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Risk Assessment Strategies to Reduce Profitability Losses from Pipeline Accidents in the Natural Gas Industry

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Abstract

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MS, Walden University 2014

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Abstract

Ineffective risk assessment strategies can negatively impact the natural gas industry. Engineer project managers who struggle to maintain a risk assessment plan are at high risk of failure, which could result in devastating consequences for the business and environment. Grounded in the theory of risk assessment, the purpose of this qualitative single case study was to explore strategies engineer project managers in the natural gas industry use to improve risk assessment planning to reduce pipeline accidents and improve profitability. The participants comprised of 5 engineer project managers in Virginia, who effectively use risk assessment strategies to promote safety metrics and maximize effective approaches to improve the natural gas industry. Data were collected from semistructured interviews, company documents, and company social media platforms. Thematic analysis was used to analyze the data. Four themes emerged: safety, training and development, process management, and strategic risk assessment. The implications for positive social change include continuous monitoring of project engineer managers to create a risk assessment plan to support safety initiatives for economic development in the business, environment, community, and society.

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Dedication

This study is dedicated to my late father Rev. Willis Hurdle who started out with me on this journey but was called home to be with the Lord before I could finish. Love and miss you daddy. To my mom the late Odessa Hurdle, my big sister the late Sharon Hurdle and my little sister who called and checked on me daily as I went to my residences the late Freda Hurdle. I love and miss you all.

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Section 1: Foundation of the Study

This qualitative research study involved the safety risk assessments and the importance of implementation of policy standards in the natural gas pipeline industry. An abundance of natural gas pipelines exists in the United States (Lee & Dupuy, 2018) for which managers may develop a risk assessment plan as a safety precaution that includes monitoring and responding to natural gas leaks and disasters. I conducted a series of interviews with project managers in the natural gas industry in central Virginia. Management understand the value of a risk assessment plan that must continually be updated and on which managers in the natural gas pipeline industry must be regularly educated. Managers must implement strategies to reduce profit losses and maintain required safety documents.

Background of the Problem

Natural gas is a primary source of energy in the United States (Weber et al., 2014). When considering laying a natural gas pipeline, flammable or toxic gases from a pipeline failure constitute a safety risk of adverse effects on the daily operations of project engineers. (Kirchhoff & Doberstein, 2006). As the demand of the pipeline industry's transportation consumption of natural gas increase so does the cost to the consumption of natural gas for commercial purposes (Sklavounos & Rigas, 2006). Global corporate leaders' practices and responses to safety initiatives support a risk assessment plan. Safety and injury concerns for employees are increasing in the oil and gas industry (Wei, Zhou, & Wu, 2015). The lack of safety initiatives poses a particularly serious risk because of the hazards involved in the daily field service of the operations.

This includes employee exposure to harsh weather conditions, hazardous chemicals, and other dangerous materials. In addition, unidentified pipe leaks could lead to an explosion.

The engineers' project managers' training and education are critical for providing awareness of the potential dangers of working with a natural gas pipeline. The proper training includes how to maintain safety, risk assumptions, pre job briefings, OSHA requirements, and emergency response protocols. The Occupational Safety and Health Act of 1970 mandates safe working conditions for all employees by providing education and training on safety and health (Occupational Safety and Health Administration, 2015). Energy is a major commodity to the U.S. and global community (Bigliani, 2013). Safety, transportation, and profitably are important concerns to the gas industry. Continuous process improvement, risk assessments, and continuous process monitoring, and updates are essential in the oil and natural gas industry to minimize accidents and employee injuries.

Problem Statement

Companies in the natural gas industry often experience financial devastation because of revenue losses resulting from natural gas accidents involving employees, and poor safety methods can be a contributing factor (Silvestre & Gimenes, 2017). Natural gas industry pipeline accidents account for 45 million dollars of lost revenues in the past two decades (Parfomak, 2015). The general business problem is that some natural gas companies are being negatively affected by safety hazards, which results in loss of profitability for the businesses. The specific business problem was that some natural gas engineer project managers lack strategies to improve risk assessment planning to reduce pipeline accidents and improve profitability.

Purpose Statement

The purpose of this qualitative single case study was to explore strategies that engineer project managers in the natural gas industry use to improve risk assessment planning to reduce pipeline accidents and improve profitability. The population for data collection in this single case study came from engineer project managers in the natural gas industry located in central Virginia who have successfully implemented business strategies to reduce pipeline accidents and improve profitability. The implication for positive social change includes the potential to provide a safer workplace environment throughout the central Virginia region by developing risk assessment strategies for engineer project managers. In addition, by reducing safety risks associated with natural gas pipelines, project managers could enhance community perceptions of the industry and improve relationships with environmentalists.

Nature of the Study

After comparing the qualitative and quantitative methods, I chose a qualitative study as the method for this research. The qualitative method was appropriate for the study because it included exploration of real experiences to answer the research question. Through the qualitative method, researchers can gain a deeper understanding of a problem. The qualitative method provides an opportunity to explore sensitive and complex issues (Brannen, 2017). The quantitative method was not suitable for the study because I did not concentrate on statistical study variables, which include opinions, motivations, and hypotheses (Yin, 2014). Thompson and Carlson (2017) stated that they would not concentrate on statistical study variables. In this study, I documented the data analysis by including the participant's concepts obtained from collecting research data. The mixed methods approach includes the advantages of both the qualitative and the quantitative methods and mitigates the weaknesses of each by combining the two. The mixed methods approach was not appropriate for the study because there was not a need to use multiple data collection methods to document data analysis or variables.

The design I used for my study was a single case study. Robinson (2014) stated that the identification of best practices in a single case study design allows for a minimum of three participants to be acceptable for conducting a single case study. Yin (2014) concluded that a qualitative case study involves real-life experiences that assist a researcher in exploring a complex process in the form of how or why. The qualitative study offers many designs including narrative, ethnography, phenomenology, and the case study (Yin, 2013). According to Percy, Kostere, and Kostere (2015), the ethnographic approach explores areas that define a culture's practices, behaviors, and social concerns. A phenomenological design explores a phenomenon or a concept from a particular point of view (Kahlke, 2014). The phenomenological and ethnographic designs were not appropriate for my study because this study consisted of gathering data on a risk assessment plan from the perspective of interviewed participants (Yin, 2013).

Research Question

RQ: What strategies do engineer project managers in the natural gas industry use to improve risk assessment planning to reduce pipeline accidents and improve profitability?

Interview Questions

1. What cost strategies do you use to improve risk assessment safety initiatives?
2. What are some successful technologies you and your team's engineer project managers incorporated into the risk assessment plan that have reduced the costs associated with pipeline accidents?
3. How do employees assist managers in documenting risk issues?
4. What is your strategy for training staff on risk assessment and have they improved firm performance?
5. What strategies have you successfully used to ensure employee safety?
6. What successful strategy does your organization use to evaluate risk assessment for profitability?
7. What successful method did you find worked best in implementing the risk assessment strategy?
8. Do you have anything additional to add regarding strategies you use to improve financial losses associated with pipeline accidents?

Conceptual Framework

The conceptual framework for this study was the Scholz and Gary (1990) theory of risk assessment, which helps to identify safety measures for becoming compliant with the OSHA guidelines. The risk assessment theory was developed to help explain how companies could prevent catastrophes. Scholz and Gary (1990) used the risk assessment theory to realign business objectives to the hazard process by applying a hazard strategy that added validity to y. For this study, a risk assessment theory implemented by project managers referred to strategies for reducing potential failures in the natural gas industry. As a valuable resource to the employees, the risk assessment plan may increase profitability by preventing breeches in natural gas pipelines.

Grote (2015) indicated that aligning company practices with risk assessment theory will improve employee safety and company processes while minimizing the risk and costs associated with procedure failures. Risk assessment is defined as a systematic process that managers use to evaluate potential risks of an activity and strategize a plan to moderate high risks. Project managers can apply the risk assessment theory to reduce losses associated with pipeline incidents. Project managers may use risk assessment to improve employee safety and as a guideline for processes aimed at eliminating risk. The key constructs of risk assessment theory include safety to ensure a clear response to risk, and technology for improvement of equipment and profitability. However, risk assessment without training can lead to serious consequences, such as injuries to the employees (Zhi-qiang & Ya-mei, 2016). The inclusion of policies in the risk assessment plans must align with the business processes for improvement and functionality to the company's infrastructure (Choi, Cho, & Seo, 2004).

Operational Definitions

Natural gas: Natural gas is a compound mixture of methane and other hydrocarbons, which is flammable and used as fuel (Guo & Ghalambor, 2016).

Project management: Project management is the knowledge of the skills and tools required when implementing strategies and processes for a project (Ramazani & Jergeas, 2015).

Risk: A risk is a probability or likelihood of a failure that results in an adverse effect (Amir-Heidari, Ebrahemzadih, Farahani, & Khoubi, 2014)

Assumptions, Limitations, and Delimitations

All research includes assumptions, limitations, and delimitations, which researchers must articulate clearly (Njiraini, 2014). This study included interviews with engineer project managers regarding the strategies used to reduce losses associated with pipeline accidents. There were assumptions in three key areas of the study, the requirements, interview data, and collaboration between the interviewees and me. Limitations are factors that may have hindered the study in interviews and sampling, and the delimitations consisted of centralized locations and time. Delimitations included lack of safety metrics, project manager's ability to change policy, and the uncertainty effects of the risk assessment prior to the proper risk assessment.

Assumptions

Assumptions, which without any truth or proof, may be accepted or certain to occur (Brannen, 2017; Njiraini, 2014). One assumption was that the participants would be truthful when answering the interview questions. Another assumption was that the engineer project managers would be nonbiased in the data they provided. The final assumption was that engineer project managers would provide some strategies for developing an effective risk assessment plan.

Limitations

Limitations described by Marshall and Rossman (2014) are boundaries that reflect disadvantages that may affect outcome of the study. Limitations are weaknesses in the study that are out of a researcher's control to change or adjust. One limitation of this study was the use of purposive rather than random sampling. Purposive sampling reduced the population needed to complete the study in a short span of time. The other limitation population became too small because participants were selected purposively from one company.

Delimitations

Corluka, Hyder, Segura, Winch, and McLean (2015) asserted that delimitations are the researcher's ability to control and identify the boundaries and scope of the study. Delimitations of this study included project managers level of authorization resulting in the lack of implementing strategies to improve a risk assessment plan. One delimitation was that the study was confined to one company in a centralized location in Virginia. The study was focused on research in the State of Virginia.

Significance of the Study

The significance of the study included identifying safety strategies for the natural gas industry and providing information on how risk assessment plans play a prominent role in monitoring and accessing decayed pipelines for repair or replacement. For example, managers may use modern technology such as simulated models to monitor for leakage (Wang, Wu, Zhou, Qi, & Li, 2014), which add value to the risk assessment plan. The study included documentation about effective risk assessment processes to reduce losses associated with pipelines.

Having the knowledge and awareness of how a risk assessment plan is developed and deployed in the field to decrease the risk of decayed pipelines may benefit project managers worldwide. A gas leak is difficult to detect by project managers and require risk assessment and safety procedures to ensure the safety of the project managers, employees, and community. Urbanek et al. (2012) suggested implementing a risk assessment plan, which is difficult and may require several revisions to policy to incorporate safety metrics within the risk assessment plan. Information in this study may be beneficial to engineer project managers with implementing strategies for a risk assessment plan.

The results of the study may fill gaps in understanding about how project managers implement successful strategies for a risk assessment plan. The study may identify areas of improvement for a risk assessment plan in the natural gas industry that help managers with strategies to avoid or minimize risk in natural gas pipelines, leading to a safer environment (McJeon et al., 2014). Protecting the environment is positive social change at a national and international level.

A Review of the Professional and Academic Literature

The literature review consists of a collection of research material I obtained about risk assessment plans project managers use to offset risks or threats to their natural gas pipelines that might cause a catastrophic loss. The literature review contains information on risk assessment theory, gas line safety policies, and different strategies project managers may use to increase profitability and reduce losses due to acts of nature or corrosion of pipelines. The peer reviewed articles for this study included research on companies in the natural gas industry and how they can safely provide natural gas to customers. The following research question guided this study:

RQ: What strategies do engineer project managers in the natural gas industry use to improve risk assessment planning to reduce pipeline accidents and improve profitability?

