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Train Derailment Case Study and the Contributing Cultural Components

by

Brenn M. Schiess

A thesis

submitted in partial fulfillment

of the requirements for the degree of

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Homeland Security and Emergency Management

To the Graduate Faculty:

The members of the committee appointed to examine the thesis of Brenn Schiess find it satisfactory and recommend that it be accepted.

_____

Laurie Holien,

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Idaho State University

October 12, 2023

Brenn Schiess
Homeland Security & Emergency Management Program
1311 E. Central Drive
Meridian, ID 83642

Dear Brenn Schiess,

After speaking with you about your study titled "Train Derailment Case Study and the Contributing Cultural Components", I have determined that it does not fall under the definition of research as defined in Title Code of Federal Regulations, Part 46[45CFR 46].

Research is defined as:

> Federal research regulations and the Health Insurance Portability and Accountability Act of 1996 (HIPPA) define research as "a systematic investigation, including research development, testing, and evaluation, designed to develop or contribute to generalizable knowledge." The first of these two elements-the use of a systematic investigation-may be a characteristic of both research and non-research projects. Public health practice, quality assessment (QA) and quality improvement (QI} programs, resource utilization reviews, and outcome analyses are examples of non-research activities that frequently use statistical and other scientific methods to collect and analyze data in a manner that is identical to research studies... The primary goal of the activity must be to develop or contribute to generalizable knowledge to be called research.

A list of activities that are not research is: Quality Assessment, Quality Assurance, Case Report or Case Series, Needs Assessment, Medical Practice and Innovative Therapy, Medical Practice for the Benefit of Others, Public Health Practice, Outcome Analysis, Resource Utilization Review, and Education.

Your proposed study is not subject to review by the Human Subjects Committee.

Sincerely,

Ralph Baergen, PhD, MPH
Chair, Human Subjects Committee

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List of Abbreviations

AAR	Association of American Railroads
FDA	Food and Drug Administration
FRA	Federal Railroad Administration
NTSB	National Transportation Safety Board
PSR	Precision Scheduled Railroading
US DOT	United States Department of Transportation
UP	Union Pacific

Train Derailment Case Study and the Contributing Cultural Components

Thesis Abstract—Idaho State University (2023)

Train derailments are common events in the United States and the world. While several factors lead to train derailments, this research focuses on and explores the cultural components of the railroad industry that contribute to train derailments. This thesis examines literature, and previously conducted interviews to illuminate cultural components and their effects on derailments. To accomplish the objectives of this thesis, 22 previously conducted interviews, a case study, and available literature were analyzed that demonstrate different aspects and elements of cultural components of the railroad industry. This research shows that several in the railroad industry are overwhelmed and challenged by current railroad operations. This research is essential, specifically for safety, as derailments occur each year, and 0 train derailments are the only acceptable goal. Many organizations can benefit from this research as it looks at elements of the railroad industry that have not been fully examined.

Executive Summary

The railroad industry is important to local and federal government, supply chains, and consumers, and serves as a popular commuting option. Additionally, the railroads boost the economy and assist consumers and businesses in several ways. The benefits and dependence of the railroad are constant and are expected to increase by up to 30% in the coming years (Association of American Railroads, 2023). All the good things that the railroad industry does can be overshadowed by train derailments that can cause severe economic, safety, and other disruptions.

The purpose of this thesis is to examine different reasons and causes of train derailments, specifically the cultural components. These components are the expectations, values, norms, practices, and pressures of the railroad industry that may contribute to derailments. This research uses mixed methods and qualitative research to examine the cultural components to determine the relationship between the cultural components and train derailments. The results of this thesis highlight the opinions and feelings of those who work in the railroad industry on the role of the cultural components and how they relate to railroad operations. This research examines a case study and examines previously conducted interviews with railroad employees to determine factors of the cultural components.

The results of this thesis showcase that some in the railroad industry feel (but are not limited to this list):

- Overwhelmed

- Tired

- Overworked and understaffed

Scared of the implications of bringing up safety concerns

This research seeks to examine the railroad industry and answer the following research questions:

- Why is there a need to examine the cultural components of the railroad industry?

- What needs to be changed to decrease train derailments?

- Can researching the cultural components of the railroad industry show correlations and causes of train derailments?

The scope of this thesis is to determine what cultural components are contributing to train derailments and what may need to be addressed to decrease and eliminate train derailments. The researcher recommends the following recommendations:

- **Recommendation #1:** The (Federal Railroad Administration, or FRA) should start applying research methods, efforts, and time considering several aspects of the cultural components of the railroad industry.

- **Recommendation #2:** Regulatory bodies such as the FRA should conduct a cultural component assessment after each derailment using expectations, values, practices, and pressures to assess necessary changes that need to be made.

- **Recommendation #3:** The railroad industry needs to improve cultural components to keep up with the growing demand of the industry.

- **Recommendation #4:** An assessment of different elements of cultural components, and how to improve these areas should be conducted by each railroad.

- **Recommendation #5:** The FRA should take the abundance of funds they receive and use a portion to investigate cultural components of the railroad industry.

- **Recommendation #6:** Railroad companies should work closely with employees to determine what cultural components are leading to unsafe environments.

- **Recommendation #7:** Researchers should seek to build on this study's principles and to investigate other cultural components.

- **Recommendation #8:** Entities with higher budgets and time should further examine cultural components in the railroad industry and how making improvements can decrease derailments.

- **Recommendation #9:** Other industries and organizations should utilize looking at cultural components to improve practices.

This research is important as it provides a different approach to examine train derailments and implement changes in the railroad industry, and other industries through the lens of cultural components. This research can serve as a way to assess the internal components of an industry and how to improve operations.

Chapter One: Train Derailment Case Study and the Contributing Cultural Components

Trains and railways transfer close to 1.6 billion tons of supplies on nearly 140,000 miles of railways in the United States each year and are one of the most fuel-efficient transport methods in the United States (Association of American Railroads, 2023) The need for the rail system is global and international. This thesis does highlight some aspects of the railroad industry in other countries, but the main focus of this research and its data are from the United States. Railroad operations bolster the economy and expedite supply chains by transporting millions of varying supplies worldwide. They also serve as a popular commuting option where in 2021 large metro areas, close to 12% of all workers commuted by rail (The United States Census Bureau, 2021). US freight railroads provide 167,000 jobs, and close to $80 billion as an industry (FRA, 2020). When train operations are deficient, unsafe, or falter, trains can derail. Train derailments cause millions of dollars in damage (Lazo, 2023). Some additional results of derailments can include physical, economic, and social distress and adverse impacts on communities and those affected by railroad derailments and failures. This research examines derailments and operations of class I, class II, and class III railroads. These have been defined as the following:

Class I- Trains with annual revenue of $250 million or more(Trains.com, 2012).

Class II- Trains with annual revenue of less than $250 million but exceeds $20 million (Trains.com, 2012).

Class III- Trains with annual revenue of less than $20 million (Trains.com, 2012)

This research also examines commuter or passenger trains which transport people and freight trains which transport freight and other materials.

Train derailments have occurred since the creation of the railroad system in the 1800s (Library of Congress, n.d.). When train derailments occur, severe consequences can extend far beyond its contents unintentionally going off the rails. Train derailments cause serious threats to the public economically, physically, and in other negative ways. The February 3, 2020, Ohio train derailment illustrates what can go wrong and the immediate and lasting consequences of a train derailment (Hauser, 2023, 1). Derailments plague the railroad industry and produce crippling aftermath and chaos, which will be discussed and explained further in this research.

Significant investments of time and money are invested into the railroad industry attempting to alleviate and reduce railroad derailments, find necessary solutions, and make improvements. Despite these efforts, in 2022 there were over 1,000 train derailments in the United States (Hernandez, 2023). This is the equivalent of roughly three train derailments per day nationwide. The continual and costly train derailments necessitate researching these derailments and the railroad industry from a different scope and method to determine their frequency and severity. This thesis examines the following:

Problem Statement

Despite the millions of dollars and countless hours of effort to increase the safety of the railroad industry, train derailments continue to occur nationally and globally.

Research Questions

Because train derailments continue to occur, there is a need to examine some of the internal components of the railroad industry. Looking into these internal components can be examined by investigating the cultural surroundings of the railroad industry, and those who work in, or are closely associated with it. This research examines the first research question:

1) Why is there a need to examine the cultural components of the railroad industry?

Examining elements and components of the workplace and organizational culture have been known to include developing a high-performance culture, and guiding employee actions, and can help set the context and tone for how an enterprise achieves its objectives (Society for Human Research Management, 2023). It is also important to note that each organization has its own culture and can vary, and there is not a one-size-fits-all approach to examining cultural elements (Society for Human Research Management, 2023).

Change has been categorized as the process of replacing something current with something new or altered (Oxford Learner's Dictionaries, 2023). Change in any organization can be difficult and require several different elements and efforts. Because trail derailments are a frequent event, it is important to discover what needs to be changed to alter the current result of train derailments by answering the second research question:

2) What needs to be changed to decrease train derailments?

Discovering the changes that need to be made to decrease train derailments is a step in the right direction toward the only acceptable goal the railroad industry should have regarding train derailments, which is zero train derailments. The railroad industry should make eliminating train derailments their highest priority and while train derailments are decreasing each year, 2021, and 2022 each encountered over 1,000 train derailments as will be shown in this research.

Because derailments have occurred by the thousands in recent years, this demonstrates that current efforts are not progressive enough, nor effective. Looking at cultural components and elements of the railroad industry can reveal several aspects that could be intervention points for change and improvement. The current statistics that this research reveals show that a different approach is necessary to implement greater change. This different approach is accomplished by examining the third research question:

3) Can researching the cultural components of the railroad industry show correlations and causes of train derailments?

Having a better understanding of the correlations and causes of train derailments and cultural components can illuminate how to cause higher rates of change and become more efficient and effective. The cultural components that will be examined will be identified further in this research.

Hypothesis

Production is a high goal of the railroad, and the principle of doing more with fewer employees is echoed throughout this research. In the last six years, class 1 railroads have cut their entire workforce by roughly 29% or 45,000 employees (Semuels, 2023). These cuts are only part of the changing railroad industry that invests $23 billion a year for the last five years to increase operations, and infrastructure (Association of American Railroads, n.d.,1). Production has become such a large priority that the railroad industry has invested $242 billion of its own capital to make improvements to the industry (Association of American Railroads, n.d., 1). With the emphasis on production, safety standards such as eliminating train derailments have been successful in illuminating the researcher's hypothesis that production trumps all other priorities.

An important part of all industries is maintaining production and operating safely and efficiently. Excessive workloads, fewer employees, and several added pressures revealed in this research support the hypothesis. Eliminating train derailments will increase production and support the need for and dependence on the railroad industry. This research aims to highlight several areas that can positively influence the railroad industry.

There are several extenuating circumstances contributing to railroad derailments. Some contributing factors to train derailments are listed below and will be examined further throughout this thesis:

- System/equipment failures
- Railroad design and maintenance
- Human error
- Training and enforcement
- Management pressures
- Economic pressures
- Cultural components

There are several causes and reasons for train derailments. This thesis examines several causes but focuses on cultural components as discussed further in this research. An important part of railroad operations is railroad equipment's efficiency and effective use.

System/Equipment Failures

Trains are comprised of many systems, parts, and interdependent mechanisms that rely on conditions and functionality. These dependent and co-dependent materials impact the operation and effectiveness of a train's operations. System failures can vary and occur independently or simultaneously. Some examples of failed railroad equipment include damaged or broken rails, overheated equipment, failed designated train signals, and improper or incorrect system-operated railways, switches, or equipment. Additional equipment failures can include wheels, detectors, signals, heat sensors, and other essential items needed for railroad operations. There are several reasons for equipment failures, however, they can be catalysts and contributors to the most severe failure of the rail system: train derailments (FRA, n.d.). According to the FRA's accident type by causes, FRA systems reported from 2021-2022 train derailments caused by equipment failures resulted in 15% of all train derailments (FRA. n.d.). It is important to maintain equipment including tracks and other essential functions to railroad operations.

