouraging, and coaching them. Passive avoidant leaders fall into a separate category. In other words they are mutually exclusive.

Furthermore, the passive avoidant leadership category is at the bottom of the effectiveness measures (Bass et al., 2003; Frooman et al., 2012).

Multifactor Leadership Questionnaire

The standard instrument for assessing the psychometric characteristics of leadership is the MLQ (Avolio & Bass, 2004). They are the most widely used measure of transformational leadership (Batista-Foguet et al., 2021; Edwards et al., 2010; Northouse, 2013). MLQ is a psychometric instrument designed to test the full range leadership theory (Bass & Avolio, 1997). Leadership styles are measured by 36 questions and leadership outcomes by nine questions (Avolio & Bass, 1991). The psychometric characteristics, reported as leadership styles, are rated as transformational, transactional, and passive-avoidant behavior subscales. As a multi-rater or 360-degree instrument, the MLQ may be administered by self-rating, peer rating, employee rating, and outsider rating, which increases the validity much more than using the Leader (Self) Form (Avolio & Bass, 2004).

Transformational leadership is measured within five subscales: idealized influence-attributed, idealized influence-behavior, inspirational motivation, intellectual stimulation, and individualized consideration (Antonakis, 2001). Transactional leadership is measured within the following three subscales: contingent reward, management by exception-active, and management by exception-passive. Finally, the most inactive form is laissez-faire leadership. Both management by exception and laissez-faire styles of leadership are considered forms of passive-avoidant behaviors (Munaf, 2011).

Sivanathan et al. (2005) explored whether and how transformational leadership interventions can improve occupational safety. This quasi-experiment compared

pretest/posttest open-ended questionnaires of swimming pool supervisors. Their behaviors were measured using a 20 item MLQ. These were compared to Safety Compliance forms taken from Neal et al. (2000). Third-party observations confirmed the results.

They showed an increase in safety participation and an increase in safety behaviors of the experimental group but not of the control group. A weakness of the study was that it used a small, non-randomly assigned sample. Thus, it had low power and was quasi-experimental.

Since surveys using rating scales are very prevalent, research ethics and measurement bias were explored and tested by Friedman and Amoo (1999). They sampled 180 college students in New York City and randomly assigned them either of two oppositely phrased or reverse coded sets of questions. One issue explored was whether the wording of questions could influence the outcome of studies, leaving them open to manipulation by dishonest researchers.

Seven of the questions from each group were analyzed using univariate analyses of variance (ANOVA) of each question and multivariate analyses of variance (MANOVA) comparing the means of the two vectors. After analyzing and tabling the data, they performed a literature review and determined whether the following biases were present (a) tendency to agree; (b) negative numbered scales making descriptors look worse; (c) strong vs. weak descriptors as anchors; (d) improvement-needed scale vs. overall rating scale; and (e) compared-to-ideal scale vs. overall rating scale. (Friedman & Amoo, 1999)

In interpreting the results, they concluded the responses were "…slanted and in the direction expected" (Friedman & Amoo, 1999, p. 14). Friedman et al. (1994) made an important observation regarding left-sided bias being a particular risk of the MLQs which was particularly compelling since the design of the questions made them difficult to compensate for it by simply rephrasing.

Organizational Culture and Organizational Climate

Organizational culture, also referred to as organizational climate, has been positively linked to many benefits to organizations. These include job satisfaction and job performance (Rentsch, 1990). Clarke (2010) found a direct relationship between the influence of organizational climates on the psychological climates of employees and their safety climates. This research study documented abundant empirical data supporting a causal relationship between negative safety climates and increased accidents. Until this study, there was little investigation into the relationships between safety climate and precursors, such as organizational climate and individuals' psychological climates. Yahyagil (2004) made the analogy that organizational climate at an individual level is one's psychological climate.

Organizational climate is a multidimensional construct that reflects how employees share and understand organizational events. Meaning and sense have become the essence of organizational climate (Rentsch, 1990). The elements of an individual's psychological climate are important in shaping the safety climate (Neal et al., 2000). Clarke (2010) sought to link psychological climate, safety climate, work attitudes, and individual safety outcomes through meta-analyses.

The number of studies analyzed through computer data retrieval, such as PsychInfo, resulted in 113 studies and over 94,000 participants. The following variables were analyzed (Clarke, 2010):

- job
- role
- workgroup
- leader
- organization
- safety climate
- satisfaction
- commitment
- well-being
- behavior
- accidents

Complex theories were tested on several hypotheses, making the studies confirmatory. The variables were tested as mediators toward outcomes. Hypothesized causal links between variables were subjected to Structural Equation Modeling (SEM) testing using IBM SPSS AMOS 6.0. Chi-square goodness of fit and root mean square errors were assessed and the results were found to be significant. Clarke's (2010) study found that safety climate acted as a mediator between the psychological climate of the organization and safety behavior. Job satisfaction was associated with safety climate and occupational accidents.

Yahyagil (2006) explored the fit between the concepts of organizational culture and organizational climate. This study was a precursor to Clarke (2010) in the study of organizational climate perceptions. Organizational culture has been positively linked to many benefits to organizations, including job satisfaction and job performance (Neal et al., 2000).

In the 2006 study, Mehmet Y. Yahyagil, an organizational behavior researcher at Yeditepe University in Istanbul, Turkey, investigated organizational culture and climate using three measurement instruments amongst four organization sample groups. He had the questionnaires translated into Turkish and slightly modified. Employees were selected from multiple job titles. The following four diverse businesses in two major cities in Turkey had employees fill out three different questionnaires shown in Table 1 (Yahyagil, 2006).

Table 1

Translated Organizational Climate Questionnaire Components

Survey number	Description	Number of Items	Likert Scale
Questionnaire 1	Organizational Climate	20	6-point
Questionnaire 2	Organizational Culture	24	4-point
Questionnaire 3	Denison's Organizational Culture Questionnaire	36	6-point

The results of the questionnaires are shown in Table 2.

Table 2

Sample Population Participation Percentage

Business Sector	Label	Number Sampled	Responses	Percentage
Finance	A	73	41	56%
Textile	B	50	50	100%
Manufacturing	C	43	30	70%
Pharmaceutical	D	81	54	67%

The results of Yahyagil's (2006) study indicates the results of the analyses for the climate questionnaire indicated a reliability coefficient value, $\alpha = 0.91$ for organizations A, B, and C, and $\alpha = 88$ for organization D. The reliability coefficient value of Wallach's OCI was $\alpha = 0.78$ for organizations A, B and $\alpha = 0.79$ for organization D, while it was $\alpha=0.87$ regarding the Denison Questionnaire for both organizations, namely A and C. All of these values indicated statistically satisfactory results for all of the measurement instruments.

The factor analyses of the questionnaires showed a meaningful composition of cultural and climatic variables. According to Yahyagil (2006), the research findings demonstrated a fit between organizational culture and climate concepts. An organization's cultural climate fit may be used by management by designing organizational activities to reach corporate goals. For example, an organization's safety culture may be enhanced to improve safety climate, in the quest for safety outcomes.

Safety Culture and Safety Climate

Although safety culture and safety climate are often used interchangeably, there are important distinctions. Culture is often a fixed trait, while climate is variable (Hecker

& Goldenhar, 2013). In other words, organizational safety culture is deep, stable, qualitative, and encompasses values, while its safety climate is a superficial snapshot of quantitative perceptions of the employees. These safety climate factors make it possible to measure it and predict safety outcomes. Ultimately, they may be used to take appropriate actions to improve safety outcomes.

Safety climate was contrasted to safety culture by Milijic et al. (2013) as containing management's commitment to safety and workers' involvement in safety. In contrast, safety culture describes the way safety is managed in the workplace. In other words, norms and values determine behaviors and reactions in situations. Leader roles also appeared to have a primary effect. Safety climate was found to play only a partial mediating role. There was a direct link, however, between safety climate and occupational accidents. Organizational commitment and job satisfaction partially mediated the effect of safety climate on safety behavior (Gyekye & Salminen, 2005; Yahyagil, 2006).

Scottish physicist William Thomson, aka Lord Kelvin, is credited with the axiom, "What gets measured gets managed" (Stellman, 1998, p. 1992). Measuring safety climate accurately is especially important because it is an antecedent of safety performance (Clarke, 2010).

Zohar (1980) developed and tested a 40-item questionnaire to test safety climate in 20 factories. He explained safety climate as composed of employees' shared perceptions of their leaders' safety commitment, policies, procedures, and practices. These shared perceptions included the following factors:

- importance of safety training

- effects of required work pace on safety
- status of the safety committee
- status of safety officer
- effects of safe conduct on promotion
- level of risk at the workplace
- management attitudes towards safety
- effect of safe conduct on social status (p. 100).

Organizational climate appeared to have a powerful effect on employees' perceptions of safety climates and is relevant to safety conduct because employees' perceptions guide their job behaviors (Freiwald, 2013; Gyekye, 2006; Yahyagil, 2006).

Safety Leadership

Xuesheng and Wenbiao (2012) studied the effect of leadership on safety climate levels in coal mines. Questionnaires were used as data collection instruments. The sample population of Chinese coalminers studied was 450. Demographic characteristics included age level, educational level, past workplace injuries, and past witness to workplace injuries.

The relationship between safety leadership and safety climate was tested by SEM. Goodness of fit values for all three models exceeded .90, indicating a good fit. The study concluded that transformational leadership was positively associated with safety climate. This study can be instrumental in the development of successful action plans for training leaders to improve safety. This study supported the importance of safety climate in the behavior-based safety (BBS) model previously reported by Gyekye (2006) and Gyekye and Salminen (2005).

Zohar (2002) challenged traditional approaches to accident prevention, which focused on engineering controls and work-site monitoring while ignoring the role of line managers. In this study, Zohar tested the following six hypotheses:

- Hypothesis 1_a: Transformational and constructive leadership will be positively related to safety climate level.
- Hypothesis 1_b: Corrective and laissez-faire leadership will be negatively related to safety climate level.
- Hypothesis 2: Safety climate will mediate the relationship between leadership dimensions (or variables) and behavior-dependent injury.
- Hypothesis 3: Transformational leadership will be positively related to safety climate, and this relationship will be stronger under high assigned safety-priority.
- Hypothesis 4: Constructive leadership will be positively related to safety climate under high assigned safety-priority and unrelated under low assigned safety-priority.
- Hypothesis 5: Corrective leadership will be positively related to safety climate under high assigned safety priority and negatively related under low assigned priority.
- Hypothesis 6: Laissez-faire leadership will be negatively related to safety climate under high assigned safety priority and unrelated under low assigned priority.

Zohar (2002) showed that the relationship between leadership and climate, or corporate culture, in organizational subunits were associated with the priorities set by

immediate superiors. The results varied depending on how high in the organizational hierarchy the leader-follower relationship was.

An interesting result of the study by Zohar (2002) was the suggestion that transformational and transactional leadership provide complementary modes of influence on the safety behavior of group members, not antagonistic. Transactional leaders engage in a lot of corrective actions, which have a positive influence on safety outcomes. However, the data suggested that participative management, as undertaken by transformational leaders, provided better predictions of safety outcomes than authoritarian management methods of transactional leaders. One weakness of this study was the small sample size of 42 workgroups. The need for further research was, nonetheless, established by Zohar.

Clarke (2013) developed and tested a model of safety leadership which showed the importance of transformational and active transactional leadership styles. The data collected for the study from a sample population of over 20,000 were retrieved from PsycInfo, Medline, and ABI-inform sources. The data were then coded into the two leadership styles, transformational or transactional, and two behaviors, safety compliance or safety participation. Additional variables included safety climate and work-related accident frequency. Transformational leadership and active transactional leadership had positive associations with safety climate and safety participation. Active transactional leadership was further associated with safety compliance.

The meta-analysis procedures of Hunter and Schmidt (2004) were used in the calculation of validity coefficients. The model correlated (a) leadership styles, (b) safety climate, (c) safety participation, and (d) safety compliance. The goodness of fit statistics

included chi-square and root mean square error averages. An average reliability distribution was calculated for each variable to correct for unreliability. SEM analyses were undertaken using IBM SPSS AMOS 6.0.

The findings suggested that active transactional leadership is instrumental in ensuring compliance with regulations, while transformational leadership helps to enable employees to participate in safety. Combinations of the two forms of leadership were found to have the greatest benefit on safe work practices. This research model was a good resource for studying the effect of transformational leadership on safety (Hunter & Schmidt, 2004).

Kumar (2011) studied why Australian workers get injured in their workplaces. Data drawn from the period of 2009 to 2010 indicated that 636,000 Australians were injured in work-related accidents. Individual factors that affected workplace injuries were gender, age, personality, substance use, and ethnic group. Some unexpected factors discovered were broader social and organizational ones such as safety culture, quality supervision, and occupational safety and health training. It was suggested that these factors influence individual worker attitudes and behaviors in workplace injuries and fatalities. Kumar (2011) concluded that the "lack of quality occupational health and safety training in the workplace is associated as a contributing social factor in workplace injuries and fatalities" (p. 617).

The importance of effective safety leadership in attaining better safety outcomes was a common theme of these studies.

Safety Climate Scale

A measured safety climate questionnaire is a strong predictor for safety performance and is often utilized by researchers, managers, and safety professionals (Clarke, 2006; Ghahramani & Khalkhali, 2015).

Lin et al. (2008) developed a safety climate measurement among Chinese workers with a 21-item questionnaire. It has been used internationally in worker safety surveys due to its validity and reliability. Milijic et al. (2013) administered a 21-item questionnaire, divided into seven groups of questions: safety awareness and competence, safety communication, organizational environment, management support, risk judgment and management reaction, safety precautions and accident prevention, and safety training. It was developed from a pilot study of 300 workers who used international questionnaires, including Lin et al. (2008). It was then modified to fit the demographics of Serbian workers. The sample population of 1,098 Serbian employees from five different industries took the final questionnaire.