This literature review was informed by a discussion of risk theory from peer-reviewed journal articles and other publications. I searched databases and seminal literature to obtain full-text, scholarly, and peer-reviewed documentation in the literature. I used a total of eight databases in my search: (a) Walden library databases, (b) Google Scholar, (c) SAGE Premier, (d) ProQuest, (e) eBook Collection (EBSCOhost), (f) Emerald Management Journal, (g) Thoreau Cross Reference, and (h) governmental databases. I used the following key search words alone and in combination: *natural gas pipeline, natural gas assessments, business assessment, natural gas loss revenues,* *pipeline accidents, safety natural gas risk assessment, safety-awareness project manager's pipeline, Total Quality Management Theory, Six-sigma theory, faults, pipeline,* and *planning and safety*. The criteria for the literature in this review were that they must be at least 85% peer-reviewed journal articles with a publishing date within the last 5 years. The review of the professional and academic literature included dissertations, articles from peer-reviewed journals, seminal books, websites, and government sites. The total number of sources in the literature review was 225 of which 189 (86%) were peer-reviewed scholarly journal articles published between years 2015 and 2019.

Conceptual Framework

The purpose of this qualitative single case study was to explore business strategies that project managers in the natural gas industry used to reduce losses associated with pipeline incidents. The literature covered the conceptual framework for the study, natural gas pipeline risk assessments, and planning strategies when building or repairing a gas line to mitigate risks (Elia, Li, & Floudas, 2015; Lee & Dupuy, 2018; McJeon et al., 2014). Kuo and Lu (2013) agreed that having a risk assessment model benefits the planning process and assists managers in locating potential hazards in a project. In addition, the overall business strategy for safety may improve the quality of the risk assessment plan and decrease losses or profitability associated with natural gas pipelines.

Risk assessment theory. The import and use of natural gas have increased throughout the years causing a higher concern for the care of decayed pipelines (Wang, Wu, Zhou, Qi, & Li, 2014). Risk assessment theory includes concepts regarding safety, training, and technology (Scholz & Gary, 1990). Project managers not utilizing risk assessment methods may experience devastating consequences from increased accidents (Zhi-qiang & Ya-mei, 2016). Natural gas project managers have the responsibility for the safe delivery of natural gas and the continuous and timely inspection of pipelines under their purview, ensuring the protection of transportation of natural gas. The first step to addressing potential threats to natural gas pipelines is a risk assessment plan to enable project managers to map processes that prevent catastrophic events (Shafiee, 2015). The risk assessment is a robust tool that contains the foundation for and direction of information for safety precautions. Gong, Forrest, and Hazards (2014) stated the basis of the risk assessment consisted of:

- meteorological disaster prediction,
- prevention,
- compensation, and
- all other works related to server conditions.

Gong et al. (2014) suggested the use of a risk assessment plan would include research regarding weather disasters and the use of modern technology to reduce the threat to pipelines. Gong et al. (2014) focused on the meteorological disaster risk analysis, which included positive benefits to implementing a risk assessment plan to improve the society. Natural gas pipeline failure has become costly to the global energy market (Amir-Heidari et al., 2014; Kirchhoff & Doberstein, 2006) because of third party interference, corrosion (internal and external), leaks, fatigue, stress corrosion cracking (SCC), and weather-related elements. In addition, threats beyond weather conditions may adversely affect safety and profitability with the pipelines. The Interstate Natural Gas Association of America provides an outline of other threats in addition to those mentioned above.

A. Resident threats (threats that do not grow over time but tend to manifest when influenced by another condition or failure mechanism):
    a. manufacturing,
    b. fabrication/construction, and
    c. equipment.
B. Time-independent threats (not influenced by time).
C. Human error (U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration [PHMSA], 2014)
D. Excavation Damage (*IADC*)

To offset the financial losses, risk assessments and mitigation plans are used as guidelines to help companies adhere to all OSHA (2015) safety and other government regulations. Scholz and Gary (1990) identified safety measures related to their risk assessment theory. Amir-Heidari et al. (2014) referred to risk as a probability or likelihood of a failure that results in an adverse effect. Graetz and Franks (2015) referenced risk as danger and discovered that leaders will develop safety policies to prevent dangerous outcomes on the by educating employees on responding to critical situations. Ezzat, Ossaama, Kamal, and Farag (2015) investigated the need to apply a risk assessment plan when a decreasing temperature of liquid natural gas caused a pipeline rupture. In addition, Ezzat et al. (2015) stated that pipeline ruptures might affect employee safety. Arias and Tucker (2002) reasoned that the use of critical task analysis, potential risk cards, advanced safety audits, and incident investigation reports are tools to assess and reduce risk. Although these reports are useful, the tools sometimes fail to include enough data to track the risk occurrence (Arias & Tucker, 2002).

Some investors depend on management and practitioners of risk governance to compile a sustainable conceptual approach to reducing risk (Wong, 2015). The identification of potential risks can lead to determining which safety concerns will receive the highest priority.

Reducing Risk within Power Stations

Saffarian, Shafiee, and Zaredar (2015) examined two risk areas in a gas power station and plant operations. Saffarian et al. (2015) applied a Delphi questionnaire for collecting risky activity, natural disaster, and plant operations data. The questionnaires were sent to crises and accident-prone centers. Saffarian et al. (2015) analyzed data from the survey and considered the decision-making heuristics and other methods used by managers in which the Technique for Order of Preference by Similarity to Ideal Solution application and analytical hierarchy process (AHP) were used. These tools connected to safety risk prioritization by identifying what safety risk should be considered a high threat and which a low. The results indicated that the type of pipe, terrorism, and dust storms were the highest areas of risk to a gas power plant. The decision-making process used by Saffarian et al. (2015) indicated a prioritization of importance, which could benefit project engineers by providing sustainable risk assessment plans, reducing financial losses to the organization.

Krane, Olsson, and Rolstadas (2012) indicated that project managers too often focus on the short-term risk of a project and tend to forget to the potentially greater risks that project owners recommend that they focus on. Although risk assessments are creative processes, there are stages that require some regulations to mitigate the pipeline safety threats in both the long- and short-term (Perry, 1986). Graham, Rupp, and Schenk (2015) stated that using best risk assessment practices kept threats low and in a lenient state, which raises the level of safety of the natural gas pipeline. Graham et al. (2015) noted that President Obama’s political stance on the development of safer drilling of natural gas was a determining factor that helped to keep safety threats low. In addition, Kim, Kang, and Kim (2015) argued that risk analyses can be used as safeguards for current technology. Kim et al. noted some hazard identification in their risk assessment process, which project managers identified as dangerous substances. The hazard identification also is a measurement for reducing any threat of accidents that may occur. Kim et al. noted that hazard identification is the process for noting critical and noncritical hazards. Understanding where to interject processes and the need to include hazardous material descriptions can provide project managers a baseline of assurance that they are reducing threats and securing safety of employees and curbing the probability of losses to organization (Kim et al., 2015).

Best Practice Model for Approving a Risk Assessment Plan

Successful project engineers tend to research and study the best practice model, which include tools such as fuzzy technology or logic (Brito, 2009). Fuzzy technology is the formulation of different variables of truth-values using numerical reasoning (Brito, 2009). Brito (2009) identified best practice models that provide a clear and consistent risk assessment plan. By using risk assessments, project managers gain the ability to identify threats such as accidents and implement safety strategies for delivering natural gas.

Schiff (2018) proclaimed pipeline assessments as the safest practice to improve safety for the public and businesses. Risk assessment theory includes a variety of fuzzy technologies that provide a variety of techniques to derail threats. Elsayed, Marghany, and Abdulkader (2014) stated using fuzzy technologies provides data such as the probabilities and consequences of hazards, allowing researchers to study the safety of shipping of liquefied natural gas.

Bayesian Networks

Threats are physically located throughout pipelines, particularly at the beginning of drilling, which often is occurring when risks are higher and profitability higher (International Association of Drilling Contractors, 2014; Wu, Zhang, Liu, & Lunteigen, 2016). Wu et al. (2016) argued that using the dynamic Bayesian network model as a risk assessment tool would help project managers to capture and analyze findings from the mud density test before digging and laying pipelines. Guo, Meng, Meng, Wang, and Shuhai (2016) agreed that the use of models is important to the natural gas pipeline construction and maintenance to bring clarity to the risk assessment.

Natural Disaster Events Impacted by a Risk Assessment Plan

When a threat occurs, costs increase for the project; therefore, project managers use the risk assessment theory to reduce the cost associated with crises, thereby increasing project profitability. An and Peng (2016) argued the need for management to create a risk-cost function. Threats to natural gas pipelines and current from weather conditions may vary. The possibility of hurricanes and earthquakes require project engineers to consider safety using risk assessment theory. Earthquakes are an example of how the safety of the pipelines can be compromised (Bursi, Reza, Abbiati, G., & Paolacci, 2015). Earthquakes have a major impact on an organization in terms of profitability and safety (Mousavi, Hesari, & Azarbakht, 2014). According to Zhou, Gong, Roda, and Farrag (2016) a well-planned safety risk assessment will protect gas meters and pipeline segments from a catastrophic event.

In Figure 1, the pyramid includes the hierarchy of risk assessment, hazard ratings, and vulnerability standards.

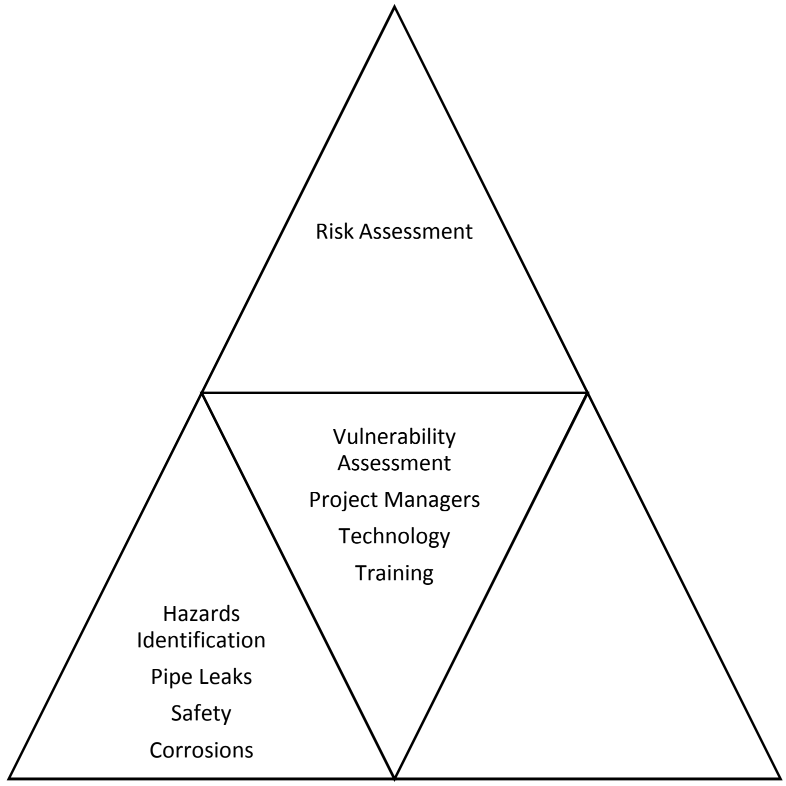

Figure 1. Risk assessment hazard identification and vulnerability. This shows a hierarchy of the risk assessment process for the natural gas pipeline. Section 1 of the pyramid represents the development of the risk assessment process. Section 2 represents the areas of concern when assessing the threat. The third section represents the risk assessment plan.

Analysis and synthesis of risk assessment. Risk assessment theory is useful for project managers in the natural gas industry in providing a reliable protocol for reducing threats to natural gas pipelines. The engineer project managers may use the risk assessment plan to improve safety and to increase profitability in the natural gas sector of the organization. Other guiding theories for this study included transactional leadership, total quality management (TQM), and Lean Six Sigma (LSS).

Transactional leadership theory. This theory influences an organization's management team by helping its' leaders meet expectations (Sommer, Howell, & Hadley, 2016). However, I chose not to utilize transactional leadership because this study is focused on examining the successful processes of risk assessment plans. Transactional leadership theory aligns with leadership but there is minimal research related to improving procedures and processes in the natural gas pipeline industry. Judge and Piccolo (2004) described transactional leadership as an exchange of resources employees provide while meeting expectations of the management team. In addition, transactional leadership influences adverse responses, which may not be favorable in certain situations (Hater & Bass, 1988). Some management teams may use transactional leadership to control daily operations and processes (May, Peus, Frey, & Kerschreiter, 2014). According to Vito, Higgins, and Denney (2014), transactional leadership has three divisions: (a) rewards, such as pay or time-off offered by the leaders, (b) objective of transactional leadership to measure accuracy data, which is a set margin for protocol, and (c) transactional leaders who act upon issues or concerns when they occur. The different types of leaders interviewed for this proposal will include the engineer project managers who understand safety regulations for strategizing a risk assessment plan.