Railway Design and Maintenance

Railway design and proper maintenance includes design of and proper maintenance of several aspects including rails, curvature, and routes of travel. Speed limits and weight limits are also important aspects of railroad safety and effectiveness. Due to the heavy loads and repeated use of rail equipment systems, constant and efficient maintenance is required. Improper or nonexistent maintenance of rails is a known cause of derailments and other railway incidents (Brown, 2023). Factors such as design and maintenance are relevant; however, the scope of this thesis is examining the cultural components and results of those components that may or may not contribute to train derailments. According to the FRA's accident type by causes, FRA systems reported from 2021-2022 train derailments caused by track failures resulted in 29% of all train derailments (FRA, n.d.). The consistency, frequency, and severity of train derailments necessitate the need for understanding, intervention, and corrective action and an understanding of what cultural components may or may not contribute to train derailments.

Cultural Components

In every professional environment, there are cultural components that affect day-to-day operations, safety and procedural protocols, and the emphasis of priorities of that organization. This research looks at components such as the values, expectations, norms, practices, and pressures of the railroad industry. The rail system has several different components that can influence efficiency and operability. Many aspects of cultural components stem around people and their ability or lack of ability to make decisions. Cultural components are subsets of other components of an industry and can influence several different aspects and operations.

Human Error

      Operator/human error can have a severe impact on a train's operations. Human error can include improper decisions and errors made by employees. Human error includes decisions made by management, line workers, maintenance crews, engineers, and conductors. Human error can include inadequate equipment maintenance, operator decisions on speed, and improper use of railroad equipment such as switches, couplings, or other essential functions. Human errors are responsible for over 1/3 of train accidents in the entire United States (FRA, 2019, 1). Any human error with the rail system can contribute to a failure, accident, or train derailment. Human error also includes improper or errors in interpreting railroad signals. According to the FRA's accident type by causes, FRA systems reported from 2021-2022 train derailments caused by human failures resulted in over 46% of all train derailments (FRA, n.d.).

      Ineffective or insufficient training and enforcement have been known to contribute to human errors in other industries. For example, up to 24% of human errors were attributed to poor training and enforcement in the Food and Drug Administration or FDA (Wright, 2020). Insufficient training and enforcement in the railroad industry could vary from the FDA, however, it is important to show the significance and correlation to training and enforcement in an industry environment.

Training and Enforcement

      The qualifications, standards, and training rail employees receive are contingent on the enforcement and teaching of their respective leadership. There are federal, state, and private instituted mandates and rules that rail employees should abide by. The enforcement of these principles is primarily the responsibility of the FRA, railroad companies, and management. The FRA holds the authority to delegate and enforce federal railroad safety and hazardous materials

regulations and standards (FRA, 2023, 1). Safely and correctly adhering to standards is also a shared responsibility of the line workers and employees as outlined in Title 49 Code of Federal Regulations (CFR) part 243 (Code of Federal Regulations, 2023).

The FRA oversees much of the training for railroad employees and staff as illustrated by Title 49 Code of Federal Regulations (CFR) part 243 (Code of Federal Regulations, 2023). According to the FRA, each rail entity that employs at least one safety-related employee is required to build and implement a safety-centered plan and submit it to the FRA for approval (FRA, 2019, 2) The safety plans include safety measures and suggested guidelines on practices. Railroad companies often can customize safety plans to fit their respective objectives.

The ability for owners to provide a plan also provides opportunities for check-the-box safety initiatives that can allow for more production and quick operations that may overshadow all other priorities. The railroad industry benefits from fast and immediate production, reduced staffing and time limits, and increased capabilities whenever possible. This is evident from several pressures of the railroad industry.

Management Pressures

The railroad industry has placed greater emphasis on regulated schedules with quicker timelines, protocols, and orders of operations otherwise known as Precision Scheduled Railroading or PSR (Union Pacific, 2019). PSR focuses on moving trains, with additional and often unscheduled rail cars, needing to be shipped and added on available trains (Union Pacific, 2019). Adding railcars to already existing railcars adds several factors to trains such as weight, and train length, both of which can affect railroad safety. Instituting aggressive and progressive pressures such as PSR can benefit the economy and railroad industry.

PSR and other management pressures also affect safety as some results of these programs cut costs and reduce employees. Cutting costs and employees means fewer people are working to ensure safety and operations are being performed correctly (Marsh, 2021, 1). These employee cuts can result in a loss of institutional knowledge, experience, and turnover. The constant pressure to continue operations, improve efficiency, and cut costs, places added pressure on management to act accordingly.

Additional time constraints and fewer employees are also hindering the ability and railway functions such as railroad safety inspections. Randy Cox, a 25-year railroad employee who works as a safety inspector has noticed a drastic decline in safety standards and performance with the implementation of PSRs. Cox highlights some of the negative impacts of PSR and other cost-cutting measures. He mentions things such as a decline in employees, which adds more responsibilities on remaining workers, added mileage and area of responsibility for inspectors, and the lack of notice or the time railroads give workers to perform proper inspections (Marsh, 2021, 1). Added pressures and aggressive measures showcase an emphasis on production over all other priorities.

According to some rail employees such as Cox, as the railroad industry expedites operations and bypasses primary and secondary safety standards, derailments and other safety issues are likely to continue. Many of the pressures of the railroad industries' cultural components revolve around economic gain as illustrated by economic pressures as will be further discussed in this research.

Economic Pressures

The rail industry's economic pressures drive production and continual operation. For the railroad industry, time is money, and stopping operations is not an option if they want to make an

economic profit. Because of economic pressure, certain tasks that may require significant time and resources, or add additional steps or processes can be difficult and cumbersome. Train derailments deplete funds, and resources, and in some cases result in halted operations. The AAR has highlighted the negative impacts the economy and the railroads face when railroad operations are stopped.

The AAR reports an estimated loss of close to $2 billion a day if freight 1 railroads stop production (Association of American Railroads, 2022). Effects and consequences of the loss of the railroad could include retail products, plant shutdowns, and lost jobs, which in turn would raise the prices for consumers, and place more of an emphasis on semis on roadways (Association of American Railroads, 2022). With the economic pressures and time constraints on railroads, the emphasis and focus on safety can be overlooked due to the pressure to operate.

According to the AAR, from 1980-2022 the railroad industry invested $780 billion on maintenance, and expenses for items such as locomotives, railroad cars, tracks, tunnels, and bridges, and increasing infrastructure and improving equipment (Association of American Railroads, n.d. 1). The billions of dollars from railroad companies, the US economy, and stakeholders aim to increase production and productivity. The rapid expansion and economically profitable railroad industry require significant research to assist with the many growing pains as illustrated by the continuance of derailments, incidents, and accidents each year. This fact and need makes researching train derailment through the lens of cultural components invaluable to the important necessary rail industry. The principle of triple bottom line focuses on three aspects that train derailments affect, people, the environment, and financial consequences (UW Extended Campus, 2022). Train derailments have adverse effects on people, the environment, and adverse

financial consequences also contribute to and drive the significance and importance of this research.

Significance of Research

There are many reasons why this research is significant including a need to increase safety, efficiency for the railroad, and to improve operations. The implications of train derailments can have several negative consequences for those who depend on the rail industry for economic, safety, and efficiency. The need for this research is exemplified by the repeated incidents and previous attempts to reduce and or eradicate railroad safety incidents such as derailments. The US and the global economy invest billions in railroads furthering the need to improve safe operations. Millions of people depend on the railroad industry and its effective operations.

Dependence

There is a dependence on the railroad industry nationally and globally for a wide variety of services and functions. Some of these include transportation, supplies, economic growth shown by the existing railroads, food and water, and other services. The national and global economies also heavily depend on safe and efficient railroad operations. Disruptions, derailments, and incidents slow down the economy and can cost the rail industry and the economy millions.

Safety

One of the major concerns and challenges of derailments is safety. When derailments occur, the safety of the railroad employees, the communities, and the people affected by the derailment is a high concern. Derailments can include spilling millions of pounds of hazardous

materials that can adversely affect the environment, the ecosystem, the impacted communities, and the safety of people.

Efficiency

Railroads are one of the nation's premier freight services. Efficient and safe railroad operations benefit not only the US economy but also free up highways and interstate travel that would be placed on freight semi-trucks. Railroads are extremely fuel-efficient and dependable (CSX, 2016). Dependence and reliance on the railroad industry for freight, commutes, and other services requires the need and ability for railroads to operate as timely and efficiently as possible. Researching the cultural components of the rail industry can benefit millions.

New and Unique Research Approach

Many attempts, millions of dollars, and countless hours have been spent on seeking solutions to the causes, and elements surrounding railroad safety. Despite these efforts, train derailments continue to occur, many of which have serious economic, physical, environmental, and life safety implications. The advantage of a graduate researcher looking into the circumstances contributing to train derailments is substantial and builds on previous research. Collecting and analyzing data and looking at train derailments from a unique approach can provide valuable insights into new solutions and components that contribute to train derailments.

Limitations of Research

Many factors can contribute to train derailments. The scope and limitations of this research focus on the cultural components that lead to train derailments. Other components and factors of train derailments are addressed in this research for the context and correlating reference; however, the primary focus and limits of this research are on the cultural components that contribute to train derailments.

Chapter Two: Literature Review

Much of the available literature agrees that train derailments are continual occurrences that garner national attention and have severe consequences (Groves, 2023). In the United States in 2022, there were over 1,000 train derailments (Hernandez, 2023). Train derailments can result in drastic consequences such as chemical spills, injuries and deaths, and cost millions of dollars in damages (Kearse, 2023). The literature also concurs that there is a reliance on the railroad to move goods and services and the US Transportation Department, specifically for railroads and that this need is expected to continue to increase by 30% over time (Association of American Railroads, 2023).

Three major concepts are echoed through the available literature that leads to train derailments: 1) human/operator error, 2) mechanical errors/failures, and 3) engineering controls and designs. These concepts in the literature reveal patterns of train derailment causes. Each of these concepts is intertwined with and directly influenced by cultural components. However, the available literature regarding cultural components is less expansive and under-evaluated as further explained in this research. An example of cultural components in the literature includes an emphasis on operations, particularly on safety culture (Zuschlag, 2016). An example of non-cultural components includes topics such as equipment failures (Liu, 2016). One of the most common and heavily researched aspects of railroad safety is human/operator errors. Some examples of cultural components in the literature include:

Human/ Operator Error

There is an ample amount of research and literature on human error in the railroad industry**.** In 2022, Human error was the number one leading cause of train derailments (Hernandez, 2023). Human error is the mistake or failure of a person, rather than a failure of a

machine or equipment (Merriam-Webster, 2023). In the railroad industry, factors such as poor training, a lack of knowledge, or negligence can all be considered human errors that lead to more than 1/3 of all railroad incidents that occur from human-related errors (FRA, 2019, 1). A 2019 study was conducted on human-factor railroad train derailments from 2000-2016, resulting in 551 casualties, and 9,214 derailed railroad cars (Zhang, 2019).

From 2016-2023 there has been a report of 3,240 operator or human-error-related derailments, totaling $418,329,037 in the United States and 195 casualties (FRA, n.d.). The FRA has identified the following as some specific human-related causes for train derailments (FRA, n.d.), however, the number of human-related causes is not limited to this list:

- Failure to comply with speeds
- Failed to couple
- Failing to comply with flag signals
- Coupling speed excessive
- Fail to release the handbrake
- Failure to comply with radio communication

- Failure to comply with hand signals
- Improper use of dynamic brake
- Employee asleep
- Hand signal failures
- Movement without authority
- Failure to comply with failed equipment

There are also individual errors such as using cell phones, being distracted, having drugs in one's system, or other individual factors that can result in incidents and derailments.