Various demographic groups' responses were compared. The reliability of the measurement methods used for measuring the safety climate was analyzed by Milijic et al. (2013). The Cronbach alpha of .79 was determined for the whole population. It was, therefore, sufficient to show internal validity. The Spearman-Brown coefficient of 0.77 was also sufficient to validate the length of the safety climate scales. "This study suggests that using the new questionnaire may improve safety climate issues for each industrial sector and to address them in practice" (Milijic et al., 2013, p. 641).

Sixteen safety climate questionnaires were analyzed by Seo et al. (2004), who identified the following core constructs and dimensions of safety climate:

(a) management commitment to safety, (b) supervisor safety support, (c) co-worker safety support, (d) employee participation in decision making and activities, and (e) employees safety competence level.

Shen et al. (2017) surveyed construction workers in Hong Kong on transformational leadership's correlation to a 24-item safety climate scale. They adapted six items from the MLQ that Avolio et al. (1999) identified as transformational behaviors. They concluded that transformational leadership positively impacted safety climate through two-way communication. This in turn improved safety knowledge and behaviors.

The Nordic Occupational Safety Climate Questionnaire (NOSACQ-50) was summarized by Kines et al. (2011). It consisted of 50 items across seven dimensions, i.e., shared perceptions of: (a) management safety priority, commitment and competence; (b) management safety empowerment; (c) management safety justice, and shared perceptions; (d) workers' safety commitment; (e) workers' safety priority and risk non-acceptance; (f) safety communication, learning, and trust in co-workers' safety competence; and (g) workers' trust in the efficacy of safety systems. The importance of cross-validation of safety climate scales through reviews from experts were demonstrated by Seo et al. (2004).

Yule et al. (2007) reinforced that a workforce questionnaire should measure safety climate and was a compelling conclusion since his meta-analysis of 32 studies over 20 years covered a large cross-section of safety climate research. Lee et al. (2015) studied the development of a trucking industry-specific safety climate scale. They tested its external validity across different trucking companies. They determined that these safety

climate scores can be used across multiple trucking companies and validated their safety climate intervention.

Summary

The literature review was instrumental in describing the theoretical framework employed in this study, the full range leadership model, and using it as a tool for analysis of leadership styles. It is one of the most widely studied theories of leadership (Humphrey, 2012; Meuser et al., 2016; Tejada et al., 2001). It has been positively associated with motivation and performance. These were important elements of behavior-based safety, which were shown to improve safety outcomes. Transformational leadership was shown to be a style that can be easily measured through the MLQ questionnaire. Numerous meta-analyses correlating transformational leadership with improved safety outcomes reinforced the psychometric properties of the measurement scales' validity and reliability.

CHAPTER 3

METHODOLOGY

Introduction

The purpose of this study was to investigate the effect of leadership styles, by safety professionals and supervisors, on safety indices in the U.S. commercial trucking industry.

The 12 research questions that were explored are listed as follows:

1. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?
2. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?
3. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?

4. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a negative correlation with their companies' safety ratings?
5. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a negative correlation with their companies' safety ratings?
6. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a negative correlation with their companies' safety ratings?
7. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores?
8. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores?
9. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores?
10. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a negative correlation with their companies' safety climate scores?

11. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety climate scores?
12. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety climate scores?

The implications of determining such correlations were that specific leadership traits may be selected among safety and management job applicants, and that leadership styles may be improved through training. These steps may then be implemented to improve the safety of trucking companies.

Data Sources and Collection

This was a quasi-experimental, correlational study of leadership styles in trucking companies to their respective safety indices. Convenience sampling was used to select individual commercial truck drivers across the continental U.S. through social media trucker chat groups, online contacts, and referrals by subject matter experts. Sampling site visits to truck stops was not feasible due to the COVID-19 public health emergency. Drivers completed quantitative MLQ questionnaire rater forms. These surveys were anonymously self-reported using paper and pencil or specially keyed online Likert scaled responses. Rater assessment MLQ survey questionnaires were provided to participants to determine whether the leadership styles of their companies were

MLQ licensing was purchased from Mind Garden, Inc. for 100 paper and pencil and 100 online surveys. Safety and supervisory leaders were rated by drivers, who were

solicited to complete MLQ questionnaires of their trucking companies. The MLQ scores were correlated to the safety indices of each rater's respective trucking company.

The SMS of the U.S. DOT FMCSA methodology was used to determine the safety ratings of the trucking companies. These ratings were available to the public and researchers. DOT's FMCSA SAFER System website. The BUD score combined total reported accidents and safety inspections calculated every six months. The BUD score was averaged over the most recent 24 months available. Since they are calculated and reported in 6-month intervals as a rate, each company's BUD score averaged four measures. The BUD scores ranged from 0-4.9 on a 0-100 scale. A score of zero reflected no reportable accidents and a minimum of three driver inspections with no violations. Greater BUD scores represented more unsafe events reported to the DOT over time.

A short 10-question safety climate questionnaire was administered to all participants as well. They rated the safety climates of their companies on a 4-point Likert scale. This 10-question safety climate questionnaire, modeled after the 50-question Nordic Occupational Safety Climate Questionnaire (NOSACQ-50-EN), was validated for content by five subject matter experts in the trucking industry (Seo et al., 2004). They were comprised of two commercial truck driver instructors, one administrator at a commercial truck driver school, and two retired commercial drivers. All had over 10 years or one million miles of commercial truck driving experience. These safety climate scores were then grouped as either low, fairly low, fairly good, or good scores. The reason for grouping the safety climate data was to replicate the standard reporting method of the NOSACQ-50-EN. The safety climate scales provided another source of quantitative safety data to correlate to the MLQ scores.

Participants

The study was approved by the Institutional Review Board (IRB) before any participants were contacted in any way (Appendix A). The anonymity of the demographics, survey questionnaires, responses, and data was protected. Ethical considerations, such as not sharing identifiable participant information with the employer, was exercised. This was beneficial to the trustworthiness of the participant responses. Participants were told that none of their information would be shared or published with demographic information that may be traced back to individuals or specific workplaces. MLQ surveys did not contain a space for the subjects' names to be filled in. Trucking companies were not identified in the finalized research report.

Each trucking company selected for the study had at least 10 employees and five or more tractor-trailer trucks. Local, short-distance delivery companies such as dump trucks and lumber trucks were not selected. Tanker trucks were not selected because these drivers have additional safety training and follow stricter safety standards than those hauling non-hazardous cargo. Exclusive mail carriers such as Federal Express (Fed-Ex), United Parcel Service (UPS), and United States Postal Service (USPS) were not selected. However, independent trucking companies that sub-contract to deliver mail and other cargo were not excluded.

Subjects of the drawing were not disqualified for incomplete questionnaires. Respondents were informed, before participating:

- on the closing date for entry,
- the nature of the prizes,
- if a cash alternative could be substituted for any prize,

- how and when winners would be notified of results, and
- how and when winners and results would be announced.

All this information was clearly explained in an information sheet that all in-person participants were given. Online participants received the same informed consent information before proceeding with the surveys designed by Mind Garden, Inc.

All participants were also be asked to complete a safety climate questionnaire as well. They may be paper and pencil or online Likert scaled responses. The safety climate surveys did not contain spaces for the subjects' names to be filled in, and rather they will identify the trucking company and DOT number. However, trucking companies were not identified in the finalized research report.

Subject matter experts validated the proposed safety climate scale anonymously. These individuals were selected from both the trucking industry and vocational training sectors. All of them had a minimum of 10 years of professional experience or at least one million miles of commercial truck driving experience.

Participating subjects, including the subject matter experts, were allowed to enter into a free prize draw for a $100 gift certificate. In order to protect their identities an anonymous link was provided to those who choose to enter the drawing. This link was not attached to their companies' information or survey responses in any way. The participants email contact information was voluntarily self-reported solely for contacting the winner of the lottery prize. Participating trucking companies were given access to the finalized research report by request. Recommendations for such interventions such as training programs were made available when warranted by the study.

Data Analysis/Analytic Plan

Quantitative safety data from the FMCSA website and safety climate scores were collected for each participant's company. Quantitative data collected from the MLQ questionnaires rated by each participant were tabulated by Mind Garden, Inc. to either represent a transactional leader, transformational leader, or passive-avoidant leader. Leadership outcomes also measured by the MLQ survey were:

- satisfaction with the leader,
- leader effectiveness, and
- extra effort of the follower.

These were evaluated and correlated to the safety indices. Incomplete surveys were not eliminated from the study. The data were analyzed to determine whether there was an association between leadership styles and safety indices.

Cluster sampling, convenience sampling, and opportunity sampling were conducted. Cluster sampling were proposed to consist of blast emailing and postal mailings to many eligible trucking companies fitting the criteria. Convenience sampling consisted of individual truckers recommended by subject matter experts and asked to complete surveys. Opportunity sampling consisted of individual truckers at a known public truck stop, service, and restaurant locations across the country.

Correlational studies and multiple regression analyses using the Excel Statistical Analysis ToolPak statistics were performed. Ordinal variables collected from Likert items were converted to interval data to fit some models for analysis. Multiple regressions were calculated to determine the magnitude of relationships among leadership styles and safety indices. Data were presented in tables, graphs, and scatterplots.

CHAPTER 4

DATA ANALYSIS AND RESULTS

Introduction

This chapter begins with the purpose of the study, data collection, data analysis, and results. This quantitative research study's sampling techniques, collection methods, data examination, analyses descriptions, and descriptive statistics are presented and discussed.

Purpose of the Study

This chapter aims to present the investigative research methods of analyzing the alternative hypotheses and null hypotheses tests aligned to the twelve research questions listed.

1. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?
2. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?
3. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?

4. Do the transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
5. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
6. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
7. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores?
8. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores?
9. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?
10. Do the transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?

11. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
12. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?

The following hypotheses that were tested are listed below.

- Hypothesis 1 (H_{A1}): Transformational leadership styles of safety professionals, supervisory, and management leaders have a positive correlation with higher safety scores of commercial trucking companies.
- Null hypothesis 1 (H_{01}): There is no positive correlation between transformational leadership styles of safety professionals, supervisory, and management leaders and the safety scores of commercial trucking companies.
- Hypothesis 2 (H_{A2}): Transactional leadership styles of safety professionals, supervisory, and management leaders have a positive correlation with higher safety scores of commercial trucking companies.
- Null hypothesis 2 (H_{02}): There is no positive correlation between transactional leadership styles of safety professionals, supervisory, and management leaders and the safety scores of commercial trucking companies.

- Hypothesis 3 (H_{A3}): Passive avoidant styles of safety professionals, supervisory, and management leaders have a positive correlation with higher safety scores of commercial trucking companies.
- Null hypothesis 3 (H_{03}): There is no positive correlation between passive avoidant leadership styles of safety professionals, supervisory, and management leaders and the safety scores of commercial trucking companies.
- Hypothesis 4 (H_{A4}): Transformational leadership styles of safety professionals, supervisory, and management leaders negatively correlate with higher safety scores of commercial trucking companies.
- Null hypothesis 4 (H_{04}): There is no negative correlation between transformational leadership styles of safety professionals, supervisory, and management leaders and the safety scores of commercial trucking companies.
- Hypothesis 5 (H_{A5}): Transactional leadership styles of safety professionals, supervisory, and management leaders negatively correlate with higher safety scores of commercial trucking companies.
- Null Hypothesis 5 (H_{05}): There is no negative correlation between transactional leadership styles of safety professionals, supervisory, and management leaders and the safety scores of commercial trucking companies.
- Hypothesis 6 (H_{A6}): There is a negative correlation between passive avoidant leadership styles of safety professionals, supervisory, and

management leaders and the safety scores of commercial trucking companies.

- Null Hypothesis 6 (H_{06}): There is no negative correlation between passive avoidant leadership styles of safety professionals, supervisory, and management leaders and the safety scores of commercial trucking companies.
- Hypothesis 7 (H_{A7}): Transformational leadership styles of safety professionals, supervisory, and management leaders have a positive correlation with higher safety climate scores of commercial trucking companies.
- Null Hypothesis 7 (H_{07}): There is no positive correlation between transformational leadership styles of safety professionals, supervisory, and management leaders and the safety climate scores of commercial trucking companies.
- Hypothesis 8 (H_{A8}): Transactional leadership styles of safety professionals, supervisory, and management leaders have a positive correlation with higher safety climate scores of commercial trucking companies.
- Null Hypothesis 8 (H_{08}): There is no positive correlation between transactional leadership styles of safety professionals, supervisory, and management leaders and the safety scores of commercial trucking companies.

- Hypothesis 9 (H_{A9}): Passive avoidant styles of safety professionals, supervisory, and management leaders have a positive correlation with higher safety scores of commercial trucking companies.
- Null Hypothesis 9 (H_{09}): There is no positive correlation between passive avoidant leadership styles of safety professionals, supervisory, and management leaders and the safety scores of commercial trucking companies.
- Hypothesis 10 (H_{A10}): Transformational leadership styles of safety professionals, supervisory, and management leaders negatively correlate with higher safety climate scores of commercial trucking companies.
- Null Hypothesis 10 (H_{010}): There is no negative correlation between transformational leadership styles of safety professionals, supervisory, and management leaders and the safety climate scores of commercial trucking companies.
- Hypothesis 11 (H_{A11}): Transactional leadership styles of safety professionals, supervisory, and management leaders negatively correlate with higher safety climate scores of commercial trucking companies.
- Null Hypothesis 11 (H_{011}): There is no negative correlation between transactional leadership styles of safety professionals, supervisory, and management leaders and the safety scores of commercial trucking companies.