Systems theory. Leaders address system theory as organizations consisting of interacting and symbiotic elements, interacting with a structure to include subsystems (Senge, 2006). Ludwig von Bertalanffy (1976) created and used general systems theory in life sciences. The study of von Bertalanffy's structure is an arrangement of the general systems theory as seen through the lens of a holistic approach. von Bertalanffy also noted the general systems theory was a process developed for the structure of an organizational method. Both systems theory and risk assessment theory share some of the same constraints and shortcomings, and both theories are relevant to this study because they highlight the improvement of the risk assessment plan and provide guide lines for the project managers. Systems theory is composed of different parts, therefore, the search between useful and non-useful variables are too extensive for this study (von Bertalanffy, 1976). The literature review will include research on risk assessment theory for the conceptual framework of this study. The risk assessment theory is vital to the natural gas pipeline industry because it provides guidelines, processes, and protocols useful in reducing pipeline accidents and increasing profitability.

Lean Six Sigma. Lean is defined as a process improvement that delivers faster time release, reduces employee enrolment and the reduction of space while delivering quality customer service. The first recognition of Lean was used in 1913 by Ford at its then Michigan plant (Laureani & Antony, 2018). Laureani and Antony, (2018) described Six Sigma as processes that are data-driven which lessen the need for excess methods with same results, unneeded or defects. Corporations merged and integrated LSS to enhance the production time, and accuracy while maintaining a positive customer service base. Six Sigma was first used at the Motorola research central. Hess and Benjamin (2015) conducted a study suggesting that LSS could apply to daily business processes, improving overall productivity (De Jesus Pacheco, 2014).

Project managers' use of risk assessment and LSS can improve a project but does little to reduce the risk of a pipeline failure. However, use of both the risk assessment module and LLS can enhance a project manager's knowledge and provide an additional tool to manage processes, leading to the success of the management team and organization (Usman Tariq, 2013). In combination, and by using a data-driven approach to risk assessment and LLS, managers gain the ability to reduce, and, eliminate risk associated with gas pipeline accidents.

The combination of the two methodologies improves customer service and delivers exceptional positive results (Tukker, 2015). Harry (1998) created the Lean and Six Sigma (2017) theory, which is a tool used by project managers to reduce work and waste through a data-driven method (Cucoranu, Parwani, & Pantanowitz, 2014; Naslund, 2008). Key principles of LSS are to manage and improve the efficiency of the workflow, locate unnecessary steps, and remove waste. The use of LLS can also empower people associated with business processes and systematically undertake improvements in all activities (Cucoranu et al., 2014). Hess and Benjamin (2015) conducted a study suggesting that LSS could apply to daily business processes, improving overall productivity (De Jesus Pacheco, 2014).

The main function of LSS is to eliminate redundancy within a process, which includes labor, lack of sustainability processes, and a decrease in productivity; and therefore, I chose not to use LSS in this doctoral study. In addition, LSS lacks the focus on employee experiences. LSS does not improve the risk assessment plan because it does not aid managers in reducing profitability losses to the organization, whereas, risk assessment consists of a safety measurement protocol for pipeline threats.

Total quality management theory. One of the many benefits of TQM processes is that they allow researchers to explore a strategy to develop a risk assessment plan custom made for each situation. TQM and risk assessment theories share similar qualities such as safety and sustainability measures. One difference between TQM and risk assessment is that TQM is a model for offsetting risk (Adrianatisca, Cornu, Diaconu, & Dumitrescu, 2015). In addition to offsetting risk, there are other aspects of the TQM that distinguished it from risk assessment such as its emphasis on cultures, competitive advantage, and safety problems that may occur in the natural gas industry. Although TQM history dates back as far as the early 1920s, it was not introduced to the global business until the 1950s by Edwards Demining Sallis (1993). TQM is about continuous process improvement so that the products or services created using the system exceed customer expectations. Benavides-Velasco, Quintana-Gracia, and Marchante-Lara (2014) stated the main purpose of TQM is to have outstanding consumer service.

TQM is a tool to enhance an organization's competitive advantage. In addition, Jeffords and Thibadoux (1993) suggested that quality is measurable at the beginning of any process thus allowing managers to compare with work performance and the continuous demand of the customer. Adrianatisca, Cornu, Diaconu, & Dumitrescu (2015) noted that managers use TQM at the beginning of a process to help eliminate waste and redundancy and inefficiency in the process, in turn helping to reduce or eliminate the jobs' risk. Demining had 14 points for TQM. Improving constantly and forever every process for planning, production and service, create constancy of purpose for improving products and services, and a vigorous program of education and selfimprovement for everyone are a few of the 14 points. The Demining 14 points are within TQM Additional elements that comprise the concepts of TQM consist of social and technical processes. In addition, according to Calvo-Mora, Picon, Ruiz, and Cauzo (2013), managers must implement social and technical processes during phase one of a project.

Talib, Rahman, and Qureshi (2013) stated that customer satisfaction is a major objective of TQM. However, management's approach to an employee is also critical to how successful or unsuccessful a manager will be when using TQM theory. Talib, Rahman, and Azam (2011) investigated the role of TQM and its relationship with quality performance. Talib et al. (2013) used a self-administered survey technique to gain data necessary to complete the research. Researchers sent 600 emails to participants involved in service industries (Talib et al., 2013). The results of the returned assessments were a factor in other analyses such as the Pearson's correlate, which is the linear between two variables. The findings in the study by Talib et al. (2013) indicated that TQM had similar traits such as processes like quality performance. The exception of TQM and quality performance is quality systems, training, education, and teamwork benchmarking. Other findings were the culture's role in controlling the TQM.

The key roles of TQM are to increase productivity and profit. TQM has characteristics such as the scientific approach to problem-solving, long-term commitment, and a strong connection with quality (Goetsch & Davis, 2014). Depending on how TQM works in any given project, the scientific approach to problem-solving, and long-term commitment can offset TQM to either favor or lessen the effect of the theory.

The effects of process management on organizational performance include top management commitment, teamwork and participation, education and training, customer focus, and better resource management (Talib et al., 2013).

TQM is not the traditional method of use according to management. However, management (along with their experience and training) can use TQM to implement decisions reflecting elements outlined in the theory. The training expands to a broader audience to include not only managers but also individual contributors (Grant, Shani, & Krishnan, 1994). The awareness of the barriers of TQM may equip management teams in ensuring the success of the theory. In addition, management teams should monitor the environment to ensure the support of TQM (Mosadeghrad, 2014). Singh and Sushil (2013) stated that top management participation is critical to the success of TQM and the delivery of high profitability. Employees are the best resources for making TQM work. According to Nau (1992), engaging employees in the TQM implementation process may produce favorable attitudes, improved work ethics, and a feeling of fulfillment.

Yunis, Jung, and Chen (2013) researched TQM strategies and characteristics, focusing mainly on the stability of the TQM-performance model. Yunis et al. (2013) examined the alpha effect or if TQM was serving as compromiser to bridge the strategy-performance relationship. The study included a validity and reliability structural equation model to analyze survey data. The findings indicated that TQM contains the dominant effect over TQM-performance. Yunis et al. (2013) recommended further research in which, other methods are a part of the equation over the self-reported questionnaire within this study (Yunis et al., 2013). TQM is a valid source of innovation management within an organization when management is willing to change how they view current TQM processes in a business (Steiber & Alange, 2013), however, TQM has the history of not being consistence when it comes to labor wages (Steiber & Alange, 2013). TQM and risk theories share common roles regarding safety and management involvement. However, I did not use TQM as the guiding theory for this study, as it focuses on areas such as wages, extensive obstacles, and customer service, and would not serve as a successful theory to investigate risk assessment. In addition, TQM theory did not capture the role of safety as it pertains to natural gas pipelines. Risk assessment theory provides data that managers use to focus on safety complexities and probability losses associated with natural gas pipelines.

Safety. Natural gas is a domestic fuel and is the most utilized source of energy throughout the world (Amir-Heidari et al., 2014). Natural gas has both economic and environmental benefits. The high demand for natural gas, along with the lack of safety in its production and logistics functions has become increasingly alarming in many countries. In addition, safety has a financial impact on an organization’s performance (Miller & Saldanha, 2016). Aminbakhsh, Gunduz, and Sonmez (2013) suggested that a risk assessment framework would create cost savings regarding safety.

Aminbakhsh et al. (2013) conducted a study to identify a risk assessment tool that would reduce potential hazards in construction projects. The researchers developed the cost of safety (COS) model and the AHP. Aminbakhsh et al. (2013) used the COS and AHP theories in collecting data regarding injury and death rates from accidents in the natural gas industry and compared the two to other construction industries for an in-depth analysis. The final data analysis defines a risk assessment framework that prioritizes security and safety protocols to reduce risks in construction projects while maintaining realistic goals. Project managers use COS and AHP theories as a guide to ensuring the physical security of all involved in the project.

The length of natural gas pipelines and safety concerns arising from pipeline leakage has led to the development of protocols focused on safety, safeguarding of the environment, and profitability cost (Jackson et al., 2014). Using risk assessments, project managers gain the ability to not only mitigate threats such as accidents but also ensure the safety of natural gas deliveries. A spill from a ship's ocean can carry to nearby developed areas, creating a danger to the land in the path of the spill (Hightower et al., 2004). Hightower et al. (2004) noted the improvement of safety measures involving safety equipment would minimize the risk.

Tong, Lo, Zhang, and Chen (2013) indicated that safety concerns associated with the delivery of natural gas through pipelines have increased because of the high development of urban and business construction utilizing the natural gas pipelines. European Law Directive 96/82/ECC was used as a safety improvement measurement to control enormous, dangerous substances. In 2001, an amendment of the European Law Directive 96/82/ECC (ELD) included details of standard distance for all dangerous substance between public and public dwellings (Sklavounos & Rigas, 2006). The reasoning to the credibility of the ELD amendment was because of the European Law, consisting of stability and adaptability while managing control and responsibility that was pivotal for safety (Grote, 2015). Mohsin, Majid, and Yusof (2014) identified a code of direction from Malaysia that required a gap of separation from the public dwellings.

Natural gas can leak from a damaged pipe creating health concerns and the climate-damaging greenhouse effect. To improve safety, the Obama Administration collaborated with the PHMSA to insert a safety method that removed menthol from the natural gas process (Webb, 2015). Chemical leaks pose a threat to the natural gas pipeline. In addition, Mohsin et al. (2014) notated that high-pressure water leaks can initiate danger to an underground gas pipeline, jeopardizing the pipeline's safety.

Ma, Li, Liang, LI, and Cheng (2013) identified models to protect the natural gas pipeline network from risk. The researcher's study includes a risk assessment based on the grid difference of individual pipeline line sectors (GDP). The city's gas pipeline network is the model identified by other researchers, utilized in the study. The purpose of the model was to describe and analyze the fatal pipeline length, accident probability, and accident consequence of unconfined vapor cloud explosion (UVCE). The results by Wu, Zhou, Xu, and Wu (2017) indicated the risk assessment benefit from the use of the city's gas pipeline network. Natural Gas Pipeline Safety is a sophisticated system that allows leadership to implement standard policies and procedures for the industry. (Charmberlain & Modarres, 2005). Moreover, the approach for effective implementation was for management to examine elements such as establishment and maintenance of safety zones and improved modeling and analysis (Hightower et al., 2004). Committing to safety regulations may decrease the risk of natural gas spills and other pipeline accidents (Frosch & Roberts, 2011). Furthermore, field workers and PHMSA share a responsibility to ensure project managers comply with all safety regulations (2016).

Mapping and unregulated pipelines. Underground utility lines pose potentially negative outcomes to organizations such as extended cost, project delays, and property damage. Li, Cai, and Kamat (2015) related these findings to the lack of (a) reliable data (b) pipeline location, and (c) end-users receiving proper communication and data from non-documented pipeline location. Underground spaces, also known as a city of wires for the utility network community. The vast number of utilities buried underground has made the mapping of the unregulated pipelines a daunting and problematic job (Jaw & Hashim, 2014). The challenging task of locating pipelines with the use of mapping, in conjunction with the lack of the proper assessment and monitoring tools could become shattering and threaten the civil infrastructure and maintenance of underground pipes (Jaw & Hashim, 2014). Baiden, Bissiri, Luoma, and Henrich (2014) agreed that with the proper tools such as 3D navigation system would assist with the safety of the mapping process. The safety of natural gas pipelines includes external protection (Cusick & Phillips, 2016). Mapping and unregulated pipelines are common in rural areas. Cusick and Phillips (2016) repeated safety protocols for customer awareness by using line markers as a paver for mapping underground pipelines. Groeger (2012) shared the concerns of safety for the external protection of pipelines above and underground. Although Groeger documented pipelines as being safe, he warned managers of the catastrophic consequences in the event of pipeline failure. Groeger argued that managers must implement proper safety risk measures to minimize pipeline accidents.