Human error has been studied and examined previously, particularly in the study of factors that affect human performance in the railroad industry in the United Kingdom in 2015. This study examined several components of human performance using empirical data from 1945-

2012. The author argues that regardless of new or evolving mechanical and technological advancements, derailments continue to occur due to human error and poor performance and discusses the need to improve those areas for sufficient and safe operations (Kyriakidis, 2015).

Human error is the number one cause of derailments and has been examined as a predictor in risk analysis by Jia Zhang in 2015. Zhang examined human factor correlations to railroad incidents for risk identification using methods such as analytic hierarchy processes (Zhang, 2015). In 2019, Zhipeng Zang analyzed human-factored train accidents in the US Zhang argued that before his research, despite statistics on human-related errors contributing to railroad accidents, there had been no prior research attempts at analyzing human-related and caused accidents (Zhang, 2019). Human error and operator error in the railroad industry are one of the primary means of derailments, while another leading cause of train derailments has to do with improper or equipment failures (Zhang, 2019).

Human error has been examined because of several factors in the railroad industry. Human error has been argued as a consequence, not just simply a cause of railroad incidents (Reinach, 2006 para 6) Reinach argues that human errors in an industrial environment are, "shaped and provoked by upstream workplace and organization factors," these factors can include several different aspects of training, environment, leadership, procedures, and operational requirements and duties that symbolically force the employee into a situation that provokes or invokes errors (Reinach, 2006). An additional factor that has been argued by Reinach to provoke errors is the railroad equipment (Reinach, 2006). The second leading cause of train derailments is mechanical and equipment failures. Previous research has not specifically examined how cultural components influence train derailments.

Mechanical/ Equipment Errors and Failures

From 2016 to 2023, there were 1,249 mechanical or electrical failures leading to train derailments in the United States totaling $309,118,106 in damages and 13 casualties (FRA, n.d.). By law, railroad companies are required to check their equipment and tracks for defects and potential failures (Association of American Railroads, n.d., 2). The FRA has identified the following as examples of mechanical or equipment failures that have led to train derailments (FRA, n.d.), however, equipment failures are not limited to this list:

- Air hose uncoupled or burst

- Rigging down or dragging

- Knuckle broken or defective

- Hydraulic hose uncoupled or burst

- Hand brake broken

- Side bearing clearance insufficient

- Obstructed brake pipe

- Computer-controlled brake communication

- Wheels

- Brake valve malfunction

- Center plate broken or defective

- Deficient doors

The defects and failures of trains and tracks and their undesired effects on derailments were examined in 2011 by Xiang Liu. Liu argued several recommendations such as a heightened risk of failures that come with upgrading and advancing railroad operations and machinery (Liu, 2011). Liu also argued that factors such as speed, weight limits, and other sophisticated and complex factors of the railroad infrastructure have added to the likelihood that equipment will fail (Liu, 2011).

Mechanical and equipment errors are affected by several different elements and factors. In 2022, Mohammadfam argued that human errors directly impact the accuracy and failures of equipment due to circumstances such as use, familiarity, and knowledge (Mohammadfam, 2022).

Railroad tracks and accompanying conditions leading to derailments have also been a topic that has been researched. In 2022, Jun Lai examined several components of railroad safety, particularly railroad joint failures near railroad switch panels (Lai, 2022). Lai argues that railroad joints can come loose over time due to loose or missing bolts which creates a misalignment causing train wheels and the railroad track causing jumps or jolts which can lead to a derailment (Lai, 2022).

Railroad track conditions in Japan, such as ballasted tracks and their contribution to railroad track irregularities were researched in 2018 by Masashi Miwa. Miwa makes the argument that while many innovative and cost-efficient options are utilized by the railroad industry, such as ballasted tracks, the lack of sufficient and regular maintenance can fail, leading to derailments (Miwa, 2018). Additional considerations and proponents of the railroad industry and equipment are engineering controls and designs.

Engineering Controls and Designs

Engineering controls and designs and other factors such as weather impacts can play a major role in safe and efficient operations. In 2022, preventative measures and the causes of a derailed passenger train in Guizhou China, were examined. Wang and his coauthors examined the role of geological and environmental impacts on train derailments, and how the design and location of tracks contribute to the likelihood and probability of train derailments (Wang, 2022). Wang argued that factors such as debris flows caused by landslides, consisting mostly of rocks

and coal can contribute to derailments (Wang, 2022). The design, locations, and controls of the railroad tracks, and railroad equipment and industry are pivotal to safe operations.

In 1978, the FRA conducted a study on technology, power system modeling, resistance modeling, brake system modeling, data collection, and model validation (Kim, 2010). In 2023, subway train safety and accident causes were examined by Yongliang Deng. Deng studied and examined China's subway rail systems noting that there are several associated risks with railroad operations and that analyzing railroad accident causes through a holistic, simultaneous approach is required for optimal safety (Deng, 2023). This study revealed that accidents and derailments can be minimized by using engineering controls such as betweenness, using vertex betweenness, and other factors such as train length, weight, and distribution can all prevent the risk of railroad accidents, such as derailments (Deng, 2023).

Track design, train configurations, and railroad operations have been examined and researched by Olga Makova in 2013. Makova argues that using engineering controls, designs, and other measurable factors as inputs for mathematical equations can be effective tools for predicting dynamic coefficients such as train vibrations, motion activities, and the interactions between the train, and the tracks as a model to predict factors such as stability and safety (Markova, 2015).

Research attempts and efforts have been proven to show errors in equipment, human mistakes and failures, and insufficient designs and controls. However, there is little research that discusses and investigates the cultural components of the railroad industry that can lead to train derailments.

Cultural Components

Workplace or organizational culture has been referred to as the methods or ways things get done and is team members' agreeance and acceptance of shared values (Rebello, 2021). Many factors can influence the railroad's organizational culture. Rail is a highly efficient subsector in the transportation sector, and the economic benefits of the transportation system, and the railroad industry's operations will continue to increase as previously mentioned in this thesis. This increase in demand and production necessitates the need to investigate the circumstances that are contributing to train derailments. These circumstances can be viewed through the frame and study of the cultural components that contribute to train derailments. Components have been defined as parts of something or a system (Cambridge University Press, 2023, 1).

Previous researchers have covered aspects of the safety culture of the railroad industry (Ranney and Nelson, 2007). However, there is limited literature that examines the cultural elements of railroad safety and train derailments, indicating a gap in the currently available literature. The University of Minnesota has characterized the major elements of culture as language, norms, symbols, and values (The University of Minnesota, 2016). Thus, the cultural components regarding this research are the values, norms, expectations, practices, pressures, and other components of the culture of the railroad industry, and how they contribute to train derailments.

In 1994 G. Hofstede wrote that culture "is the collective programming of the mind which distinguishes the members of one group or category of people from another" (Hofstede, 1994, as cited in Spencer-Oatey, 2012 pg. 2). Cultural components of any industry can dictate the activities, agendas, and focus of that industry and the results that come from adhering to a

group's ideals or culture. The most successful organizations have cultural-based ideologies that are widely accepted and supported (Society for Human Resource Management, 2023).

Expectations

In 2022, the Union Pacific Corporation Board of Directors approved several revisions to their "The How | Matters Statement of Policy on Ethics and Business Conduct" pamphlet. The pamphlet outlines several expectations and obligations that Union Pacific demands of its employees. (Union Pacific, n.d.). These expectations include but are not limited to ethics, operations, and practices. The role of the expectations of an organization's leadership having a direct correlation to results was referenced in 2007 by Simon Tagger. Tagger notes that low leadership expectations resulted in low results and that higher expectations often yield raised results in activities such as collaboration, and problem-solving (Tagger, 2007).

Employer expectations and the correlation between safety outcomes were examined in 2017 by Jane Mullen. Mullen highlights that high employer safety expectations and obligations are associated with high safety results (Mulle, 2017). Mullen asserts that a company's effective leadership can make an impact on the culture and results of an industry (Mullen, 2017). Mullen argues that using social exchange theory can be a vital tool in assisting an industry's outcomes (Mullen, 2017). In 2015, Karen Cook references Blau's (1994) and Emerson's (1996) combined definition of social exchange theory as exchanged-based rewards, mechanisms, and values. An example of a potential for exchanged-based rewards and values is the safety culture of an industry. Railroad expectations are important to examine for clarity and reference.

Rail Safety (Expectations)

There is significant literature that describes the safety expectations of the rail system. The importance of safety culture for the railroad has been referenced by the FRA. The FRA

highlights that an organization's safety culture can have direct impacts on safety outcomes and that a strong safety culture can yield less frequent and severe accidents (Department of Transportation, 2017). The FRA has identified safety culture as a set of shared values, actions, and behaviors that show a commitment to safety individually and collectively by everyone at all levels of the organization (Department of Transportation, 2017).

Union Pacific states that they have a total safety culture as outlined by their Total Safety Cultural four primary objectives or aims. These four objectives are: safety is upheld by all employees, individuals should feel responsible for the safety of themselves and their coworkers, individuals should be willing and able to go beyond the call of duty for safety, and individuals should demonstrate active caring and safety measures for others (Union Pacific, n.d.).

AMTRAK has committed to being the United States' safest passenger railroad, despite acknowledging the need to improve its safety culture (AMTRAK, 2018). AMTRAK has alleged to be committed to empowering each of its employees to stop operations if unsafe conditions exist, exceed regulations, be proactive in identifying risks based on data, and become an organization that can learn and commit to safety self-reporting (AMTRAK, 2018). Ian Shaw, President of Norfolk Southern wrote in April of 2023, that at Norfolk Southern "everything starts with safety" (Norfolk Southern, 2023). Norfolk Southern, like AMTRAK, acknowledges the need to enhance (our) safety culture (Norfolk Southern, 2023). Furthermore, Shaw acknowledges that enhancing (our) safety culture requires a stronger emphasis on the development of leaders and line workers (Norfolk Southern, 2023).

In 2018, Tor-Olav Naevestad studied the effects, required interventions, and factors of safety culture for transportation systems. Naevestad shared that organizational safety culture refers to the safety aspects including behavioral regularities such as language, customs,

traditions, rituals, group norms, values, embedded skills, habits, mental models, and shared meanings (Naevestad, 2018). Naevestad (2018) also argues that safety culture is shared ways of thinking or acting that are created in joint negotiation of social settings by people.

In 1995, James McElroy conducted a study on Railroad Employee Commitment and Work-Related Attitudes and Perceptions. McElroy (1995) noted the difficult financial and safety issues of the railroad industry during the 1970s. He argued that Employee commitment, attitudes, morale, and dedication are all elements that contribute to productivity and service quality (McElroy, 1995). McElroy also indicated positive associations between organizational commitment to positive results, and negative associations contribute to stress and poor results (McElroy,1995). An additional consideration of an industry's cultural components that affect safety and operations is affected by what employees and companies value (Mylett, 2010).

Values

Values are paramount to how businesses and corporations conduct business. In 2013, Joel Gehman of the University of Canada, and Linda Trevino and Raghu Garud of Pennsylvania State University conducted a study entitled *Values Work: A Process Study of The Emergence and Performance of Organizational Values Practices*. The authors highlight that organizations typically reflect the values of their respective members, their executives, and leaders (Gehman, Trevino, Garud, 2013). The emphasis on an organization's values is only as effective as it is practiced by an organization's employees (Kaila, 2023).