- Hypothesis 12 (H_{A12}): Passive avoidant styles of safety professionals, supervisory, and management leaders negatively correlate with higher safety climate scores of commercial trucking companies.
- Null Hypothesis 12 (H_{012}): There is no negative correlation between passive avoidant leadership styles of safety professionals, supervisory, and management leaders and the safety climate scores of commercial trucking companies.

This study was approved by the Human Use Committee of the IRB of Louisiana Tech University. The instrument used to measure the leadership styles was the MLQ. This psychometric instrument consisted of 45 items covering the full range of leadership models (Avolio & Bass, 2004). In determining leadership styles, more specific leadership attributes are measured MLQs. The trucking companies' safety indices measured were safety climate scores and FMCSA's database on trucking company safety scores.

The safety climate score was derived from a content-validated, 10-question safety climate survey and was based on the Nordic Occupational Safety Climate Questionnaire (NOSACQ-50). The FMSCA safety score data was limited at the time of the research. Due to the enforcement of the FAST Act of 2015, certain information previously available on the FMCSA's Safety Measurement System (SMS) website related to property carriers' compliance and safety performance became unavailable for public display (Galas & Lucca, 2016). For this reason, only the Basic Unsafe Driving (BUD) scores were used. BUD scores are displayed on the FMSCA website every six months. In order to cover a range of safety scores per trucking company, the four most recent BUN scores, covering the most recent 24 months, were averaged for each.

Data Collection

The researcher purchased licenses for two hundred MLQs from the publisher Mind Garden, Inc. (Appendix B). All the participants were commercial truck drivers who rated their companies. No safety professionals, supervisors, or managers participated. Therefore, no leader self-rater MLQ surveys were used. Demographic data collected on the surveys were the company names, states, and their DOT numbers. Sixty-two participants completed the MLQ short rater form consisting of 45 questions. Each question had choices on a 5-point Likert scale. The responses ranged from "not at all" to "frequently if not always."

The following three sample items allowed by the copyright from this instrument are as follows:

"The person I am rating…

- talks optimistically about the future
- spends time teaching and coaching
- avoids making decisions" (Bass & Avolio, 2004).

The safety climate survey was attached to the front of the MLQ survey. It was content validated by the five subject matter experts by rating the top 10 questions of the original 50 question NOSACQ-50. Each question had choices on a 4-point Likert scale. The responses ranged from "strongly disagree" to "strongly agree." A score of more than 3.30 indicated a good level allowing for maintaining and continuing developments. A score of 3.00 to 3.30 pointed to a fairly good level with a slight need for improvement. A score of 2.70 to 2.99 showed a fairly low level with a need for improvement. A score below 2.70 indicated a low level with a great need for improvement.

The trucking companies of each of the 62 participants were researched on the DOT's FMCSA Safety and Fitness Electronic Records (SAFER) System website. The BUD score combines total reported accidents and safety inspections calculated every six months. The BUD score was averaged over the most recent 24 months available. Since they are calculated and reported in 6-month intervals as a rate, each company's BUD score averages four measures. The BUD scores ranged from 0-4.9 on a 0-100 scale. A score of zero reflected no reportable accidents and a minimum of three driver inspections with no violations. Greater BUD scores represented more unsafe events reported to the DOT over time.

Data Analysis

Mind Garden, Inc. automatically scored the MLQ responses following the Multifactor Leadership Questionnaire Instrument (Leader and Rater Form) and Scoring Guide (Form 5X-Short; Appendix C). Data cleaning was conducted by the researcher in accordance with the Multifactor Leadership Questionnaire Scoring Guide (Avolio & Bass, 2004). The unanswered questions were automatically scored zeroes by Mind Garden, Inc. The average of each question's responses was calculated by the researcher and substituted in place of the automatically assigned zeroes.

The safety climate score responses were also automatically scored by Mind Garden, Inc. The researcher then grouped the respondents into the four safety climate levels per the NOSACQ-50 scoring protocol: low, fairly low, fairly good, and good.

Multiple regression analyses were conducted to determine the magnitude of relationships between leadership styles and safety climate scores. Specific leadership attributes associated with leadership styles were reflected in the data analyzed. These

identified the Pearson correlation coefficients, *R*, the coefficients of determination, R^2, and probabilities. The results were set for significance at 95% confidence intervals, $p < .05$, except for the grouped data of the four safety climate levels. Their confidence intervals were Bonferroni corrected ($\alpha' < .0125$).

Internal validation of the safety (BUD) scores and safety climate scores were conducted using two-tail t-tests. The safety (BUD) scores of companies with low, fairly low, fairly good, and good safety climate ranges were compared as determined by the NOSACQ-50 scale, which created a comparison of groups having unequal sample sizes. The results were set for significance at 95% confidence intervals, $\alpha' < .0125$.

Results

The sample size was 62 ($n = 62$), and all correlations had 60 degrees of freedom (*df*). A total of 2,790 questions were given in the MLQ-5X survey of 62 participants, each having 45 questions to answer. There were 157 unanswered questions. Therefore, the 2,633 answered questions out of the 2,790 total questions produced an MLQ survey response completion rate of 94.37%. Each participant averaged 2.53 unanswered questions per his/her 45 question MLQ survey.

In the case of the safety climate survey, every participant completed all 10 questions. The hypotheses of this study were examined by using Pearson correlation coefficients, *R*, and the correlation of determination, R^2. The statistical relationship between the MLQ scores and safety indices, BUD scores and safety climate scores of the corresponding trucking companies were plotted on scatter diagrams. The scatterplots were plotted to show the direction and strength of the correlations.

The results were not significant for Research Questions 1 through 6, MLQ scores to BUD scores. Each p-value exceeded the standard alpha level of .05. The Pearson correlation coefficients, *R*, and correlations of determination, R^2, did not suggest correlations between the variables (Table 3).

Table 3

Comparison of Leadership Styles to BUD Scores

Leadership Style	*R*	R^2	*p*	Significance	Correlation
Transformational	0	0	1.00	$p > .05$	None
Transactional	0	0	< .001	$p > .05$	None
Passive/Avoidant	0	0	.82	$p > .05$	None

For Research Questions 1 through 6, since the p-value was not statistically significant there was strong evidence for the null hypothesis.

Results for Research Questions 7 through 12, MLQ scores to safety climate scores, are displayed in Table 4.

Table 4

Comparison of Leadership Styles to Safety Climate Scores

Leadership Style	*R*	R^2	*p*	Significance	Correlation
Transformational	-.53	.280	< .001	$p > .05$	Negative
Transactional	.04	.002	.77	$p > .05$	None
Passive/Avoidant	.58	.340	< .001	$p > .05$	Positive

The results presented in Table 4 support a negative correlation between safety climate and transformational leadership and a positive correlation between safety climate

and passive avoidant leadership. The study did not produce statistically significant data for a correlation between safety climate and transactional leadership. This was strong evidence to accept the null hypothesis.

Research Question 7 was not supported by the data. Instead, a negative correlation was demonstrated as statistically significant. Table 4 shows that safety climate scores and transformational leadership scales had a Pearson correlation of R = -.53 (df = 60), $p < .001$.

Alternative Hypothesis 7 (H_{A7}): Transformational leadership styles of safety professionals, supervisory, and management leaders had a positive correlation with higher safety climate scores of commercial trucking companies, was not supported by the research.

Null Hypothesis 7 (H_{07}), which states no positive correlation between transformational leadership styles of safety professionals, supervisory, and management leaders and the safety climate scores of commercial trucking companies. We failed to reject the null hypothesis.

Research Question 8: Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores?

Table 4 shows the safety climate scores and transactional leadership scales had a Pearson correlation of R = .04 (df = 60), p = .765. The results were not statistically significant in that the p-value exceeded the standard alpha level of .05. The Pearson correlation coefficient of .04, R, and correlation of determination value of .002, R^2, did

not indicate correlations between the variables. Therefore, the hypotheses were not supported by the research.

Research Question 9 asks if passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores. Table 4 shows the safety climate scores and passive avoidant leadership scales had a Pearson correlation of $R = .58$ ($df = 60$), $p < .001$, indicating a statistically significant positive relationship.

The data supported alternative Hypothesis 9 (H_{A9}), which questioned if passive avoidant styles of safety professionals, supervisory, and management leaders had a positive correlation with higher safety climate scores of commercial trucking companies. The correlation of determination is $R^2 = .34$ (Table 4).

Null Hypothesis 9 (H_{09}), which stated there was no positive correlation between passive avoidant leadership styles of safety professionals, supervisory, and management leaders and the safety climate scores of commercial trucking companies, was rejected.

Research Question 10 asked if the transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety climate scores. Table 1 shows that safety climate scores and transformational leadership scales had a Pearson correlation of $R = -.53$ ($df = 60$), $p < .001$, and indicated a statistically significant negative correlation. The correlation of determination is $R^2 = .28$ (Table 4).

Alternative Hypothesis 10 (H_{A10}) stated that the transformational leadership styles of safety professionals, supervisory, and management leaders negatively correlated with

higher safety climate scores of commercial trucking companies. There was enough evidence to support the alternative hypothesis.

Null Hypothesis 10 (H_{010}), which stated there is no negative correlation between transformational leadership styles of safety professionals, supervisory, and management leaders and the safety climate scores of commercial trucking companies was rejected.

Research Question 11 asked if transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety climate scores. Table 4 shows the safety climate scores and transactional leadership scales had a Pearson correlation of $R = .04$ ($df = 60$), $p = .765$. The results were not statistically significant in that the p-value exceeded the standard alpha level of .05. The Pearson correlation coefficient of .04, *R*, and correlation of determination value of .002, R^2, did not indicate correlations between the variables. there is not enough evidence to support the corresponding null or alternative hypotheses of Research Question 11. Therefore, the hypotheses were not supported by the research.

Research Question 12 asks if passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety climate scores. Table 4 shows the safety climate scores and passive avoidant leadership scales had a Pearson correlation of $R = .58$ ($df = 60$), $p < .001$, indicating a statistically significant positive relationship.

Alternative Hypothesis 12 (H_{A12}), which contended that passive avoidant styles of safety professionals, supervisory, and management leaders negatively correlate with

higher safety climate scores of commercial trucking companies, was not supported by the data.

The Null Hypothesis 12 (H_{012}), which stated there is no negative correlation between passive avoidant leadership styles of safety professionals, supervisors, and management leaders and the safety climate scores of commercial trucking companies. We failed to reject the null hypothesis.

Summary

Two hypotheses were supported by the results presented in Chapter 4 in which there were significant correlations between leadership styles and safety climate scores. There data supported evidence that there was a positive correlation between passive avoidant leadership styles of safety professionals, supervisory, and management leaders and the safety climate scores of commercial trucking companies. The data supported evidence that there was a negative correlation between transformational leadership styles of safety professionals, supervisory, and management leaders and the safety climate scores of commercial trucking companies.

Two of the hypotheses were supported by the research: (a) passive avoidant leadership styles positively correlated with higher safety climate scores of commercial trucking companies, and (b) transformational leadership styles had a negative correlation with higher safety climate scores of commercial trucking companies.

Specific leadership attributes associated with the three main leadership styles that were also measured by the MLQ survey (see Appendix E). Specific leadership outcomes were associated with the three main leadership styles (Appendix E).

The correlations between the BUD scores and the safety climate scores were presented in Appendix E. The calculations resulted in a Pearson correlation coefficient of $R = .07$ ($df = 60$), $p = .6$. The result was not significant at $p < .05$. The Pearson correlation coefficient of $R = .07$ and the correlation of determination value of 0.01, R^2, did not indicate correlations between the BUD and safety climate scores (Appendix E).

Two-tailed t-tests were performed on the four safety climate levels designated by the Nordic Occupational Safety Climate Questionnaire and their corresponding BUD scores (Appendix E). Low to Good, Low to Fairly Low, and Fairly Good to Good levels did not produce significant results. The results were not significant in that the p-value exceeded the Bonferonni corrected alpha level of .0125. These sample sizes did not meet the general rule of thumb of $n \geq 30$ since statistical power is positively correlated with the sample size.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

Chapter 5 includes a review of the purpose of the study and research questions analyzed, discussion of the study results, implications, future implications, limitations, and delimitations, based on the data analyses. It concludes with recommendations for future research.

The purpose of this study was to research whether the leadership styles of safety professionals, supervisory and management leaders of commercial trucking companies, were related to their companies' safety ratings. The theoretical framework employed in this study was based on the full range leadership model of Avolio and Bass (1991).

Sixty-two long-haul commercial truck drivers participated in the study. This quantitative research was a quasi-experimental, correlational study comparing leadership styles with safety indices of trucking companies. The research logic was aligned to the literature review based on the following academic publication topics:

- the full range leadership model,
- transformational leadership,
- transactional leadership,
- passive avoidant leadership,
- the MLQ instrument,

- organizational culture and organizational climate,
- safety culture and safety climate,
- safety leadership and
- the safety climate scale.

Determining whether significant, measurable correlations existed between the leadership styles of safety and management leaders and the safety indices of their trucking companies were important to this study.

The following 12 research questions were analyzed with their corresponding null and alternate hypotheses.

1. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?
2. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?
3. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?
4. Do the transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?

5. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
6. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
7. Do transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores?
8. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety climate scores?
9. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies have a positive correlation with their companies' safety ratings?
10. Do the transformational leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?
11. Do transactional leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?

12. Do passive avoidant leadership styles of safety professionals, supervisory, and management leaders of commercial trucking companies negatively correlate with their companies' safety ratings?

Summary of Findings

Results were not significant in Research Questions 1, 2, 3, 4, 5, 6, 8, and 11. Each p-value exceeded the standard alpha level of .05. The Pearson correlation coefficients, *R*, and correlations of determination, R^2, the research did not indicate correlations between the variables.