Regulations. All-natural gas pipelines are subject to state and federal regulations. Bowden (2014) stated that the Federal Energy Regulatory Commission (FERC) implemented a Notice of Proposed Rulemaking (NOPR), which was a result of the merger of the natural gas and electric power generation industries in the United States (US). McKenna (2016) noted a lack of regulations in the natural gas pipeline industry, concomitant with the improper storage of the liquid natural gas could result in disasters. For example, the leak on October 23, 2015, at the Aliso Canyon in Orange County, California was the result of inadequate inspections of emergency shutoff valves and a weak configuration of pipelines. The lack of regulations in this instance, created a major disaster, including a major financial loss. (McKenna, 2016). Lawrence and Tipton (2015) noted financial impacts from such disasters could lower safety standards and therefore, the implementation of regulations to protect the pipeline industry's safety risk. Natural gas pipelines increase of gradients, velocity, and flow rates pose a danger to the integrity of pipelines. The concerns have forced PHMSA to increase safety requirements. Natural gas companies experience cost savings when purchasing new pipelines by controlling the integrity of current pipelines (PHMSA, 2016). Pipeline regulations are a pillar of "how" the natural gas industry will structure maintenance, operate, and build pipelines (Lawrence & Tipton, 2015). Fernald (1914) stated the regulations for all pipelines should always remain fair to both the public as well as utility companies. Pricing of large, well-established gas organizations must remain the same as smaller companies, to avoid monopoly from the larger companies and the raising of prices. The community will benefit from the regulations by restricting the pricing to remain fair (Joskow, 2008).

The jeopardizing of safety created the leak at Aliso Canyon in Orange County, California. Regualtions proctects the safety of the emplpyees and the natural gas companies from the lost of profits. FREC and PHMSA were designed to assure all safety measures are taking when it comes to safety.

Development. The development of a risk assessment plan includes prioritization and accessing potential hazards, ensuring pipeline safety (Aminbakhsh et al., 2013). A risk development plan consists of prioritization from the most dangerous to the least dangerous in the critical analysis (*MITRE*, 2017). Queensland Government (2017) stated a manager's continuity plan within the development strategy would deploy as a recovery proposal to the measurement of the critical impact of the business. The natural gas risk development plan must include topics regarding leakage and corrosion. Stress corrosion cracking is the leading cause of pipeline damage, often creating catastrophic situations (Cheng, 2013). Plumtree and Lambert (2014) documented stress corrosion cracking growth occurred with the frequency of the gas flow. Beavers (2013) explained stress corrosion cracking as integrity awareness to natural gas pipelines and the connection to providing safety apprehension.

Kuo and Lu (2013) discussed the fuzzy multiple criteria decision-making approach as a preferred method. Project managers can use this decision-making approach not only to measure the threat but also discover its' impact. Another approach to decision-making is the group method inserted by a systematic process (Chaudhuri, Mohanty, & Singh, 2013). The decision-making process can include how management describes the life-cycle method. The life-cycle method identifies characterization models that provide the best methodologies (Hauschild et al., 2013). The success of a well development of a risk assessment plan asserted with strong project managers provided a balance to critical thinking. In addition, the opportunity to utilize the decision-making approach and prioritization of threats from an event such as the corrosion and cracking of the pipes.

Processes management. Transportation of natural gas requires a mixture of processes before the gas reaches its' destination. Each holding hub, which is where the natural gas is stored until movement is necessary, requires a process to include risk and safety before moving to the next station (U.S. Energy Information Administration, 2015). The list below identifies stations the gas must travel through to reach its' destination.

- Gathering lines,
- processing plant,
- mainline transmission systems,
- market hubs/centers,
- underground storage facilities, and
- peak shaving (U.S. Energy Information Administration, 2015).

The risk management planning process is a life cycle and serves as a platform to create improvement and reduce risk (Australian Sports Commission, 2016; Zsidisin, Panelli, & Upton, 2000). Mitigating the risk in processes can turn a negative risk into a positive outcome (Cibulka, 2014).

Cibulka (2014) noted reliable information to produce a positive outcome originates from communication between management and the organization unit gaining insight into any new variants to the risk assessment. Other methods to gain insight into any new variants to the risk assessment are: to identify the risk, analyze the risk, evaluate or rank risk, treat and monitor risk review risk, establish and identify the likelihood and consequence of the risk, add descriptions regarding other controls, and decision-making (Kloosterman, 2014; *Southern Cross University*, 2016). *Southern Cross University* (2016) stated risk analysis should include a collaboration with management who has the skill set and extensive knowledge of objectives outlining the processes. The use of process tools within the risk assessment strengthens the communication chain to all involved in the process and improves the results of controlling threats (Ganguly & Bandyopdhyay, 2014). The main elements in the risk development process include processes that management can use, such as communication and consultation, which establish context, identify risks, and monitor and review the risk of a life cycle process event (Sun, Keim, He, Mahany, & Yuan, 2013). Sun et al. (2013) noted that without those elements, management teams would most likely produce an ineffective risk assessment plan.

According to Cormican (2014), implementation of the risk development process provides management the advantage of analyzing record keeping and a pathway to continuous monitoring and updating. Bajcar, Cimerman, and Sirok (2014) suggested a model process to monitor the ventilation within pipelines, ultimately storing data on the airflow. The natural gas industry utilizes a broad range of methods to collect and store data. The safety data sheet (SDS), formally known as the material safety data sheet (MSDS) contains the material's main components: (a) flammability, (b) physical properties, and (c) toxicity (Ronald, 2012). Fleury et al. (2013) agreed the SDS was a favorable tool to save valuable information on hazardous substances materials. The SDS is a recommendation sheet detailing method on the proper handling and the dangers of hazardous substances materials. In addition to the SDS, pictograms reveal the threats in a more visible content, producing a speedy recognition of the dangers and the hazards chemicals listed (Boelhouwer, Davis, Franco-Watkins, Nathan, & Claudiu, 2013). Boelhouwer et al. (2013) noted the reason pictograms (pic) are so popular is the design of the pic tools compared to the SDS. However, Andrade-Rivas and Roather (2015) disagreed by sighting pictograms may provide a different meaning and confuse the end-user. Confusion may cause the end-user to make wrong decisions in addressing the risk of the materials.

Business Process Management (BPM) is a broad management tool used to add innovation to current processes (Rosemann & vom Brocke, 2014). BPM is a combination of technology and knowledge received from management and delivered to team members ensuring positive outcomes in everyday business operations and procedures (Van der Aalst, 2013). Process management is a source of TQM and is an educational awareness tool for implementing or enhancing current procedures (Benner & Tushman, 2003). Rausand (2013) categorized analyzing, planning, tracking, and control as part of processes for continuous risk management or risk assessment planning. Managers noticed an improvement in BPM when adding IT processes and usage of workflow charts, enhancing management mobility. Management teams can use BPM for process automation within everyday operations (Schmiedel, vom Brocke, & Recker, 2014). Estimates, developing plans, and measuring quality are also benefits of BPM because managers gain the ability to take necessary steps at each level of development (Coleman & O'Conner, 2007). Figure 2 includes a hierarchy of the BPM Continuous risk assessment for natural gas pipelines.

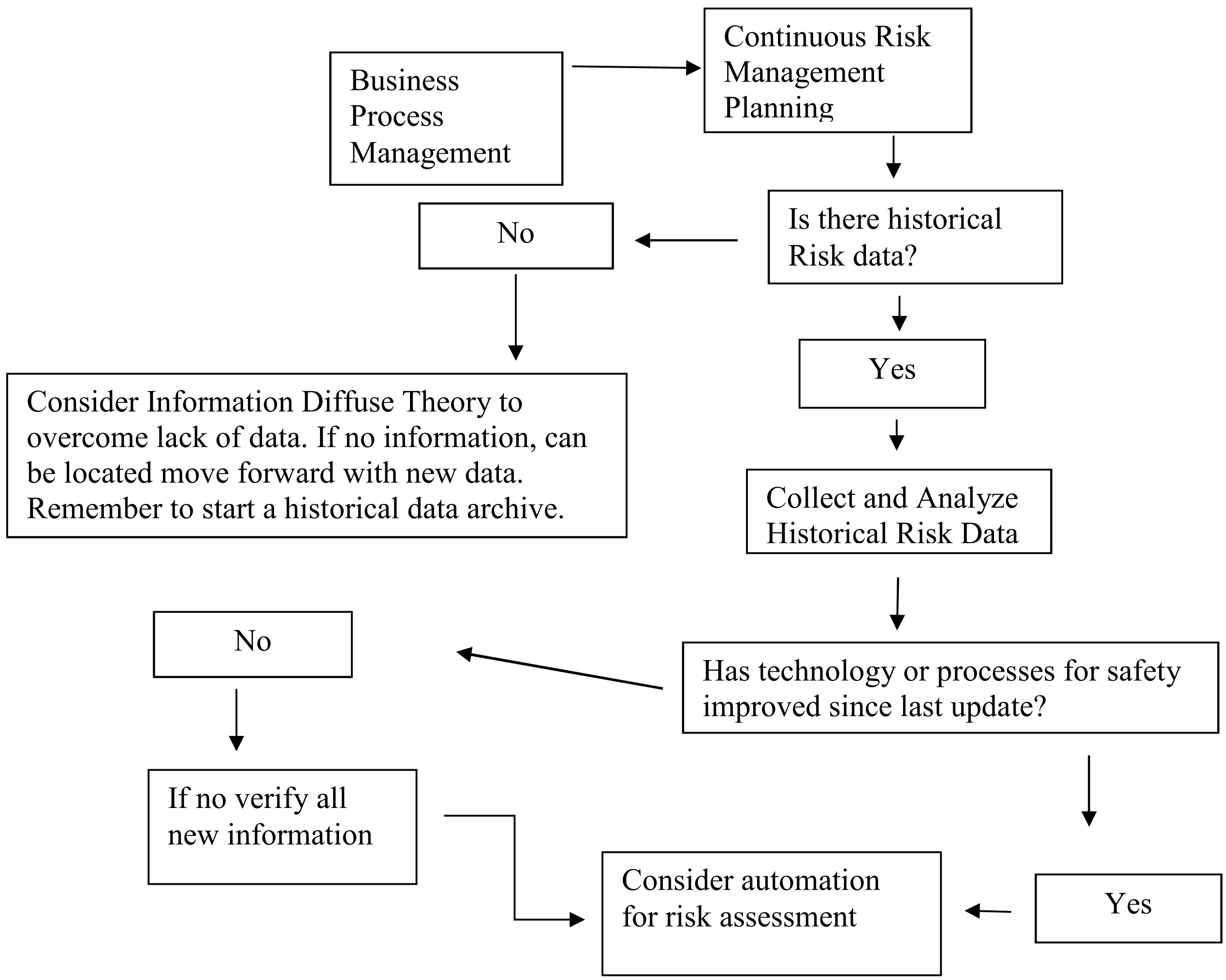

Figure 2. BPM continuous risk management planning This BPM figure defines the process of a continuous risk assessment process. The flow of the chart provides a “yes” and “no” response. The response will decide which way the flow chart will be used. The result is to have historical data to monitor and update the risk management plan direction that is taken.

Liu, Siu, Mitchell, and Xu (2013) developed a practicable multi-hazard risk assessment method that utilized what the researchers call information diffuse theory to overcome the lack of historical or spatial data that were lost or never captured. A racking score compares resources to the natural hazards that occurred. The results of the multi-hazard process allowed researchers an opportunity to collect data by using a racking score, which indicated high and low risk assessment.