One important way to get employees to buy into values is positive relationships between leaders and employees. Higher volumes of employee engagement and buy-in are the result of a two-way relationship between employees and employers, and are the responsibility of both

parties (Markos, 2010). This type of employee engagement and buy-in is evident in the willingness to accept the vision and goals of an organization (Markos, 2010).

In 1995, McElroy stated that "one key to the continued economic recovery of railroads is improved employee relations. The significance of reducing the traditionally adversarial relationship between rail management and employees cannot be overstated" (McElroy, 1995, para 4). Union Pacific (UP) has identified their values as "passion for performance," and that passion, determination, and expertise drive our safety, customer experience, and financial results (Union Pacific., n.d., para 5). UP also highlighted high ethical standards, working as a team, and doing the right thing through a series of ethical terms such as honesty, integrity, accountability, and compliance as values of the company (Union Pacific, n.d.).

In 2020, AMTRAK identified, doing the right thing, working/excelling together, and putting the customer first as their core values (AMTRAK, 2020). To accomplish these values, AMTRAK lists actions such as focusing on knowledge, and the abilities and skills necessary to be successful (AMTRAK, 2020). The values of an industry can guide the norms of an environment.

Norms

The term norm has been defined as a typical behavior or situation (Cambridge University Press, 2023, 2). Railroad norms can include several factors that encompass railroad operations, language, cognitive and social ideologies, and other repetitive actions and duties. Scott Baker of Forbes has referred to workplace or team norms as how members converse, interact, share, and coordinate in their respective roles (Baker, 2019). Baker (2019) asserts that norms are influenced by leadership, the organization's culture, and the employees in the organization, and are shaped

over time. Baker also asserts that stresses, successes, and new team members or leaders can influence norms.

The role and ability of leadership's influence on a team or group's norms was researched in 2007 by Simon Tagger. Tagger (2007) asserts that team norms can influence behavior, social contacts, and performance. Norms are influenced by the beliefs and subsequent actions and processes of members (Feldman, 1984). Norms can also influence other components and facets of a work environment such as safety culture (Tear, 2022). Examining norms through the lens of social behavior has been argued to illuminate connections between a group's culture and individual and or team behaviors (Tear, 2022). Norms can influence many aspects of an industry, including its practices.

Practices

Practices have been referred to as something common or usually done, often from habit tradition, or customary practices (Cambridge University, 2023). Practices can be simple physical or mental actions, or include social practices and contexts. Practices have been viewed as the tangibles that make up organizational cultures such as the procedures, values, and other practices that are shaped by organizational goals and policies (Rebello, 2021).

An organization's practices and procedures have been estimated to contribute to an organization's climate, which is the shared or universal viewpoints and perceptions of the members in an organization (Wallace, 2006). Individual practices of employees are shaped by the environment, opportunities, and norms of a work environment (Billett, 2004). Practices and activities of the transportation sector are focused on the movement of products and people (Hayes, 2021). The Department of Transportation is a co-sector of the transportation sector (Cybersecurity & Infrastructure Security Agency, n.d.).

Some of the Department of Transportation's main goals include safety, security, mobility, and enabling and assisting transportation systems subsectors with the ability to add to the US. economy (US DOT, 2022). AMTRAK has identified several responsibilities, operations, and practices they require their workforce to adhere to. AMTRAK states that, following safety rules, providing service, conducting maintenance, and checks of trains, monitoring signals, conditions, tracks, communicating, and other factors that could potentially deviate a train's operations as practices of their employees (AMTRAK, 2018). One of the factors of the railroad industry that motivates, and guides practices is the several different pressures of the railroad industry.

Pressures

There are several pressures and motivators that affect the railroad industry and can contribute to operations and safety, including staff shortages, slowed or behind-curve rail technologies, difficulties hiring, and alternative options such as trucking (Semuels, 2022). An emphasis and pressure to increase production and lower industry costs has been known to be associated with safety and health risks for railroad employees, and the communities they operate in (Silver, 2022). Silver also asserts that understaffed and overworked employees under production pressure can lead to shortcuts and mistakes (Silver, 2022). Shortcuts and mistakes can result in accidents and derailments (Earle, 2023).

Organizational pressures have been known to increase workplace injuries (Caskey, 2017). Managerial pressures and subsequent shortcuts on safety measures, equipment maintenance, and training can all contribute to insufficient safety standards that can lead to accidents and injuries (Caskey, 2017). The correlation between economic pressure and crashes in the trucking industry has been examined by Michael Belzer (2023), he notes that while other factors cause crashes, the

economic pressures affecting drivers are catalysts to crashes. Additional pressures on the railroad industry have occurred from staff cuts and expanded responsibilities.

Overworked and Understaffed

A series of interviews with current or former railroad employees showcases some of the challenges associated with being overworked and safety concerns. Many in the railroad industry have expressed concerns about being short-staffed and overworked (Sainato, 2022). In an interview Union Pacific engineer Ross Grooters explained that "the job is just really becoming fewer people doing more work faster, we've seen in this country all workers getting more and more squeezed," (Grooters, 2022, as cited in Sainato, 2022 para 6). Grooters claims that factors such as labor cuts, no paid days off, and enhanced scheduling to reduce the number of workers have all contributed to a difficult environment to work leading to several issues (Sainato, 2022). Ron Kaminkow an AMTRAK engineer expressed concern that being on call 24/7 has made work-life balance difficult and adds to fatigue, sickness, and job safety leading to low morale industry-wide (Sainato, 2022).

Pressures such as precision scheduled railroading, the need to make staffing cuts, and perform more efficiently with fewer employees have also been addressed (Chang, 2023). Aaron Gordon highlighted that since 2016, the railroad workforce has been cut by 30% (Chang, 2023). Fewer employees have also added to the amount of work required by those working. An example of this would be that Norfolk Southern Employees are expected to inspect up to 100 ft trains in less than 90 seconds (Chang, 2023).

The US Government Accountability Office (GAO) reports the objective of PSR is to increase efficiency and reduce costs (US Government Accountability Office, n.d.). The GAO reports that PSRs reduce staff, produce longer train lengths, and reduce assisting equipment such

as additional locomotives (GAO, n.d.). Despite railroad industry claims that PSR has helped efficiency and has not added to safety concerns, there have been several accounts of those who work for the railroad industry who claim PSR and other railroad industry pressures have contributed to added responsibilities with decreased time and resources (Chang, 2023).

Sarah Jaffe spoke with Ross Grooters and he indicated that there is not a single blame or cause for major rail incidents, however, a series of failures led to these major accidents (Jaffe, 2023). One of those failures is PSR and how several factors lead to train derailments and accidents. Jaffe (2023) argues that cutbacks and increased workloads are a large contributor to railroad safety. The associated pressures imposed by production, time constraints, and PSR require special attention and research that can illuminate themes and patterns in the literature.

Themes in the Literature

There is a correlation between railroad employee attitudes and accidents. Several key ideas demonstrated the relationship between the workplace environment, cultural settings, and their correlations to accidents. One of those workplace environmental factors is a positive or negative environment on safety, as demonstrated by Palencia's argument that a positive work environment decreases the likelihood of injuries and accidents (Palencia, 2015). Railroad train derailments were examined from 2000-2016, resulting in 1,510 accidents, 551 casualties, and 9,214 derailed railroad cars (Zhang, 2019). The role of ontology, and how it relates to a domain or shared environments has been explored regarding railroad safety and accidents. In 2020, the idea that personnel, management, and equipment are interconnected and are causes of train incidents (Cao, 2020). The following themes were revealed through the literature.

Do The Right Thing

Many railroad companies claim or state the mantra of doing the right thing. Both AMTRAK and Union Pacific have adopted the mantra of, *Do the Right Thing* in their respective values sections (Union Pacific 2022), (AMTRAK, 2020). AMTRAK has identified doing the right thing as the following (AMTRAK, 2020):

- Citing Safely

- Spending Wisely

- Using Integrity

- Protecting the Environment

- Honoring and Embracing Diversity

Union Pacific has identified doing the right thing as a priority in ethics, business conduct, and adhering to laws, policies, and standards (Union Pacific, n.d.). To accomplish doing the right thing, UP has identified the following as ways to accomplish these standards (Union Pacific, n.d.):

- Honesty

- Integrity

- Fairness

- Respect

- Accountability

- Adhering to Laws and Policies

BNSF railway shares a similar sentiment in its values and vision. BNSF states that to live the vision of meeting customers' expectations and fulfilling potential, employees must embrace listening to customers, empowering team members, and continuously improving by committing to doing the right thing (BNSF, 2022).

Train Accident and Derailment Causes

Derailment causes and trends globally have shown a correlation between environmental, human errors, and equipment failures to contribute to railway incidents. Train accident causes in

Japan were examined by Masashi Miwa. Miwa asserts that the causes of derailments and accidents in Japan are ground-level crossing, human error, natural disasters, car or equipment troubles, and other causes (Miwa, 2006). Derailment trends in Canada showed that from 2001-2014 the most severe incidents resulted from railroad breaks, track geometry issues, and weather and environmental conditions (Leishman, 2017). These reoccurring patterns from the available literature strengthen the need for research on the surrounding components of derailment causes and the railroad industry.

Previous Research Approaches

Work environment and addressing employee needs and interests have been shown to contribute to workplace accidents. Greg Palencia wrote a Literature Review on the Psychological and Cultural Components Affecting Railroad Worker Culture. Palencia concurred that factors such as environmental elements such as a positive work environment, and that a negative environment can increase potential for accidents (Palencia 2015). Palencia used theories such as motivation for workers, and how those motivations affect safety in the railroad industry. He also addressed Maslow's Hierarchy of Needs addressing employment needs and how addressing or not addressing those needs affects safety. Palencia also addressed McClelland's Theory of Needs and three needs 1) Achievement, 2) Power, and 3) Affiliation.

The idea of accident causation theory and ontology has been researched and examined as a contributor to accidents (2012). Ahmad Maalel, Lassad Mejri, Habib Mabrouk, and Henda Ghezla explored the role of accident theory, and ontology, which draws from a correlation to factors such as hierarchy, conceptual and generic, and method ontology and their effects on train safety operations (Maalel, 2012). In 2018, Tor-Olav Naevestad referred to the previous research

on culture in organizations as falling under two different approaches, they are interpretive

approaches and functionalists (Naevestad, 2018).

Naevestad (2018) argues that functionalists interpret culture as a critical variable that

influences outcomes in a system, he also argues that interpretive research and approaches view

culture as a metaphor for the system. Naevestad also refers to previous research methods on

organizational culture as a part of an organization, but instead, as an approach to that

organization. The research that has previously been conducted shows that there are some gaps in

the literature regarding the cultural components and train derailments.

Gaps in Current Knowledge

Most of the available data shows statistics, and measurable causes of train derailments, as

shown by the FRA's listed causes such as equipment, track, human factors, signals, and a

miscellaneous section (FRA, n.d.). There is limited literature regarding the components or

additional cultural components and elements of the railroad industry that are contributing to train

derailments. The abundance of statistics on human error and other causes of train derailments

and incidents illustrates an emphasis and study and research on errors made. Further analyses of

the factors and components of human errors in train derailments are exemplified by Chaojie's

research on railroad employee fatigue and distraction caused by lack of sleep, workload, being

distracted, and mobile phones (Chaojie, 2022).

Available literature can be categorized into statistical data, root causes such as operator or

equipment errors, or deficient equipment. An example of another gap and reason for limited

information would be imposed gaps such as the FRA's lack of requirement after accidents occur

to provide basic information such as train length after accidents or other information (Schwartz,

et al, 2023). This is an industry-imposed gap that prohibits the ability to track evidence and other components of train incidents (Schwartz et al, 2023)

Several aspects of the railroad industry have been examined through different research approaches. There are no current measures to examine the cultural components of the railroad industry that contribute to train derailments. This gap reinforces the importance of this research.