The first six research questions tested, comparing companies' safety rating comparison measured by the BUD scores to their MLQ scores, were not statistically significant (Table 3). Research Question 8 asked for a positive correlation, and Research Question 11 asked whether a negative correlation between safety climate scores and transactional leadership existed. The results of Research Questions 8 and 11 were not significant at $p < .05$. Therefore, no correlations could be supported by the research. The research did not support any correlations between the variables of research questions 1, 2, 3, 4, 5, 6, 8, and 11.

The analyses of the following research questions found evidence of significant correlations as follows:

- For Research Question 7, we failed to reject the Null Hypothesis (H_{07}). There was no positive correlation between transformational leadership styles of safety professionals, supervisory, and management leaders and the safety climate scores of commercial trucking companies.

- For Research Question 9, the Alternative Hypothesis (H_{A9}) the data supported that passive avoidant leadership styles of safety professionals, supervisory, and management leaders were positively correlated to higher safety climate scores of commercial trucking companies.
- For Research Question 10, the Alternative Hypothesis (H_{A10}) the data supported that transformational leadership styles of safety professionals, supervisory, and management leaders was negatively correlated to higher safety climate scores of commercial trucking companies.
- For Research Question 12, we failed to reject the Null Hypothesis (H_{012}). There was not sufficient evidence of a negative correlation between passive avoidant leadership styles of safety professionals, supervisors, and management leaders and the safety climate scores of commercial trucking companies.

The next step in the data analysis was to determine whether a correlation existed between the BUD and safety climate scores. The calculations resulted in a Pearson correlation coefficient of $R = .07$ ($df = 60$), $p = .6$; $R(60) = .07$, . The Pearson correlation coefficient of $R = 0.07$ and the correlation of determination value of 0.01, R^2, did not indicate correlations between the BUD and safety climate scores (Appendix E). However, it may be a moot point since the results were not statistically significant in that the p-value exceeded the standard alpha level of 0.05. To further investigate this, the calculated Spearman's Rho correlation resulted in $r_s = 0.08$, p (2-tailed) = 0.53. The results further indicated that the strength of association between the two variables was not considered significant.

Two-sided dependent t-tests between the four levels of safety climate scores; low level, fairly low level, fairly good level, and good level; and the corresponding BUD scores, were not significant even after the results were Bonferonni-corrected at p-values of .013 (Appendix E). The dependent variables, safety climate, and BUD scores did not provide evidence of correlation to leadership scores.

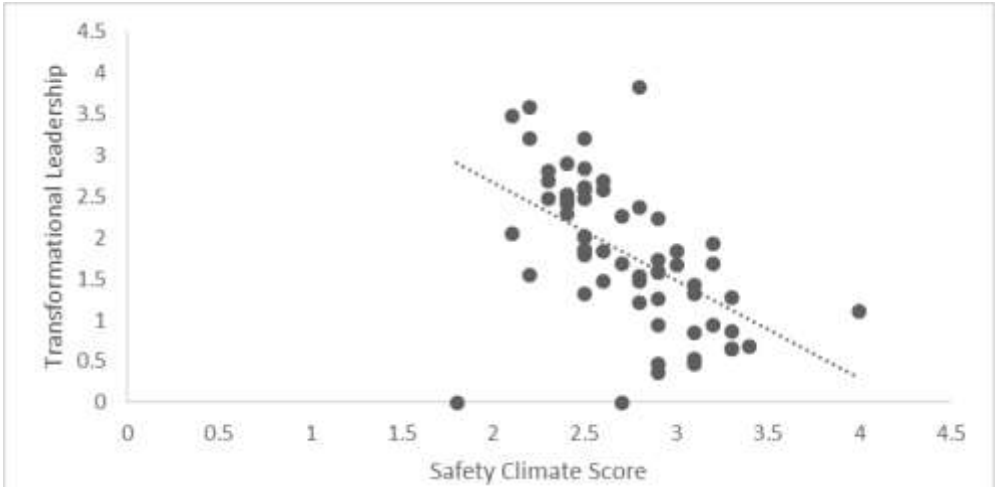
Discussion

This study suggested an association between safety climate scores of the trucking companies and two types of leadership; transformational and passive avoidant.

Transformational leadership had a negative correlation to safety climate scores. (Figure 1).

Figure 1

Transformational Leadership Correlated to Safety Climate Scores

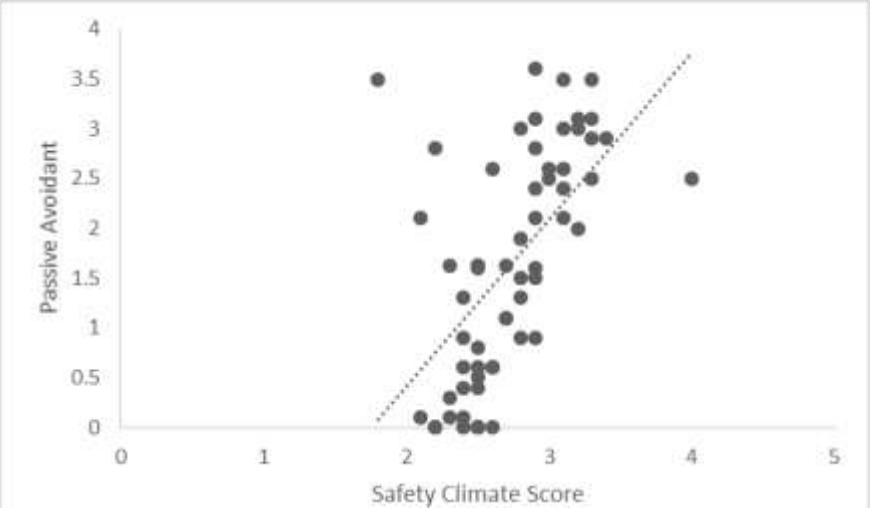


Note: The p-value is < .001. The result is significant at p < .05
R^2 = .28 Negative Correlation.

Passive avoidant leadership had a positive correlation to safety climate scores (Figure 2).

Figure 2

Passive Avoidant Leadership Correlated to Safety Climate Scores



Note: The p-value is < .001. The result is significant at p < .05.
$R^2 = .34$ Positive correlation.

The implications of this are that the truck drivers who participated in the surveys rated their companies' safety climates higher when company managers practiced passive avoidant leadership. These results were unexpected since there is much research literature on the success of transformational leaders on workers and the corresponding failure of passive avoidant leaders (Bass et al., 2003; Frooman et al., 2012; Mullen et al., 2017; Olsen et al., 2020).

Since there is no single, universal, organizational setting or personality type for all workers, it would be prudent to explore other characteristics of the participants. What made this sample of workers rate their companies' safety climates better when supervised by passive avoidant leaders, and worse when supervised by transformational leaders?

It may be that not all leaders fall neatly into transformational, transactional, or passive avoidant categories (Dinh et al., 2013).

The basic analysis of the MLQ survey into transformational, transactional, and passive avoidant leadership has been labeled the three-factor model solution (Hartog et al., 1997). This study's research questions and hypotheses have followed the three-factor model; however, additional information was collected in the MLQ survey that deserves mention. Avolio et al. (1999) encouraged calls for additional research on broader ranges of leadership styles and orientations using the MLQ survey. They concluded that a wider and more detailed range of leadership factors would result in more accurate measurements across cultures and organizational settings. In addition to the hypotheses aligned to the 12 research questions, some specific leadership attributes and outcome scores that the MLQ survey measured were also found to be correlated to companies' safety climate scores.

The three-factor model is a convenient yet over-simplified leadership theory in many practical applications. Bass (1985) further categorized leadership styles as active vs. passive, which is relevant to this study's positive passive avoidant correlation to safety climate scores. Hartog et al. (1997) found a positive correlation of .42 between laissez-faire leadership and passive management-by-exception. They also found a negative correlation between active and passive management-by-exception. Thus, active management-by-exception factors, such as constant monitoring of performance and immediate corrective measures, are now classified under transactional leadership.

None of the transactional leadership measures in this study had statistically significant results. However, one of the leadership attributes transactional leaders often

share, was positively correlated to safety climate scores at a p-value of < .05. This leadership attribute of actively Monitoring Deviations and Mistakes, or Management-by-Exception: Active (MBEA), resulted in a Pearson correlation coefficient of R = .39 *(df* = 60*)*, p = .002, and coefficient of determination, R^2 = .15 (Appendix E).

In contrast, the Rewarding Achievement (Contingent Reward) attribute was negatively correlated to safety climate scores resulting in a Pearson correlation coefficient of R = -.40 *(df* = 60*)*, p = .001, and coefficient of determination, R^2 = .16 (Appendix E).

Acting with integrity, building trust, coaching and developing people, encouraging others, and encouraging innovative thinking are transformational leadership attributes that produced negative correlations to safety climate scores. The leadership attribute of one who Acts with Integrity was negatively correlated to safety climate scores resulting in a Pearson correlation coefficient, R = -.48 *(df* = 60*)*, p < .001, and a coefficient of determination, R^2 = .23 (Appendix E).

The leadership attribute of Building Trust was negatively correlated to safety climate scores resulting in a Pearson correlation coefficient, R = -.46 *(df* = 60*)*, p < 0.001, and a coefficient of determination, R^2 = .21 (Appendix E).

The leadership attribute of one who Coaches and Develops People was negatively correlated to safety climate scores resulting in a Pearson correlation coefficient, R = -.51 *(df* = 60*)*, p < .001, and a coefficient of determination, R^2 = .26 (Appendix E).

The leadership attribute of one who Encourages Others was negatively correlated to safety climate scores resulting in a Pearson correlation coefficient, R = -.38 *(df* = 60*)*, p = .002, and a coefficient of determination, R^2 = .15 (Appendix E).

The leadership attribute of those who Encourages Innovative Thinking (Innovation) was negatively correlated to safety climate scores resulting in a Pearson correlation coefficient, R = -.61 *(df* = 60*)*, p < .001, and a coefficient of determination, R^2 = .37 (Appendix E).

Leadership outcomes measure the follower's extra effort rating of how effective the leader is and his/her satisfaction with the leader. The outcome in which followers rated leaders as those who "Generate Extra Effort", resulted in a Pearson correlation coefficient of R = -.62 (df=60), p < .001, and coefficient of determination, R^2 = .39 (Appendix E). These three outcomes each had negative correlations to safety climate scores.

The leadership outcomes that the followers rated their leader as "Is Productive," resulted in a Pearson correlation coefficient of R = -.54 *(df*=60*)*, p < .001, and coefficient of determination, R^2 = .29 (Appendix E).

Measuring the leaders who were classified as those who "Generates Satisfaction" resulted in a Pearson correlation coefficient of R = -.57 *(df*=60*)*, p < 0.001, and coefficient of determination, R^2 = .32 (Appendix E).

Passive management by exception involves not acting before mistakes or before problems cannot be ignored. Passive avoidant leadership made up of laissez-faire and passive management-by-exception is associated with lower workplace safety and higher injury rates (Harold & Holtz, 2014). This study did not support the conclusions of Harold and Holtz if safety climate scores are an indicator for lower workplace safety and higher injury rates.

Besides this study producing evidence that passive avoidant leadership was indicative of higher safety climate scores (Table 4), two leadership attributes, Fights Fire with Fire and Avoids Involvement, did also.

Fights Fires with Fires, or Management-by-Exception: Passive (MBEP), resulted in a Pearson correlation coefficient of $R = 0.64$ $(df=60)$, $p < 0.001$, and coefficient of determination, $R^2 = 0.41$ (Appendix E). Avoids involvement or Laissez-Faire Leadership resulted in a Pearson correlation coefficient of $R = 0.46$ $(df=60)$, $p < 0.001$, and coefficient of determination, $R^2 = 0.22$ (Appendix E).

Personality types of followers may explain their responses to types of leadership styles. Noble (2010) reported that different types of leaders, extraverts and introverts, can be successful with different employees. Grant et al. (2011) found that extroverted leaders had lower group performances with proactive employees, and extraverted leaders had higher group performances with employees who were not proactive. Parker et al. (2006) and Straus et al. (2011) described proactive behavior as self-initiated and future-oriented.

Bono and Judge (2004) concluded "extraversion was the strongest correlate of ratings of transformational leadership behavior" (p. 908) in their meta-analysis. Chen et al. (2018) found that positive and negative effects of transformational leadership can coexist. They based negative effects on the principle of diminishing marginal utility or the "Too-Much-of-a-Good-Thing (TMGT)" effect, leadership, and employees' personality traits. The personality traits of the sample population may be a confounder to the effectiveness of leaders. However, this study suggested that the truckers sampled shared a personality trait that skewed the results in the opposite direction from active leader to passive leader.

Empirical data on the personality types of truck drivers were not readily available in the academic literature review. However, due to an increasing number of online employment services that screen job applicants through self-administered questionnaires, there are popular quasi-scientific measurement tools of personality types in many categories of the workforce. Two self-administered, self-rating instruments commonly used by workforce professionals in the U.S. are the Myers-Briggs Type Indicator (MBTI) and the Holland Code assessment (Eggerth et al., 2005).

The MBTI self-assessment classifies people into one of 16 personality types. The Personality Database of Famous & Fictional People (2019), which describes itself as a user-driven community to discuss personality types, reported that the most likely MBTI subcategory for truck drivers was ISTP. ISTP is the acronym for Introverted, Sensing, Thinking, and Perceiving. The Myers-Briggs Company describes these personality characteristics as analytical, practical, realistic, logical, adaptable, and enjoying working alone. It is estimated that 3.5 million MBTI tests are taken annually (Capraro & Capraro, 2002).