Risk Assessment Technology

Risk assessment technology has a distinct role in ensuring process and personal safety in the natural gas pipeline industry and is paramount to the success of reducing pipeline failure. Implementation of a risk assessment policy may improve leaders' knowledge of educating current and future employees on the safety requirements of the natural gas industry. Cheng and Tezier (2013) discussed the use of modern technology to assist project managers in documenting critical safety procedures. Hwang and Ng (2013) identified challenges project managers encountered with documenting critical situations to reduce safety risks. Chien, Wu, and Huang (2014) discovered that technology leaders could develop a proactive approach to preventing major problems by accurately documenting and reporting potential risks. The natural gas industry could profit by modern day technology to enhance the recording of safety precautions that project engineers use in preventing risks. Some substantial companies use expensive microcomputers to store data, which is a benefit to leaders. What's more, Liu and Kleiner (2013) found the right choice of technology could improve the functionality of a company. Albeit there are managers that view technology as a positive source, technology likewise has a downside. Philip Chen and Zhang (2014) distinguished technologically shortcomings that could result in the inability to access databases when researching large amounts of data. Technology requires upgrades to maintain accuracy and percussion of data.

Cimellaro, Villa, and Bruneau (2014) used modern technology as an incentive to provide a performance index, allowing leaders to establish a clear understanding of disasters. Nguyen, Marmier, and Gourc (2013) stated the use of decision-making tools allows the project manager to survey and provide effective risk assessment strategies. Nguyen et al. (2013) utilized the ProRisk tool in their study, which consists of risk scenario concepts treatment and project scenarios. Project managers who use ProRisk to highlight situations to focus on the consequences of each scenario, enabling them to provide a suggested corrective treatment of risk. Project managers use ProRisk in combination with risk management assessment to collect and exchange information from the risk database (Qureshi & Albarqi, 2015).

Mousavi et al. (2014) discussed software technology that managers use to identify all components and fragility functions within the route of pipelines. Mousavi et al. used probabilistic seismic hazard analysis as the method for recording data. According to the U.S. Department of Homeland Security (2007), probabilistic or seismic hazard analysis is a description of the magnitude location and timing of all earthquakes or movement of the earth. Mousavi et al. utilized a risk assessment to determine the financial loss an organization may experience as the result of an earthquake. Seismic activity within pipelines was located and monitored using CRISIS 2007 a seismic hazard assessment and software. Mousavi et al. revealed the potential for significant financial loss over a wide period for several earthquakes, which reinforce the need for a risk assessment plan.

The tools managers use to detect leaks have improved over time. Acoustic signal detects low-risk pressure and can collect and transfer data of a leaky pipeline (Liang, Zhang, Xu, & Yan, 2013). Mostafapour and Davoudi (2013) reported that managers who use the acoustic signal receive adequate data by tracking the leak' stress wave. The stress wave is the sound made when a leak occurs within the pipeline (Mostafapour & Davoudi, 2013). You, Fan, Zhu, and Bai (2014) included a synopsis of multi-attribute analysis (MAAM) in their research. (MAAM) serves as a decision- making the tool in determining the potential consequences related to gas accidents and multi-dimensional risk measurement. The use of the Geographic Information System (GIS) provides the project manager with multiple data functions because of GIS's capability to integrate with other systems and input from spatial data management, analysis, data visualization and simulation (Huang & Handfield, 2015; Wang, Chai, & Niu, 2013). Federici, Bovolenta, and Passalacua (2015) noted GIS narrows the procedure in locating the area of concerns and other platforms needed to access the risk.

Since early detection is a major function in reducing pipeline failure, project engineer's managers rely on technology to provide continuous data. Smart pigs' usage has evolved through-out the years and project engineers have used smart pigs to obtain data on pipeline integrity such as pipeline wall density and thickness and dents. Data analysis to mitigate possible risk allows project managers the opportunity to address any threat that might occur (Kishawy & Gabbar, 2010). Pipeline and Hazardous Materials Safety Admininstration (2016) documented that smart pigs were effective in capturing data of irregularities. PHMSA noted the irregularities list may contain but not limited to corrosion, laminations, cracks, and other defects. PHMSA noted there are three types of smart pigs; Magnetic Flux Tools, Ultrasonic Tools, and Geometry Tools, all of which may aid project engineers when updating a risk assessment.

Determining when there is a potential threat is difficult and the risk's consequences can become costly, resulting in a loss of profitability for an organization. Behún, Kleinová, and Kamaryt (2014) used the failure mode analysis (FMEA) to provide an examination of the system, design, and process of an element that causes problems, errors, and risks or concerns. Behún et al. (2014) noted that FMEA is a tool to analyze potential problems for the early stage of risk assessment and is particularly useful in a process that has already started. FMEA model is flexible and modifiable throughout the business management process. Petrovskiy, Buryukin, Bukhtiyarov, Savich, and Gagina (2015) noted FMEA has a coefficient characteristic to risk and a basic method to protect profitability losses.

Petrovskiy et al. (2015) suggested six tasks required of the FMEA method for processes:

- Detection of bottlenecks;
- completion of technologies/structures to the most appropriate in terms of reliability and safety indicators, develop proposals for keeping the design and technological reliability;
- reducing the cost of removing defects;
- preventing the latent defects;
- preventing threatening situations and/or minimizing their consequences; and

- achieving the required performance security, environmental impact, and reliability

Consequences can be costly, providing the best technology can eliminate cost increase and safety incidents in a failed pipeline. Using technology such as the pigs and GIS as suggested by Wang et al. (2013), provided the data to insert into a proactive risk assessment plan. In addition, the safety of all involved. A risk assessment plan and the safety of the natural gas pipeline provides performance security and the most current technology. FEMA and the PHMSA assure all technology are approved.

Training

Ramazani and Jergeas (2015) noted gaps in current training trends for project managers. The training and educational background may prepare project managers for a future in project management in the natural gas industry. Ramazani and Jergeas (2015) argued extended training will increase project managers' awareness of interpersonal and critical thinking skills towards complex projects and will engage managers in real life scenarios. The project manager's role in natural gas risk assessment is critical. Therefore, project managers have the responsibility to ensure a risk assessment is ready and available in case of a catastrophic disaster that would lead to financial loss and threaten the safety of employees (Tannahil, 2013).

Project Systems Technologies Oil Gas Facilities (2013) suggested project managers have a different challenge when evaluating a risk asscessment plan and incur unique projects, which require a different approach to the gas industry. The development of a risk assessment requires skilled personnel with project management experience.

Project engineer training will prepare management teams to bridge the gap between risks, safety, and control (Card, Ward, & Clarkson, 2014). Boschee (2013) argued that project managers in the natural gas industry are managers by either life experience or informal mentoring and they tend to be engineers turned project managers. Mentors and life lessons are the current trend of training project managers, but managers questioned the effectiveness of this approach (Project Systems Technologies Oil Gas Facilities, 2013).

Boschee (2013) stated that engineers turned project managers brought vast skills that benefit risk assessment and safety. According to the *Project Management Institute* (2016), a successful project manager is detail-oriented and does not pivot away from current processes. Project managers are aware of time restraints and the importance of meeting deadlines while staying on budget. Project managers have a sense of management expertise and leadership skills while maintaining a multi-tasking attitude (Saade, Dong, & Wan, 2015). Fabricius and Buttgen (2015) argued that project management success includes the probability of the risk and noted the rewards of a project's success are overcoming the risk.

When completing a risk assessment plan, project managers must remain in a neutral state. Being biased could result in a partial decision regarding the probability of risk occurrences (Fabricius & Buttgen, 2015). Ahuja, Dozzi, and Abourizk (1994) added that bias could affect a manager's ability to plan successfully. To minimize bias, a project manager must employ people- oriented, information-oriented, and action-oriented traits. When managers employ these traits, they gain the ability to move the project forward in a positive manner (Laufer, Hoffman, Russell, & Cameron, 2015).

The project manager's role has increased throughout the years and is now a valuable part of all projects (Bredin & Jonas, 2013). Therefore, training is crucial for all managers, ensuring they have all the tools necessary to complete risk assessments. Leadership is one of 15 critical areas for successful project managers (Trivellas & Drimoussis, 2013). A project manager's leadership style may be the leading factor in how well their team performs (Yang & Wu, 2011).

Emphasizing the importance of organizational communication during training sessions with project managers may improve the quality of risk assessment plans (Globerson & Zwikael, 2002). Thamhain (2013) suggested organization and communication are core skills to a project's success. Thamhain stated intense organization and communication from project management teams might possibly lessen the project's risk. Engaging in communication processes may allow managers to pre-identify risk in potential areas that might be vulnerable to negative outcomes. Project Systems Technologies Oil Gas Facilities (2013) noted that conducting formal and exclusive training for project managers along with the traditional mentor and life experiences could possibly deliver a higher success level. Project Systems Technologies Oil Gas Facilities offered upper-level managers the following five suggestions when training project managers:

- The success of project management depends on not only the tools and techniques applied to the project. If an organization is set up as a line organization and project managers struggle to have control over their resources, the best tools and techniques will be of limited use. Organizational boundary conditions must be set for the success of project management as the means to conduct business.

- Support only works if it is true support. Project managers must separate support groups from portfolio management or project governance. The tangibility of the support in the form of tools, direct coaching, and mentoring is critical. Upper management must make and support decisions about the model managers use to provide these services.
- Upper management must ensure the project management approach aligns with underlying organizational business processes. For example, if the project management approach suggests a schedule or budget management that differs from that used in approval processes, it will not be helpful to the project manager, possibly placing a burden on the project manager.
- Do not expect immediate effects. It takes time to change people's mindsets and approaches toward project management. Training and coaching are important components.
- Do not underestimate the need for change management. Be prepared by seeking expert help in the change process and current best practices. Project Systems Technologies Oil Gas Facilities indicated that project managers take time to get people interested before they launch a program Project Systems Technologies Oil Gas Facilities (2013).

Jeong and Bozhurt (2014) evaluated a simulation training exercise and the value-added when training project engineers and project managers. Their focus was on the combined knowledge and skills the project manager obtains from the training. Each participant participated in a pre-and post-simulation to assess the effectiveness of the course as a tool for learning. The study provided results as to who benefited the most from the training; rather it was the less knowledgeable or, the more experienced project management team. The results indicated that which project management teams with the most experience excelled in the educational valve, also brought prior knowledge and understanding. Jeong and Bozhurt (2014) noted the simulation training exercise was indeed a positive instrument for all project engineers to consider as a tool for training.

The danger of natural gas pipelines and the concerns for safety includes the efficiency of first responders and or other members of the fire departments. Levy (2014) noted public awareness and proper training would aid in the safety of responders and fire departments. Levy discussed federal regulations, which required all-natural gas facilitators to implement an awareness program. Levy reported that a utility company created an online training module to address protocols, consisting of different natural gas incidents. The modular consists of gathering data from surveys distributed to various fire departments and first responders. Once all data analysis was completed, the course went life and was set as a self-paced course. The self-paced course may accommodate firefighters' rigid schedules. Upon completion of the training module (including an 80% passing score), firefighters and first responders received certifications, qualifying each to respond to natural gas incidents. According to the result of Jeong and Bozhurt (2014), the research revealed the importance of training, quick response time, and responding safely to situations. Furthermore, training provided first responders and firefighters with a module to reference when responding to a natural gas incident.

Summary and Transition

This qualitative single case study was critical to project engineer managers looking to obtain successful processes when working with natural gas. The information presented in the literature review on risk assessment and safety could serve as a benefit for project engineers to review when developing successful risk mitigation plans. The recent increase of production in the natural gas industry has caused great concerns for safety and the loss of profitability. The research question of this qualitative case study aligned with the different tools that project manager's use in mitigation of safety and profitability loss accrued by the acts of nature or corrosion to pipelines. Project engineer managers who offset risk and provide safety when employees are working on natural gas pipelines and who prevent incidents that may be catastrophic might find the study's results useful. I explored training and technology techniques project managers could use to be successful. The conceptual framework was the concept for the theories of the study. Safety was a concern when transporting natural gas and maintaining the maintenance of natural gas pipelines and therefore, safety was a construct for this study.

In Section 1, I have included discussions of the purpose, problem statement, research method, background, and nature of the study. I have also provided operational definitions and an extensive literature review. I have outlined the assumptions, limitations, and delimitations of this qualitative case study. Section 2 included a discussion of my role as the researcher, in which I describe the data collection process.

Section 2 included discussions on participant interviews, collection techniques, ethical research practices, data organization, and the reliability and validity of the data.

Section 3 was the final section of this qualitative case study. Section 3 contained the presentation of the findings to include analyses. In addition, incorporated were the explanations or recommendations for action and further research. This concludes my review and edit of the review of literature section.

Section 2: The Project

In Section 2, I cover the following topics: research methods, resources used for the study, the role of the researcher, participants, design, the population sampling, data collection, and reliability and validity.