Importance of Research

Train derailments and railroad safety are important as illustrated by previous research, policies, and efforts taken to decrease derailments. Derailments are dangerous and can have serious consequences. This research can provide potential solutions and remedies by providing insights into cultural components and their consequences.

Chapter Three: Methodology

Background

Consistent and continual derailments occurring in the United States have been a focus of national media and communities nationwide for decades. Train derailment causes have been examined through varying scopes and objectives yielding several results. Despite millions of dollars in damages, training, changes in policies, and investigating root causes of these events, train derailments continue to occur in the United States and globally. The researcher examines the cultural components that contribute to train derailments through qualitative methods.

Research Design

A qualitative method design will be used for conducting research, including secondary research on the available literature, and interviews, and secondary research will be conducted on a case study as shown in Table 1.

Table 1

Research Design

	Phase 1	Phase 2
Type of Research	Secondary Research on Available Interviews, and Literature	Secondary Research on a Case Study
Methods	Analysis of patterns and personal experiences of those with cultural components in the rail industry.	The case study will be examined to reveal patterns, and discrepancies, from varying experiences

Research Setting

The literature that will be examined will be previous rail incidents, facts and databases, mandatory FRA incident reports, and conducting a case study. News articles and interviews will also be examined. Assessing previous interviews and available literature regarding train operations provides information and emphasis on what is examined regarding train derailments

and railroad safety. This research requires sensitivity to and adherence to several ethical and moral considerations.

Ethical Considerations

Ethical considerations for this research will guide and direct the efforts and analysis of the research. A set of principles or guidelines for this research are as follows:

- The researcher will analyze and report previously conducted interviews.

- The researcher will seek to remain sensitive to the interviewer, the interviewee, and those affected by railroad derailments.

It is important to note that this research uses secondary research on previously conducted interviews and available literature. The interview participants were part of several different interviews from different platforms and media outlets. The available literature in this thesis is from publicly accessible sources. Individual experiences do not represent all members in a subset. This research examines the experiences of some in the railroad industry to illustrate the cultural components of the railroad industry.

Chapter Four: Results

Culture has been defined as symbols, language, values, and beliefs (The University of Minnesota, 2016). Several aspects of culture affect workplace results. Work and organizational culture is composed of values, practices, and procedures that stem from an organization's policies (Rebello, 2021). Previous research on safety culture in transportation systems reveals that transportation systems, including the railroad industry, have several aspects or commonalities that affect and are influenced by safety culture. These commonalities include employment and dependence on people, transporting goods, and activities that come with potential negative consequences. Each is affected by time constraints, and each is conducted under difficult and changing conditions that may include efficiency over safety (Nested, 2018).

Several union officials and railroad employees support this claim of efficiency over safety and will be elaborated on further in this research. This research examines available literature, previous interviews, and a case study to address that despite the millions of dollars and countless hours of effort to increase the safety of the railroad industry, train derailments continue to occur nationally and globally, while the intent should be to eliminate them. This research investigates efficiency over safety and answers the research questions:

- Why is there a need to examine the cultural components of the railroad industry?

- What needs to be changed to decrease train derailments?

- Can researching the cultural components of the railroad industry show correlations and causes of train derailments?

The emphasis on production is evident through policies, procedures, and business models of the railroad industry.

The Need for and Benefit of Examining Cultural Components

Analyzing and using different approaches and methods can reveal factors in an industry or organization contributing to strengths, weaknesses, and outcomes. In 2022, Eric Austin assessed the impact and importance of culture-based interventions and analyses on traffic injuries and fatalities. Austin (2022) argues that there are limited safety evaluations on safety-imposed initiatives. Austin further substantiates his claim that barriers and challenges are associated with evaluating and implementing the results of evaluations (Austin, et al, 2022). One of those barriers and challenges to assessing culture-based literature and safety-related outcomes of the railroad is the lack of transparency and information available on cultural components as shown through interviews, and a lack of specific literature on cultural components.

One of the challenges of assessing cultural components is that most data, statistics, and information regarding railroad operations are measurable acute numbers and facts closely associated with quantitative research. These numbers and facts come from articles such as the FRA's derailment accident by causes (FRA, n.d.). Uncovering and finding ways and tools to measure cultural components is a key part of this research project. This information comes from previously conducted interviews with railroad personnel or those who have inside knowledge, experience with, or correlation to the railroad industry and specifically, train derailments.

To counter the challenge of accessing cultural component data, the researcher analyzed and compiled data from existing literature, interviews, and a case study. This research shows evidence of cultural components that have contributed to errors in decisions, a lack of consistency and capabilities, and undesired consequences such as train derailments. The benefit of examining cultural components in the railroad industry and its effect on train derailments is that this information, data analysis, and results can be used in other industries to duplicate and

implement the results of this research. An important part of this research is to show and document what needs to be changed to decrease train derailments from those with first-hand experience.

Analysis of Available Literature

According to Union Pacific (2023), the use of wayside detectors, safety technology, and railroad network data, combined with efficient railroad track inspections aid in the process of keeping people, communities, and railroad shipments safe. The following use of technology, when properly used, can decrease railroad derailments (Union Pacific, 2023):

- Hot Box Detectors**:** Measures bearing temperatures and can notify crews through radio transmissions if bearings are exceeding safe temperatures.

- Wheel Temperature Detectors: Measures temperatures of wheel plates, sticking brakes, and handbrakes that may be stuck on.

- Acoustic Bearing Detectors: The use of microphones intended to record and assess sounds of bearings on trains. These detectors can help identify defects and can be used to inform crews when to change hot bearings. Some specific technology includes:

- Wheel Impact Detectors: Measures strain and wear on train wheels notifying crews when a wheel is no longer acceptable.

- Wheel Profile Detectors: The use of lasers and optical scanning techniques to measure and assess the shapes of wheels which can alert to wear and overuse.

The importance of safety-enhancing technology is paramount and can prevent many undesirable railroad safety events from occurring. There are also things like positive train control

that can help enforce safety measures. Additional safety measures are regulations set forth by the FRA and railroad industry regulators to ensure safe transport and safe operations. According to the FRA's Office of Railroad Safety, (they) promote and regulate safety through a staff of 400 FRA safety inspectors who have specialized training and knowledge in the following six areas of expertise (FRA, 2023, 2):

- Railroad Grade Crossings
- Signal and Train Control

- Hazardous Materials
- Track

- Motive Power and Equipment
- Operating Practices

Additionally, the FRA's Title 49 outlines regulations for the railroad industry ranging from transportation to hazardous material shipments, and other significant elements of the railroad industry (Code of Federal Regulations, 2023). Despite some of these intended safety measures, the need to do more has been documented by the US Department of Transportation (US DOT). On February 21, 2023, the US DOT noted the importance of the railroad industry to the US economy and societies they serve and the need for the rail system to be safe (US DOT, 2023). The US DOT highlights that since 2010, the rail industry has made safety improvements and advancements, yet derailments continue to occur each year necessitating and highlighting the need for the railroad industry to do better (US DOT, 2023). The principle of no regrets decision methodology is the concept that can increase workplace change in dynamic environments through identifying no-regret decisions such as something that provides benefits under any future condition or scenario (Kelley, 2023). Because the railroad industry is so crucial to the US economy, the safety and well-being of many, and a growing industry, the need to identify areas and no-regret decisions to ensure the safety and stability of this industry.

A deep dive into the need for the railroad industry to improve and do better is best illustrated by analyzing available literature on train derailment types, causes, and frequencies. For simplicity and context, this research examines data from the years 2021-2022. The FRA lists the following as Train Accident caused by Railroad and Accident Type 2022 (FRA, n.d.).

This data shows that 2022 train derailments were costly ($225,688,014) re-occurring (1,202), and dangerous resulting in two deaths, and 15 injuries (FRA, n.d.). These statistics closely align and correlate to 2021 train derailments.

In the fiscal years 2021-2022, train derailments resulted in five deaths, 107 injuries, and $485,698,450 in damages. These numbers illustrate that current efforts to decrease train derailments, and railroad safety are not sufficient. This is alarming considering the time, effort, costs, advanced technologies, and years of experience dealing with train derailments and safety components of the rail system. These derailment facts emphasize the need for no-regrets decisions and policies that parallel the only acceptable goal: zero train derailments.

According to the Association of American Railroads, railroad companies invest on average $23 billion each year to modernize equipment, increase safety, and improve capabilities (Association of American Railroads, n.d. 1). With $23 billion coming from private investments, the Federal Government also heavily invests in the railroad industry each year. For example, in 2022, the President's Budget requests included $4.01 billion for the FRA including $2.70 billion for AMTRAK rants, $247.70 million for safety operations, and $58.83 million for research and development (US DOT, 2022). These funds are in addition to the $80 billion rail investment proposed in the American Jobs Plan (US DOT, 2022). The appropriation and distribution of these funds are shown as follows:

- Safety: With a main emphasis on stopping trespassing, prevention capital projects, and suicide prevention efforts (US DOT, 2022).

- Equity: An emphasis on equal job opportunities and community resources. This includes $50 million in rail line relocations and other mitigations for safety and quality of life for communities negatively affected by rail lines (US DOT, 2022).

- Climate and Resilience: An emphasis and improvement on advancing clean power investments in alternative fuels and improving aged equipment and technologies (US DOT, 2022).

- Economic Recovery and Core Assets: Investing in infrastructure, and other rail improvements (US DOT, 2022).

Distribution of these funds does not indicate seeking to improve or investigate cultural components of the industry to improve safety and decrease derailments. This suggests that billions of dollars are being spent on safety operations, research and development, and additional private investments to make improvements and increase safety and capabilities. Despite these funds and efforts, acceptable results are not occurring and require looking at derailment causes and contributors from a different angle. The need to look at components around derailment causes and how to make improvements is poignant as discussed in this research. Train derailments pose safety, economic, and other threats to societies, workers, and the goods and services provided by the railroad industry.

The need and benefit of researching derailment causes and railroad safety through assessing cultural components can be shown through a system thinking approach. System thinking is the process of investigating events, and data and identifying patterns, and behaviors

through underlying structures and circumstances (Goodman, 2018). Systems thinking is ideal for intervening in important problems, re-occurring events, and issues that have been unsuccessfully resolved (Goodman, 2018). Train derailments are extremely hazardous and threaten life safety. Efforts to eliminate these catastrophic events have not been sufficient.

Derailments are the culminating event that is the result of several unseen or seen components. Day-to-day activities, training, and cultural components can all lead to events and incidents. Systems, structures, policies, practices, pressures, and other negative consequences for workers, like steep regulations are some elements of the railroad industry that may or may not be visible to those not directly involved. Derailments are a visible and continual occurrence, determining root causes requires a deeper and more precise examination to fully comprehend subsequent causes and make proper solutions.

Reacting to train derailments could include many different practices. Some immediate reactions to train derailments could include negative consequences for workers, steeper regulations, and other quick changes. However, the immediate reaction does not necessarily result in long term change. Reacting to events with immediate reaction often lacks long-term solutions and requires further actions (Compass Education, 2021). Patterns of events allow for anticipation which are caused by systems, structures, and rules of an environment (Compass Education, 2021). Through a better understanding of systems and structures, redesigning these structures and systems becomes possible (Compass Education, 2021). Systems thinking also suggests that systems and structures are heavily influenced by values, beliefs, thoughts, and ideals also known as mental models. The ability to influence and change mental models allows for the transformation of systems and creates desired change (Compass Education, 2021).