The Holland Codes self-assessment classifies people into the following six types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (Armstrong et al., 2008). According to the Occupational Information Network (O*NET), a free online occupational database sponsored by the U.S. Department of Labor/Employment and Training Administration (USDOL/ETA), heavy and tractor-trailer truck drivers commonly share the Holland Codes categories of Realistic and Conventional. These are further described as: practical, hands-on, not working closely with others, involving set procedures and routines (National Center for O*NET Development, 2021).

CareerExplorer (2019) surveyed the personality traits of 1,979 truck drivers and reported truck drivers as realistic and conventional, duplicating the Holland code categories reported by O*NET.

The MBTI and Holland Codes personality traits reported above suggest that the truck driver occupation predisposes to introverted, proactive personality types. Extroverted leaders were reported by Grant et al. (2011) to have lower group performances from proactive employees. Bono and Judge (2004) found transformational leadership was strongly correlated to extroversion. Therefore, it is plausible that negative correlations between safety climate scores and transformational leaders were due to the proactive personality type of the truck drivers in the study's population. If the sample population was homogeneous in this personality type, it might explain why transformational leadership negatively correlated to safety climate scores in the study. Ng et al. (2008) correlated leader personalities with effectiveness, moderated by leader self-efficacy. Additionally, Chen et al. (2018) found that the employees' proactive personalities moderated transformational leadership and employees' task performances. Noble (2010) reported that both extroverts and introverts can get equal results from different employee followers. Introverts can be better leaders than extroverts when their followers are proactive (Grant & Ashford, 2008; Grant et al., 2011).

Implications

The unexpected negative correlation with transformational leadership, and positive correlation with passive avoidant leadership, to safety climates of the participants' trucking companies may be explained by proactive and introverted personality traits among the sample population of long-haul commercial truck drivers.

The study results inferred that these followers respond better to more autonomy and self-reliance on the job than micromanagement. To back this up further, in their research study interviewing 104 truck drivers, Johnson et al. (2011) reported one of the most positive aspects of the job as being with no direct supervision. These truckers indicated they were more responsible and independent.

Daily responsibilities of commercial truck drivers require them to be very dependable, if not proactive. A mandatory pre-trip inspection of the vehicle and its major systems must be logged into each logbook and be available for review by regulatory authorities. Pre-trip inspections are comprised of safety inspections of the coupling system, the vehicle lights, engine compartment, tires and brakes, the chassis, the fuel tanks, and an in-cab inspection (MacMillan, 2020). These daily, solitary tasks intuitively favor proactive, introverted individuals. Strauss et al. (2011) summed up traits of proactive workers as self-starting, future-oriented, and focused on change. In addition, driving up to 11 hours alone would attract such personality types.

Online self-assessments and pre-employment screening tools are very common, economical, and useful to human resource professionals. Job seekers initiating them voluntarily are being proactive and are an immediate advantage in selecting truck drivers. An example of online assessment services that trucking companies may use is the Optimize Hire behavioral tests developed by Dr. Adam Grant of the Wharton School of the University of Pennsylvania. These short, 10-minute tests measure standard cognitive ability, personality, and motivation. They claim a 96% national completion rate and validation of 95% CI to show improvement in job performance outcomes, such as turnover (Optimize Hire, 2020). Criteria Corp. is another company that claims to have

done over twenty-five million online pre-employment assessments tests measuring cognitive aptitude, personality, emotional intelligence, risk, and skills (Criteria Corp., 2019).

The Society for Human Resource Management (SHRM) refers to these measures as talent assessments. SHRM categorizes the assessment measures as cognitive ability, job-relevant integrity, physical fitness, biographical data, job-relevant knowledge, writing, situational judgment, behavioral interviews, work simulations, assessment centers, and physical ability (Pulakos & Kantrowitz, 2016). Industrial-organizational psychologists and subject matter experts (SMEs) may also investigate what qualities workers need to perform well. These qualities are known as knowledge, skills, abilities, and other characteristics (KSAOs). Personality types fall under the "Other characteristics" category.

Raymark et al. (1997) devised the Personality-Related Position Requirements Form (PPRF), a job analysis form to assess personality predictors of performance in different jobs. The Big Five personality traits (B5) or the Five Factors Model (FFM), consisting of openness, conscientiousness, extroversion, agreeableness, and neuroticism, are the PPRF. The personality trait of extroversion is a continuum in which extroversion is on the high end, ambiversion in the middle, and introversion is on the low end (Nettle, 2005). While predicting proactive personality types is seemingly straightforward, the continuum of extroversion implies a more complicated task.

Lee and Ashton (2004) added the trait of honesty-humility to the Big 5, creating the HEXACO Personality Inventory. Developing the Big 5 and HEXACO models

through empirical processes, independent peer reviews, and consistent, reproducible predictions of both these models make them the most reliable personality tests.

Tett et al. (1991) performed a meta-analytic review of personality measures as predictors of job performance. They expounded on the Big 5 by investigating moderating effects of other characteristics on personality scale validity, in addition to the locus of control, Type A, and miscellaneous. Their corrected mean personality scale had twice the validity of previous studies by comparing job analysis to selecting these personality measures.

Grant (2013) found that ambiverts were more productive than extroverts and introverts to complicate matters further. He surmised that the reasons for this are that they are flexible in talking and listening, persuasive by showing just enough assertiveness and enthusiasm to persuade yet good, empathetic listeners, and not appearing overenthusiastic or overconfident. In other words, extroverted leaders may trigger negative responses from followers by directing them instead of allowing feedback and locus of control. Extroverted managers dominate in ways that hinder the performance of proactive employees, while introverted managers succeed by listening to employees' suggestions and validating their initiative (Caramela, 2017). The positive characteristics of ambiverts observed by Grant (2013) may also be more useful in selecting leaders than the narrow categories measured by the MLQ surveys.

Future Implications

In 2016, the Talent Board, a non-profit research organization, calculated that over 80% of companies use pre-employment assessment tests (Zielinski, 2019). The popular use of online pre-employment selection tools may increase the potential for greater job

performance by screening applicants for desirable characteristics and enabling employers to target employees with customizable, enhanced training to improve the performance of leaders and followers. Artificial Intelligence (AI) is often used for scoring assessments, and with advanced machine learning, algorithms are evolving to predict an applicant's likelihood of success better. Despite the latest technology, some companies still utilize outdated, two-decade-old applicant tracking systems (ATS). The use of AI will improve the analyses and screening of employees by continuously adjusting to new data.

Personality assessments can be specially designed for specific jobs to include the HEXACO personalities, the eight distinct categories of personality content, and the Big 5 personality factors as described by Tett et al. (1991). The assessments can significantly improve the selection of commercial truck driver applicants and safety leadership development due to their common personality traits suggested by this research. According to Road Scholar Transport (2017) the trucking industry must invest more capital into recruiting high-quality drivers.

Remote leadership is another pertinent area of research that will benefit leaders in the trucking industry. Gajedran and Harrison (2007) found that distance negatively impacted relationships between leaders and followers. Kelley and Kelloway (2012) suggested that successful proximal management styles differed significantly from remote management styles. Since the 2020 COVID-19 public health emergency and lockdowns in the United States, many companies have been forced to adapt to the remote workplace.

A remote workplace has always been the case for long-haul trucking companies. However, the latest technology has an impact today as never before. For one thing, two-way communication is now expected in real-time due to audio and video calls.

Examples of these monitoring technologies are:

- sensors that transmit GPS locations,
- satellite signals,
- hours of service,
- electronic logging devices,
- speed,
- braking,
- crash indicators,
- trailer temperature monitoring,
- supply chain management,
- theft deterrence,
- theft detection,
- tire pressure,
- mechanical data,
- dashcams,
- seat belt use,
- cell phone and data usage,
- pre and post inspections, and
- driver vehicle inspection's digital reports replacing paper.

Some safety precautions still are not digitalized and must be complied with by the worker, such as personal protective equipment (PPE), including a safety vest, hard hat, safety boots, coveralls, gloves, and safety glasses. These require acceptance of the safety equipment's value by the driver.

Neufeld et al. (2010) found that in remote leadership, communication effectiveness was a strong predictor of leader performance and acted as a mediator of his/her behavior on performance and may be useful toward the leadership of long-haul truckers. The contextual elements that Kelley and Kelloway (2012) found effective in leading remote workers were perceptions of control, prior knowledge of the leader, unplanned communication, and regularly scheduled communication with a leader. Introverted, remote followers, such as long-haul truckers, would likely respond better to leaders who communicated with them more effectively. Henderson (2013) determined that leadership styles correlated with workers' behaviors to speak up about safety issues. Garrett (2012) found that 90% of the virtual managers surveyed ranked communication as the leading factor of their success. Mumphrey (2020) determined that a key recommendation for the freight trucking industry is to promote open communication. Leadership development programs can be designed to address these issues.

Besides individual supervisors, virtual teams are another useful method of managing remote workers and are especially relevant to long-haul truckers since they may be driving on multiple shifts. The technology useful for virtual teams includes project management software, time tracking solutions, video conferencing tools, and instant messaging platform (Wrike.com, n.d.). Empowering remote workers can be aided by establishing clear expectations, allowing for flexibility and autonomy, connecting their daily work to the bigger picture, fostering accountability, and providing adequate recognition, including asking how they prefer to be praised (Wrike.com, n.d.). Asking employees how they prefer being praised is especially important for followers on the introvert end of the personality spectrum.

Limitations and Delimitations

The study's main limitation was substituting the trucking companies' BASICs score with the Basic Unsafe Driving (BUD) score. The substitution was done due to a policy change by the Fixing Americas Surface Transportation (FAST) Act, Pub. L. No. 114-94. In this new policy, trucking company safety scores annually reported on a 1 to 100 scale on the FMCSA's safety measurement system (SMS) website were no longer available for public display (Galas & Lucca, 2016). The Crash Indicator and Hazardous Materials Compliance BASICs remain hidden from public view but available to that company only with its PIN. Without written permission from each trucking company, researchers cannot access these data. Due to time constraints, they were not contacted for permission. Instead, the four most recent public inspection and crash data were averaged and substituted for the non-public safety score.

These were reported in the study as the BUD scores. These data are available to the public; include inspection and crash data, investigation results, and measures for all public Behavior Analysis and Safety Improvement Categories (BASICs); and are reported at 6-month intervals. However, these measures are generated directly from safety data and not relative to other motor carriers (U.S. Department of Transportation Federal Motor Carrier Safety Administration, 2016). It cannot be ruled out that these safety data collected were not equivalent to the confidential, non-public data originally proposed and may have corrupted the correlations and significance levels, which prevented the outcome of interest, transformational leadership.

The second limitation was using a 10-question, condensed version of the 50-question Nordic Occupational Safety Climate Questionnaire (NOSACQ-50). Although

subject matter experts reduced 50 questions to 10, content validated questions, it could have made them less comprehensive. As described by Kines et al. (2011), the NOSACQ-50 covers seven dimensions of safety perception. Ten questions may not have sufficiently represented all seven dimensions. They could have also corrupted the results which may explain the unexpected results of passive avoidant leadership having the highest correlation to safety climate. Prior research strongly suggested that passive avoidant leadership is the least effective form (Bass et al., 2003; Frooman et al., 2012; Olsen et al., 2020). This study indicated the opposite effect. The reduced 10-question safety climate questionnaire may not have been a valid measure of the actual safety climate and corrupted the outcome of interest, transformational leadership.

Some limitations of this study were due to diverging from the constructed methodology of this research design. Although it was unintended, it must be addressed, especially to improve future research. The MLQ surveys were designed to be divided between self-rater and rater forms. Supervisors, managers, and safety professionals were supposed to complete self-rater forms to determine their leadership styles. The followers completed rater forms on the leadership styles of their supervisors, managers, and safety professionals. Due to time constraints and the COVID-19 public health emergency restrictions, none of the self-raters were contacted. Only the followers were surveyed in the study, which prevented the full 360-degree multi-rating intended by Bass and Avolio (2004) to fully analyze the leaders' self-assessments alongside their followers' perceptions of their leadership. Therefore, the MLQ surveys were not triangulated as planned. Left-handed bias, that could not easily be eliminated by rephrasing the MLQ questions, may have slanted results in one direction (Friedman et al., 1994).

The sampling methods were limited to convenience sampling of individual truckers recommended by subject matter experts, word of mouth, and notices on several social media trucker-friendly chat rooms and groups, on social media platforms. Cluster sampling through emails and postal mailings was not done. Opportunity sampling at known truck stops had been arranged in Arkansas, California, Florida, and Louisiana. Due to the COVID-19 public health emergency, they were not done. This may have introduced sampling biases, since most of the participants responded from social media sites, taking online surveys. Perhaps younger truckers were more likely to participate online than older truckers. Older truckers may have been more likely to participate in person at truck stops and restaurants.

The lottery incentive to win a $100 gift certificate was chosen over $5 in cash for each participant. The lottery might have attracted older drivers, being more financially secure, and the cash might have attracted younger drivers. Since more older drivers could have been surveyed in person at truck stops than on social media sites, this may have skewed the participation demographics of the sample population.

Licenses for 200 combined paper and online MLQ tests were purchased, but only 62 were completed. While the sample size (n = 62), being greater than 30, gave the study sufficient power to perform basic statistical analyses, it was less than planned. For this reason, the main statistical tests performed on the data were correlational studies. The scatterplots derived from Pearson correlation coefficients and correlations of determination displayed compelling visualization of the linear association between variables. However, correlation does not imply causation. Since the statistically significant associations were moderate at best, the scatterplots may appear misleading.