Purpose Statement

The purpose of this qualitative single case study was to explore strategies that engineer project managers in the natural gas industry used to improve risk assessment planning to reduce pipeline accidents and improve profitability. The population for data collection in this single case study came from engineer project managers in the natural gas industry located in central Virginia who had successfully implemented business strategies to reduce pipeline accidents and improve profitability. The implication for positive social change included the potential to provide safer workplace environment throughout the central Virginia region by developing risk assessment strategies for engineer project managers. In addition, by reducing safety risk associated with natural gas pipelines project managers would enhance the public perception and improve relationships with environmentalists.

Role of the Researcher

In the data collection process, I was the primary instrument responsible for collecting interview data about risk assessment plans. Rudestam and Newton (2007) noted that the leading role of the researcher was to bring clarity to research and the theories previously studied by other individuals. Langley, Smallman, Tsoukas, and Van de Ven (2013) stated the role of the researcher was to ensure that all information had creditability and validity to improve past or current processes. My role as the researcher was to gather data on strategies used by project managers in the natural gas industry to reduce losses associated with pipeline accidents.

I have no experience in the construction of natural gas pipelines. However, I do have 4 years of natural gas administrative logistics and 17 years of energy experience. My expertise in the natural gas industry provided information on risk assessment to develop questions for conducting a semistructured interview process. I conducted phone interviews and transcribed and coded the responses. According to Walden University, I required written authorization to conduct my semistructured interviews with the participants. During my training with the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (1978), as a requirement, I received ethical training of standards to adhere to with participants in my study. According to Yin (2013), in the data collection process, the researcher gathers data from participants and other research sources. The project managers had the opportunity to provide their viewpoints on strategies they used to improve profitability associated with natural gas pipelines.

To protect the integrity of this study, I used the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (1978). *The Belmont Report* outlined the ethical protection needed for all participants in this study. The paper interview, flash copy, hard drive, and digital copies of the transcripts will remain in storage for 5 years to comply with the Institutional Review Board (IRB) regulations. After the 5 years have expired, all paper copies and digital work will be destroyed. Participants were free to withdraw from the study at any time. The interview process required confidentiality.

I maintained an unbiased attitude towards the survey and interview questions as suggested by Moustakas (1994). During the data collection, I used peer-reviewed sources to collect data, which helped avoid personal bias. I had no relationship with the participants, which could introduce bias in the interview process. My role as the researcher was to mitigate bias. I conducted further analysis as needed.

Consent forms were required for all participants to protect their privacy and reduce any risk associated with unethical behavior in the semistructured interview process. In addition, consent forms were a regulatory and ethical requirement for this research (Grady, 2015). I used the protocol as a guide for the interview process (see Appendix), which required responses to be recorded and transcribed to help ensure the cohesion and reliability of the study.

Participants

In a qualitative study, participants are individuals who share their knowledge and experience of the research topic (Cleary, Horsfall, & Hayter, 2014). The participants in this study were managers and employees with experience in the natural gas industry. Candidates met the following qualifications: (a) must currently work or previously have worked in the natural gas industry for at least 1 year, (b) was an engineer project manager, (c) was at least 18 years of age, (d) had knowledge of the current risk assessment and safety process for the natural gas industry, and (e) signed the consent form. To address the overarching research question, my primary focus was to interview qualified participants involved in a successful risk assessment process. Thus, the participants must implement strategies that might improve organizational profitability.

The location chosen for this study was central Virginia. I chose central Virginia because the location would provide me the opportunity to conduct personal interviews with a telephone interview available as a backup. The participants' knowledge of the research topic and the amount of data collected determine data saturation (Marshall & Rossman, 2014; Yin, 2014). According to Brown et al. (2013), the semistructured interview process was important for gathering research data from the participants while sustaining the validity of the study. Therefore, upon approval from the Walden University IRB, I solicited participants to schedule interviews.

Research Method and Design

Research Method

Researchers choose from three study methods, mixed methods, quantitative, or qualitative (Wahyuni, 2012). The qualitative study was the assigned method for this study. According to Yin (2014), a qualitative study is an exploration of a social or human problem as it relates to an individual or a group of individuals. Yin (2014) noted the characteristics of a qualitative study included the ability for researchers to acquire answers to sub- and central questions. Alex, Näslund, and Jasmand (2012) noted the validity and reliability methods for developing the case study.

I chose a qualitative study to obtain comprehensive knowledge of the lived experiences and perceptions of the participants. Interviews, collecting open-ended data, and observations are part of the qualitative research data collection process (Alsaawi, 2014; Yin, 2014). According to Yin (2014), a qualitative study consists of open-ended questions that increase the participants' freedom to have an in-depth dialog about their own experiences.

Thompson and Carlson (2017) and Martins, Pestana, Souza, and Schleder (2016) stated that quantitative methods involve statistics that assess empirical relationships. In addition, Yin (2014) described a quantitative method as a study that included variables and hypotheses from research questions. A quantitative method by its nature could not yield the data needed to answer the research question for this study; therefore, I did not use a quantitative design. The study I chose was not about conducting experiments based on the requirements of quantitative analysis. Frels and Onwuegbuzie (2013) noted that mixed methods had a dual role of qualitative and quantitative methodologies. In addition, mixed methods require data sets and statistical tests of quantitative data (Bansal & Corley, 2012; Trotter, 2012).

Research Design

Qualitative studies encompass several designs including narrative, ethnography, phenomenology, and the case study (Yin, 2013). The research design chosen by the researcher should align with the study's research question (Trotter, 2012). Yin (2014) noted researchers conducting a case study should focus on the main theory to project the decisions associated with the research.

The design of the research was a single case study. Yin (2014) stated a qualitative case study goes beyond lived experiences and includes perspectives and additional evidence beyond interviews that assist a researcher in exploring a complex process in the form of how or why. A phenomenological researcher explores lived experiences to understand a problem (Moustakas, 1994), and ethnography consists of a particular perspective of what people do and say (Yin, 2013). Bevan (2014) noted the phenomenological design is restricted to collecting biased data and prevent or restrict my own biases while researching public data. Hazzan (2014) described the ethnographic study as a culture-driven process exploring groups and behaviors. However, my study did not require a cultural-driven process.

Neither a phenomenological study nor an ethnographic study worked because the study consisted of exploring risk assessment plans using semistructured interviews from the perspective of interviewed participants. I could have used a quantitative or mixed methods research approach to obtain data for my study; however, it was most beneficial to explore risk assessment plans to improve safety by using the qualitative method. This study focused on project engineers and operations with an emphasis on safety. In addition, Chikweche and Fletcher (2012) noted data saturation occurred with findings from multiple sources on the research topic of the study. In a case study, data saturation occurs when the topic has been exhausted and no new information is forthcoming (O'Reilly & Parker, 2012). It was not the amount of the data collected, it is the depth of the data that produces data saturation (Yin, 2014). I conducted five interviews for this study to complete the data saturation process.

Ethical Research

Protecting the participants and providing each person with respect and privacy by utilizing the informed consent process will eliminate any research ethical problems or collection of the data that may arise (Judkins-Cohn, Kielwasser-Withrow, Owen, & Ward, 2014). I did not start the interview process until approval was granted from Walden's IRB. I conducted the research under Walden University IRB approval number 04-22-19-0170614. Guillemin et al. (2016) noted three elements to ensure valid informed consent (a) information, (b) voluntariness, and (c) confidence. Participants should not feel overwhelmed but have all the proper information to make a sound decision as to the interaction of the interview process (Lambert & Glacken, 2014).

The participants were sent the informed consent form which stated the purpose of the research, in addition, the consent form also included a request to interview the participants. The participants were informed of their right to confidentiality, participating in the study was voluntary, and they could withdraw at any time (Harriss & Atkinson, 2014). When each participant agreed to participate, they received an informed consent form found in Appendix B. The consent forms were delivered to the participants through e-mail correspondence. Since technology has improved, this was a good source for collecting data and protecting research participants. The participants received information, which included the purpose of the study, the research process, and information regarding compensation.

To ensure all participants felt comfortable with the interviews and to address any concerns the individuals may have had, I scheduled the interview upon their availability. The interviews were conducted via telephone conference in a private space. The private space served to address ethical issues and maintain a protocol for the interview sessions

(Block & Erskine, 2012; National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978; Vainio, 2012).

According to Yin (2014), the researcher's responsibility includes all data analysis, data gathering, and data storage. The researcher's responsibility was to protect the privacy of the participants. Alex (2012) noted the importance of eliminating all names in the final study. Therefore, my participants were referred to as P1, P2, and so forth. The data was stored on a secured computer thumb drive. In addition, the computer thumb drive was stored in a secured place. Walden IRB required data to be safely stored for a period of 5 years. After the five-year tenured, all data collected will be safely discarded by deleting all information on the hard drive and shredding all written data.

Population and Sampling

In this qualitative single-case study, the sample consisted of participants within the United States. I chose project engineers for this study because of their successful risk assessment strategies and the ability to limit the loss of profitability. The participants were educated and well trained. The eligibility of participants for this study (a) had to work in the natural gas industry for a least one year, (b) been an engineer project manager (c) at least 18 years of age or older. Data saturation determined the precise number of required interviews (Baker & Edwards, 2012; Dworkin, 2012; Fusch & Ness, 2015; Robinson & Schroeder, 2015). Data saturation occurred when new information was hard to obtain, and coding was depleted (Coenen, Stamm, Stucki, & Cieza, 2012; Palinkas et al., 2015). The sampling, participant's involvement, and in-depth responses saturated the research (Marshall, Cardon, Poddar, & Fontenot, 2013; Robinson, 2014). I assured the sample sizes of the participants provided enough evidence to reach data saturation.

Data saturation must occur within the participants' interview process; therefore, saturation transpired when I exhausted all data collection and replicated. I used mythological triangulation to achieve data saturation (Chikweche & Fletcher, 2012; Denzin, 2012; Wilson, 2014). Data saturation was composed of transparent boundaries, which achieved quicker results when used in a case study (Fusch & Ness, 2015). Meetings via telephone in a private office allow participants to be comfortable and flexible to participate in interviews. Lewis (2015) noted meeting in a quiet location and setting a timeframe of no more than 60 minutes would reduce repetitive talking points.

Protecting the participants and providing each person with respect and privacy by utilizing the informed consent process assured the participants that all efforts were done to safeguard their well-being (Judkins-Cohn et al., 2014). Guillemin et al. (2016) noted three elements to ensure valid informed consent (a) information, (b) voluntariness, and (c) confidence. Participants should not feel overwhelmed but have all the proper information to make a sound decision to participate in the interview process (Lambert & Glacken, 2014).

The consent form delivery to the participants was through e-mail correspondence. The participants were aware this was voluntary and could withdraw at any time (Harriss & Atkinson, 2014). To ensure all participants were comfortable with the interview and to address any concerns the individuals may have had, I scheduled the interview based on their availability. The interviews consisted of a telephone conference in a private area.

The private space served to address confidential issues and protect the privacy of the interviewee (Block & Erskine, 2012; National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1978; Vainio, 2012).

The researcher's responsibility was to protect the privacy of the participants. According to Yin (2014), the researcher's responsibility included all data analysis, data gathering, and data storage. In addition, Walden required researches to store data safely for 5 years. I stored data on a secured computer thumb drive. In addition, the thumb drive storage was stored in a safeguarded place within my residence. Alex (2012) noted the importance of eliminating all names in the final study. Therefore, my participants were P1, P2, P3, P4, and P5 for the interview process.

Data Collection Instruments

Participants provided the data for the researcher to collect. The image data from a qualitative approach must contain at least two data collection sources (Yin, 2014). Boblin, Ireland, Kirkpatrick, and Robertson (2013) noted data collection sources came in many forms, artifacts, reports, focus groups, videos, observations, and current documents. I was the interviewer and served as the primary data collector. I took notes and used the open-ended semistructured interview questions as suggested by (Grant, Rohr, & Grant, 2012; Ivey, 2012; Murthy, 2013).

Houghton, Casey, Shaw, and Murphy (2013) noted the researcher must be aware of all procedures and maintain a strategy throughout the study to assure (a) dependability, which was compared to quantitative research because of the reliability it presents (b) transferability maintains the meanings while it was being determined if it was transferable or not, (c) confirmability can be confusing with dependability because the two are similar. The difference in confirmability was it defined the accuracy of neutrality of the data and (d) credibility was the findings and the credibility and its values. The researcher had the responsibility as the individual contributor in collecting the data from the real-life experiences of the participants (Chenail, 2011). In addition, Chakraverty and Tai (2013) noted the researcher's role included a strategy for reducing non-bias and disregarding any data collection with tainted views. I utilized the open-ended questions interview process (see Appendix E) for this study. In addition, Yin (2014) noted the importance of connecting to the participants to allow full participation and conducting the interview in a natural setting. I used the audiotape recorder, phone, company website, notebooks, and laptop and writing tools as the data collection instruments. I used Dragon software to analyze interviews and audio recordings. The interview process also consisted of a notebook, pencil, and my laptop for notetaking. There were eight open-ended interview questions given to the participants. In addition, each participant had the opportunity to provide additional information that would solidify this study.