**Researching Cultural Components**

The study and emphasis on cultural components have been used in several fields of study to gain different perspectives and ideologies regarding undesired effects and consequences. Researching cultural and social components shows additional perspectives of broader implications and causes in the field of medical anthropology. Medical anthropology focuses on perspectives, and social and cultural factors that can influence health, well-being, illnesses, and negative consequences and is used as a tool to prevent and treat sickness and social relationships and interactions (Arnault, 2018). Like gaining a better insight into health, cultural components in the workplace and their effect on results can show important correlations.

The railroad industry is made up of several different players, stakeholders, and components that are interrelated and interdependent. Regulating, and making lasting improvements is an essential responsibility of the railroad industry and those who are responsible for safe operations. Each of these separate but equally important components of the railroad industry relies on and influences each other. The importance of the railroad industry's interdependence can be explained through Peter Senge's System Interdependence Theory. Senge's Theory shows the need for balance, and continuity to achieve maximum effectiveness and that when one side outweighs the other, problems are likely to occur as shown below:

Figure 1

Systems Thinking Collective Model (Educational Systems and Instructions for Learning, n.d.).
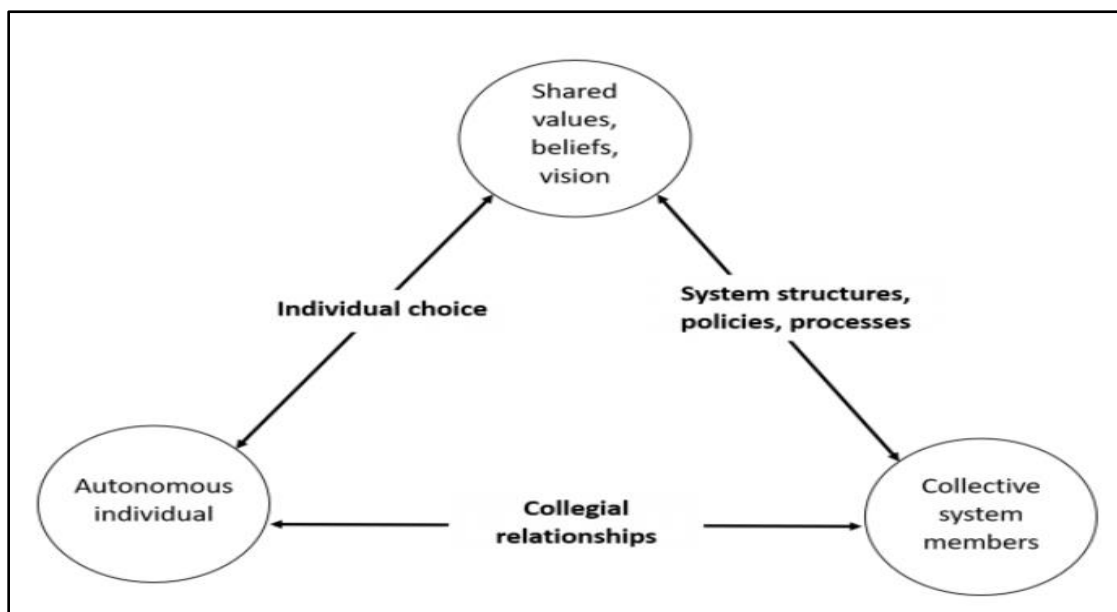
This model represents the interdependence and influence shared values, beliefs, vision, collective system members, and autonomous individuals have on one another in a given system (Educational Systems and Instruction for Learning, n.d.). For the railroad, each of these components is influenced by expectations, values, practices, norms, and pressures, otherwise referred to as cultural components. These components can heavily influence outcomes and events. Assessing the correlations, connections, and influences of each requires the need to assess their relationship to and study a system that has been under the national spotlight from several recent train derailments.

Case Study on the Ohio Railroad System

The Ohio Rail System has been around since 1836 (Burns, 2023). It has grown substantially and currently utilizes 1,588 miles of active railways (Burns, 2023). Several stakeholders and other owners of the rails, including private and or state rail companies, local

and federal governments, county and port authorities, and railways for transporting tourist activities each have a stake in and a continued interest in the rail system (Burns, 2023). Ohio's State Rail Plan lists laws and regulations that align with the FRA's federal railways laws and regulations. Compliance with these regulations is non-negotiable and ensures efficiency and safety for the rial systems and communities that are impacted by railways and the train industry. An event that showcases deviation from regulations was a costly derailment.

Around 9:00 AM on February 3, 2023, a 150-car Norfolk Southern train in-route to Conway PA derailed in East Palestine (Hauser, 2023, 2). This event caused 38 cars to derail which erupted into flames from hazardous chemicals being transported that spilled from the derailment. The Environmental Protection Agency has identified (Table 2) the hazardous materials that were spilled into the environment and a local stream causing lasting damage and implications for the communities in and around East Palestine.

Table 2

Chemicals (Environmental Protection Agency, 2023)

Chemical	Physical Effects	Environmental Effects
Isobutylene-	Severe irritant to eyes, nose, and mouth, known to cause frostbite with close contact.	Flammable
Vinyl Chloride	Irritates eyes, mucous/ sinus membranes, and respiratory system.	Airborne contaminate
Ethylene glycol	Irritates lower back, and throat can cause headaches and nystagmus.	Can cause death to fish, birds, and small animals.
Ethykhexyl Acrylate	Causes drowsiness, headaches, lethargy, nausea type symptoms. Can cause convulsions and respiratory illnesses.	Can injure or kill aquatic specimens.
Butyl Acrylate	Can cause severe irritation to the eyes, nose, and throat. Can also inhibit breathing and can produce skin issues	Extremely flammable, National Fire Protection Association Flammable Rating of 2 (CDC, n.d).

According to the investigating agency conducting research as to why the derailment occurred, a wheel bearing that was far past maintenance and severely overheated led to the derailment of 50 rail cars (National Transportation Safety Board, 2023, 1). The implications of this event are ongoing having an economic, physical, and reputational effect on the rail system and the citizens of East Palestine Ohio. Ohio ranks in the top four for the most train derailments in the United States (FRA, n.d.).

Railroad derailments cost millions of dollars and countless resources to fix, repair, clean, and dissolve or remove harmful materials released from the derailment. For reference, the Ohio train derailment required the assistance of the Environmental Protection Agency for assessments such as air quality, and infection control, working jointly to ensure cleanup costs were covered, ensuring Norfolk Southern rail company was accountable, and ensuring residents had access to clean water (The White House, 2023).

The National Transportation Safety Board and Department of Transportation were also on the scene investigating the root causes of the event, making sure that all rail safety regulations were previously and currently being followed and complied with and began formulating plans to ensure safer rail safety moving forward (The White House, 2023). The Federal Emergency Management Agency was also involved in working jointly with the Palestine government through the Emergency Operations Center in Palestine (The White House, 2023). The estimated cost of the East Palestine Ohio train derailment reportedly cost Norfolk Southern $387 Million (FOX 8, 2023).

This derailment is important to assess based on context and severity. Contextually, the 2023 East Palestine event was catastrophic for several reasons and yielded several unwanted and

negative consequences. This incident reveals two main contributing factors to the train derailment:

- Equipment Failures - Overheated Axle

- Three sensors failed to detect the hot axle before the derailment (National Transportation Safety Board, 2023, 1).

By the time a wayside detector notified crews, it was far too late, and the hot axle led to the train derailment. These failures led to the train derailment as noted by the National Transportation Safety Board (NTSB). The NTSB's preliminary report on the East Palestine incident notes that sensors, detectors, and overheated equipment all contributed to the derailment (National Transportation Safety Board, 2023, 2). This event also highlights what happens and how derailments are investigated.

Equipment failures occur in the railroad and other industries, and systems can fail. However, the factors and contributors leading up to these failures can shed light on the railroad industry and what may have led to these failures. Assessing some of the cultural components of the railroad industry that lead to train derailments requires research and evaluation of interviews with those who have first-hand experience. A series of interviews show the cultural components that contribute to train derailments. These interviews were previously conducted.

Table 3

Interviews Values Coding Cultural Components

Source	Main Concept of Interview	Expectations	Values	Norms	Practices	Pressures
Greg Raegan President of AFL-CIO Transportation Trades Department	Interview with ABC News (Charalambous, 2023)	The railroad industry would gain more accurate and more frequent numbers if there was a way for employees to share safety concerns without fear of punishment or retaliation.	Employer expectations on decreased times to conduct inspections on railcars.	There is a Deterioration of safety culture. There is a lack of confidence in the industry to protect against retaliation for reporting concerns.			Changing business model. Precision Schedule Railroading Years of employee cuts make employees afraid to report potential issues.
Jared Cassity Official at Smart Union Transportation Division	Interview with ABC News (Charalambous, 2023)	The railroad industry would gain more accurate and more frequent numbers if there was a way for employees to share safety concerns without fear of punishment or retaliation.				The FRA relies on the practice of self-reporting incidents, making the actual number of close calls difficult to assess.	Concerned that lack of confidentiality can make reporting close calls and incidents deter employees from coming forward.
Two Anonymous Officials In Interview with ABC News (Charalambous, 2023)	The railroad industry would gain more accurate and more frequent numbers if there was a way for employees to share safety concerns without fear of punishment or retaliation.				Cutting Corners. Railroads use practices that pose danger to workers and the public.	

Source	Main Concept of Interview	Expectations	Values	Norms	Practices	Pressures
Jeremy Ferguson President Smart-TD Interview with CNBC (LaRocco, 2022)	Record profits and new business railroad models and efforts required have placed distress and pressure on rail crews.	It is time for CEOs to take a look at their culture	Morale is at an all-time low. CEOs are out of touch with what is going on at the "ballasts" level where work is done.			They are working us to death.
Allen Shaw Norfolk Southern CEO (Fung, 2023)	Norfolk Southern's CEO acknowledges the need to make changes after the E. Palestine Train Derailment.				Safety Culture and investments did not prevent the derailment.	
Scott Wilcox Retired Norfolk Southern Employee (Fung, Maher, Berger, 2023)	Said that what used to take companies minutes minute to do inspections is now taking 30 seconds to 1 minute to complete due to time constraints and pressures.					Time constraints on checks are adding pressure on crews. .
Michelle Belt, Norfolk Southern Employee (Fung, Maher, Berger, 2023)	Claimed she received backlash for pointing out safety issues.	Fewer workers inspecting switches			Staff cutbacks	The belt was investigated more than once in response to safety concerns.
Cabell Brockman Former Norfolk Southern Manager (Fung, Maher, Berger, 2023)	Reported in an interview that he tried to stop what he determined to be an unsafe train, but he was told the train needed to continue to avoid slowing operations.					There is pressure from the railroads regarding reporting safety issues. .

Source	Main Concept of Interview	Expectations	Values	Norms	Practices	Pressures
James Orwan General Chairman of 1 AM Lodge 19 Labor Union (Fung, Maher, Berger, 2023)	Changes have made it difficult to conduct safe work practices.					There is a need to hurry up and get it done. Hurry up and get it out of the door mentality.
Matt Weaver Railroad Employee of 28 years. (Alvarez, 2023)	The demand to do more with less to keep up with new railroad models and earnings has taken a heavy toll on railroad workers.	(Railroad workers) need to get our voices heard.	Preventative maintenance is not popular with shareholders.	Crews are down 30% in the last 10 years. Repairs are like putting a band-aid on a broken limb.	Skeleton Crews. There are not enough people to do the required work.	Doing more with less Crunch Time. Doing less with less . There is fear of retaliation against rail workers, and labor workers
Ross Grooters Railroad Employee, Cochair of Railroad Workers United (Baur, 2023)	Changes need to be made or else derailments will continue.	Railroad companies will not do the things they need to to make it safe unless they are forced to.	.			There is a likelihood that (derailment) will happen again if root causes are not addressed.
Anonymous rail worker in an Interview with Mel Baur (Baur, 2023)	Several factors contribute to the problem.		I feel the railroads look at derailments as a cost of doing business, still coming out ahead. .		Railroads have cut off maintenance and tracks are getting inspected less. There isn't one cause, nor one fix, this is a series of failures	The loss of people and crews in the last five years comes at a price, often it is public safety. People should be concerned.
Anonymous Norfolk Southern rail workers in an Interview with CBS News. (Kaplan, 2023)	Multiple things need to be fixed to address this issue. There should be some limitations on train length, and weight.		.	There are no regulations on train lengths	Trains shouldn't be longer than 150 car lengths long	Workers are exhausted, times for inspections have been cut drastically

Source	Main Concept of Interview	Expectations	Values	Norms	Practices	Pressures
Aaron Gordon, Reporter for Vice Magazine has interviewed and written several safety concerns for rail workers. (Change, 2023)	Railroad workers are increasingly feeling unsafe because of aggressive policies, decreased crews, and other pressures and constraints.	None of the railroad employees spoken to were surprised the Ohio train derailment occurred. They expected a derailment of this magnitude much sooner.	Rail companies are stating they value safety, but results are demonstrating something else.		Less time and fewer resources to conduct work.	Doing more with less. 90-second time requirements to conduct inspections on trains with over 100 points to inspect.
Anonymous Conductor and Engineer at BNSF (Gordon, 2022)	An interview with VICE regarding 28 anonymous rail employees sharing the challenges of railroad life, schedule, and culture.					
Anonymous Conductor and Engineer at BNSF (Gordon, 2022)	An interview with VICE regarding 28 anonymous rail employees sharing the challenges of railroad life, schedule, and culture.					We have so little time off, we parent our kids VIA platforms like Facebook.
Anonymous Engineer BNSF (Gordon, 2022)	An interview with VICE regarding 28 anonymous rail employees sharing the challenges of railroad life, schedule, and culture.			Every day is the same for us, we do not know when we will be sleeping on any day or night.	If you want to remain employed you better not take more than a day off every month	

Source	Main Concept of Interview	Expectations	Values	Norms	Practices	Pressures
Anonymous Conductor Union Pacific (Gordon, 2022)	An interview with VICE regarding 28 anonymous rail employees sharing the challenges of railroad life, schedule, and culture.					Manpower issues are self-manipulated.
Anonymous Engineer at BNSF (Gordon, 2022)	An interview with VICE regarding 28 anonymous rail employees sharing the challenges of railroad life, schedule, and culture.					I'm tired of being tired. Most of my coworkers can't stay awake anymore during trips.
Anonymous Conductor, BNSF (Gordon, 2022)	An interview with VICE regarding 28 anonymous rail employees sharing the challenges of railroad life, schedule, and culture.			We do not get weekends off. We frequently work more than 276 hours per month.		
Anonymous Track Inspector, CSX (Gordon, 2022)	An interview with VICE regarding 28 anonymous rail employees sharing the challenges of railroad life, schedule, and culture.		The railroad used to be a good career. It's just a job now.			
Anonymous Wife of BNSF Conductor (Gordon, 2022)	An interview with VICE regarding 28 anonymous rail employees sharing the challenges of railroad life, schedule, and culture.				Railroad workers go to work sick, they miss funerals, they miss saying goodbyes to parents on hospice, and they miss holidays and birthdays.	

A breakdown of the interviews conducted on cultural components shows the percentage through words and feelings that were used to describe their experiences. This thematic analysis includes the following patterns, excerpts, and themes.

Expectations

Expectations have been defined by the National Library of Medicine as beliefs that shape and influence perceptions, cognition, and behavior in several contexts (Panitz, 2021). Expectations can influence decisions, and shape behaviors based on anticipated expected experiences (Panitz, 2021). For this research, expectations can be measured from two forms, employer expectations, and employee expectations. Of those interviewed, words used to categorize expectations were referenced <u>six</u> times.

Values

Values have been identified as something that is culturally approved, internalized, and something that motivates actions (Jaspers, 2023). Safety has been identified as a core value by the Occupational Safety and Health Administration (n.d.). Values can also be defined as something that gives organizations and people direction and defines what is acceptable (Jaspers, 2023). Of those interviewed, words used to categorize values were referenced <u>eight</u> times.

Norms

Norms are the guidelines and rules that are shared within a group, that dictate acceptable behaviors (Jaspers, 2023). Norms typically are referred to as rules that are enforced socially (Horne, 2018). Norms can be used to explain behaviors (Horne, 2018). For this research, words used to describe norms include normal aspects or functions that are enforced by a group or team. Of those interviewed, words used to categorize norms were referenced <u>six</u> times.

Practices

Practices are things that are regularly done, as custom or habit (Cambridge University Press, 2023, 3). Practices are the methods and way things are done, not the rules, policy, or description of tasks. For this research, practices can be assessed as the act of completing tasks. Words that fall under this category include the nature, scope, and ways in which things get done. Of those interviewed, words used to categorize practices were referenced 14 times.

Pressures

The World Health Organization has referred to stress at the workplace as the response people may experience when presented with work demands, and pressures that may exceed their knowledge or abilities (World Health Organization, 2023). Research shows that the most stressful work environments are where excessive demands and pressures do not match workers' knowledge, and abilities, and where there is limited support (World Health Organization, 2023). Pressures can come in the form of several different factors and can lead to unintended consequences. Some synonyms of pressure are strained, overloaded, burned out, stressed, exhausted, fatigued, and overburdened (Dicitonary.com, 2023).

For this research words used to describe pressures include staff shortages or cuts, self-inflicted or self-manipulated issues, doing more with less (increased responsibilities with fewer crew members), time constraints, or other factors that could reasonably produce pressure on the working environment including difficult work environment, schedule, etc. Of those interviewed, words or feelings used to categorize pressure were referenced 24 times.

Figure 2

Interview data graph shows the results of the interviews through the cultural components.
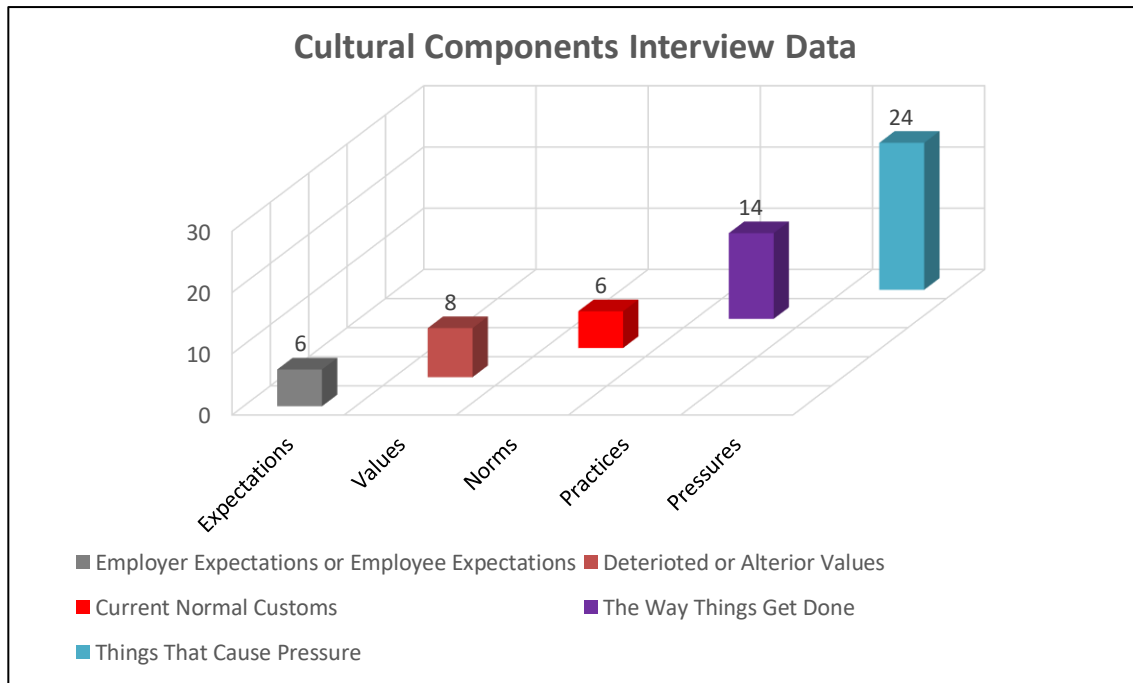
These interviews serve as a powerful tool to assess the cultural components of the railroad system and measure how they contribute to railroad safety. The cultural components of the industry affect several aspects of safety and can lead to derailments. From the wide range of those interviewed, some common consensus' reveals that railroad workers:

- Feel overworked

- Are tired

- Feel pressure to conduct faster work, with fewer crew members

- Have low morale

- Feel scared of retaliation for bringing up safety concerns

- Feel several pressures and constraints

- Feel that practices and norms are contributing to unsafe work environments

These issues and contributors will be further examined in the next chapter through categorizing, grouping, and other methods to show succulent data and analysis on train derailment causes and those who are interviewed and how they assess contributing factors.

Chapter Five: Discussion

Summary of Findings

The results of this research indicate that several railroad employees and those close to the

railroad industry have experienced diverse cultural components of the railroad industry such as

fear of reporting safety concerns, pressures, and unrealistic expectations to perform tasks. These

cultural components are the railroad industry's expectations, values, norms, practices, and

pressures. The research suggests that efficient organizations rely on each system that results are

dependent on the functions, and operations of all components of a system (Educational Systems

and Instruction for Learning, n.d.). The railroad industry has shifted to a business model that

encourages streamlining, fast-tracking, and expediting processes, inspections, and

responsibilities, all of which some railroad employees report makes them feel it contributes to an

unsafe environment. While derailments are decreasing, the only acceptable goal should be to

eliminate derailments.

The purpose of this research was to determine the relationship between train derailments,

and cultural components to answer the research questions:

Can researching the cultural components of the railroad industry show correlations and

causes of train derailments?

Research Question 1

"Why is there a need to examine the cultural components of the railroad industry?"

Researching the components such as cultural and social aspects has been proven as a

valuable tool to assess, indicate, and suggest necessary corrections (Arnault, 2018). Assessing

various aspects and elements of culture in several different organizations has been researched

and has been shown to define proper ways to behave within organizations (Society for Human Resource Management, 2023).

Constraints, employee cuts, and decreased times to conduct work were each attributed to increasing workloads and making work conditions more difficult. The most prevalent cultural components that were identified from the research were pressures, practices, and norms. Funk (2023) suggests that safety concerns from employees against railroad companies have declined to just 96 in 2022, a decrease from the 218 reported in 2018. This fact could supplement the research results that fear of retaliation is prevalent and can affect railroad operations. A fear of retaliation could suggest a culture of fear that is affecting reporting safety concerns.

The results of this study indicate that several aspects of the railroad industry culture such as safety culture, and employee work conditions have shifted or declined due to increasing production which has increased dangers and contributed to train derailments. Researching the components such as cultural and social aspects has been proven as a valuable tool to assess, indicate, and suggest necessary corrections (Arnault, 2018). An additional intention of this research is to provide the benefits and reasons for examining cultural components to answer the second research question:

Research Question 2

"Why is there a need to examine the cultural components of the railroad industry?"

The research shows that each year, thousands of train derailments occur in the United States (US DOT, 2023). Millions of dollars are invested into the railroad industry from private donors, the federal government, and stakeholders to improve railroad operations each year. Despite these efforts, train derailments continue to occur resulting in severe consequences

demonstrating the need to analyze derailments from a different approach. Researching the cultural components surrounding specific incidents such as the East Palestine train derailment shows the importance and need to examine cultural components providing insights into necessary changes and improvements, and aspects of the industry that contribute to railroad outcomes. The concluding purpose of this research is to show the changes that need to be made from the results and answer the research question:

Research Question 3

"What needs to be changed to decrease train derailments?"

This research can decrease train derailments while providing a safer railroad environment. Changes can be made to ameliorate the concerns this research provides. A key concern is that there is a fear of retaliation for reporting safety concerns. Other concerns and challenges the research identified were:

- Being tired

- Overworked

- Feeling overwhelmed and unprepared

- Feel low morale

- A lack of trust in the railroad industry

Factors like this can provide a glimpse into the need to address cultural issues that can affect safety outcomes such as smaller crews, decreased time to do more work than previously required, and pressures.

Interpretations

The data suggests that increasing production and economic benefits have become a large focus of the railroad industry. Of those who were interviewed, several elements of cultural components were revealed. Many workers are feeling overwhelmed with employee cuts, lack of schedule, increasing demands, reduced times to conduct work, and added responsibilities. These elements contribute to an unsafe and inefficient environment. The researcher suggests that the railroad industry will continue to have thousands of train derailments each year due to increasing demands, progressive railroad policies, and pressures on the railroad industry. Employee work-life balance, pressures, and difficult demands will continue to result in low morale and poor performance.

The data also suggest that millions of dollars are invested in the railroad industry from several sources for industry-sought improvements to:

- Increase capacities
- Bolster and maintain equipment
- Increase safety

The data suggests that increasing safety typically involves safety programs, rules, regulations, and other formal implications. The data does not suggest that efforts have been or are being made to look into the cultural components of the railroad industry as indicators and determinants of train derailments. The data suggests that through the lens of systems thinking culminating events such as train derailments can be the tip of the iceberg where unseen and undocumented actions, beliefs, practices, and other elements contribute to train derailments.

Several of those interviewed reported a fear or concern of retaliation for bringing up safety concerns, and some mentioned that they were fired for doing so. This fear is consistent with a hostile work environment. Figure 3 illustrates the types of concerns expressed during the interviews that were analyzed. This type of behavior and derailment causes requires a deeper change than stricter policies, punishments, and more training. The change needed requires an investigation, and improvement of the cultural components of the expectations, values, practices, norms, and pressures of the railroad industry from organizations such as the FRA, which can lead and implement necessary corrections. The data suggests that despite current efforts to decrease derailments, thousands are occurring each year, necessitating changes in scope, nature, and the way derailment causes are being measured.

Figure 3

Interview Word Cloud (wordart.com)
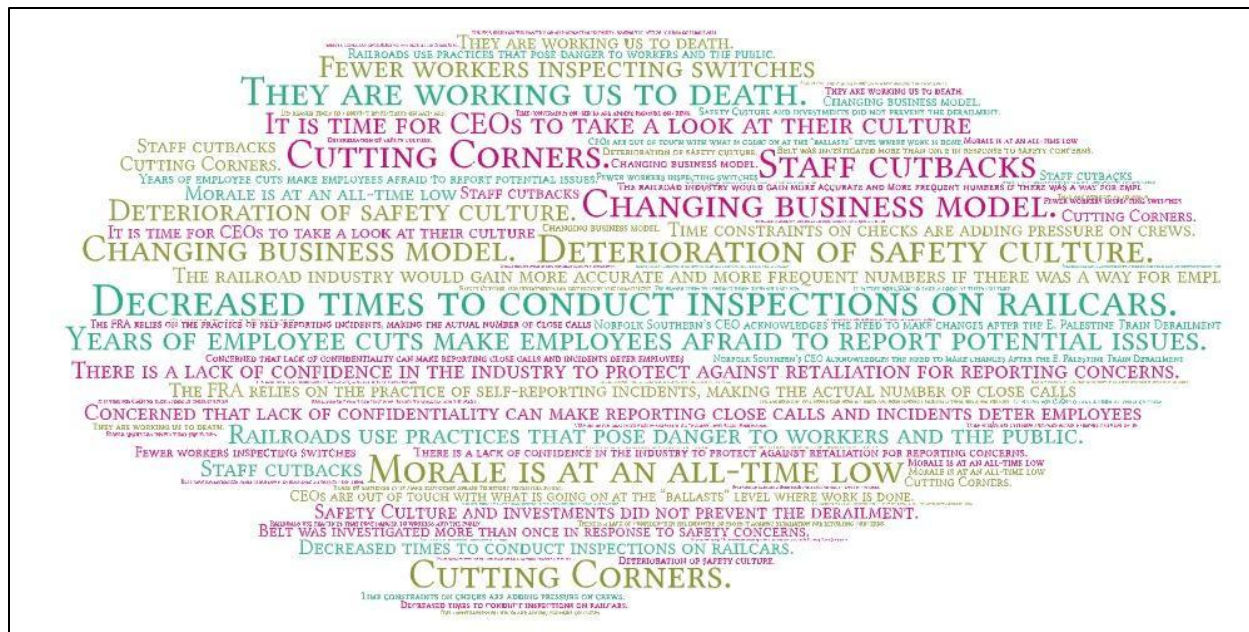
Figure 3 is a compilation of some of the feelings and concepts from the interviews displayed as a word cloud.

Implications

This research matters for several reasons, and to millions of people including railroad workers and their families, communities, and individuals that rely on and are affected by railroads each year, and the US and global economies. This research shows that despite a sample size of 22 previously conducted interviews, elements of cultural components were brought up 58 times as shown in Figure 3. Despite the small sample size, there were concerning and abundant results. Utilizing the researcher's methodology to investigate derailment causes and surrounding elements could be used as a powerful tool to guide the industry to make necessary preventative adjustments to the internal culture of the railroad industry.

Limitations

This research focuses on five major elements of cultural components of the railroad industry, expectations, values, norms, practices, and pressures. Each of these has several elements that contribute to several outcomes and environments. This research was limited to examining available literature, and previously conducted interviews, therefore the data and analysis show the results from this subset.

Recommendations

Given the severe consequences of the ever-present train derailments in the United States, several recommendations for the railroad industry include:

- **Recommendation #1** The FRA should start applying research methods, efforts, and time considering several aspects of the cultural components of the railroad industry.

- **Recommendation #2** Regulatory bodies such as the FRA should conduct a cultural component assessment after each derailment using expectations, values, practices, and pressures to assess necessary changes that need to be made.

- **Recommendation #3** The railroad industry needs to improve cultural components to keep up with the growing demand of the industry.

- **Recommendation #4** An assessment of different elements of cultural components, and how to improve these areas should be conducted by each railroad.

- **Recommendation #5** The FRA should take the abundance of funds they receive and use a portion to investigate cultural components of the railroad industry.

- **Recommendation #6** Railroad companies should work closely with employees to determine what cultural components are leading to unsafe environments.

- **Recommendation #7** Researchers should seek to improve this study by building off of its principles and seeking to investigate other cultural components.

- **Recommendation #8** Entities with higher budgets and time should further examine cultural components in the railroad industry and how making improvements can decrease derailments.

- **Recommendation #9** Other industries and organizations should utilize looking at cultural components to improve practices.

Recommendations for further research include assessing different elements of cultural components, and how to improve these areas. The Federal Railroad Administration is responsible for regulating several aspects of the railroad industry. One of the important roles of the FRA is

ensuring safety standards are appropriately listed and followed. Safety needs to become more of a priority over production, as evidenced by aggressive policies, shifts in culture, and thousands of derailments each year.

In 2022, the FRA reported that the Biden Administration allotted over $368 Million in grants to improve rail infrastructure and enhance supply chains (US DOT, 2022). The emphasis and importance of the railroad is evident. However, of the surplus and funds allotted to the railroad, it would be beneficial to increase efforts for the FRA and private railroads to listen to employee concerns, produce a culture of safety, and make necessary changes. This process could include:

- Employee surveys

- Increasing Training

- Increase capabilities for railroad workers to discuss safety concerns and necessary cultural components that require changes

- HR policies and procedures

- Focused efforts to change the culture of the industry

- Conducting Primary interviews on things that would be beneficial to frontline employees.

- Conducting data and analysis through cultural component

Cultural Components Railroad Safety Alliance

As discussed in this research, there is a need to view circumstances through the lens of cultural components. Several of the recommendations could be addressed through a new national rail safety strategy to gain the knowledge, and create a framework for rail safety that includes cultural components. This national rail safety strategy should require the FRA, the US DOT, the

National Transportation Safety Board, and the Association of American Railroads to work together, collaborate, conduct future research, and formulate a plan to improve the culture of the railroad industry. This could come out of the annual budget and revenue of the railroad and could create a railroad task force that would investigate and determine cultural components of the railroad industry and make necessary corrections that could alter the culture and improve operations. One possible element of the national strategy for rail safety could be a dedicated team that includes several line workers from different regions and railroads to ensure accurate information and representation. This team could be called the Cultural Components Railroad Safety Alliance or the CCRSA. The CCRSA would be tasked with ensuring cultural components as researched in this thesis are examined, and appropriate changes and recommendations would come from the CCRSA's efforts to determine how to improve railroad safety.

Chapter Six: Conclusion

This research aims to answer if researching the cultural components of the railroad industry shows correlations and causes of train derailments. Based on the qualitative research results of assessing available literature, previously conducted interviews, and a case study, the research suggests that there are correlations between train derailments and cultural components.

The second aim of this research is to identify why there is a need to examine the cultural components of the railroad industry. The research shows the benefits and advantages of looking at systems and organizations by examining cultural components. This research also suggests that current systems, policies, and techniques are not aligned with railroad industries' safety goals as illustrated by the thousands of train derailments each year.

The concluding aim of this research is to identify what needs to be changed to decrease train derailments. The results suggest that several elements of cultural components contribute to unsafe conditions and eventual train derailments. The data from the interviews suggests that railroad workers are negatively impacted by cultural components of the railroad industry such as expectations, values, norms, practices, and pressures.

The negative consequences of cultural components on railroad employees could also be an additional focus of research on performance and employees. Factors such as difficult schedules, feeling tired and overwhelmed, increased pressure, and decreased times were each identified in the interviews. These factors as well as depression, anxiety, and other mental health challenges are known to contribute to driving drug addiction and difficult home life (Recovery Ways, 2021). A study and examination of cultural components on several factors of the railroad

industry and employees could improve quality of life as well as decrease derailments and other railroad incidents.

Lynda Gratton and Tamara Erickson of Harvard Business Review identified several ways to build collaborative efficient teams. At the forefront of success, Gratton and Erickson (2007) suggest that in any organization, at rudimentary and basic levels, a team's successes or failures at collaborating and working together are a direct reflection of the philosophy of the executives and leadership of that organization. Gratton and Erickson also suggest that executives and leaders invest in signature relationship practices, which they identify as building and maintaining social and professional relationships.

Having shared values, beliefs, and vision, collective system members, and the individual members of the team are each vital to the team's success (Educational Systems and Infrastructure for Learning, n.d.). Furthermore, results and actions are interdependent on and influenced by other participants, practices, and pressures in their organization. The research suggests that many railroad employees lack trust in the railroad industry and feel that there are several cultural component elements that are negatively affecting aspects of railroad operations.

Consequentially, there is a need for the railroad organization to work together and produce a shared vision of expectations, norms, values, practices, and pressures otherwise referred to as cultural components. One of the ways Gratton and Erickson (2007) suggest organizations can best collaborate and work together comes from what they refer to as creating a "gift culture" which requires executives and leaders to create and establish daily coaching tips and assistance replacing what they refer to as "tit-for-tat culture" (Gratton, Erickson, 2007). A shared vision and a deviation from common, current railroad culture could be a new research

method that could take all the cultural components and compare the railroad to other

organizations with different cultural components.

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