The assignment of variables on the x or y-axes was not based on the conventional practice of plotting the independent variable on the x-axis and the dependent variable on the y-axis. Instead, they were plotted for visual purposes in the direction that created the neatest slopes (Appendix E). SCS vs. BUD was plotted y vs. x and MLQ value vs. SCS were plotted x vs. y. Since the grids of the scatter plots are not squares but rectangles, this changed the visualization of the slopes. Causation of the correlations was not implied, therefore the designation of independent or dependent variables on the axes was not implied in this study.

The delimitations of the study were the sampling of only long-haul truckers. Separate studies may be appropriate for short-haul truckers, bus drivers, mail and package delivery drivers, and fuel tanker drivers. These drivers may have various personality types that might respond better to different types of leaders.

Recommendations for Future Research

Findings of the study have relevance to U.S. interstate commerce. The importance of interstate trucking was recently displayed during the COVID-19 public health emergency, in which the supply chains in the U.S. were disrupted. Consequentially, commercial truck drivers were identified as essential workers so they would work during pandemic lockdowns. In the future, the interest in motivating these essential workers will persist regardless of changes in fuel, automation, and unforeseen innovations.

Transportation safety is an ongoing issue in the U.S., whether measured in monetary or human costs. Developing leadership skills and qualities to address safety practices in the commercial trucking sector will improve safety outcomes. The MLQ survey is a valuable tool in assessing leadership. Identifying the most effective measures

to improve safety performance in the trucking industry and aligning them to the measurable traits of truck drivers will help achieve this. The training and development of leadership teams in this industry should be explored since the vast workplaces of truckers operate around the clock.

Future research in this area of concern should include the full MLQ self-rater and rater surveys of trucking company leaders and followers. Additional procedures to triangulate these data should be considered. FMSCA's SMS Crash Indicator and Hazardous Materials Compliance BASICs scores should be used as the dependent variable instead of the BUD scores. The 10-question safety climate questionnaire should be improved or replaced. It should cover all seven dimensions of safety perception that the NOSACQ-50 does.

The sampling methods must be expanded to ensure a good representation of the long-haul trucker population. Truck-stop solicitation of participants may be in-person or with interactive touch screen kiosks. Interviews of participants also may add another layer of data to triangulate with the questionnaires. The sample size must also be increased, to at least several hundred, to add statistical power.

Finally, further research must be done on common personality types of leaders and followers in the trucking industry. Background investigations of their safety leaders will be useful to determine if a notable proportion of them are former truck drivers. Similar or different personality types of leaders and followers will affect coaching, engagement, and training methods. Future job selection, training, and other professional development can be customized based on the findings of this research.

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APPENDIX A

H UMAN USE APPROVAL LETTER

LOUISIANA TECH
UNIVERSITY

MEMORANDUM

OFFICE OF SPONSORED PROJECTS

TO: Mr. John McMahon and Dr. Randall Parker

FROM: Dr. Richard Kordal, Director of Intellectual Property & Commercialization (OIPC)
rkordal@latech.edu

SUBJECT: HUMAN USE COMMITTEE REVIEW

DATE: April 2, 2019

In order to facilitate your project, an EXPEDITED REVIEW has been done for your proposed study entitled:

"Effects of Transformational Leadership on Safety Performance in the United States Commercial"

HUC 19-091

The proposed study's revised procedures were found to provide reasonable and adequate safeguards against possible risks involving human subjects. The information to be collected may be personal in nature or implication. Therefore, diligent care needs to be taken to protect the privacy of the participants and to assure that the data are kept confidential. Informed consent is a critical part of the research process. The subjects must be informed that their participation is voluntary. It is important that consent materials be presented in a language understandable to every participant. If you have participants in your study whose first language is not English, be sure that informed consent materials are adequately explained or translated. Since your reviewed project appears to do no damage to the participants, the Human Use Committee grants approval of the involvement of human subjects as outlined.

Projects should be renewed annually. ***This approval was finalized on April 2, 2019 and this project will need to receive a continuation review by the IRB if the project continues beyond April 2, 2020.*** **ANY CHANGES** to your protocol procedures, including minor changes, should be reported immediately to the IRB for approval before implementation. Projects involving NIH funds require annual education training to be documented. For more information regarding this, contact the Office of Sponsored Projects.

You are requested to maintain written records of your procedures, data collected, and subjects involved. These records will need to be available upon request during the conduct of the study and retained by the university for three years after the conclusion of the study. If changes occur in recruiting of subjects, informed consent process or in your research protocol, or if unanticipated problems should arise it is the Researchers responsibility to notify the Office of Sponsored Projects or IRB in writing. The project should be discontinued until modifications can be reviewed and approved.

Please be aware that you are responsible for reporting any adverse events or unanticipated problems.

APPENDIX B

CITI PROGRAM SOCIAL AND BEHAVIORAL RESEARCH CERTIFICATION

CITI PROGRAM

Completion Date 23-Feb-2019
Expiration Date 22-Feb-2022
Record ID 30693554

This is to certify that:

John McMahon

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Social & Behavioral Research - Basic/Refresher
(Curriculum Group)
Social & Behavioral Research - Basic/Refresher
(Course Learner Group)
1 - Basic Course
(Stage)

Under requirements set by:

Louisiana Tech University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?we40d6e7d-34ee-4708-8b42-3407db722d8a-30693554

APPENDIX C

MLQ SAMPLER SET MANUAL, TEAM ANSWER SHEETS, AND SCORING KEY

Team Multifactor Leadership Questionnaire

Sampler Set

Manual, Team Answer Sheets, Scoring Key

by Bruce Avolio and Bernard Bass

Published by Mind Garden, Inc.

info@mindgarden.com
www.mindgarden.com

APPENDIX D

PERMISSION TO ADMINISTER COPYRIGHTED MLQ SURVEY INSTRUMENT

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Online Use of Mind Garden Instruments:
Online administration and scoring of the Multifactor Leadership Questionnaire is available from Mind Garden, (https://www.mindgarden.com/16-multifactor-leadership-questionnaire). Mind Garden provides services to add items and demographics to the Multifactor Leadership Questionnaire. Reports are available for the Multifactor Leadership Questionnaire.

If your research uses an online survey platform other than the Mind Garden Transform survey system, you will need to meet Mind Garden's requirements by following the procedure described at mindgarden.com/mind-garden-forms/58-remote-online-use-application.html.

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APPENDIX E

SUPPORTING TABLES AND FIGURES

Table E-1

Large Truck and Bus Fatal Crash Statistics, 1975-2018

Year	Fatal Crashes	Million Vehicle Miles	Trucks and Buses
1975	4,304	1,327,664	5,824,525
1976	4,754	1,402,380	6,053,524
1977	5,485	1,467,027	6,180,664
1978	6,131	1,544,704	6,365,161
1979	6,431	1,529,133	6,418,336
1980	5,709	1,527,295	6,319,442
1981	5,572	1,555,308	6,260,262
1982	4,935	1,595,010	6,149,615
1983	5,184	1,652,788	6,091,276
1984	5,444	1,720,269	5,984,746
1985	5,490	1,774,826	6,589,822
1986	5,383	1,834,872	6,314,733
1987	5,461	1,921,204	6,320,321
1988	5,528	2,025,962	6,752,553
1989	5,295	2,096,487	6,851,522
1990	5,065	2,144,362	6,822,863
1991	4,621	2,172,050	6,803,425
1992	4,320	2,247,151	6,689,937
1993	4,591	2,296,378	6,742,587
1994	4,902	2,357,588	7,258,308
1995	4,743	2,422,696	7,404,924
1996	5,081	2,485,848	7,707,396
1997	5,214	2,561,695	7,780,874
1998	5,244	2,631,522	8,447,810
1999	5,239	2,691,056	8,520,203
2000	5,320	2,746,925	8,768,774
2001	5,115	2,795,610	8,607,223
2002	4,861	2,855,508	8,687,997
2003	5,012	2,890,221	8,533,438
2004	5,181	2,964,788	8,966,638
2005	5,231	2,989,430	9,289,052
2006	5,071	3,014,371	9,640,966
2007	4,914	3,031,124	11,586,455
2008	4,340	2,976,528	11,716,583
2009	3,432	2,956,764	11,815,207
2010	3,745	2,967,266	11,616,105
2011	3,878	2,950,402	10,936,757
2012	4,078	2,969,433	11,423,889
2013	4,203	2,988,280	11,461,905
2014	3,985	3,025,656	11,777,983
2015	4,337	3,095,373	12,092,091
2016	4,796	3,174,408	12,474,722
2017	5,038	3,212,347	13,212,447
2018	5,096	3,240,327	14,226,062

Note. Adapted from "National Center for Statistics and Analysis. (2019, October). 2018 fatal motor vehicle crashes: Overview. (Traffic Safety Facts Research Note. Report No. DOT HS 812 826)". Washington, DC: National Highway Traffic Safety Administration.

Table E-2

Translated Organizational Climate Questionnaire Components (English to Turkish)

Survey number	Description	Number of items	Scale
Questionnaire 1	Organizational Climate	20	6-point Likert scale
Questionnaire 2	Organizational Culture Index	24	4-point Likert scale
Questionnaire 3	Denison's Organizational Culture Questionnaire	36	6-point Likert scale

Note: Yahyagil, M. Y. (2006). The fit between the concepts of organizational culture and climate. *Journal of Organizational Culture, Communications and Conflict*, pp. 90

Table E-3

Sample Population Participation Percentage

Business Sector	Label	No. Sampled	Responses	Percentage
Finance	Org. A	73	41	56%
Textile	Org. B	50	50	100%
Manufacturing	Org. C	43	30	70%
Pharmaceutical	Org. D	81	54	67%

Table E-4

Comparison of MLQ Leadership Styles to BUD Scores

Leadership Style	*R*	R^2	p	Significance	Correlation
Transformational	0	0	1	$p > .05$	None
Transactional	0	0	0	$p > .05$	None
Passive/Avoidant	0	0	.82	$p > .05$	None

Table E-5

Comparison of MLQ Leadership Styles to Safety Climate Scores

Leadership Style	*R*	R^2	p	Significance	Correlation
Transformational	-.53	.28	< .001	p > .05	Negative
Transactional	.04	.002	.77	p > .05	None
Passive/Avoidant	.58	.34	< .001	p > .05	Positive

Table E-6

Comparison of MLQ Leadership Attributes to Safety Climate Scores

Leadership Attributes	*R*	R^2	p	Correlation
Transformational Attributes	-.53	.28	< .001	Negative
Rewards Achievement	-.40	.16	0.001	Negative
Transformational Behaviors	-.43	.19	0	Negative
Acts with Integrity	-.48	.23	0	Negative
Builds Trust	-.46	.21	0	Negative
Coach/Develop People	-.51	.26	0	Negative
Encourages Others	-.38	.15	.002	Negative
Encourages Innovation	-.61	.37	< .001	Negative
Avoids Involvement	.46	.22	0	Positive
Monitors Mistakes	. 39	.15	.002	Positive
Fights Fire with Fire	.64	.41	< .001	Positive
Passive/Avoidant	. 58	.34	< .001	Positive
Transactional	.04	.002	.77	None

Table E-7

Comparison of MLQ Leadership Outcomes to Safety Climate Scores

Leadership Outcomes	*R*	R^2	*p*	Correlation
Is Productive	.54	.29	< .001	Negative
Generates Extra Effort	.62	.39	< .001	Negative
Generates Satisfaction	.57	.32	< .001	Negative

Table E-8

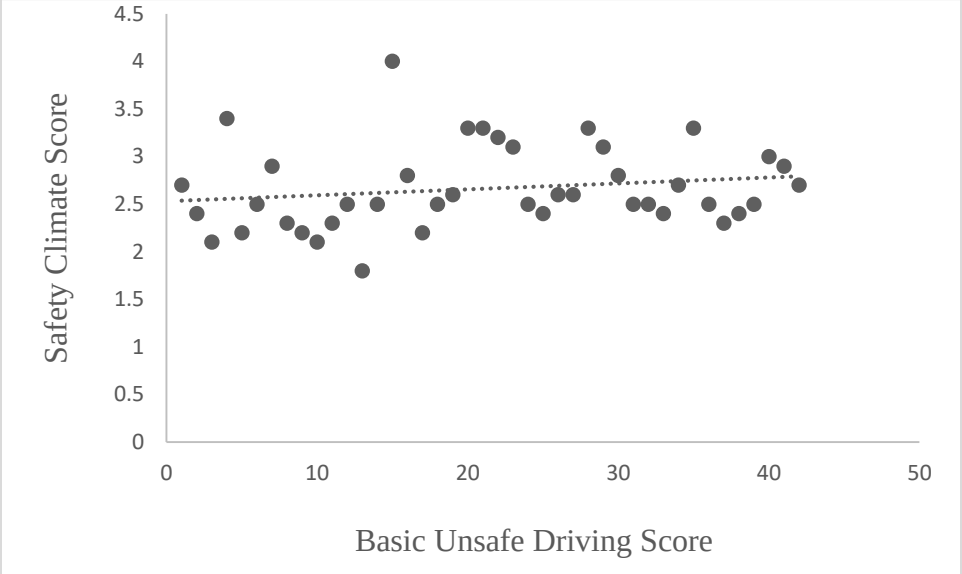
t-Test Scores of Safety Climate Levels to Average Basic Unsafe Driving (BUD) Values

Safety Climate Levels	ranges	Avg. BUD values	Sample Size (n)
Low	< 2.7	1.40	28
Fairly Low	2.7 – 2.99	1.75	18
Fairly Good	3.0 – 3.29	0.75	10
Good	≥ 3.3	1.09	6
Comparison	*t*-Test Score	*p*-value	Significant ($p < .05$)
Low to Good	-0.09	$p = .40$	No
Fairly Low to Fairly Good	2.43	$p = .02$	Yes
Low to Fairly Low	-1.07	$p = .29$	No
Fairly Good to Good	-1.66	$p = .12$	No

Note: Fairly Low to Fairly Good was the only comparison with significant two-tailed t-Tests.
The sample sizes did not meet the general condition of $n \geq 30$ since statistical power is positively correlated with the sample size.