Data Collection Technique

The data collection techniques included phone interviews and artifacts (Yin, 2014). Each interview was 30-45 minutes long, which was recorded and transcribed. Qualitative researchers were best-suited using personal interviews as part of the data collection process (Haahr, Norlyk, & Hall, 2014; Potter, Mills, Cawthorn, Donovan, & Blazeby, 2014). Before the interview, I reminded each participant the reason for the questions, the criteria, and their rights in participating in the research process along with their right to withdraw. Each participant was provided with a copy of his or her consent form and present the questions for the study to capture the individual contributor's real-life experiences (Stuckey, 2014). In addition, I allowed the participants to ask any additional questions about the study.

Rowley (2012) stated the interview(s) when completed in a semistructured process was beneficial to the data collected. As indicated in Appendix C I set protocol with each participant by sending an email to schedule time for phone interviews. I also took the conference call in a private office creating a friendly atmosphere before starting the interview process (Grant et al., 2012). Once again, I explained the purpose of the interview and the primary objective I was attempting to achieve in the conversations. The phone interview was audio recorded with the permission of the participants until data saturation occurred. Data saturation was composed of transparent boundaries, which achieved quicker results (Coenen et al., 2012; Palinkas et al., 2015). Once data was transcribed from the semi-interviews, I provided each participate (s) with a copy of the transcript for member checking purposes. Conducting member checking ensured that all data collection was accurate.

The advantage of semistructured questions as noted by Kendall and Kendall (2010) was having the freedom to discuss participants' thoughts and the researcher's ability to ask non-script questions. In addition, the advantage of open-end questions allowed the researcher to extend the interview questions if needed (Lewis, 2015; Yin, 2014). However, the disadvantages of semistructured open-ended interviews according to Kendall and Kendall (2010) were (a) participants' hypertensive to disclosing sensitive information, (b) time restraints, and (c) challenge monetary limits.

A pilot study was not a choice conducted in this study. As suggested by Yin (2014), researchers used the pilot study to test the research questions. The positive note of using a qualitative study was the flexibility of learning in real-time for the researcher (Pritchard & Whiting, 2012), which would eliminate the need for the pilot study.

Data Organization Technique

Organized data in a qualitative study was a required component for the researcher (Yin, 2014). In addition, Saldaña (2013) noted the use of codes along with organizational skills and themes would produce a successful data collection. Yin (2014) noted the codes would generate from the interview response, however, there were 4 components to the development of themes; (a) interview responses, (b) triangulation sources, (c) proof from the literature review, and (d) alignment with the conceptual framework. Doing the interview process, I assigned an identifier such as P-1 to ensure that the participant identity remained confidential. In addition, Irvine, Drew, and Sainsbury's (2012) stated organization, labeling, and the categorizing method were also beneficial in doing the interview process.

Having a systematic coding system benefited the collected data analysis process, and when analyzing the final interview questions (Marshall & Rossman, 2014). Yin (2014) suggested a semistructured interview process included an accurate note-taking and organized labeling system. I used OneNote and Dragon software to store, organize and transcribe my data. I saved all documents in an identifier file for easy access as suggested by Bazely and Jackson (2013). All interview materials (notes, responses) will remain in a secured location with password protection for 5 years. The deletion of all documents and data collected will occur after the 5-year period has expired to protect the privacy of the participants.

Data Analysis

According to Rowley (2012), researchers utilize data analysis for a qualitative study to collect data and divide the data into categories and themes. I used the responses from my participants to categorize and organize the data into themes. The central research question was in alignment with the interview questions. In addition, the interview questions for this qualitative case study was serving as the enabler for methodological triangulation. According to Horne and Horgan (2012), methodology triangulation provided clarification of collected data; findings reassurance and allowed additional validity.

The data collection process began with successful strategic processes project engineers used from the past to the presence of risk assessments and improvement of profitability and reduction of losses associated with pipeline accidents. The data collection process required a logistic and chronological approach (Schreier, 2012). All notes sent to my email and my personal computer were for transcribing and protecting rights. The software used for transcribing and coding was Dragon. I used Microsoft Word and Excel to store the data on my computer. Miles, Huberman, and Saldaña (2014) suggested the use of computer software for data analysis purposes. To format the theory, I used coding identifiers and tabs. The data analysis included limiting inefficient data which according to (Miles et al., 2014; Sikahala, 2014; Yin, 2014) would compromise the research findings.

There were five stages to data analysis according to Yin (2013) and Yin (2014): (a) regrouping of data to themes, (b) data collection, (c) date separation grouping, (d) information assessment, and (e) conclusions development. The data analysis included themes from my literature review and conceptual framework. I used Dragon software to collect and then transfer data to my personal computer. The Dragon software transfer includes the coding and analyzes of my interview data into word.

Reliability and Validity

Reliability

Yin (2014) identified reliability as a valuable tool to ensure the study was consistent and replicable. Morse (2015) demonstrated that steady strategies and interview processes would yield dependable and accurate outcomes by different analysts' accordingly uncovering relevant results. Fusch and Ness (2015) proposed member checking would assurance the understandings of the participants' responses to the interview questions are precise. I conducted member checking on all participants in the interview process to ensure information was accurate. During the expiration of collecting data for my study, I conducted member checking to prevent bias information as the requirement of Walden University IRB as stated based on IRB. To mitigate the error of miscommunication, I took notes and recorded all interviews.

Validity

As indicated by Burchett, Mayhew, Lavis, and Dobrow (2013), empowering others to evaluate the validity and reliability of qualitative data was basic in deciding the balance and credibility of discoveries, conclusions, and suggestions. Reliability and dependability, according to Munn, Moola, Riitano, and Lisy (2014), interact with each other. Burchett et al. (2013) noted credibility, dependability, transferability, and believability all have a relationship with qualitative validity. I followed Yin's (2014) suggestion of member checking, which, was another method for approving reliability, credibility, transferability, and confirmability.

I utilized methodological triangulation for this single case study to gain the phenomenon viewpoint. Fusch and Ness (2015) described methodological triangulation as an approach utilized by researchers to use various sources of proof and manages the chance to explore a more extensive scope of behavioral concerns. The methodological triangulation was used to improve the validity of the findings by utilizing reviewing documents and asking the interview questions. Bekhet and Zauszniewski (2012) suggested using two or more sources to strengthen the validity of the study.

Data saturation was a repetitive process with no clear information, no themes, or a lack of data development (Coenen et al., 2012; Palinkas et al., 2015). Habersack and Luschin (2013) referred to saturation as a sign of all-important information received for the study. Data saturation must occur within the participants' interview process; therefore, saturation occurred when I exhausted all data collection and replication arose.

The study results was a reflection of assurance from reliability and validity throughout the data analysis process.

Summary and Transition

The purpose of the qualitative single case study was to explore the strategies: What strategies do project managers in the natural gas industry use to reduce profit losses associated with pipeline accidents? Section 2 included the role of the researcher, which described the data collection for this study. In addition, contained within Section 2 was the participants, the reliability and validity and data collection. The focus of Section 2 was to center on the actual research. Section 2 included the expansion of the Nature of the study from Section 1, or as a reference in Section 2 as the research method. In addition, Section 2 included collection techniques, ethical research, and data organization. Section 2 ended with the reliability and validity data. The research in Section 2 outlined Section 3 summary and conclusion.

Section 3 was the final section of this study. Section 3 contained the presentation of the findings to include analyses. Section 3 included the purpose statement and research question. In addition, incorporated were the explanations or recommendations for action and further research. The study ended with the implication for social change and summary and conclusions.

Section 3: Application to Professional Practice and Implications for Change

Introduction

The purpose of this qualitative single case study was to explore strategies that engineer project managers in the natural gas industry use to improve risk assessment planning to reduce pipeline accidents and improve profitability. The target population consisted of five engineer project managers, who had successfully implemented business strategies to reduce pipeline accidents and improve profitability. The engineer project managers received consent forms after I received approval from the IRB at Walden University for data collection to take place. In an e-mail to the participants, the purpose of the study was described in the consent form. After receiving consent from the participants, I scheduled phone interviews. The data came from semistructured interviews with five engineer project managers contacted via social media. Member checking ensured the accuracy of the interpretation of the participants' interview statements. Methodological triangulation came from interview data, my interview notes, and reviewing the company website.

Presentation of the Findings

The overarching question for this doctoral study was: What strategies do engineer project managers in the natural gas industry use to improve risk assessment planning to reduce pipeline accidents and improve profitability? I identified four themes from the participants' interview notes, interview data, and company websites. All four themes were linked by the conceptual framework of the risk assessment theory.

I scheduled follow-up sessions to conduct member checking. Myers (2013) suggested organizing the information once it has been compiled and interpreted into categories. Four themes emerged from my analysis of the participants' responses: (a) safety, (b) training and development (c) process management, and (d) strategic risk assessment (see Table 1).

Table 1

Frequently Used Strategies for Implementing a Risk Assessment Plan

Thematic categories	Frequency of most used strategy
Safety	39
Training and development	17
Project management	19
Strategic risk assessment	29

Safety

The first theme that emerged from the data analysis was safety. Each participant considered safety as a major component of the risk assessment strategy. According to Miller and Saldanha (2016), safety has a financial impact on an organization's performance. In addition, Aminbakhsh et al. (2013) posited that a risk assessment framework would create cost savings through safety. P3 emphasized the importance of safety over profitability. P3 stated,

> First, we must remember that risk assessment assists with identifying any possible risk and addresses new developments or actions to be taken in the future. It is an ongoing process to assist with mitigation of the risk to the pipelines. We do not

> focus as much on the cost part of the risk assessment, but more on the safety and awareness of all working. This would include contractors and vendors. This would also include but not limited to OSHA training, classroom time, and incentives.

P2 echoed the same sentiments as P3 that there should be more focus on safety then cost. P2 stated,

> Cost on safety could jeopardize employee welfare and company profitability, so we focus on the prevention of risk. We do so by offering safety awareness classes, incentives, setting mandatory work requirements, and training. Our employees are constantly reminded of the dangers of the natural gas pipeline and know we rely on them to monitor and report any hazards they see.

P1 noted strategies for improvement of risk assessment safety included regular safety meetings and recognition of good safety behavior for employees. P1 stated,

> Weekly safety meetings allow managers to engage and encourage employees to make healthy safety decisions when working on or around pipelines. They also provide managers an opportunity to circle back around and address the company's safety policies and rules. This process also includes all contractors. We provide all PPE's update and reward good safety behavior.

Safety aligns with the conceptual framework and literature review because it involves improved employee awareness and thereby promotes eliminating accidents. Scholz and Gary (1990) stated that risk assessment could identify safety measures to prevent accidents and provide data on injuries. Scholz and Gary based their theory and data from the OSHA guidelines and inspections on how it would reduce the financial loss as well as decrease the number of injuries. Scholz and Gary indicated all companies should have some form of inspections or risk assessment in place to offset the risk. The companies should focus more on safety improvements than the profitability aspect.

Grote (2015) reported that best outcome for a company when it comes to the safety of employees occurs when firms align their practices with a risk assessment. The alignment with the risk assessment will minimize potential risk and cost from consequences of pipeline failure. The findings of this study are consistent with risk assessment, which enables the engineer project managers to improve organizational safety performance and reduce any losses that may occur from natural gas pipeline incidents.

Training and Development

The Occupational Safety and Health Act of 1970 noted employers should consider the well-being and working conditions for all employees by providing education and training on safety and health. Both P2 and P4 agreed that when it comes to safety, management must lead by example. P2 felt the company offered training tools to enhance safety when working on natural gas pipelines or in the proximity of the lines. P2 stated,

> We offered pipeline safety classes on topics such as awareness, accountability, and knowledge learning, weekly safety meetings to address employees' concerns and information we might share, job training on equipment, office safety, and other topics. We encourage employee involvement as much as possible. Our

> company takes the training of every employee and contractor that enters our site seriously, and safety accidents are down.