Figure E-1

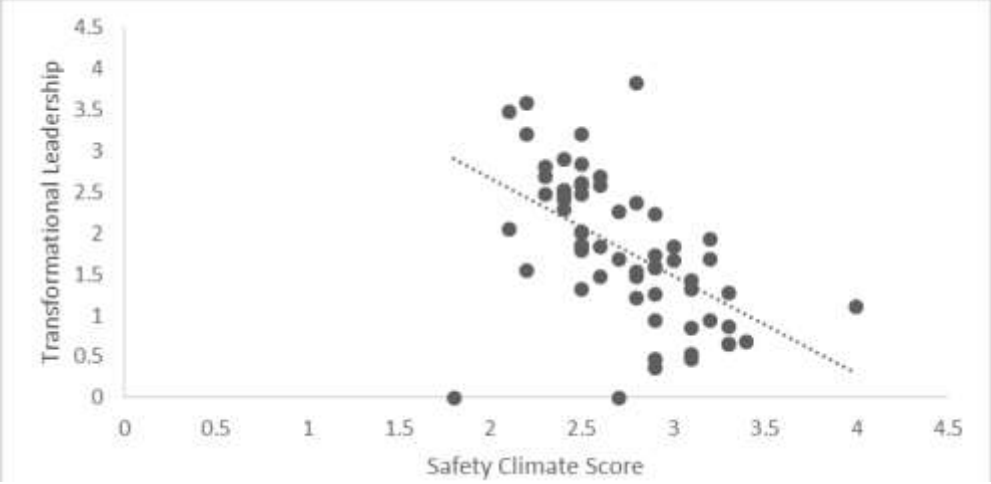
Scatterplot of Safety Climate Scores to Basic Unsafe Driving Scores



Note: The p-value is .6. The result is not significant at p < .05.
$R^{2 =}$ .01 No Correlation.

Figure E-2

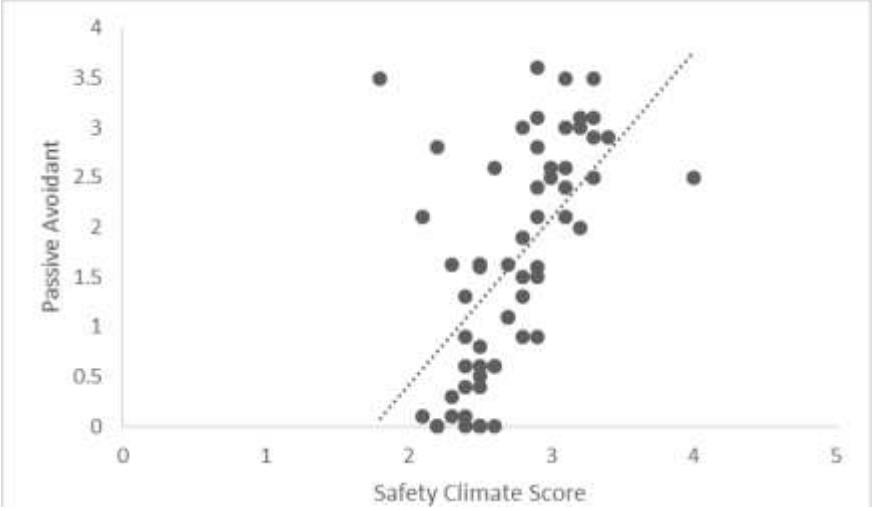
Transformational Leadership Correlated to Safety Climate Scores



Note: The p-value is < .00001. The result is significant at $p < .05$
$R^2 = .28$ Negative Correlation.

Figure E-3

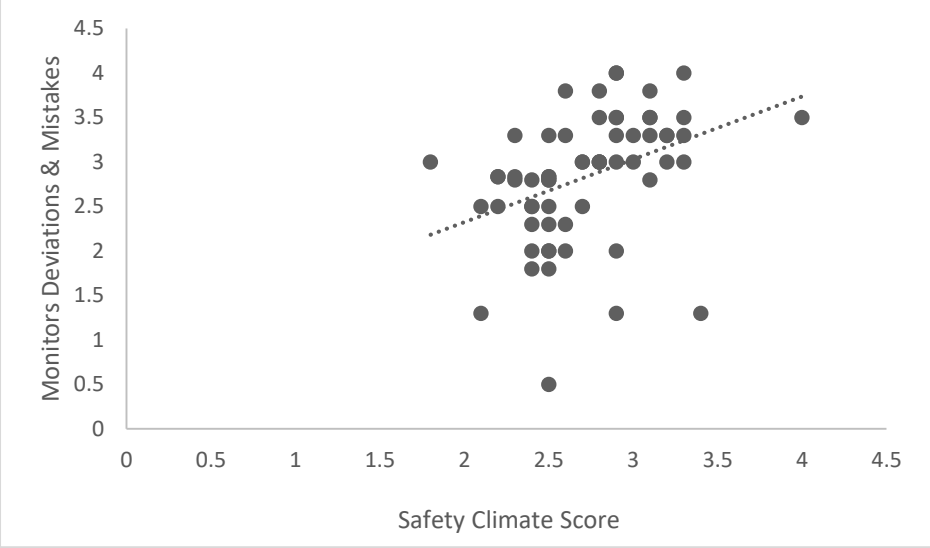
Passive Avoidant Leadership Correlated to Safety Climate Scores



Note: The p-value is < .00001. The result is significant at $p < .05$.
$R^{2 =}$ .34 Positive correlation.

Figure E-4

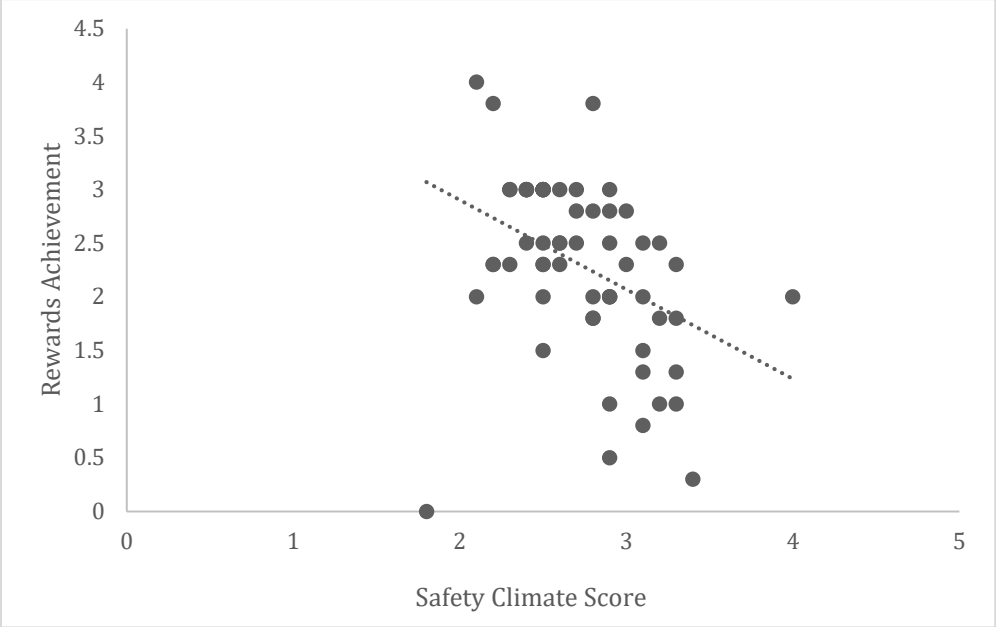
Monitors Deviations & Mistakes or Management By Exception-Active (MBEA) Correlated to Safety Climate Scores



Note: R(60) = .39, p < .001. The result is significant at p < .05.
R^2 = .15 Positive correlation.

Figure E-5

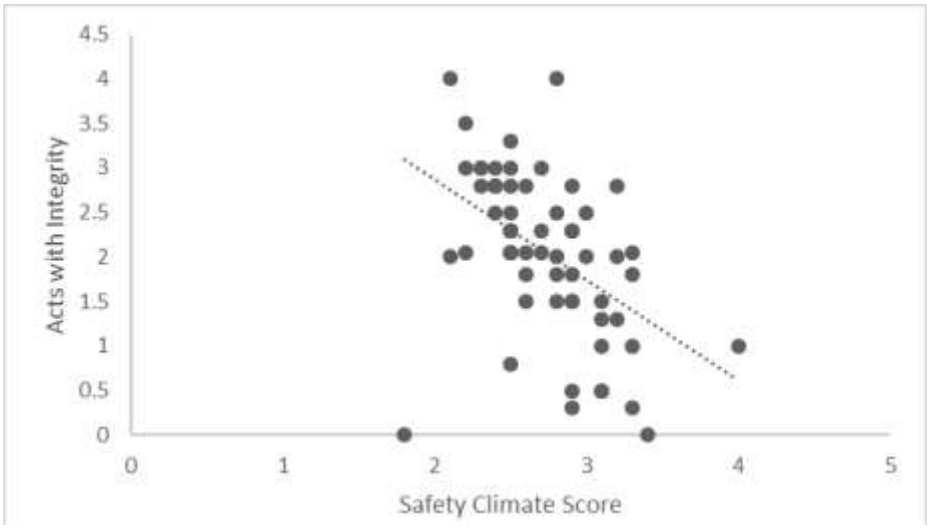
Rewards Achievement (Contingent Reward) Correlated to Safety Climate Scores



Note: The p-value is .001341. The result is significant at $p < .05$.
$R^2 = .16$ Negative correlation.

Figure E-6

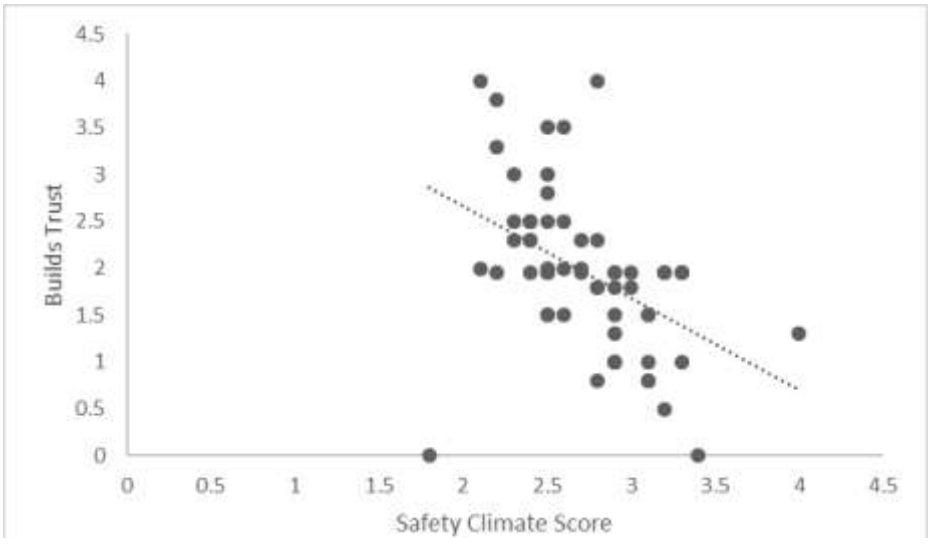
Leader Acts with Integrity Correlated to Safety Climate Scores



Note: $R(60) = -.48$, $p < .001$. The result is significant at $p < .05$
$R^2 = .23$ Negative correlation.

Figure E-7

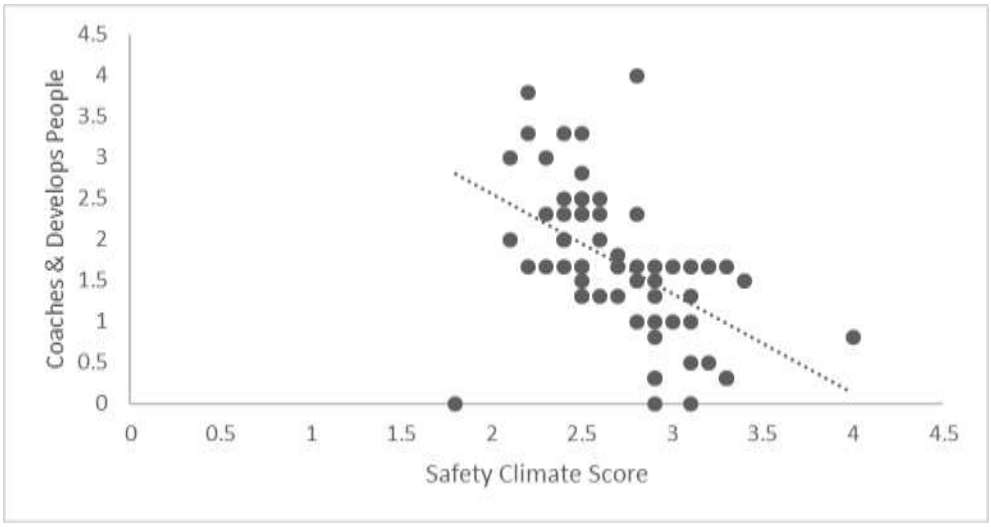
Leader Who Builds Trust Correlated to Safety Climate Scores



Note: $R(60) = -.46$, $p < .001$. The result is significant at $p < .05$.
$R^2 = .21$ Negative correlation.

Figure E-8

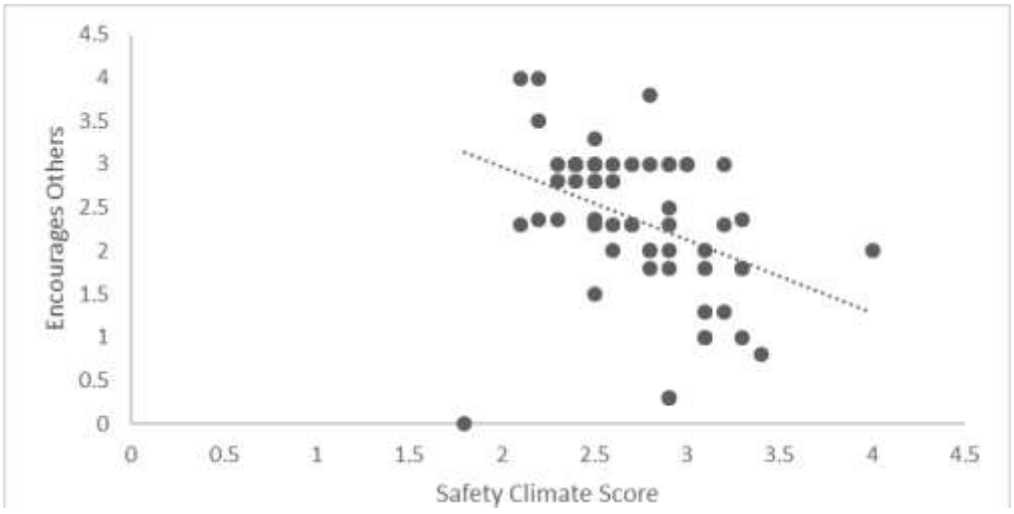
Leader Coaches and Develops People Correlated to Safety Climate Scores



Note: $R(60) = -.51$, $p < .001$. The result is significant at $p < .05$.
$R^2 = .27$ Negative correlation.

Figure E-9

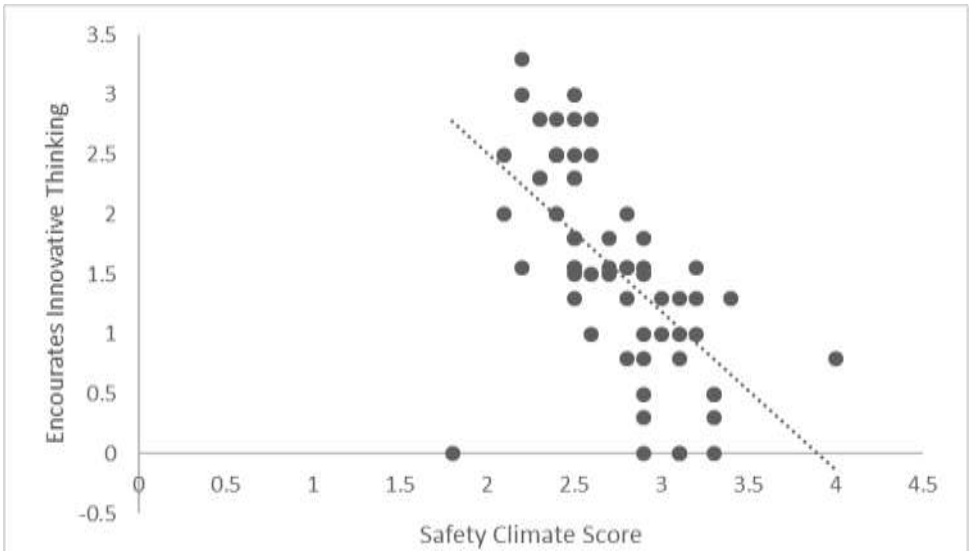
Leader Who Encourages Others Correlated to Safety Climate Scores



Note: $R(60) = -.38$, $p < .001$. The result is significant at $p < .05$
$R^2 = .15$ Negative correlation.

Figure E-10

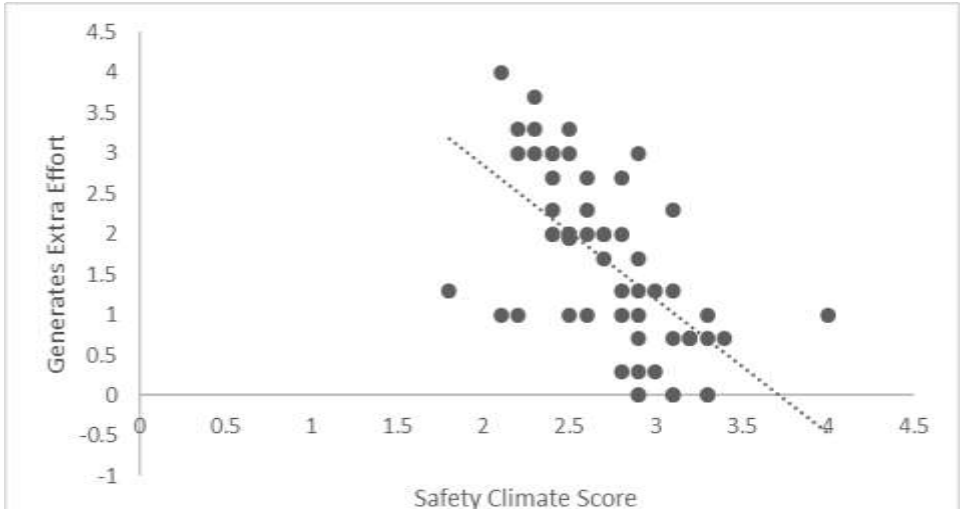
Leader Who Encourages Innovative Thinking Correlated to Safety Climate Scores



Note: R(60) = -.61, $p < .001$. The result is significant at $p < .05$.
R^2= .37 Negative correlation.

Figure E-11

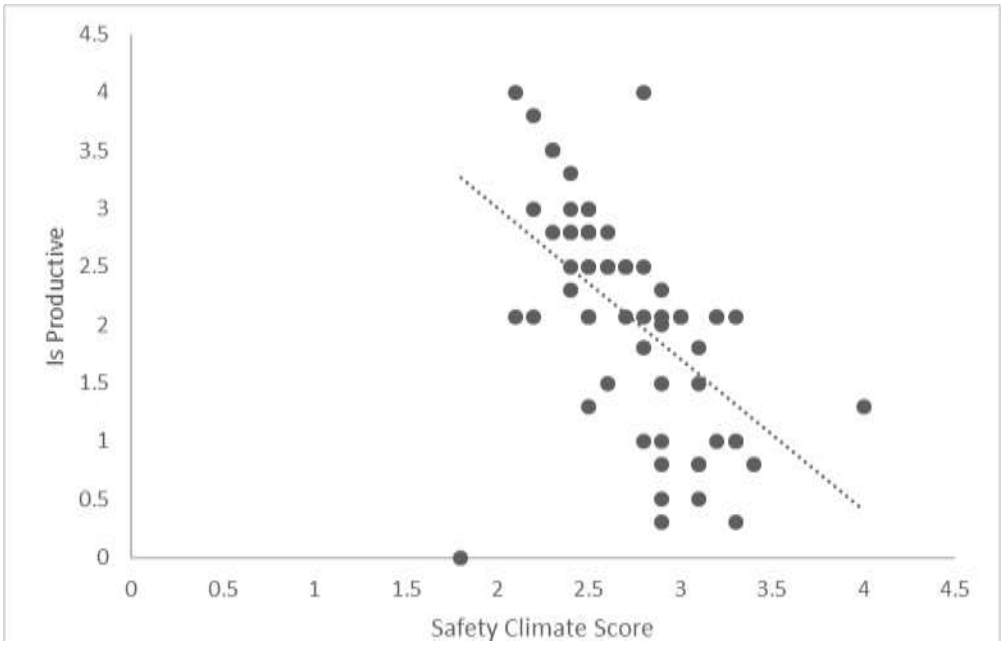
Leader Generates Extra Effort Correlated to Safety Climate Scores



Note: R(60) = -.62, $p < .001$. The result is significant at $p < .05$
R^2 = .39 Negative correlation

Figure E-12

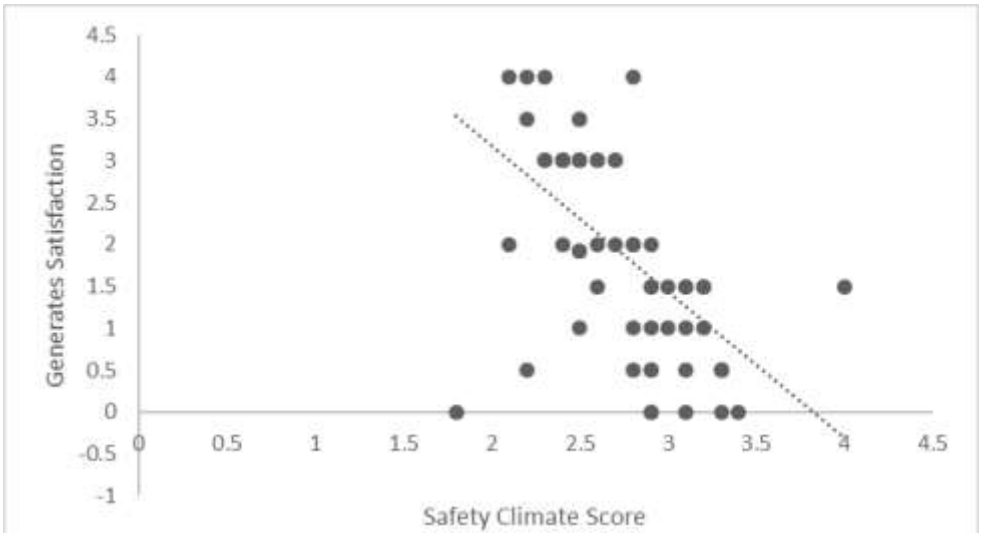
Leader Is Productive Correlated to Safety Climate Scores



Note: $R(60) = -.54$, $p < .001$. The result is significant at $p < .05$.
$R^2 = .29$ Negative correlation.

Figure E-13

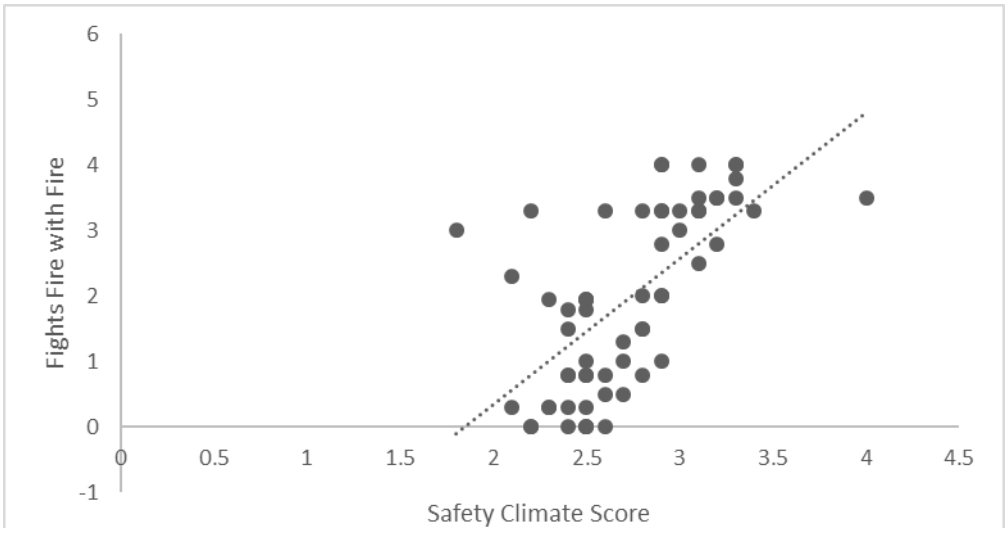
Leader Who Generates Satisfaction Correlated to Safety Climate Scale



Note: $R(60) = -.57$, $p < .001$. The result is significant at $p < .05$.
$R^2 = .32$ Negative Correlation

Figure E-14

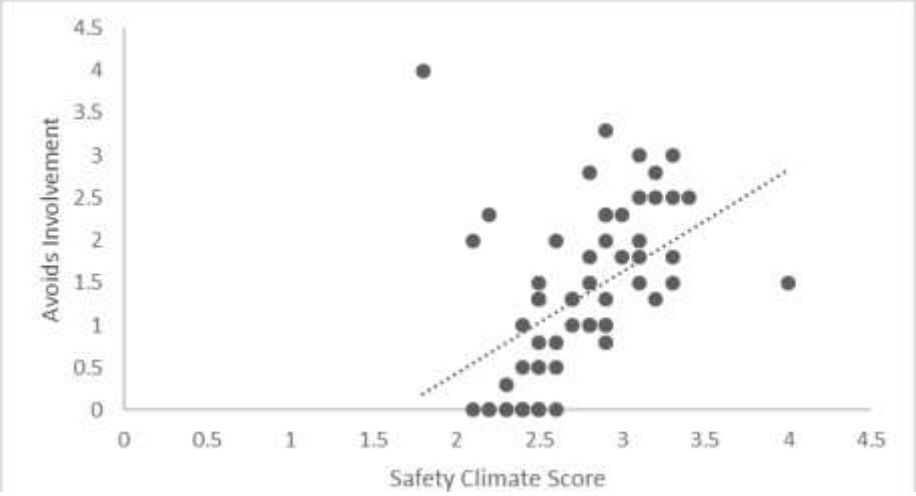
Leader Who Fights Fire with Fire (MBE-P) Correlated to Safety Climate Scores



Note: $R(60) = .64$, $p < .001$. The result is significant at $p < .05$
$R^2 = .41$ Positive correlation

Figure E-15

Leader Who Avoids Involvement Correlated to Safety Climate Scores



Note: $R(60) = .46$, $p < .001$. The result is significant at $p < .05$.
$R^2 = .22$ Positive correlation.