P4 believed that everyone should undergo safety training, even if the employee is not impacted by natural gas maintenance. At the end of the year, a recap is completed in an annual safety training. P4 stated, "This is included in our initial and annual safety training. Along with our prejob briefing, before any maintenance is done. By tracking all incidents, we can address most risk and have implemented corrective actions to improve performance." P5 believed organizations should have a safety specialist to provide updates and training to employees. P5 also expressed the importance of employees buying into the safety training. P5 believed that if the employee feels valued then the result of training will lead to higher safety performance ratings and fewer incidents. P5 stated,

> Our strategy is always trying to avoid any risk or danger. But that always cannot be. So, we educate, educate, educate. I can't express that enough, knowing the dangers, how to act upon them, and how to avoid any hazard. Prevention first, then we consider past incidents. We try to keep the processes updated, as well as adding new ones.

Training and development aligned with the conceptual framework and literature review. Ramazani and Jergeas (2015) noted that project managers would benefit from training, as it would increase their awareness of risk and risk mitigation. In addition, training extends their critical thinking skills. The training would also equip and prepare management teams to bridge the gap between safety and risk initiatives (Card et al., 2014). Completing a risk assessment plan requires management to approach it with a nonbiased attitude and to avoid partial decisions (Fabricius & Buttgen, 2015); therefore, training would address proper decision-making skills.

Process Management

The participants rated process management as important as a risk assessment plan. Documenting risk issues will allow the management team to understand past incidents, which can serve as a backdrop for future risk assessments. P5 stated the plant employees refer to the station's prints as their "bible." The documentation provided updates, which the project engineers used to help with safety and keep costs down; whereas, P4 noted the project managers referred to reports and briefing memos. P5 stated,

> We have prints and anytime a change is made, or a new process is added on the pipelines, the prints are updated to keep cost down. We also know new processes are needed to keep up with technology; the engineers are assigned to making sure they are updated and shared with the team.

P4 noted the reports gave insight to trends and how the process could reduce the risk. P4 stated,

> We utilized near-miss reports that help us keep an eye on safety issues. The employees also fill out an incident report describing the event, and from there a briefing is held to discuss correction. We can see trends and decide how the process can be changed, to ensure they do not reoccur on our pipelines and provide safety to our employees.

Process management aligned with the literature review by offering a wide range of recording data, either by monitoring or documentation. Cormican (2014) noted processes had the advantage of analyzing records or historical data and providing continuous monitoring and updates. Documenting processes will assist engineer project managers in being proactive with the risk assessment plan for the next critical situation with the pipelines.

Strategic Risk Assessments

P2, P3, and P4 all were in unison with team awareness and team buy-in when it came to successful methods in implementing the risk assessment strategies. Whereas, P1 noted concerns over incidents, policy, and procedures. P1 stated:

> Continuous enforcement reviewing incidents and policy procedures are a part of our strategy. Highlights on our pipelines in high-frequency incidents occurred within a certain period time, such as fall, winter, and summer. We are always looking for new strategies in this area by, adopting a framework that looks at the scope of work and pinpoints the biggest threats to the natural gas pipeline.

P2 noted having area management approval is part of the strategy and would provide a safety net in getting the risk assessment implemented and in having a successful outcome, as well as, with onboarding from employees. P2 stated:

> We discuss everything with our area managers before we implement any type strategies. It's best to obtain their input and match it with our employees for it to work in our organization. It's all about team culture. By doing so we can improve safety to employees and the natural gas pipeline. We also consider

> keeping processes updated and having mitigation plans in order, as a crucial part of implementing the risk assessment.

P5 stated:

> Team awareness and buy-in are important. Collecting positive feedback from the team has proven very successful in implementing the risk assessment. The employees are the ones that work on the pipelines, they are our eyes to potential hazards. Of course, management onboarding is important and necessary, but to gain a full perspective you must reach out to the staff.

Strategies aligned with the literature review as Fabricius and Buttgen (2015), which noted that project management strategies success includes the probability of the risk. In addition, Thamhain (2013) suggested the core skills to a successful risk assessment strategy is organization and communication. Having onboarding of upper management, feedback from employees, and team culture awareness helps pivot to a successful strategy for the natural gas risk assessment.

Risk assessment focused on concepts regarding training, safety, and technology (Scholz & Gary, 1990). By using risk assessments, engineer project managers gain the ability to identify threats, such as accidents, and implement safety strategies for delivering natural gas. Zhou et al. (2016) posited that a welled planned safety risk assessment will protect gas meters and pipeline segments from a catastrophic event. The semistructured interview process further confirmed the themes that evolved concerning the risk assessment theory. The participants concluded that in order to have a successful risk assessment plan, engineer project managers should have a cohesive strategy and assessment design. Engineer project managers who maintain employee engagement, training and development will allow for growth and sustainability, which will produce a successful risk assessment. The findings of this doctoral study aligned with Scholz & Gary's risk assessment theory and the literature review. The study revealed that engineer project managers use best business practices of a risk assessment plan to mitigate risk and improve safety and profitability.

Applications to Professional Practice

There are consequences in all areas of businesses, including natural gas. There are natural gas engineer project managers who lack strategies to improve risk assessment planning, to reduce pipeline accidents and improve profitability. I used the risk assessment theory to guide the direction of the research of this study. The examination of the data revealed four themes that may add to the achievement of a risk assessment plan.

The natural gas pipelines are affected by harsh weather conditions, corrosions, and incidents. There is modern technology that would detect corrosion to the pipeline. Beavers (2013) noted stress corrosion cracking as integrity awareness to natural gas pipelines, and the connection to providing safety apprehension. Ignoring modern technology to avoid pipeline accidents has the potential to increase injuries among the employees, which could decrease profit and safety goals for the natural gas companies.

The information in this study may also provide engineer project managers with the necessary material to train the employees to enhance safety awareness. The engineer project managers should keep all documents of past and present events to assist in mitigating future near misses or major accidents. Chien et al. (2014) noted that technology leaders should develop a proactive approach to preventing major problems by accurately documenting and reporting potential dangers. Technology is ever-evolving, it is important that engineer project managers utilize all modern technology to detect gas leaks.

The engineer project managers may find the result of this study as a valuable tool to educate future engineer project managers and employees on the importance of updating risk assessments. In addition, upper management beyond the engineer project managers may have a muse understanding as to the process of risk assessment. The knowledge or awareness of the dangers and consequences of failure in a pipeline will ultimately save lives, reduce injuries and decrease loss profits for the company.

Implications for Social Change

The implications for positive social change included the potential for engineer project managers to gain an in-depth understanding of a risk assessment, as it pertains to the safety of the natural gas industries. This knowledge could also provide project engineers with the tool to educate employees about the safety of the natural gas pipelines, as well as, detect potential hazards from maintenance transportation and delivery of the gas. The risk assessment plan could also be used as part of a training tool for employees, which would enhance safety awareness.

Utilizing the risk assessments to project hazards with the pipelines would subsequently save lives, protect the environment, and increase profitability for the companies. Businesses and residential customers use natural gas for cooking, electric, heating, and day-by-day daily operations. Therefore, the risk assessment plan and all strategies associated with the plan should be strategically implemented by the project engineers to assure the safety of customers and employees.

Recommendations for Action

I recommend engineer project managers implement a risk assessment plan, as it relates to safety, for the employees and the pipelines. Management has an important role in maintaining the safety and updates to a risk assessment plan; therefore, I also recommended that project engineers document all safety incidents and provide new strategies to implement in the risk assessment. Risk assessment should include, not limited to, safety, pre-job briefings, and training. Engineer project managers should also encourage employee involvement, as the staff is the ones working on the frontline of the pipelines and can provide valuable strategies to mitigate risk. The study participants revealed the importance of employee onboarding. Utilizing a risk assessment plan will assist in mitigating risk and other dangers when working on or maintaining the natural gas pipelines.

Recommendations for Further Research

The findings from this study warrant additional investigation of risk assessments for project engineers concerning the safety of the natural gas pipelines. The safety of the gas pipelines is a high priority of the risk assessment project engineers and requires continuous updates. Further studies are needed to explore additional strategies such as; additional training, update of current and future risk assessment processes, and future technology not covered in this study to address limitations and delimitations.

Limitations described by Marshall and Rossman (2014) are boundaries that reflect disadvantages or the outcome of the study. In addition, limitations are weaknesses out of a researcher's control, when attempting to change or adjust for the study. The limitations of this study were based on purposive sampling. The purposive sampling reduced the population needed to complete the study in a short span of time. For further study, I am recommending probability sampling, which will expand the population. Population sampling will ensure the larger population is represented through randomization, which will allow the generalization of the results (Marshall et al., 2013).

Reflections

I did not know what to expect when I started this journey. I did know I wanted to explore safety as it related to natural gas pipelines. My experience has allowed me to gain a better understanding of safety risk assessment and how it affects the natural gas pipeline. This degree comes with a bitter-sweet conclusion. While on this journey I lost my dad and my sister. They were both extraordinary individuals that are deeply missed. My faith in God served as the anchor and my family as the wind beneath my wings, especially when I felt like giving up. This journey also allowed forever friendships with colleagues to develop. We encouraged each other, set goals and assisted one another. I strengthened weaker skills, such as researching, time management, and organization. My network of friends, present and past classmates, mentors from Walden, and family helped me to remain focused.

Remaining unbiased requires self-reflection and introspection. Certain biases might hinder the researcher's study and results. In order to remain non-bias, I incorporated protocols throughout my study. One was to seek participants that I did not know, and another was to have my study read to ensure it was not conveying a bias tone. I reminded myself to stay true to my study and focus on the purpose of my research.

Conclusion

Project managers too often focus on the short-term risk of a project and tend to forget to seek the potentially higher risks that project owners recommend them to focus on. Engineer project managers are encouraged to implement a risk assessment plan, which will assist in mitigating a hazard or catastrophic incident to the transportation, maintenance, and safety of the natural gas pipeline. Responses from the participants indicated project engineers must focus on safety, training and development, process management and strategic risk assessment. In addition, the findings indicated that successful risk assessment strategies for the natural gas industry must also have onboarding from upper management and the other employees. Management should encourage open dialog with the employees, as they are the ones who have a day-to-day connection to the natural gas pipelines.

Engineer project managers have the liberty of researching archive data to assist with being proactive to address future safety incidents. Risk assessment technology has a distinct role in ensuring processes and personal safety in the natural gas pipeline industry and is paramount to the success of reducing pipeline failures. There is modern-day technology that will provide information on leaks, corrosion, and other dangers within the pipeline. The project managers have the responsibility to utilize all sources to protect the employees and any social concerns.

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Appendix: Interview Protocol Form

Interview Subject:

The purpose of this study is to explore policy strategies is risk assessment strategies to reduce profit losses from pipeline accidents in the natural gas industry. The natural gas industry needs improvement on safety strategies within the risk assessment to protect the employees and reduce profit losses associated with pipeline accidents.

a. I will identify myself as Cynthia Lightfoot, and greet the participants by stating, "I am a Walden University Doctoral Student conducting a study on Risk Assessment Strategies to Reduce profit losses from Pipeline Accidents in the Natural Gas Industry"
b. The participants will be thanked for their time provided for the interview process.
c. Participants will be asked to review the forms of consent and provide a signature. I will inquire if the participants have additional questions to be answered prior to the interview.
d. The participant will be given a copy of the consent form for their records.
e. I will announce that I will record the interviews with my Smartphone. I will provide notification to the participants that the Smartphone will be turned on and the interview process will begin. I will state the date, time, and location.
f. The participant will be known as Interviewee xx for the Smartphone but known as I- for the thematic coding. This information will be noted on the recorder and documented on my copy of the consent form.
g. The interview is expected to last only 15 minutes, but a block of time of 30 minutes has been scheduled as a precaution.
h. When the interview is over, I will thank the participants.

i. The participants will be required to review the interviews to ensure the accuracy of the information and make corrections upon completion to confirm member checking. I will ask the participant if they would like to have a summary of the interview for validation. The Smartphone will be turned off, and the interview will be completed.

Leaders' Interview Questions:

1. What risk assessment strategies did you implement in the Natural Gas Industry?
2. What are some successful technologies project managers incorporated in the risk assessment plan?
3. How do employees assist managers in documenting risk issues?
4. What is your strategy for training staff on risk assignment?
5. What strategy have you used to implement employee's safety?
6. What successful strategy does your organization use to evaluate risk assessment for profitability?
7. What successful method did you find work best in implementing the risk assessment?
8. What strategies are available to improve a policy that includes risk assessments?
9. Do you have anything additional to add regarding strategies that project managers in the natural gas industry use to reduce profit losses associated with pipeline accidents?

Signature of Interviewer:

Post Interview Comments: