2021

Strategies for Reducing Project Cost Overruns in the Oil and Gas Construction Industry

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Abstract

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MS, Heriot-Watt University 2013

B.Sc., University of Benin, 2005

Doctoral Study Submitted in Partial Fulfillment

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October 2021

Abstract

Leaders of oil and gas organizations experience financial losses when construction project costs exceed their original estimates. Completing projects without cost overruns is essential to oil and gas business owners for long-term profitability. Grounded in chaos theory, the purpose of this qualitative multiple case study was to explore strategies project managers in oil and gas construction used to deliver projects without cost overruns. The participants comprised four project managers in oil and gas construction companies in Nigeria with successful experience delivering projects without cost overruns. Data were collected from semistructured interviews and organizational documents, such as company publications and policies. Thematic analysis was used to analyze the data with four themes emerging: selecting competent contractors, building a realistic initial cost estimate, applying project management principles, and using strategic leadership. A key recommendation is that project managers develop a reliable process for managing and setting limits for relevant changes during project execution to prevent cost overruns during construction. The implications for positive social change include the potential of financially successful oil and gas organizations to create positive social outcomes by providing energy to power public infrastructure in host communities and employment opportunities to the local community.

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Dedication

I dedicate this doctoral study to my children, Chukwudinum Stephen and Chimeninma Arlene Efebeli. Trust in the Lord with all your heart, and lean not on your own understanding, in all your ways acknowledge Him, and He shall direct your path (*King James Bible*, Prov. 3:5). Thank you to my husband, Hycent Efebeli – my strong support during a storm. I am grateful to my parents, Mr. and Mrs. Briggs, for the endless encouragement to keep trying till I finish the race. And to my family, I am grateful for your love.

Acknowledgments

I acknowledge my chair, Dr. Jonathan Schultz, who has been a light for me in darkness. I am grateful for your patient support, leadership, and guidance. Thank you, Dr. Schultz, you have set for me an example of the leader I hope to be one day. You are a critical part of my success story. I also acknowledge Dr. Jorge Gaytan, my second committee member, and Dr. Matthew Knight, my University Research Reviewer, for your diligence and commitment to my success in the doctoral journey. Finally, my appreciation to Dr. Natalie Casale, my first chair, for her valuable contribution to my study.

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Section 1: Foundation of the Study

Large and complex construction projects run a high risk of cost overruns (Zarei et al., 2018). Many oil and gas construction projects are large projects in which political, economic, and technological factors influence cost (Kazemi et al., 2018; Zidane & Andersen, 2018). When cost overruns occur, clients lose profits, contractors demand variations, and tensions arise within the project team (Vazhathara & Mathew, 2018). As oil prices continue to decline since 2014 (Nurmanto et al., 2019), and the business climate in the energy sector evolves (Dahl et al., 2017), project managers in the oil and gas construction industry may require strategies to eliminate cost overruns in construction projects and stay competitive. Project managers might benefit from developing a taxonomy of knowledge on the methods firms deploy to complete construction projects without cost overruns. The purpose of this qualitative multiple case study was to explore strategies project managers in the oil and gas construction industry employ to complete projects without cost overruns.

Background of the Problem

Oil and gas construction companies face challenges in projects from construction costs overruns (Olaniran et al., 2017; Rui et al., 2018). Rui et al. (2018) stated that although oil and gas developments in Nigeria had low subsurface complexities and required minimal technology interventions, Nigerian oil and gas projects had a high average cost overrun of 38% and schedule overrun cost of 37%. Oil and gas projects are usually large and complex, with a risk exposure grossly disproportionate to the financial

economies (Callegari et al., 2018; Rui et al., 2018). Thus, project managers require skills to sustain organizational financial goals in oil and gas construction project delivery.

Brent crude oil is an essential raw material used for manufacturing many goods, and price fluctuations impact global economics (Dahl et al., 2017). From 2011 to 2014, Brent crude traded above $100 per barrel (Nurmanto et al., 2019); however, by late 2014, the world oil supply became substantially higher than demand, and prices fell from $108 per barrel in mid-2014 to $32 per barrel by early 2016 and remained lower than $80 until 2020 (Organization for Economic Co-operation and Development [OECD], 2020a). Oil and gas exploration and production companies select viable projects and plan their profits at a specific oil price. Hence, lower oil prices may imply (a) lower profits or even losses, (b) extended payback periods, and (c) reduced share value prices for oil and gas companies (Liao et al., 2018). Business leaders in the oil and gas industry require a design for construction projects which supports organizational goals of profitability, shareholder returns, and sustainability by leveraging project management tools (Liao et al., 2018).

Problem Statement

Eliminating project cost overruns has become a consistent challenge for project managers within the oil and gas construction industry (Seddeeq et al., 2019). In a 2018 study of 65 projects, Rui et al. (2018) reported a high average cost overrun of 38% for Nigerian oil and gas projects. The general business problem is that some project managers in the oil and gas construction industry struggle to complete their projects within the agreed cost. The specific business problem is some project managers in the oil

and gas construction industry lack effective strategies to complete oil and gas construction projects without cost overruns.

Purpose Statement

The purpose of this qualitative multiple case study was to explore strategies project managers in the oil and gas construction industry employ to complete projects without cost overruns. The target population for this study consisted of four project managers working in the oil and gas construction sector in Port-Harcourt, Nigeria, with successful experience in completing projects without cost overruns. The implications of this research study for positive social change include awareness and cognition about construction project cost escalations in the oil and gas construction industry and the mitigation strategy in project management. This knowledge may help project managers maintain profit margins in construction projects, reduce the occurrence of abandoned projects in some regions, and contribute to developing the communities that host construction companies.

Nature of the Study

I used the qualitative research method for this study. According to Hayashi et al. (2019), qualitative research applies to exploration and an in-depth understanding of an event or activity. Quantitative research is more appropriate for a study that involves numerical data, hypothesis testing, and validation (Zyphur & Pierides, 2019). Quantitative analysis was not suitable for this research because this research inquiry contained constructs that could not be easily measured or hypothetically tested. Mixed-method research is used when quantitative or qualitative data will not provide a clear

understanding of the phenomenon because one approach is not enough (Manzoor, 2020). The mixed-method approach was unsuitable due to the time frame and context of this research. In this study, I explored the strategies that project engineers employed in the oil and gas industry to execute their projects without experiencing cost overruns. Based on the above analysis, I considered the qualitative method the most appropriate approach to conduct the study.

The considerations in choosing a research design include the nature and objective of the study (Baran, 2020). The research design for this study is a qualitative multiple case study. The primary purpose of a case study is to gain a clear understanding of a problem by reviewing a case sample or multiple cases (Hancock & Algozzine, 2017). The ethnography research design approach is suitable for a study that involves a cultural sharing group and data gathering from the group for a prolonged period (Ingold, 2017). The ethnographic design was unsuitable because the research did not include cultural sharing for any group. The purpose of the phenomenological model is to describe the meanings of the lived experiences of people and groups who have shared similar phenomena (Sohn et al., 2017). Narrative design is appropriate for telling a story about individuals' lives and experiences (Sohn et al., 2017). Neither the phenomenological nor the narrative design supported the research objective of identifying the strategies that prevent project costs overruns because the study did not relate to the personal meanings of lived experiences of people or narrate a person's story. Researchers use multiple case studies to investigate existing similarities or differences between cases and to determine opportunities for replication (Bartlett & Vavrus, 2017). The single case study is relevant

for a typical example, which represents the experience of a broader set (Ninci, 2019). After considering all these design approaches, the multiple case study design was most appropriate for the study because I investigated existing similarities or differences between multiple cases to seek opportunities for replicating successful strategies.

Research Question

What strategies do project managers in the oil and gas construction industry employ to complete projects without cost overruns?

Interview Questions

1. What is your experience of construction projects that involved successful managers who reduced cost overruns?
2. What strategies do you use to complete oil and gas projects without cost overruns?
3. How have you implemented the strategies that prevent cost overruns in projects?
4. What were the key challenges of developing and implementing the strategies?
5. How did your organization address the problems or barriers to implementation?
6. How do you measure your approaches' effectiveness to achieve the stated objective of completing projects without cost overruns?

7. What else can you share with me about your organizations' success in developing and implementing strategies for reducing construction project cost overruns?

Conceptual Framework

The conceptual framework for the study was chaos theory. Lorenz (1963) developed chaos theory in the early 1960s. The chaos theory is the rationale that unplanned events can result in unpredictable effects in an existing equilibrium where many constructs are interdependent (Lorenz, 1963). Farman et al. (2019) determined project cost overruns follow a similar pattern of chaos. In megaprojects, there is a risk of uncertainty because as more information becomes available as the project definition unfolds, events may change, leading to a possible cost overrun on the project (Project Management Institute, 2017). The project management theory presents diverse external factor influence project costs, which may not be predictable at the start of the project.

The characteristics of chaos theory are sensitive dependence on initial conditions and positive feedback mechanisms (Nesa et al., 2019). The delicate dependence on initial conditions means small changes in the system cause significant and unpredictable consequences (Carbajal-Gomez et al., 2019). Oil and gas projects fall into this category of complex, capital-intensive projects with a precise definition and dependence on the initial scope (Ansari, 2019). In many cases, project scope changes cause a ripple effect on the cost parameters (Ansari, 2019). These features link the concept of oil and gas construction projects overruns to chaos theory, where the project is like a chaotic system and change becomes necessary and risky.

Operational Definitions

Construction extension to the PMBOK guide: The *construction extension* is a compilation of supplemental knowledge and practices that are generally accepted as good practices on construction projects most of the time (Du Plessis & Oosthuizen, 2018).

Megaprojects: Major oil and gas development projects that cost more than $1 billion or projects of a significant cost that attract a high level of public attention or political interest due to impact on the community, environment, and budgets (Söderlund et al., 2017).

Production cost: Production cost is a cost incurred by a business when producing goods or providing services (MacDonnell, 2019).

Project cost overrun: The deviation between the estimated costs of projects and realized costs after inflation adjustments (Hwang et al., 2018).

Project Management Body of Knowledge (PMBOK): The PMBOK® Guide contains specific knowledge and practices generally recognized as good practices on most projects most of the time (Varajão et al., 2017).

Assumptions, Limitations, and Delimitations

Assumptions

Assumptions are facts a researcher considers right but are beyond the researcher's control within the study (Luoto et al., 2017). The first assumption I made was that project managers of oil and gas organizations would provide a comprehensive description of the strategies employed to complete projects without cost overruns. The second assumption was that project managers provided objective, unbiased, and truthful answers during their

interviews based on experience. A final assumption was that all participants responded to the interview questions candidly.

Limitations

Limitations refer to potential deficiencies of the study that are usually out of a researchers' control (Podsakoff & Podsakoff, 2019). Nagendrababu et al. (2019) opined study participants' biases motivated by company loyalty might influence exaggerated responses to the interview questions. Therefore, study participants' bias may limit this research study's results and not reflect the same results in another study. Queirós et al. (2017) noted for the qualitative case study approach, the participants may not have the requisite knowledge to answer the research question, the sample size may be insufficient, and the sample population may be inadequate, and hence the results may not be generalizable. A limitation of this study is that participants tackled the research questions based on their experience and skillset, which may be insufficient to answer the research question fully. The research is also limited by the selected sample size and population and, therefore, project managers in other oil and gas organizations may not duplicate the selected results.

Delimitations

Delimitations refer to the boundaries researchers consciously set for their studies (Theofanidis & Fountouki, 2018). The first delimitation of this study was that all participants were from oil and gas organizations in Nigeria. The second delimitation was that I did not involve project managers with less than 5 years of experience or not having managed at least $1 million on a project. The third delimitation was that, due to the time

constraint of the study, I involved only four project managers with experience in reducing cost overruns for oil and gas construction projects.

Significance of the Study

Project cost overruns within the oil and gas construction industry have eroded many organizations' profit margins (Rui et al., 2018). If project managers eliminate cost overruns in oil and gas projects, there will be more cognition and awareness on the mitigation strategy for cost overruns in projects, and the knowledge may dissipate to other sectors with the same challenge. Cost overruns also lead to unfinished and abandoned projects, value erosion, and litigation (Olaniran et al., 2016); hence, project managers with skills to prevent or mitigate cost overruns will be able to reduce conflict on projects, sustain business performance, and meet energy supply obligations (Podgórska & Pichlak, 2019). The oil price dropped from $100 per barrel in 2014 to $46 in 2015 and had maintained a lower price regime till 2020 (OECD, 2020a). Project managers need to manage capital to deliver competitive value (Armenia et al., 2019). Hence, the knowledge of strategies for avoiding cost overruns can enable managers to retain their competitive position in the market during the lower oil price regime and afterward. More employees may keep their job, less conflict may ensue on oil and gas construction projects, and value erosion may decrease.

Implications for Social Change

The study outcomes have the potential for positive social change by identifying the existing gaps in construction project management where organizations could prevent or reduce cost escalations in oil and gas projects. Eliminating cost overruns may improve

profitability. This increased profitability may encourage oil firms to continuously improve the communities where they operate by providing more schools, scholarships, infrastructure, and local jobs.

An improvement to the processes that cause project cost escalations or overruns may positively affect the members' relationships. Fewer cost escalations may promote a collaborative relationship between client companies, construction companies, and their subcontractors. Reducing project cost overruns may also improve financial planning for client companies by retaining the final cost of construction within the initially agreed price, which may reduce the occurrence of abandoned projects, especially for developing countries. Energy scarcity is a primary issue in developing countries, negatively impacting economic growth and development (Yasar et al., 2017). Completed oil and gas projects contribute to economic and social improvements because available and affordable energy may encourage small business owners to deliver better value, support public transportation activities, fuel public health infrastructure, and provide power for domestic use in developing countries (Yasar et al., 2017). Eliminating cost overruns may lead to the completion of more oil and gas projects, which may increase the availability of affordable energy for local communities, support transportation activities in host communities, and provide more jobs for local workers in developing countries.

A Review of the Professional and Academic Literature

The objective of this literature review is to explore and synthesize the knowledge base for strategies project managers employ to avert project cost overruns in oil and gas construction projects. The primary source of professional and academic literature was the

Walden University Library and Google Scholar. The databases accessed through the Walden University Library included ScienceDirect, SAGE Premier, EBSCO host, and Emerald Management Journals. I reviewed the literature through the conceptual chaos theory and project management theory. The selected keywords for global and specific searches of the databases were *project cost overruns, oil and gas industry, chaos theory, project management,* and *project management theory.* The literature I searched for contained a mix of 12 books, 14 conference paper publications, and 191 peer-reviewed articles. I examined and filtered into nine books, eight conference papers, and 112 peer-reviewed articles. Out of 129 sources used in the literature review, 117 sources (91%) have a publication date between 2017 and the 2021, which is the planned year of study completion, and 122 (95%) are peer-reviewed sources. For the entire study, 246 out of 265 (93%) of the total sources have publication dates between 2017 and 2021, and 98% are peer-reviewed sources.

I organized the professional and academic literature review in subsections, starting with chaos theory, chaos in projects, and the project management concepts that govern the dilemma. The subsequent sections are a brief overview of the oil and gas industry, historical data for cost overruns, the risks in oil and gas projects, and contractor and client management issues. The final sections include considerations for the business environment, project management and leadership approaches, governance strategies, managing stakeholders, promoting collaboration, and general project management solutions.

Chaos Theory

Chaos theory originated as a scientific concept for explaining the behavior of hydrodynamic systems that move within a closed boundary (Lorenz, 1963). Lorenz (1963) stated while some systems exhibited a steady-state flow pattern, which could be predictable, some flow patterns were less predictable and irregular. Lorenz further explained that small changes in these unbalanced systems created an unexpected ripple effect that produced instability and complexity in the structure. The characteristics of the chaos theory, as described by Olaniran et al. (2017), are shown in Table 1.

Table 1

Characteristics of Chaos Theory

Attributes	Descriptions
Sensitive dependence on initial conditions	Small changes in a system cause significant, unpredictable consequence
Positive feedback mechanism	A process where the actions are taken to reduce adverse consequences amplifies the issues
Bifurcation and catastrophic phase changes	Sudden qualitative changes in a system's performance caused by a shift in process conditions
Strange attractors	When a system self-organizes itself into order after undergoing a series of changes

The chaos theory differs from the linear thinking that actions lead to proportional results and assume stability, regularity, and predictability (Carbajal-Gomez et al., 2019). In contrast, in chaos theory, when changes occur to the conditions which govern a body, the resultant effects may not be predictable, leading to a chaotic situation (Carbajal-Gomez et al., 2019). The linear rules which governed the old stable system do not apply in the new system. Chaos theory applies to project management because of the increasing complexity of modern-day projects (Cardona-Meza & Olivar-Tost, 2017), which are structural, technically, and directionally complicated, and thus create more uncertainty in the project environment (Luo et al., 2017).

Popular culture has influenced the development of chaos theory by the relatively common use in books, movies, and video games due to the clarity of the message, which relates to small events that can radically affect the result, otherwise known as the butterfly effect (Raisio & Lundström, 2017). The chaos theory application spread from the natural sciences to social sciences and evolved into complexity science (Raisio & Lundström, 2017). Raisio and Lundström (2017) investigated chaos theory from both the science and popular culture perspectives to decipher the scientific content from a novel view. By analyzing movies with concepts on the chaos theory, Raisio and Lundström developed three ideal models for chaos management and concluded that rather than gamble with chaos or attempt to control it, agents should act as chaos pilots by steering the chaotic system between the review and self-organizing dynamics. The chaos theory is relevant for understanding and managing changes in a dynamic system.

In management science, chaos theory represents how organizations are complex, and leadership seeks to balance rigid order and random chaos (Galacgac & Singh, 2016). The application of chaos theory to management science attempts to demystify a complex concept using a dynamic system (Galacgac & Singh, 2016). Galacgac and Singh (2016) advised leadership to accept and acknowledge uncertainty and unpredictability as a method for appreciating the value of dissenting solutions and contrary cultures. In essence, chaos is not a bad thing in an organization but a revelation that more variables than had been initially considered do exist. The recommendation is to shift the organization from a hierarchical top-down structure to a flat structure, where the culture is defined by fundamental, collaborative guidelines that support flexibility in handling each situation distinctively (Galacgac & Singh, 2016). Galacgac and Singh's recommendation is analogous to giving an organization a set of standards and regulations that suggest handling general issues instead of stating precise rules on the way things should be conducted. The recommendation is to let each subgroup within the structure define its organizational life by expediting the resolutions unique to its identity.

In connecting the chaos theory to management science, Mbengue et al. (2018) agreed that chaos was not a catastrophe but an opportunity to guide a system by shifting from a current equilibrium to a new space where prospective change is a positive attribute. Organizations may operate at the edge of chaos with a structure that allows both stability and looseness in the system (Mbengue et al., 2018). While leaders should understand and accept chaos as a form of self-organization, implementing a structure for the new system is a critical management role in ensuring that the change is not

continuously evolving and never achieving any form of resolution (Mbengue et al., 2018). Leveraging chaos theory concepts, project managers should embrace complexity even without assurance of preferable outcomes; yet, acutely aware that innovation, growth, and development are parameters consistent with evolution (Mbengue et al., 2018). Mbengue et al.'s proposal may be suited for organizational development but risky for cost evolution on projects because of the negative impact on economic and social development.

Öztürk and Kızılkaya (2017) described the dependence on initial conditions in chaos theory as a butterfly effect where changes were sudden, unpredictable, and unexpected. Öztürk and Kızılkaya explained the gradual development of chaos theory into a chaos-complexity theory. The implication of chaos theory was for project managers to have a learned skill on complex adaptive systems where project organizations adapt to changing circumstances by acquiring valuable information (Öztürk & Kızılkaya, 2017). Less popular features of the chaos theory are co-evolution, which refers to the way factors in a system respond to changes in another system; equilibrium shift, which refers to the fact that some systems cannot operate in equilibrium due to energy and material exchange; and way cohesion, which represents bistability where changes in any unit may change units within the same system (Öztürk & Kızılkaya, 2017). Project managers should evaluate their opportunities to determine solutions from diverse perspectives.

N. Li (2017) researched dynamic engineering cost management through the lens of chaos theory. N. Li focused on generating a method for managing fluctuations in price

during the project construction process to enable the fluid flow of activities on project sites. The implementation of engineering bill pricing, which includes quantities and price as separate entities, has enabled project leaders to account for fluctuating prices in engineering cost management (N. Li, 2017). The current cost management system is still fixed pricing, coupled with an imperfect legal system for contractual disputes and industry stakeholders that still ossify the construction cost system (N. Li, 2017). N. Li recommended a 4-step process for rectifying the construction cost management's chaotic risk, starting with the cost profile diagnosis, designing a mitigation process, implementing the process as required, and monitoring costs. N. Li's goal was to design a cost monitoring system that could detect real-time changes and minimize the construction cost system's exposure to systemic threats.

Olaniran et al. (2017) explained the occurrence of cost overruns through the lens of chaos theory. Oil and gas projects are difficult to manage during the construction stage, and conventional project management tools and techniques may be ineffective due to the assumption of fixed variables (Olaniran et al., 2017). Therefore, megaprojects contain chaos theory features because the incidences cannot be easily modeled or predicted (Olaniran et al., 2017). For example, variables such as human error, cultural diversity, site conditions, political climate, and logistics complexities are subject to systemic changes and influenced by complex interactions (Olaniran et al., 2017). Olaniran et al. cited the principles of chaos theory related to cost overruns in megaprojects, including long-term unpredictability, high probability of sudden change, short-term stability, and risk of aggravation from corrective actions. The principles of

chaos theory can deepen scholars' and practitioners' understanding of the causes of project cost overruns.

H. C. Silvestre et al. (2018) applied chaos theory to determine the impact on strategy and organizational structures for state-owned enterprises undergoing chaotic events. Using Petrobras, Brazil's national oil company, as a case study, H. C. Silvestre et al. investigated the government implementation of national energy policy to mitigate the internal financial challenges in the organization. H. C. Silvestre et al. stated that slump in oil prices and corrupt government practices led to institutional and organizational chaos. However, strategic management policy without political influences in internal decision-making improved Petrobras officials' ability to achieve financial goals (H. C. Silvestre et al., 2018). Organizations can benefit from implementing policies to enable strategic decision-making for chaotic events (H.C Silvestre et al., 2018).

Shrestha and Behzadan (2018) described the chaos theory as a concept where small input variations could cause high output errors and presented an evolutionary algorithm to process and decrease deficient input data. Researchers had adopted simulation techniques to control scenarios that may lead to cost overruns to manage construction planning uncertainties (Shrestha & Behzadan, 2018). However, these simulations were limited to evolve with real-time changes and unreliable for decision making (Shrestha & Behzadan, 2018). Shrestha and Behzadan used the chaos theory and presented an evolutionary algorithm to reduce imperfections in input data during a simulation on construction projects and recorded accuracy and reliability in project sites' decision-making processes. The genetic algorithm method, generated using the chaos

theory, showed significant improvements in simulation outputs for time, cost, and productivity measurements compared to other simulation techniques that enhanced project scheduling and budgeting (Shrestha & Behzadan, 2018).

Hayes and Rahman (2020) argued that though scholars frequently presented chaos and complexity as justification for project schedule and cost overruns, mathematical models were insufficient to determine this assertion as true. Hayes and Rahman studied chaos theory as an applicable theory for information technology software development and could not confirm chaos in the corporate world based on mathematical models alone. There is a lack of order in projects, but unorder may not equate to chaos, as some scholars assumed (Hayes & Rahman, 2020). Extending the lack of order to chaos in corporate management may create a limited view of the cost overrun challenge and cause scholars and practitioners to seek solutions within the wrong arsenal (Hayes & Rahman, 2020). Hayes and Rahman advised leveraging grounded theory as a method for deepening the investigation after mathematical models prescribed a chaotic interference in projects. The chaos theory, confirmed by grounded theory, will help researchers develop emerging models that would be sustainable in describing cost overruns in projects.

Puértolas (2020) corroborated Hayes and Rahman's (2020) findings and argued that the concept of chaos was inexistent, and researchers used chaos theory to describe a certain order that was yet to be interpreted. While research work is focused on analysis, project work in design was a synthesis; hence, applied research in design was a product of knowledge directly applied to societal problems where the creative component

connected theory to practice (Puértolas, 2020). Puértolas further recommended using a qualitative algorithm consisting of 10 sequential stages to enable the researcher to develop an accurate visual representation of the information that displays priorities. The creative chaos theory allows exploring an area of research from an informed perspective, sorting and ranking information according to relevance, defining a specific contextual framework, determining a study problem, and developing an investigation until completion (Puértolas, 2020). Researchers may benefit from using the creative chaos theory as an inductive form of chaos theory for investigating complex situations.

In a study of chaos theory as a lens for supply chain management, Lartey (2020) stated small disruptions in the supply chain could result in very unpredictable outcomes for a company. The model of a simple action, such as material sourcing, revealed that any instability in the supply chain would increase costs, defer production, and reduce revenue and satisfaction (Lartey, 2020). An example of this disruption occurred in the 2008 global economic and financial crisis (Lartey, 2020) and the 2019 coronavirus spread that became a pandemic in 2020. Managers can use chaos theory to cope with dynamic evolution and complex interactions that disrupt organizations. An inference for forecasting by leaders may be inaccurate and unrealistic because unusual events such as the coronavirus pandemic are unpredictable (Lartey, 2020). As a result, organizational structures should be flexible and adaptive to survive in a competitive and unstable environment (Lartey, 2020). Understanding complex systems, their unpredictable profile, and key components may help project teams implement practical solutions to manage organizational complexity.

The chaos theory, augmented by project management concepts, can be used as a lens to understand the way oil and gas construction projects, which fall into the group of megaprojects with many interdependencies unique to each project, can result in escalated, unpredicted, and unexpected costs or outcomes during construction (Olaniran et al., 2017). The interactions between different project constructs are essentially a dynamic system (Damayanti et al., 2020), where project managers must maintain focus on the different influencers to ensure successful project delivery (Nachbagauer & Schirl-Boeck, 2019). The next sections contain an explanation of the way chaos occurs in projects leading to cost overruns and an overview of project cost overruns in the construction industry, particularly the oil and gas construction industry.

Chaos in Projects

Ziadat et al. (2017) described the complex nature of oil and gas projects as a metaphor called the edge of chaos. Ziadat et al. estimated an average cost overrun of $2 billion for a $5 billion oil and gas project, approximately 33% of the overall project cost due to the high risk of uncertainty. Traditional project management methods, therefore, did not account for the impact of dynamic internal and external parameters on the soft boundaries of the project context, and unexpected events or black swans could occur and negatively impact value creation in oil and gas projects (Ziadat et al., 2017). Ziadat et al. advised renovations for the existing project management knowledge base to adept content that would help project practitioners improve project outcomes, client value expectations, sustainability, and competitive growth in the industry.

San Cristóbal et al. (2018) cited complexity as a case for chaos in projects. Using the luhmannian theory, San Cristóbal et al. defined complexity as the sum of different components, including diverse project stakeholders with varied goals, the interdependence between systems and subsystems, and the variable effects in decision making. San Cristóbal et al. listed the factors influencing complexity as size, stakeholders, technology, diversity, globalization, flux, and concurrent engineering. Traditional project engineering solutions determine information presented as static and employ a discreet linear management methodology (San Cristóbal et al., 2018). For complex projects, the interrelationships between systems demand a more flexible and dynamic approach to help project managers make quality decisions regarding project delivery (San Cristóbal et al., 2018).

Afzal et al. (2019) explored the relationship between complexity and risk in projects and the resultant cost-chaos implication in construction management. By adopting a real-time Delphi process and risk pair-wise comparison to analyze 12 complexities and 60 risk attributes, Afzal et al. proposed a measure for complexity and risk against cost performance in projects. Afzal et al.'s findings suggested uncertainties related to contingency and cost escalation accounted for a significant cost overrun source. The other sources of chaos in projects were innovative technology, multiple contracts, low advance payment, design change, unclear specifications, and lack of experience (Afzal et al., 2019). Afzal et al. (2020) advocated developing a fuzzy logic framework to determine the significance of cost chaos drivers and examine the vulnerability in complex projects' decision-making.

Simard et al. (2018) posited the utopia of order presented theoretically between the different organizational hierarchies in projects was in sharp contrast with the actual relationships in project governance. Specifically, the interdependencies between the different government systems in projects were sometimes chaotic and did not distinguish between project governance and organization (Simard et al., 2018). Projects are complex temporary organizations, and the logical approach found in most project management manuals or standards was a utopia rather than reality (Simard et al., 2018). Project practitioners should understand the integrative requirement between governance and organizations to tackle the chaotic tendencies in complex projects (Simard et al., 2018).

Lorentzen et al. (2017) described a chaotic situation for cost overruns in the oil and gas construction industry. According to Lorentzen et al., cost overruns resulted from unexpected changes in the oil and gas business. Client companies made a reasonable estimation of cost components within their control sphere. However, macro variables affected cost, and unexpected economic activity changes influenced cost parameters (Lorentzen et al., 2017). Nachbagauer and Schirl-Boeck (2019) supported Lorentzen et al. that cost overruns occur because of uncertainties and unexpected changes. According to Nachbagauer and Schirl-Boeck, the manifestation of chaos in project cost management meant that small changes in the initial cost estimate created a requirement for amendments and new changes that impacted the overall cost estimates. H. S. Zheng and de Carvalho (2016) also concluded that a high level of uncertainties was the main reason for cost overruns for large projects, and based on the contingency theory, risks may be internal or external. H. S. Zheng and de Carvalho suggested that project managers tackle

uncertainty based on the change's characteristics, driven by flexible project management. Project managers need to monitor changes in the political, economic, technical, or organizational sectors to determine the cost implication of the change (H. S. Zheng & de Carvalho, 2016) and prevent the chaos that enables cost overruns.

Damayanti et al. (2020) agreed that projects were more complex from unexpected emergent behaviours and developing features. Complexity is a primary source of project failure and should not be isolated in managing projects (Damayanti et al., 2020). Nachbagauer and Schirl-Boeck (2019) supported this rationale and stated project management was complex, with specific theories related to the multifaceted dimensions for project success. Specifically, Nachbagauer and Schirl-Boeck advised scholars to employ a more realistic and pragmatic approach to project management theories. Consequently, this more pragmatic theoretical solution encompassed resilience, agility, and spontaneity when tackling project management challenges (Nachbagauer & Schirl-Boeck, 2019). Price fluctuations, climate change, technological advancement, emerging markets, political challenges, and social expectations have made the 21st-century business market more dynamic and complex, and business leaders feel pressured to predict future trends as input to sustainable business strategy (Hafezi, 2020). As mitigation for future changes and complexity in projects, Hafezi (2020) proposed using artificial intelligence to improve complex markets' interpretations like the financial and energy sectors. Hafezi opined input subset parameters into an intelligence model might improve prediction quality and enhance decision-making. Project managers may require accurate forecasting solutions to manage complex projects tactfully.

Hasan et al. (2020) nominated the chaos theory and resilience engineering as a suitable theoretical framework for the offshore oil and gas industry. According to Hasan et al., nonlinear interactions between normal parameters in projects usually shift the project system to a risky space in terms of safety. Due to the lack of theoretical basis for complex technical environments, as asserted by Hasan et al., project practitioners may require unconventional thinking to handle more dynamic business environments. Singh et al. (2017) deviated from the flexible approach thinking for dynamic conditions and posited synchronization between chaotic systems and uncertainty to achieve active control. The case for active control stems from the premise that the fractional-order system is effective for real variables, and additional variables observed in complex systems underpin the fractional-order complex Lorenz system (Singh et al., 2017). Singh et al. performed a numerical simulation using the Adams-Bashforth-Moulton method and confirmed effectiveness for complex, chaotic systems. Project managers may consider the active control methodology for managing and synchronizing the divergent parameters in projects.

Daniel and Daniel (2018) stated project management scholars required a paradigm shift from deterministic theories, incapable of dissecting dilemmas in projects, to uncertainty and complexity theories. A distinction exists between uncertainty and complexity (Daniel & Daniel, 2018). The current dynamic business climate no longer functions within the boundaries of a linear replication where one size fits all; multiple constructs are changing at different times and creating unexpected outcomes, leading to a chaotic situation (Daniel & Daniel, 2018). Hence, with different parameters playing

crucial roles in the cost performance, any unplanned changes may influence the cost and create conditions that might escalate other project cost parameters.

Dombrowski et al. (2019) advised project managers to employ proactive project management to manage complex projects' dynamic nature. Project teams should first identify the leading project driver, in this case, cost, and proactively manage the factors that may impact cost performance based on the chaotic proximity (Dombrowski et al., 2019). Chaotic proximity is the extent to which a factor influences cost performance if a change occurs (Dombrowski et al., 2019). A mathematical model that measures the deviation of a critical project parameter from the plan and the magnitude of the impact on the project objectives will enable proactive project management (Dombrowski et al., 2019). Proactive project management may pose an opportunity for project managers to tackle chaotic cost escalations in oil and gas projects.

Wood (2018) conducted a stochastic time and cost tradeoff analysis that extended the scope of concise project schedule and cost management for oil and gas field developments. Wood leveraged a dual approach optimization analysis to determine the minimum total project cost solutions for the different project durations. According to Wood, dynamic adjustment factors applied for chaotic sequences could help project managers integrate the uncertainty into the project plan and execution efficiently. Effective models for handling chaos-prone projects should include an algorithm for managing the critical parameters in an unsteady state of flux (Wood, 2018). Project managers may benefit from models that combine the variants to determine an optimal project solution.

Stakeholders confirmed low interaction with vendors in the engineering and procurement stages created opportunities for chaotic cost escalations in projects (Luo et al., 2019). Vendor engagement is crucial in planning project costs because vendors have a clear insight into the market and material logistics cost management, which are primal for cost performance (Luo et al., 2019). Although many projects include a contingency cost at the start of the project, Islam et al. (2019) argued most cost engineers in projects determined the contingency estimates related to vendor parameters from a deterministic instead of a probabilistic plan. A deterministic method of determining costs is insufficient because of projects prone to omission or commission errors, and because some projects hardly follow the typical causes and effects rules and linearity applicable to smaller projects (Islam et al., 2019). Vendors and other procurement stakeholders may bridge the information gap and reduce the risk of an overrun (Luo et al., 2019). There is a limit to project managers' capacity to determine vendor parameters changes, and real-time vendor interaction may provide information on the dynamic cost parameters and reduce overruns (Islam et al., 2019). An appreciation of this system is an opportunity for project managers in the oil and gas industry to manage the risks in oil and gas projects and design a suitable method for managing projects without cost overruns.

Cherednichenko (2020) listed the coronavirus pandemic, ongoing disagreements between the organization of petroleum exporting countries, Saudi Arabia and Russia, and market fluctuations as recent changes affecting operators in the oil and gas business outside human control. Cherednichenko corroborated Singh et al. (2017) and stated that instead of investing in multi-state management, business leaders should develop a

strategy focused on managing parameters within human control. Some of the organizational success strategies in a chaotic business climate involved shifting business focus from production growth to profit growth, prioritizing environment, social, and governance factors, and leaner business models (Cherednichenko, 2020). To secure sustainability and preserve value in uncertain conditions, business leaders may need to design a closed system where the variables are frozen and not allowed to shift from a set point (Cherednichenko, 2020).

Abdulla and Al-Hashimi (2019) investigated project management methodologies' impact on project success using oil and gas projects as a case study. From the analysis of 95 questionnaires and 17 semistructured interviews provided by project practitioners, Abdulla and Al-Hashimi discovered that though project management methodologies correlated positively with project success, applied project management was more beneficial than comprehensive project management. Project managers need not deploy project management methodologies in the full scope but leverage the principles provided to fit the dynamic nature of the project (Abdulla & Al-Hashimi, 2019). Deployment of project management guides without considering the project's requirements would lead to bureaucracy, schedule delay, employee demotivation, and project crisis (Abdulla & Al-Hashimi, 2019). The project manager may need to understand the unique requirements for specific projects before executing oil and gas construction projects.

Cost Overruns in the Construction Industry

Delay and cost overruns are a global problem in projects, and developing countries are at a higher risk (Hui-Yap et al., 2019). In Nigeria, Rui et al. (2018) recorded

cost overruns from price escalations of raw materials, delays in the planned activity, and lack of collaboration between construction teams. Kumar and Thakkar (2017) agreed with Rui et al. and posited the highest risk factor for cost overrun on construction projects was price escalation of raw materials. Ogbu and Adindu (2019) further explained that project managers did not complete many road projects because of escalated costs, including increased raw materials. Project managers did not anticipate the changes in prices and market dynamics for construction materials in developing countries; hence, fluctuations in prices, combined with other influencers, created a negative ripple effect on the project's total cost (Ogbu & Adindu, 2019). The construction team, client, and project managers may require a method for managing raw material prices to prevent cost overruns in construction projects.

Al-Hazim et al. (2017) reported differently for the 40 public infrastructure projects completed from 2000 to 2008 in Jordan. Poor weather conditions and unfavorable terrain were the leading causes of project cost overruns (Al-Hazim et al., 2017). According to Al-Hazim et al., project managers sometimes neglected the effect of bad weather during planning, which led to schedule delays and resultant cost overruns. Furthermore, Marzoughi et al. (2018) recommended that project managers consider the impact of weather on critical decision-making in construction projects. Marzoughi et al. stated climatic conditions underpinned many critical variables and proposed a framework for estimating project duration under the impact of weather. The model design incorporated qualitative and quantitative variables, including resources, weather factors, and work activities, to increase model accuracy (Marzoughi et al., 2018). Senouci et al.

(2016) further confirmed for construction projects in Qatar, the project team recorded a remarkable decline in productivity during severe weather conditions, which resulted in schedule slippage and cost overruns. However, some scholars rated weather effects as minor in cost overrun occurrences (Haruna et al., 2017) and reported other factors primal to the underlying causes of poor cost performance in construction projects (Bruggen & Luft, 2016; Callegari et al., 2018). Project managers working on construction projects should consider weather effects during the cost planning phases to mitigate the risk of cost overruns.

Bruggen and Luft (2016) stated overruns in multi-period projects resulted from cost understatements in the initial project proposals and escalation of commitment to projects when initial costs turned out to be higher than expected. Bruggen and Luft investigated prior literature on having two different managers approve the initial project commitment and the decision to continue when new costs were visible. The outcome was subordinates anticipated new supervisors would be more critical in approval of project continuation; hence, they discounted later period pay-offs and provided understated cost estimates at the initial cost review (Bruggen & Luft, 2016). Specifically, Callegari et al. (2018) detailed for mega hydroelectric dams built in Brazil, construction costs were averaged 97% higher than the initial estimates, with completion 74% later than the planned completion date. Callegari et al. concluded that megaprojects failed to deliver the economies of scale because of optimistic initial cost prediction; hence, the economic risk was disproportionate to the expected financial savings. Project managers, therefore, should align initial cost estimates with realistic parameters to minimize cost overruns.

Asmitha (2019) attempted to explain the causes of cost overrun using the probabilistic theory of cost overrun causation. Asmitha stated despite the efforts invested by scholars and practitioners to curb overruns in projects, cost overruns were still pervasive within the industry. Many scholars adopt a deterministic approach in examining the phenomenon's occurrence (Asmitha, 2019; Islam et al., 2019; Plebankiewicz, 2018). However, a pluralistic probabilistic approach to cost overruns provides a framework to consider the interdependencies of causes and understand the uncertainties and risks of increasing infrastructure projects' costs (Asmitha, 2019). Plebankiewicz (2018) corroborated Asmitha's assertion from the study of construction costs escalation and developed a prediction model to determine the most likely cost element to increase due to unexpected change. Asmitha and Plebankiewicz attempted to explain the causes using different analytical models, theories, and concepts with a view that if the causes were evident, project managers could design barriers to prevent cost escalations. For example, an integrated analytic network process and reusable system dynamics model, which connected all the parameters creating cost escalations, may help project managers make informed decisions during projects (Kumar & Thakkar, 2017). Hence, project managers need to employ an appropriate method to determine cost escalations in construction projects to mitigate project cost overruns.

Project cost overruns in diverse construction projects receive significant attention in academic literature and with project practitioners (Ahiaga-Dagbui et al., 2017; Callegari et al., 2018; Olaniran et al., 2017; Rui et al., 2018; Venkateswaran & Murugasan, 2017). However, the dominant approaches used to explain the concept have

been repetitive and superficial, and thus stagnated a robust theory development to mitigate and contain the problem (Ahiaga-Dagbui et al., 2017). There is a need to move from the single cause identification and traditional net effect correlational analysis to causal methods through systems thinking and reflective study to address the high-level interactions between delays in a project and cost overrun during a project (Ahiaga-Dagbui et al., 2017). The risks and uncertainties present in the construction industry are significant and sometimes poorly managed (Al-Hazim et al., 2017). Project managers may need to migrate to causal learning and reflective thinking to design solutions for cost overruns in construction projects.

Cost Overruns in Oil and Gas Construction Industry

Many of the results from studies conducted for causes of cost overruns in the oil and gas industry show that the initial cost estimate for oil and gas projects are usually optimistic and unrealistic (Mahamid, 2018; Roya & Jose, 2017; Rui et al., 2017; Waleed, 2020). Rui et al. (2017) studied 200 oil and gas projects and posited the average cost of overruns of projects was 18%, and many oil and gas projects recorded a high level of underestimation during the cost development, which resulted in cost escalations when more information became available (Rui et al., 2017). Cost performance is affected by project size, type, region, and joint venture information (Rui et al., 2017). The original cost planning parameters should encompass the risk and effects of changes in factors that affect critical cost parameters. Waleed (2020) corroborated the assertion that optimism bias contributed to cost overruns in megaprojects. In the study of the influence of biases in decision making, work experience, controllability, dread, and cost decision

significantly influenced cost overrun due to over-optimism (Waleed, 2020). Roya and Jose (2017) posited inaccurate cost estimations were a primary cause of project escalations in oil and gas construction projects in Iran. Roya and Jose advised project managers to employ qualified oil and gas personnel to estimate project costs and schedules to alleviate cost overruns. Skilled cost estimators with a clear understanding of the business environment recorded fewer cost escalations (Roya & Jose, 2017). If initial cost estimates include contingency plans, project managers might be able to leverage on exigency when issues affecting cost escalations occur (Mahamid, 2018; Roya & Jose, 2017; Rui et al., 2017). Optimistic cost estimates are a primary factor responsible for escalated costs on oil and gas projects, and project managers require skills to assure initial cost estimates as mitigation to costs overruns.

Watts (2016) evaluated the relationship between the oil and gas business climate and project cost performance in Nigeria. Watts explained that political, security, ecological, and many other nontechnical risks infested the business climate. With the militant insurgency in the Niger Delta area of Nigeria, the costs of construction of large hydrocarbon projects consisted of managing multiple factors related to a challenging business climate (Watts, 2016). In the investigation on the performance of oil and gas development in Nigeria, Rui et al. (2018) revealed Nigerian oil and gas projects had a high average cost overrun of 38% and schedule overrun of 37%. According to Rui et al., the overall performance of Nigerian projects was worse than global standards. Nigerian oil and gas projects have low subsurface complexity and present low technological challenges (Rui et al., 2018). However, the nontechnical factors, including local content

development, community, security, and partnership, were responsible for the poor performance of the projects (Rui et al., 2018). Hence, project managers working in Nigeria and other developing countries should recognize the multiple constructs and nontechnical factors affecting oil and gas projects to design a fit strategy against oil and gas project cost overruns.

Hoseini et al. (2020) investigated the cost and contingency performance of a plethora of projects. Hoseini et al. insisted most of the cost overrun research work was premised on either contractor or client perspective and did not provide a systemic thinking approach as a mitigation for the phenomena. Hoseini et al. advocated for a paradigm shift to managing the cost overrun challenges in the construction industry. Demirkesen and Ozorhon (2017a) corroborated Hoseini et al. and cited poor understanding of project complexity, project scope, and schedule as significant factors in cost overruns. Demirkesen and Ozorhon proposed construction-specific determinants and indicators of project management performance based on the 14 knowledge areas from the project management body of knowledge guide. Demirkesen and Ozorhon concluded time and scope management had an indirect effect on cost performance in projects. The conclusion is that project managers may reduce cost overruns in oil and gas construction if there was more cognition on project complexity, time, and scope effects on the cost parameters.

Consumption and production of natural gas and oil have significantly increased in the last decade, and hydrocarbon companies continue to increase their investments to meet these energy needs for different economies (OECD, 2020b). Oil and gas projects are

capital intensive; hence, cost overruns indicate that oil and gas organizations were late to produce revenues and compensate for investment. Seddeeq et al. (2019) cited changes in design scope and initial cost as leading causes of cost overruns in the oil and gas sector. The literature review on solutions for managing large and complex projects like oil and gas construction projects relate mainly to managing risks and providing flexibility for a swift response to unexpected events. The next section contains a description of these strategies.

Agile Project Management Strategies as a Mitigation to Cost Overruns

In traditional project management, systems are fully specifiable and predictable, the management style is command and control, and the development model is for the project life cycle (Engelhardt, 2019). In contrast, the agile project management development model in projects is evolutionary and iterative, with continuous design improvement based on rapid feedback and change (Engelhardt, 2019). Project managers have viewed agile thinking as relevant to oil and gas construction projects, and further embedment of agility in teams may be a mitigation measure in preventing the overruns (Petrillo et al., 2018).

The complexity of oil and gas construction and the requirement for mitigation against cost overrun caused scholars to think of new solutions. For example, Cooper and Sommer (2018) presented a framework that combined agile project management with the stage-gate model useful in dynamic industries. Combining agile project management approaches can be beneficial for projects with specific risks and complexities and valuable to project success and performance, especially in nontypical projects (Kaim et

al., 2019). The application of agile project management improves time, budget, scope, and stakeholder satisfaction in complex projects (Kaim et al., 2019). These agile attributes support the assertion that effective management of complex projects such as oil and gas construction projects requires a more contemporary method. The oil and gas construction projects have unique risks, which project managers must tackle to mitigate cost overruns. Project managers have an opportunity to sharpen agile skills for use in oil and gas projects as mitigation for cost overruns.

Oil and Gas Construction Projects Risks

Kassem et al. (2019a) identified changes in the internal or external environment as primary risk factors for oil and gas construction projects. According to Hatmoko and Khasani (2020), the top five risk factors affecting oil and gas construction projects were contractors' capacity, delay in delivery of long-lead items, project scope changes, delay in detailed engineering design, and lack of contractor experience. Salas and Hallowell (2016) added safety risks to the list of inherent risks in construction. Salas and Hallowell cited improving safety performance as paramount to the successful delivery of oil and gas projects. Clients should employ leading and lagging safety indicators to measure contractors' safety performance and assure mitigation strategies for the identified risks.

Kazemi et al. (2018) argued the bureaucratic government system, lengthy project approval procedures, poor design, incompetent project team, poor tendering practices, and slow internal approval processes were significant risks faced by project managers in oil and gas construction. Kazemi et al. posited reforming the project governance system, partnership with foreign collaborators, training for project executives, implementing

results from contractor evaluation, and enhancing project teams as suitable approaches for managing the identified risks. Risk management is vital for decision-making and extremely useful for successful project delivery in oil and gas construction (Kazemi et al., 2018).

Kassem et al. (2019b) deployed a probabilistic impact matrix system and determined the risk factors for oil and gas projects were of a high probability and high impact matrix. Kassem et al. further advised project managers to identify internal risk factors for stellar project performance robustly. Dehdasht et al. (2017) corroborated the assertion that the oil and gas industry required a more robust risk assessment model and opined the dynamic operating environment and rising global energy demand had increased the need for reliable risk assessment models in the oil and gas construction business. Dehdasht et al. further asserted traditional risk assessment models were insufficient for planning and governance because of the need to consider the influence of factors in the best-fit models. Also, Al Mhdawi (2020) proposed deploying a decision support methodology for risk management in oil and gas projects.

Graham and Ovadia (2019) cited weakness in institutional capacity and legal framework as a risk for oil and gas investments. Graham and Ovadia stated that despite a notable increase in upstream oil and gas projects in sub-Saharan Africa, investors should be aware of the weakness in the institutional and legal framework for petroleum management. As societies demand cleaner energy solutions and transition into a lower carbon world, oil and gas investments may seem socially irresponsible (Graham &

Ovadia, 2019). A clear understanding of the risks is paramount for a viable investment decision.

Leth et al. (2019) recommended implementing the lean project management and culture method Hoshin Kanri as a tool for managing risk on offshore oil and gas projects. Leth et al. reported a positive project lead time reduction of 10%, $1 billion savings from risk incentive accounts, and potential additional revenue of $3 million per day from reduced lead time and early production start-up. Leth et al. further asserted that Hoshin Kanri's implementation is useful for developing the interlinkage between the strategy and project organization from upper to lower levels. An opportunity exists in the further study of Hoshin Kanri as a tool for managing risks in megaprojects.

M. Karami et al. (2020) advocated for the specific deployment of risk assessment methods and techniques, prioritizing, and evaluating the risks consistent with the oil and gas project case. M. Karami et al. examined the necessity to study risk management in large-scale projects on the premise of operational risks. The complexities and uncertainties place oil and gas projects on a high-risk case investment case. M. Karami et al. concluded that the value delivered to the Iranian economy from the oil and gas business investments underpinned the urgent requirement for managing the risks, which created cost overruns, project delays, and eroded value for the oil and gas business. A primary stakeholder faced with these risks is oil and gas contractors.

Cost Overruns from Contractor Challenges

Olarenwaju et al. (2018) stated that contractor challenges, including delays in funding of projects, and inflation due to such delays, were responsible for the significant

number of failed projects in the Nigerian construction industry. In Nigeria, contractors continually face fluctuating prices for exchange rates influenced by many factors, including extreme dependence of the Nigerian economy on revenue from oil sales, political instability, corrupt practices, and poor government policies (Olarenwaju et al., 2018). Some contractor-related factors responsible for cost overruns include a shortage of skilled workers, high cost of financing, limited experience, changes in regulation, supplier relationship management, and cross-cultural management (Sarpin et al., 2019). Basak et al. (2018) validated this assertion and stated that an unrealistic schedule was typically imposed on contracts in Australia. Frequent change orders were also critical contractor issues in executing oil and gas projects (Basak et al., 2018). Project managers may require skills to assess and support contractual performance as mitigation from cost overruns.

Ahiaga-Dagbui et al. (2017) highlighted inadequate work scope definition and subsequently inaccurate cost estimation as a primary challenge for contractors executing oil and gas projects in the North Sea. According to Ahiaga-Dagbui et al., the inability to reliably estimate the work scope was exacerbated by supply chain practitioners' limited experience and capacity. Ahiaga-Dagbui et al. recommended an industry-wide forum to facilitate knowledge sharing, specifically on scope and cost information. In contrast, Jo et al. (2018) argued that poor scheduling of the pipeline scope was the main factor responsible for the cost and schedule slippages in engineering, procurement, and construction contracts for mega oil and gas projects. Jo et al. further asserted that pipeline prefabrication and installation were a crucial part of the schedule; hence, contractors

should consider critical chain project management for managing uncertainty and resources instead of the program evaluation and review techniques and critical path methods. Jo et al. conducted a case study using the critical chain project management method for scheduling and recorded a 35% schedule improvement for the piping works, which led to a 5% schedule recovery for the overall project. Prabhakar (2017) supported the case for enhancing scheduling practice and stated quality management system should form a critical part of the procurement, construction, fabrication, and installation process. Effective scheduling practice would minimize contractor execution constraints, one of the root causes of capital project deviation from planned performance (Prabhakar, 2017). Therefore, project managers require skills to manage the facets in contractual performance intricately to prevent cost overruns. Another emerging reason in the cost overrun literature is the client-related factor.

Cost Overruns from Client-Related Challenges

From the onset of a project, clients play a crucial role in decision-making throughout the project (Al Mhdawi, 2020). Al Mhdawi (2020) confirmed that client familiarity and owners' control played crucial roles in determining project delivery methods, impacting cost performance. Noorzai (2020) reported that the project critical chain's project management delivery system affected project implementation efficiency positively by providing an effective delivery system. Clients should carefully consider the most appropriate contracting strategy in designing a model for the project delivery system to mitigate project cost overruns (Noorzai, 2020). The early design of an appropriate model may set the scene for efficient project delivery.

According to Gebrehiwet and Luo (2017), clients' incomplete scope definition created numerous client-related rework noted in many projects. Famiyeh et al. (2017) also supported this assertion and stated poor initial scope definition with mistakes often led clients to seek a rework during the design and construction stages. The additional work, changes in scope, and client-related rework contributed to the considerable cost and schedule overruns in the oil and gas construction sector (Famiyeh et al., 2017). Zidane and Andersen (2018) corroborated and highlighted the top 10 universal factors responsible for construction project delays, including design changes during construction or change orders, delays in contractors' payment, and client's or owners' financial difficulty. Zidane and Andersen further affirmed the factors responsible for these delays were global, and cost and schedule were intertwined. Kazemi et al. (2018) also stated change orders and changes in work scope by clients as the main factor that created cost overruns in projects. Kazemi et al. included underestimating project costs, delay in client reviews, and delayed payments as reasons for the poor performance of oil and gas projects. Also, Bergli and Falk (2017) cited frequent changes in vendors and poor project management on the client-side as critical challenges causing project cost overruns in construction projects. Therefore, project teams need to develop skills to manage the delays from rework, scope changes, and inconsistent client reviews as mitigation against cost overruns.

Clients, investors, and project owners are under more pressure as the world embarks on a transition toward a low-carbon economy (Coleman, 2018). The costs of alternative energy sources have low operating costs but relatively high construction costs

(Coleman, 2018). Consequently, as the world focuses on decarbonizing the power grid and electrification of the transportation sector, capital costs will grow increasingly important in the energy sector (Coleman, 2018). Coleman (2018) posited that first, privatization and deregulation of electrical utilities would make energy investors unsure of recovering their capital investments. Second, the drive for more public participation in decision-making in the energy sector may result in delays and hesitation for private companies to make long-term capital investments (Coleman, 2018.) Third, increased scrutiny on environmental impact assessments may deter investors. Coleman put the responsibility for the energy sector's sustainability despite capital dearth for investors on the government. Therefore, project managers should work with investors to ensure construction projects are competitive and sustainable, with a clear understanding of the business environment as mitigation for construction costs overruns.

Cost Overruns from Challenges in the Oil and Gas Business Environment

Dahl et al. (2017) investigated the impact of the business climate on cost overruns in the oil and gas sector. Dahl et al. emphasized changes in the business cycle were a typical cost overrun driver. Business issues like disruptive technology, government regulations, and policy changes could create vicissitudes, cause more instability in the project cost structure, and create new energy organizations. Business climate changes cause significant disruptive energy innovations to meet changing climatic conditions and consumer demand (Dixon et al., 2017). Johnstone and Kivimaa (2018) further stated in some cases, the green industrial policy had facilitated the energy disruption, and new industrial policies could be a way to decrease the negative consequences of the disruptive

change, such as job losses reduced profits, and business retention. Newman and Green (2016) supported renewable energy had the features of disruptive innovation for the energy sector and predicted that the number of abandoned fossil fuel or oil and gas assets would increase by 2050, with renewable energy accounting for 100% of global energy. To ensure profitability in oil and gas projects, project teams must confirm the project details as assurance that the business environment will not potentially affect profits and generate cost overruns.

In contrast, Kat et al. (2018) opined despite the current drive to reduce greenhouse gas emissions, oil, natural gas, and coal would still be primary sources of energy by 2030. Kat et al. argued the business environment was stable, and contrary to economic analysis, investors should focus on effective project delivery at competitive costs. Kungl and Geels (2018) further advised organizations to pay close attention to the warning signs as significant change had recently impacted their industry, and there was a requirement for a paradigm shift from the traditional energy business delivery model. Sarker et al. (2018) supported global energy investment for drilling, transportation, and processing oil products that would surpass $1.6 trillion by 2035. The argument for the long-term relevance of oil and gas demand is controversial, and many scholars differ in their conclusions. To maintain competitiveness, oil and gas organizations may require a robust strategy for assessing the market demand and timing as mitigation to poor cost performance.

Investors in the oil and gas business, therefore, require a clear understanding of the business climate, including fluctuating oil prices, the potential for renewable energies

disruption, health, safety, environmental solutions, policies for success, and profits (Kungl & Geels, 2018; Newman & Green, 2016), to enable planning to mitigate against escalated costs and abandoned projects. Ahmad et al. (2017) analyzed the world's economy on oil and gas sources and stated the potential negative impact on the environment like carbon emissions and community displacement required investors to focus on sustainable solutions. The external forces in the oil and gas business climate include economic and political stability, stakeholder pressure, competition, energy transition, and regulations (Ahmad et al., 2017). Ahmad et al. concluded that economic and political stability were the most influential in the business climate. Even though academic scholars perceived regulatory factors as less significant, practitioners ranked regulatory factors as the third most important in the oil and gas business climate. An understanding of the business climate may help project managers optimize their strategy towards preventing cost overruns.

Another essential factor that requires consideration in the oil and gas sector's business climate is corporate social responsibility (CSR). According to Berkowitz et al. (2017), few industries develop CSR standards and policies like the oil and gas sector. As a result, there are many nongovernmental organizations and external firms focused on CSR. CSR implementation can be a considerable expenditure for oil and gas firms, and a cost escalation may occur from the ineffective management of CSR projects. Berkowitz et al. maintained meta-organizations collectively constructed CSR issues because of their complexity and variety. In the oil and gas business, host communities usually demand development profits for the seeming risk of carrying out drilling activities in the region

(Aung, 2017). Apart from infrastructural benefits, clients must perform environmental impact assessments, obtain licenses and governmental permits, engage nongovernmental agencies for audits, and provide numerous documentation to assure the host communities of any hidden dangers that the community would encounter during drilling (Berkowitz et al., 2017). Aung (2017) supported the rationale that political and economic transformation and drastic expansion of foreign direct investment in natural resources necessitated environmental impact assessment laws. The regulations safeguard these host communities from any adverse environmental effects (Aung, 2017). Project managers, therefore, require a method to maintain focus on costs resulting from improper management of CSR issues.

Drawing from a descriptive case study of Petrobras - a world-leading energy company, B. S. Silvestre et al. (2017) implored oil and gas organizations to invest in high standards of process safety management systems to mitigate against the risk of significant accidents in the offshore oil and gas environment which could trigger more cost expenditures from legal fines, loss of inventory, schedule delay, and reputational impacts. In general, business leaders in the oil and gas industry should factor their unique business climate in their strategy for project execution to mitigate cost overruns. A method of managing the external factors is by deploying effective project governance, as discussed in the section below.

The Role of Project Governance in Preventing Cost Overruns

Managing project governance in complex megaprojects like oil and gas projects is yet to be embedded in current project management practices (Klakegg et al., 2016). The

increase in organizational complexity and bureaucracy created hidden areas in project governance that might not be visible but require effective management (Lu et al., 2015). Lu et al. (2015) detected smaller projects were easier to govern, had fewer hierarchical requirements, and proper project management practices sufficed for project delivery. For large complex projects, the application of formal systems of project governance may be limited because the structure and outcome unfold gradually and cannot be easily predicted at the start of the project (Klakegg et al., 2016).

Klakegg et al. (2016) proffered effective project governance to balance standpoints between the different perspectives of the client, investors, contractor, host community, and other stakeholders by providing incentives for the team to deliver the objectives of the organization and support shareholders' interests. However, the project manager's choice of governance is a product of many complex factors (Noorzai, 2020). Noorzai (2020) further asserted for project governance to achieve the project objectives, increasing the number of controls was not as beneficial as defining the boundaries for balance. Hence, to use project governance as a strategy for optimized cost performance, project managers require a delicate balance between stakeholder management and boundary definition.

Derakhshan et al. (2019) highlighted external and internal stakeholders' influence in project governance and recommended more diverse theories linking stakeholders to project governance. The stakeholder and stewardship theories gear towards fostering trust and unity among the partners by creating a collective identity, autonomy, and empowerment (Young et al., 2019). Under the institutional and resource dependence

theories, project governance mechanisms use the contracting process to determine and control performance, cooperation, resource management, capabilities, and knowledge to deliver the project objectives (Bredillet et al., 2015). However, in the principal-agency theory, the governance mechanisms include an exchange relationship between the principal and the agents (Bredillet et al., 2015).

In an international survey conducted for 333 projects, project governance improved project success both directly and through increased benefit management (Musawir et al., 2017). A good project governance practice is developing a high-quality business case (Musawir et al., 2017). Zhu and Mostafavi (2017) conversely proposed a new framework for the strategic management of complex projects called the complexity and emergent property congruence (CEPC). CEPC is an increase in the synchronization between project emergent properties and complexity, which potentially increases project performance goals in construction projects (Zhu & Mostafavi, 2017). CEPC is a strategic method for project governance in contemporary and complex projects. Project complexity involves the details and dynamic complexity, while project emergent properties are absorptive, adaptive, and restorative (Zhu & Mostafavi, 2017).

Samset (2017) proposed replacing project governance with systems governance by applying the systems engineering tools such as systems thinking to improve project performance in complex environments. Systems governance involves more collaboration between stakeholders involved in the project and employment of their different expertise and competencies in decision making to achieve a holistic approach for managing uncertainty in complex projects (Samset, 2017). The systems thinking aligns with project

governance solutions, and according to Zarewa (2019), tension exists between the project goals, organizational goals, and individual interests. Uncertainty in projects will increase when individual project members pursue personal goals instead of the project and organizational goals (Zarewa, 2019). Hence, to achieve project delivery without cost overruns, effective governance should include stakeholder management as of paramount importance.

Managing Stakeholder Related Factors

The successful or unsuccessful delivery of an oil and gas project will significantly impact many diverse stakeholders: the government, host communities, investors, shareholders, associated industries, and academia (Udie et al., 2018). In the Niger Delta area of Nigeria, where many hydrocarbon exploration and drilling activities occur, the application of an effective multistakeholder approach supports sustainability in the oil and gas business (Udie et al., 2018). However, Scott (2018) observed that voluntary and deliberate engagement with all stakeholders did not guarantee a reduction in citizen complaints in oil and gas projects. The use of deliberation weakened the relationship between adopting voluntary engagements and the odds of a claim (Scott, 2018). Scott inferred the application of voluntary commitments in stakeholder management did not guarantee satisfaction for the stakeholders. Barnett et al. (2018) supported this rationale and stated selective response to the most potent and legitimate demands of stakeholders would not necessarily yield sustainable results because of self-interested stakeholders. Barnett et al. proposed government intervention and regulations were apt for solving complex stakeholder issues. Without government intervention, self-interested

stakeholders may pressure organizations away from the project goals (Barnett et al., 2018). However, stakeholder pressure was essential to ensure that industries do not take undue advantage of the presented opportunities (Barnett et al., 2018).

Additionally, Wilson et al. (2018) argued that the current mantra for collaboration between stakeholders for private resource extraction companies was a meta-governance role and could only support situations of democracy under certain conditions. Wilson et al. argued that resource extraction companies usually tailored the stakeholder management structure for self-benefit, and hence, there was a requirement for state intervention to assure that the communicative processes by corporate actors proceeded according to deliberative democracy. Bond (2019) also confirmed existing tension between investors' profit-driven horizons and the attainment of greener solutions for environmental sustainability. Hence, an alignment between oil and gas organizational financial goals and governmental expectations on the greenhouse may improve the transparent working relationship between primary stakeholders in the oil and gas project delivery. There is a requirement for project managers in construction projects to enhance effective stakeholder communication to achieve optimal project cost performance.

Lehtinen et al. (2018) shared stakeholder engagement was the cornerstone of modern business, and absolute collaboration was not trouble-free. Lehtinen et al. asserted for complex product development, the stakeholder dynamics for product development involved determining which stakeholders to engage or disengage, when and how to engage or disengage the different stakeholders, and understand how the project context was changing. Lehtinen et al. advised organizations to hire prestigious persons as heralds

to arbitrate different stakeholder interests and optimize schedules. In the semistructured interviews conducted with external stakeholders comprising of community leaders, trade unionists, and human rights activists, Amadi et al. (2018) corroborated the importance of stakeholder engagement timing.

Amadi et al. (2018) identified the five primary enablers of external stakeholders as (a) the choice of project location, (b) transparency of internal stakeholders, (c) timing of stakeholders' engagement, (d) knowledge of contractual agreement, and (e) relationship with internal stakeholders. In Japan, the success factors perception for woody biomass energy systems supply chain, obtained from semistructured interviews with stakeholders in the Kyushu region, included respect of values and traditions, transportation infrastructure, business model integration, relationship and trust, local vitalization, and quality control (Ahl et al., 2018). Ahl et al. (2018) clarified stakeholder perception convergences and divergences were essential policy considerations, and energy policymakers should consider both informal and formal dimensions in policymaking. Project managers, therefore, require a stakeholder management plan to deliver competitive projects.

Project Management Solutions for Oil and Gas Construction Projects

Ellingsen et al. (2018) proffered measures to reduce cost and delays in large offshore projects by deploying new standard specifications of bulk items developed through a joint industry project. The joint industry project specifications are occasioned by the collaboration between fabricators, class societies, operators, and engineering companies to optimize cost and schedule without compromising safety and quality

(Ellingsen et al., 2018). However, Pollack et al. (2018) posited the project management iron triangle of time, cost, and quality did not necessarily tell the whole story of project success, and the context of representation for the iron triangle had changed within the last few decades. Hence, project managers should measure success with consideration for the client and contractors' satisfaction and based on the project's outcome and impact.

Invernizzi et al. (2018) proffered benchmarking between megaprojects to curb the cost and schedule overrun. A step methodology for benchmarking includes research initiation, data codification, independent and dependent variable operationalization, detailed cross-comparison/statistical analysis, data mining, and validation/dissemination (Invernizzi et al., 2018). From their case study, Invernizzi et al. concluded that contracting strategy, location, and early stakeholder involvement were the aspects of projects likely to create cost impacts, and project managers should pay close attention to them. Loch et al. (2017) investigated the challenges faced by project teams and organizational leadership in managing complex projects. The management challenges typical to engineering and construction were stakeholder management, uncertainty, and complexity in these projects. Loch et al. proposed five themes that steering committee members could use to manage complex projects successfully; the steering committee should involve primary stakeholders, but not more than eight people who understand their role, the meeting rules, and agree to invest in trust-building. The other four themes were goal agreement, motivation and control, intelligence gathering, and managing surprises and changes (Loch et al., 2017). The hardest part of a complex project is managing surprises (Loch et al., 2017).

Jawad et al. (2018) proposed implementing innovative project control systems to mitigate the project budget and schedule overruns in the petroleum industry. Jawad et al. identified the critical barriers for successful project delivery enablers as poor skills in scheduling and controlling and a lack of confidence by the actors in the control system. Jawad et al. further posited the need to build skilled project teams with clear roles, develop accurate and trusted control systems, and ensure the owner and contractor understand the control system and contract deliverables. Callegari et al. (2018) argued the size of energy megaprojects was responsible for the cost overruns because the risk exposure was grossly disproportionate to the financial economies (Callegari et al., 2018). Hence, during project scoping, project managers should carefully evaluate the project's size to assure the manageability and prevention of cost escalation (Callegari et al., 2018).

Derakhshanalavijeh and Teixeira (2017) reviewed the cost overruns in oil and gas construction in developing countries using Iran as a case study. Derakhshanalavijeh and Teixeira advised that to mitigate cost overruns, project consultants should ensure the accuracy of initial cost estimates, provide proper planning, and minimize design changes. The other two critical success factors for alleviating oil and gas project cost overruns were the appointment of qualified consultants and personnel training (Derakhshanalavijeh & Teixeira, 2017). The literature for oil and gas projects is consistent in highlighting poor scope definition, rework, and competence as areas where oil and gas project engineers may improve to reduce cost overruns.

Importance of the Oil and Gas Industry Activities to Global Economics

Oil and gas are essential to the world's global economy (Mohaddes & Raissi, 2019). Adekunle et al. (2020) posited a positive correlation between global oil production and price to Nigeria's stock returns. Mohaddes and Raissi (2019) reported different countries' responses to a United States of America supply-driven oil price shock, with the real gross domestic product (GDP) increasing in both developed and emerging market oil-importing economies, production declining in exporters, inflation falling in most countries, and equity prices rising worldwide. The results from Charfeddine and Barkat's (2020) study of oil and gas price and revenues on Qatar GDP showed that total real GDP response to negative shocks on real oil and gas revenues are higher than the impact of positive shocks, indicating evidence for the existence of asymmetric impact of shocks in the short-run for Qatar's economy.

In Russia, oil is not just a commodity but an asset (Pavlova et al., 2017). The value of crude oil in Russia involves multiple financial processes, and the oil and gas sector accounts for 80% of foreign investment (Pavlova et al., 2017). Hence, the Russian economy depends on the oil market. In 1973, 1998, 2008-2009, 2014-2015, there was a recession in Russia that caused budget deficit, rising prices, rising inflation, rising unemployment, and declining production volumes due to lower oil prices (Pavlova et al., 2017). Neghad and Hosseini (2017) described oil as one of the most significant and useful consumer goods and a principal factor of a global financial crisis. In their 2017 study, Neghad and Hosseini assessed the effect of oil prices on unemployment in thirty-

one countries. Except for Western Europe, there was a correlation between oil prices globally and unemployment (Neghad & Hosseini, 2017).

The oil and gas sector has a crucial role in the world's global economy. Wood Mackenzie reported that oil exploration would return to profitability after 5 years of single-digit returns (Oil & Gas Journal, 2016). The focus areas will include pipe gas opportunities for undersupplied markets like North America, Eastern Europe, and Latin America (Oil & Gas Journal, 2016). At the same time, investors will retreat from liquefied natural gas and high-cost frontiers like offshore arctic drilling (Oil & Gas Journal, 2016). Shaidan et al. (2018) also stated that liquefied natural gas became a global fuel with an annual trade volume growth exceeding 7%, an anticipated growth of 6.7% per year till 2020, and a current trade volume of 240 million tons. Therefore, the performance of construction projects within the oil and gas sector plays a role in global economics and can influence some organizations' long-term sustainability. Cost overruns in this sector create negative results at intrinsic and extrinsic levels. A taxonomy for mitigating cost overruns in the oil and gas construction sector may support global economics and improve some countries' developments.

Transition

Section 1 is an introduction to the background of the problem; problem statement; purpose statement; nature of the study; research question; interview questions; conceptual framework; operational definitions; assumptions, limitations, and delimitations; the significance of the study; and review of the professional and academic literature. The objective of Section 2 is a further elaboration of the research method and design, the role

of the researcher, participants, population and sampling, ethical research, data collection instruments and techniques, data organizing technique, data analysis, and reliability and validity. Section 3 comprises a review of the collected data, presentation of the findings, the application to professional practice, and recommendations for further research. I also include recommendations for action and the study's implications for positive social change. The final part comprises personal reflections and conclusions.

Section 2: The Project

Purpose Statement

The purpose of this qualitative multiple case study was to explore the strategies project managers in the oil and gas construction industry employ to complete projects without cost overruns. The target population for this study consisted of four project managers working in the oil and gas construction sector in Port-Harcourt, Nigeria, with successful experience in completing projects without cost overruns. The implication of this research study for positive social change includes the promotion of awareness and cognition about construction project cost escalations in the oil and gas construction industry and the mitigation strategy in project management. This knowledge may help project managers retain profit margins in construction projects, reduce the occurrence of abandoned projects in some regions, and contribute to the development of the communities that host construction companies.

Role of the Researcher

The researcher's role in a qualitative study includes collecting, organizing, and analyzing the data required for the research (Moser & Korstjens, 2017). As the researcher, I was the principal instrument for data collection, organization, and data analysis. A connection between a researcher and the topic can positively reduce gaps in the research participants' data (Saunders et al., 2018). A researcher’s grasp of the subject also influences the understanding of the information presented by interviewees, supports comprehension of the secondary data, enhances cognition of the potential for participants to exhibit personal interpretation bias, and has a positive effect on awareness of

researchers in avoiding their preferences (Mackieson et al., 2019). My 13 years of experience and learning in project management and construction provided leverage for understanding the participants' data. I reviewed the current literature on the research topic to enhance my understanding of the subject further.

The Belmont Report protocol and guidelines are foundational documents for ethical research governance (Adashi et al., 2018). While conducting primary and secondary data collection, a researcher must draw clear ethical boundaries that protect study participants by explaining the participants' rights and clarifying ethical concerns before data collection (Adashi et al., 2018). I explained to participants the purpose of the research, the expected duration, and the data collection methods, including their rights to withdrawal without penalty. I also clarified to participants any exposure due to involvement in the research. I set clear ethical boundaries in my study and explained the whole process to participants before beginning data collection.

Personal values and beliefs, demographic paradigms, and exposure to participants are some elements that may contribute to biases during data collection (Galdas, 2017). Personal biases may affect the trustworthiness of the study when the researcher is the instrument of data collection (Moser & Korstjens, 2017). I mitigated personal bias by using open-ended questions during the interview to allow participants to share their experiences without any leading opinion. Researchers can minimize their own bias and enhance understanding of collected data and research topics by conducting member checking (Candela, 2019). I conducted member checking by sharing my interpretation of the interview with the participants to determine alignment with the participants'

intentions. I used data saturation to mitigate personal bias by interviewing until no new information emerged during the interview session, and I held personal ideas and feelings in epoche during the data collection process. I had no personal, academic, or organizational relationships, which could have caused a bias with the employee population of the study.

A researcher should make participants fully aware of the whole research process, including the interview protocol, before starting data collection (McGrath et al., 2018). Interview protocols are essential for creating and controlling an ethical and unbiased interview process (McGrath et al., 2018). I used an interview protocol for the study (see Appendix A). I discussed the content in the interview protocol in a pre-arranged meeting before the interview date. I ensured that participants understood each part of the research process clearly. I followed the interview protocol during the interview as a tool to achieve an ethical and unbiased interview process.

Participants

Hamilton and Finley (2019) noted that identifying participants with experience in the field of interest is crucial to obtain accurate data capable of providing answers to the research questions. Kristensen and Ravn (2015) cited proven in-depth experience, capacity to build on tacit knowledge, and detailed understanding of the research question as criteria for eligible study participants. I selected four project managers with over 5 years of experience managing projects with a cost above $1 million in an oil and gas construction company in Nigeria. Hoseini et al. (2020) advised researchers to tackle studies on cost overruns from a client and contractor perspective to achieve holistic

results. The project managers were from oil and gas client organizations and contracting consortiums to enable diverse perspectives in response to the research question.

Amundsen et al. (2017) revealed that a researchers' existing relationships within organizations and with relevant gatekeepers could improve opportunities to access suitable participants for a research study. I gained access to the participants via informal engagements within the project management community, where I have actively participated for 13 years, to request referrals. I formally requested to selected project managers via email and phone to participate in the data collection process using the letter of invitation, which details the purpose of the research, criteria for participant selection, and confidentiality information (see Appendix B). I attached an informed consent form to the letter of invitation and engaged the participants on the implication of providing informed consent before receiving acceptance via email.

To promote a healthy working relationship with participants, Lobe et al. (2020) recommended discussions with the participants on meeting time, privacy risks, and online interview modalities. I engaged participants early on any concerns, including managing meeting time, online tool preference, privacy risks, and permission to record the interview. Archibald et al. (2019) posited that although participants in online zoom interviews experience some technical difficulties, the participants rated cost-effectiveness, data management features, and the video conferencing tool's security options as satisfactory. Gray et al. (2020) advised researchers to have a backup plan for interview dates as mitigation to technology glitches during interview sessions. I proposed backup-plan options with participants, including phone calls in case of delays, technology

failures, or personal crises, to select optimal interview solutions and uphold seamless researcher and participant working relationships. Lobe et al. recommended discussions with the participant on technology requirements and modalities for online interviews. I informed participants via phone calls on the requirements for a stable internet connection, installation of the online conferencing software on a computer, and the need for a safe, quiet environment to conduct the interview. I used the participant feedback from this conversation to select a date and conference tool for the interview.

Research Method and Design

Research Method

Research methods for conducting a doctoral study are qualitative, quantitative, or mixed (Hong et al., 2018). A researcher needs to select the appropriate research method suitable for the nature of the study (Hong et al., 2018). A quantitative researcher provides statistical data on connecting relationships (Apuke, 2017). Quantitative studies are helpful to researchers needing to investigate and test correlations among variables to examine a topic by testing a hypothesis (Apuke, 2017). The quantitative method was not appropriate for this study because the intention was to understand the issues of cost overruns from study participants' experiences and not to test a hypothesis. The mixed-method research is a robust research method that involves both qualitative and quantitative studies to gain more integrated and detailed information (Gibson, 2017). A researcher conducts a mixed-method study through several stages by following a sequential process of the qualitative and quantitative methods (McKendrick, 2020). The

mixed method did not meet the requirements of this research because of the longer time frame and scope required.

A researcher uses qualitative research to acquire knowledge about a topic from the participants' experiences (Yin, 2018). The qualitative research method helps the researcher explore and understand participants' perceptions regarding the experienced phenomenon through open-ended questions (Yin, 2018). The qualitative method is adequate for a study when there is alignment with the research objectives and suitability to provide context and understanding of strategies in a complex business environment (Renz et al., 2018). The qualitative research method was appropriate for this study because the research objective was to acquire knowledge from participants' experiences and understand the cost overrun phenomenon in a complex business environment through open-ended questions.

Research Design

The research question underpins the research design (Harrison et al., 2017). The researcher selects the most suitable research design to answer the research question (Yin, 2018). Researchers use grounded theory to create a new concept with a description of the social or cultural process and interface in induction and deduction among people and groups (Yin, 2018). Grounded theory meets the requirements for collecting and gathering data in an extended time of observation to garner information on the phenomenon under study to generate a new concept (Yiona et al., 2019). Grounded theory was not suitable for this study because I did not intend to produce a study model.

The phenomenological design comprises an in-depth survey of a group of people's lived experiences by cross-examining participants, which starts with a description of participants and extends to personal viewpoints or knowledge of the occurrence (Frechette et al., 2020). The phenomenological researcher can explain the occurrence of the phenomenon by using the description made by a group of individuals who lived the experience (Frechette et al., 2020). The phenomenological design was not appropriate for this research because the intention was to explore project managers' strategies and not describe individuals' lived experiences regarding a phenomenon.

The ethnography study is an intricate process that researchers use to investigate what causes a problem or cultural phenomenon (Ingold, 2017). The researcher conducts many field interviews to obtain the traditional values and beliefs of individuals, groups, or cultures of the same race and location (Ingold, 2017). A researcher may employ ethnography if the objective is to generate a group's perception with a shared culture (Ingold, 2017). Ethnography research was not suitable for this study because there was no need to observe behaviors, ethnic groups, society, or culture. The other reason for avoiding ethnographic design was the time and cost spent with ethnography.

Narrative design helps the researcher understand in-depth details of the participants' lived experiences by clarifying any cultural barriers that may prevent the investigation (Sohn et al., 2017). Researchers use narrative design to investigate the details of human experience and life stories through the participants’ lens (Sohn et al., 2017). A narrative researcher forms the contexts of participants' perspectives and understanding by conducting interviews, questionnaires, observations, and pictures (Sohn

et al., 2017). I did not use the narrative design because the research question does not require telling a story.

The case study design allows the researcher to work with operational and organizational frameworks developed before beginning the study (Yin, 2018). Yin (2018) categorized the case study into five components: forming a case study question, building propositions, identifying the unit of analysis, linking data to hypotheses, and interpreting findings to achieve breadth and depth of scholarship when using the exploratory design. The case study design is appropriate for examining critical factors of a phenomenon where a researcher has no control over the incidences (Yin, 2018). In the case study design, it is beneficial for a researcher to have multiple data collection approaches, which may be a single case or multiple cases used for generating themes to support the findings (Bowman, 2019; Harrison et al., 2017). A case study can be conducted via a single or multiple case study design (Harrison et al., 2017). A single case study design is appropriate for a research question of how or why examination of the phenomenon (Bartlett & Vavrus, 2017; Ninci, 2019). Multiple case study is valuable for a more comprehensive investigation to analyze the phenomenon, where the researcher can address the research question (Bartlett & Vavrus, 2017). Based on the analysis above, the multiple case study was the most suitable design for this study.

The different types of case studies are exploratory, descriptive, and explanatory (Sarstedt & Mooi, 2019). The explanatory case study is most appropriate to address a research question when a researcher has no control over the studied contemporary phenomenon (Dudovskiy, 2018). Descriptive case studies are suitable for the examination

of a sequence of events that happened in the past. In contrast, exploratory case studies are apt for what and who is responsible for a phenomenon (Dudovskiy, 2018). For this study, I explored cost overruns in the oil and gas industry to determine how and why cost overruns happen and the mitigation strategies. The exploratory case study was the most suitable to understand who and what caused the cost overrun phenomenon and hence pose mitigation strategies.

A researcher achieves data saturation when further investigation yields no more data or adds no productive new themes to the study findings during the research process (Low, 2019). The researcher needs to increase the number of selected cases to achieve data saturation if three cases are insufficient for the study (Braun & Clarke, 2019). To achieve data saturation, I continued interviewing until no new information emerged during the interview session. Secondary data for the qualitative case study is mandatory to reach data saturation and conduct triangulation (Braun & Clarke, 2019). I collected and reviewed publicly available company publications and documents as part of the data collection process to achieve saturation. I conducted triangulation to augment the information received during interviews. I produced a clear explanation of how I achieved saturation, as advised by Low (2019). I detected the data saturation point when no new codes or themes emerged during the data analysis process.

Population and Sampling

The objective of this study was to explore strategies project managers in the oil and gas construction industry employ to complete projects without cost overruns. Hamilton and Finley (2019) advised a small sample size between 1 to 10 participants for

a qualitative case study. Shaheen et al. (2019) advised that sampling for qualitative case study designs should not include a high number of participants but rather small samples with a semistructured interview of open-ended questions to achieve quality data as the primary analysis. The population in this qualitative case study consisted of four project managers practicing in client companies and contracting companies in the oil and gas construction sector with experience completing oil and gas projects without cost overruns. The project managers had over 5 years of experience managing projects with a cost above $1 million. The participants' work experience was in project management in the oil and gas construction sector in Nigeria. This population was appropriate because the project managers had encountered enough opportunities to understand the cost overrun phenomenon from both the contractor and client perspective, as advised by Hoseini et al. (2020).

Cornesse et al. (2020) investigated probability and nonprobability sampling methods to determine the conditions where the application of the different sampling methods produced accurate results. Probability sampling methods involve the selection of random participants for a study, while nonprobability sampling methods comprise selective sampling to achieve a target population (Blom et al., 2020). The advantage of probability sample surveys is that validity of the research outcome is based on a set of established mathematical principles which can be justified and hence enables replication (Cornesse et al., 2020). The disadvantage of probability sampling is the ineffectiveness to provide reliable information when certain demographic parameters are required for participants to answer the research question (Blom et al., 2020). Probability sampling

may require more time and resources to achieve research objectives (Blom et al., 2020). Researchers use nonprobability sample surveys when there are specific features required for participants to accurately answer research questions, and thus participants do not have an equal probability of being selected in the study (Blom et al., 2020). Nonprobability sample survey methods require less time and resources and enable a researcher to achieve quality data from knowledgeable participants (Onwuegbuzie & Collins, 2017). The disadvantage of nonprobability sampling is that the results may not be generalizable due to the sample and sample size employed in the study, which is primarily dependent on the researchers' judgment (Gibson, 2017). I used the nonprobability sampling technique because the method aligned with the research objective for this study and required less time and resources to achieve accurate study outcomes. The object of this study was to determine strategies project managers employ to deliver oil and gas projects without cost overrun. Hence, there was a requirement for participants to have an in-depth knowledge of the subject. A random selection of participants would not have provided access to the in-depth knowledge required to tackle the research objectives. The nonprobability sampling method enabled the attainment of the research goal.

The purposive sampling method, which is a type of nonprobability sampling, is used by qualitative researchers to identify and select individuals for a study based on the specific knowledge or experience the individuals have about the phenomenon of interest (Onwuegbuzie & Collins, 2017). The screening process for selecting cases and participants was purposive sampling. The reason for choosing a purposive sampling technique during interview-based research was to have informed participants with

experience in the subject. The benefit of involving experienced interviewees was to ensure variety in quality data through the participants' view, impacting the whole population's comprehensive conclusions. I used the purposive sampling method to identify and select four project managers from client and contractor organizations. I identified and selected project managers based on their in-depth experience in project management and implementing strategies that had helped deliver one or more oil and gas construction projects without cost overruns.

Data Saturation and Sampling

The criteria for achieving data saturation in qualitative research include no new emerging themes from the data collection process, contributing to the study replication (Low, 2019). Researchers can use secondary data to achieve data saturation and answer the research question through the selected trial sample size (Braun & Clarke, 2019; Low, 2019). I collected primary data during the interviews and secondary data from publicly available documents related to the cases. To achieve data saturation, I studied patterns and justified data saturation when achieved. I focused on obtaining quality data from the four participants by using the semistructured interview questions. The researcher needs to increase the number of selected cases to achieve data saturation if three cases are not enough for the study (Braun & Clarke, 2019). I achieved data saturation after interviewing four participants. To achieve data saturation, I continued interviewing until no new information emerged during the interview session. Secondary data for the qualitative case study is mandatory to reach data saturation and conduct triangulation (Braun & Clarke, 2019). I collected and reviewed publicly available documents on

organizational website as part of the data collection process to achieve saturation. I produced a clear explanation of how I achieved saturation, as advised by Low (2019).

Hoseini et al. (2020) advised researchers investigating cost performance in projects to consider perspectives from both the client and contractor to achieve a balanced outcome. The participant selection from client and contractor was appropriate to enhance and broaden information on the cost overruns. The selection criterion also created an opportunity for mitigating solutions that concern both client and contractor companies, who are primary stakeholders in the oil and gas construction sector. The rationale for the interview setting using online communication tools was based on Gray et al.'s (2020) findings that online conferencing could facilitate effective data collection in qualitative research interviews. Gray et al. reported that participants cited a positive experience for Zoom video conferencing. The benefits of online interviews include convenience, ease of use, enhanced personal interface to discuss personal topics, accessibility, and time-saving opportunities with no travel requirements to participate in the research (Gray et al., 2020). I leveraged online interviews for data collection.

Ethical Research

Researchers should conduct their study within the boundary of ethical research (Friesen et al., 2017). Ethical research is a significant part of a doctoral study, which requires understanding the process, guidelines, and protocols essential to conduct ethical research (Friesen et al., 2017). Ethical research comprises the informed consent process, the confidentiality of agreement between the participants and researcher, and participants' rights protection (Hesse et al., 2018). Informed consent is important to

protect participants' welfare in conducting scholarly studies (Hesse et al., 2018). I complied with *The Belmont Report's* informed consent process on ethical principles and guidelines for the participants' rights protection. I submitted the informed consent form and requested participants to provide consent via email to signify acceptance to participate in the study. Tolich and Iphofen (2019) noted that participants should concede through informed consent forms before data collection. I explained the informed consent process and related form before obtaining the participants' acceptance to contribute to this research. The form included the research topic and benefits, the conditions of data collection and relevance to personal experience, acceptance to participation, as well as a note of the right to withdraw from the study at any stage. A researcher needs to record the participants' acceptance to participate in a research study (Yin, 2018). Consequently, I recorded the related acceptances to participate in this study.

Fernandez Lynch (2020) advised researchers to protect the participants' right to withdraw from a study without penalty. I informed the participants before and during the interview process that participation was voluntary. Participants had a right to withdraw from the study at any time. Participants did not need to explain their withdrawal and could communicate their intention to withdraw by written letter, text message, telephone call, email, or any other convenient means. The major codes of research ethics stipulate that consent to participate in research should not require undue coercion, and payment incentives to participants may be viewed as an inducement (Largent & Lynch, 2017).

Consequently, I offered no payment to participants. Participants volunteered based on interest to improve the project management body of knowledge. Assurance of

this data collection process was the strategy for selecting participants interested in improving a system and not motivated by a financial incentive, thereby enhancing the data collection technique as intuitive evidence for data validity and reliability (Largent & Lynch, 2017).

The Institutional Review Board (IRB) bears the responsibility for examining if researchers conduct human studies in compliance with the U.S. federal and state regulations, policies, and producers, to optimize the research quality in an ethical way (Vitak et al., 2017). I applied to Walden University's IRB to outline the study's ethical research strategies. I received Walden University's IRB approval before beginning the interview process. Walden University's IRB approval number is 05-11-21-0594487.

Researchers are responsible for maintaining the confidentiality of the companies and participants, and coding participants may encourage organizations and participants to provide more honest responses (Williams & Moser, 2019). I maintained confidentiality by coding participants. Spurlin and Garven (2016) indicated storing data in a safe place facilitates easy retrieval for future use and ensures the privacy of the data sources. To protect participants' confidentiality, I stored the data on my personal computer, protected with a password, and on a backup flash drive locked in a fireproof safe for future use or audits. I will store the data for 5 years then erase all data from the flash drive and electronic device.

Data Collection Instruments

The researcher is the principal instrument for data collection (Harrison et al., 2017). As the primary data collection instrument, I used open-ended questions during the

semistructured interview process for streamlining interviews to steer the discussions within the research boundaries and the research question, as advised by Harrison et al. (2017). Liamputtong (2019) advised using the interview process to achieve reliability, demonstrate neutrality, and foster trustworthiness. I used the interview process to collect clear and reliable data that does not distort the participants' views of actual events. I suspended judgment according to the rules of epoche and clarify participants' feedback during the interview process.

The researcher should collect data from participants in a credible and trustworthy manner (Yin, 2018). To enhance the reliability and validity of the data collection process, I demonstrated repeatability such that the data collection process would yield replicable results if conducted by other researchers. The procedure included deploying a case study interview protocol (see Appendix A) to facilitate full interview documentation and development of the case study database as advised by Harrison et al. (2017). I used the interview protocol to manage the interview procedure, define the boundaries of the interview meeting, and inform the participants of relevant information.

Gibson (2017) advised researchers to use data and methodological triangulation to improve the reliability and validity of the data collection process. Data triangulation relates and compares participants' data regarding views, time, and location (Gibson, 2017). Methodological triangulation involves linking multiple data sources, including interview transcripts, memos, documentation of participants' body language, and tone of voice. I used data and methodological triangulation to enhance reliability during the data collection process by comparing participants' views with the time and location of the

events, and linking multiple data sources, including interview transcripts, body language, and tone of voice. Using the triangulation techniques alone may lead to vague findings because of possible misinterpretation in data collection (Gibson, 2017). Member checking comprises soliciting the participant's view of the interview transcript's preliminary findings and interpretations and clarifying any misunderstandings in data collection (Candela, 2019). I enhanced the validity of the data collection process by using the member checking technique. I conducted member checking by providing study participants with my interpretation of their transcribed answers to interview questions and asking participants to verify the accuracy of my interpretations.

Data Collection Technique

Research interviews can be broadly categorized into structured, semistructured, and unstructured interviews (Miller, 2019). I used the semistructured interviewing method, with online interview technique and organizational documents review to collect relevant data and achieve the set objectives of this study. The semistructured interview comprised the researcher asking predetermined open-ended inquiries on the research topic (Miller, 2019). Abdulla and Al-Hashimi (2019) conducted semistructured interviews with 17 project practitioners and investigated project management methodologies' impact on project success using oil and gas projects as a case study. Amadi et al. (2018) also leveraged semistructured interviews conducted with external stakeholders comprising community leaders, trade unionists, and human rights activists and determined the importance of stakeholder engagement timing.

I used the semistructured interview method to conduct an initial inquiry and continue with explorative questions to the participants to derive a detailed understanding of the project managers' reflections on the project cost overrun experiences. Harrison et al. (2017) indicated that an interview protocol details the steps a researcher should follow to achieve the purpose of the interview, and a good protocol would reinforce the quality of data received during the research. I used the interview protocol (see Appendix A) to achieve quality data during the interview session and afterward. Lobe et al. (2020) advised researchers to keep an audio record of interview responses and participants' shared experiences to ensure accurate transcription and use in the data management process. Williams and Moser (2019) noted researchers must advise participants on the intention to record interviews and receive acceptance before recording the interview conversations. On receipt of IRB approval, I contacted the participants and scheduled the online interview session. During the interview, I informed participants of the purpose and provisions of the informed consent form. I assured of the confidentiality of the participants' identity and intention to record interview conversations. I also informed participants of the right to withdraw at any time. I asked each participant the questions already set in the interview protocol and recorded field notes. Williams and Moser advised researchers to take field notes to record participants' behaviors, voice pitches, and clues that may not be evident in an audio conversation. The field notes from the interview included participants' behaviors, voice pitch and tone on some questions, and the environmental context of the study that audio-recording may not capture adequately. I asked participants to disclose any pertinent issues from their experience that may be

beneficial to the study. At the end of each session, I thanked each participant for contributing to the study. I asked for feedback on the participant experience to improve the next interview session.

Gibson (2017) advised researchers to use data and methodological triangulation to improve the reliability and validity of the data collection process. In addition to the semistructured interview, I collected publicly available data from the organizations' project documents and the organization's website to achieve methodological triangulation. I collected publicly available organizational documents relevant to achieving the study objectives. I compared the organizational information to determine alignment and improve validity in data collection. Aguinis and Solarino (2019) advised that the advantage of reviewing organizational data in qualitative research was to improve the transparency of the study, but the disadvantage was that participants might share only data convenient for the organization, which could affect the quality of data collection. Sulaiman et al. (2019) also noted the degradation of hard copy documents during conversion to digital copies, which affected data quality.

The advantage of the semistructured interview is in the flexible approach where the interviewee can delve into a wider border and context (Miller, 2019). The semistructured interview has the advantage over structured interview because the researcher can explore participants' experiences by fluctuating across different timelines to understand the phenomenon under study (Cypress, 2018). The disadvantage of the semistructured interview is the researchers' skill requirement for a careful balance between rigor and relationship during data collection (DeJonckheere & Vaughn, 2019). A

semistructured interview requires good inquiry skills by the researcher to prevent a feeling of intimidation in participants during the interview process (DeJonckheere & Vaughn, 2019). I conformed to all Walden university IRB regulations to manage the interview adequately to minimize any negative feelings or discomfort to participants. The face-to-face semistructured interview has more flexibility and control than an online conversation (Brown & Danaher, 2019); however, many scholars have confirmed satisfactory results from online interview data collection methods (Archibald et al., 2019; Gray et al., 2020; Lobe et al., 2020). Due to the social distance and travel restrictions caused by the coronavirus pandemic, I leveraged online meeting conference tools according to the participants' convenience. During the online interview session, I introduced the research question, clarified receipt of informed consent, and followed the interview protocol described in Appendix A.

Boros (2018) advised researchers on the possibility of emotional tendencies from research participants. As Boros advised, I managed emotional tendencies from participants during the interview with emotional intelligence, accommodating disposition, and composure. I was attentive to the participant's emotive signals during the interview and strategic in managing participants' behavior by considering the participant's comfort as a priority during the process. I also kept an audio record of the interview, as Lobe et al. (2020) advised. After the interview process, I obtained publicly available archival data and records from the organization's website as relevant.

Malmqvist et al. (2019) informed the necessity of a pilot study for qualitative research to test the efficacy of the data collection instruments and enhance research

quality. After IRB approval, I conducted a pilot study with a selected participant to determine the viability of the online tools, the adequacy of the time allotted based on the interview questions, the interview questions' completeness, and any other relevant feedback on the entire research process. I used feedback from this pilot study to adjust any incorrect assumptions and improve the research quality, reliability, and validity. Member checking can improve data interpretation and transcript review (Candela, 2019). I conducted member checking by providing study participants with my interpretation of their transcribed answers to interview questions and asking participants to verify the accuracy of my interpretations.

Data Organization Technique

Researchers need to structure their data organization to include findings of the semistructured interviews (Tolich & Iphofen, 2019). I applied the guidelines offered by Hamilton and Finley (2019) by labeling the journals, interview records, audio, and memos. I also kept photocopies of interview transcripts after the interviews. Coding is useful in labeling data (Williams & Moser, 2019). Each interview started with an audio and written record on the date, time, place, and participants' pseudonyms to enable easy data location for retrieval during data analysis as advised by Williams and Moser (2019). I collated all field notes, audio recordings, interview transcripts, and organizational documents. I used Excel software for coding and identifying emerging themes. I will keep all raw data on an external hard drive for 5 years, after which time I will erase and delete the data from my electronic storage device, as advised by Roller and Lavrakas (2018). I will destroy information stored in hard and electronic copies after 5 years.

Data Analysis

Data analysis begins at the study design stage because the conceptual framework, literature review, and research question comprise subtle themes (Hamilton & Finley, 2019). Researchers may use codes to represent data from different participants (Hamilton & Finley, 2019). I used pre-codes to shape data collection by incorporating data and methodological triangulation. Data triangulation involves correlating participants' views, project time, and space, while methodical triangulation correlates with multiple data sources (Gibson, 2017). I used methodical triangulation to correlate the multiple data sources, including interviews, participant observation, tone, and memo. I transcribed the interview immediately after completion, ensuring to detail the entire conversation on paper and electronic equipment. On completion of each interview, I interpreted the responses received from the participants. Member checking can improve data interpretation (Candela, 2019). I conducted member checking by sharing with participants' the interpretations of the interview data and clarifying any misunderstandings in data collection. I conducted member checking by providing study participants with my interpretation of their transcribed answers to interview questions and asking participants to verify the accuracy of my interpretations. As part of the member checking process, I corrected the interpretations requested by interviewees to achieve the interpretation accuracy as Hamilton and Finley (2019) advised.

Williams and Moser (2019) advised reading the interview transcripts carefully as part of the data analysis process. The data analysis involved meticulously reading each interview transcript, compiling, refining, and reviewing the data to assess emergent

themes. Williams and Moser recommended a thematic analysis for qualitative data analysis. I used thematic analysis to determine the open codes, which are the early concepts and strategies that emerge from the interviews. All coding activity for this study was documented on Excel software. I categorized the results from the open codes to determine the axial codes and applied early selective coding to form the emerging themes as recommended by Williams and Moser. I developed and tested the preliminary codebook before completing the final coding process and reviewing the themes as stipulated by Richards and Hemphill (2018). Neale (2020) advised researchers to extend the data interpretation from emerging themes from a simple local account of their data by reviewing existing and new literature related to the research concept. After I had confirmed the key emerging themes and subthemes, I correlated the emerging themes with the literature review to determine alignment or deviation from earlier studies. After writing the proposal, I reviewed new related studies and correlated with the emerging themes to enhance understanding of the research outcomes. A researcher may explore how their findings correlate to the conceptual framework to deepen understanding of the data (Neale, 2020). I reviewed all earlier notes, assumptions, and emerging themes to determine correlation with the conceptual framework and provide a clear, holistic understanding of the research outcome.

Reliability and Validity

Researchers conducting qualitative studies should clarify the reliability and validity processes employed for the study (Mohajan, 2017). Specifically, researchers should address the reliability and validity challenges that emerge during the data

collection, analysis, and interpretation processes (Mohajan, 2018). In tackling reliability and validity issues, a qualitative researcher can reduce the effects of research bias and improve research transparency (Rose & Johnson, 2020). Qualitative researchers should align theoretical orientation and analytical techniques with trustworthiness techniques that can be assessed for quality and credibility (Rose & Johnson, 2020).

Reliability

The reliability of the findings adds credence to the overarching research (Yin, 2018). The principles of reliability and validity are (a) dependability, (b) ease of transfer, (c) credibility, and (d) confirmability of the study (Marshall & Rossman, 2017). To achieve reliability, researchers should provide a clear description of the study processes and methods to enable future researchers to replicate the work and improve knowledge in other contexts (Abdalla et al., 2018). I provided a detailed description of all the methods and processes used in data collection, analysis, and the rationale for the decisions taken during the research process that might be useful to future researchers. There is a strong relationship between credibility, dependability, and reliability, and, in practice, the evidence of credibility supports the assurance of reliability, and reliability in research underpins the dependability of research results (Abdalla et al., 2018).

A researcher can also improve the dependability of the study by making clear steps of the interview procedure (McKendrick, 2020). The research interview protocol is a step-by-step process that researchers develop and apply to guide the execution of the research interview process (Yeong et al., 2018). To ensure dependability of the study, I applied the interview protocol (see Appendix A) to guide the implementation of the

semistructured interview process. Using the interview protocol provides the opportunity for other researchers to replicate the study within a different group or context and to appreciate the rationale that guided the researcher's decisions that led to the final research outcomes. Marshall and Rossman (2017) advised researchers to use methodological triangulation and member checking to achieve research dependability, credibility, and confirmability. I used methodological triangulation and member checking to achieve research dependability, credibility, transferability, and confirmability.

Member checking is a tool for achieving dependability in a study (Candela, 2019). I ensured the dependability of the study by using the member checking technique to assess the accuracy of the interpretation of the interview data. I shared my interpretations of participants' answers to interview questions and ask participants to verify the accuracy of my interpretations, as advised by Marshall and Rossman (2017). A researcher demonstrates the reliability of a study by providing details of the documentation and methods to the research design so that future researchers may replicate the study (Hamilton & Finley, 2019). I established an auditable trail of documentation that a different researcher can follow by keeping records on sampling, research materials, interview protocol, interview data, observation notes, categorization process, emerging themes, and data management strategy. I included all the details that will be included in the final study.

Validity

Researchers must show validity for their study (Hayashi et al., 2019). Research validity is evaluating the quality of a qualitative study by measuring the truthfulness of

the research study and achieved by assuring the participants provide accurate information (Hayashi et al., 2019). Specifically, I used purposive sampling and member checking to assure validity, as recommended by Smith and McGannon (2018). I used purposive sampling to ensure participants in the study are qualified to provide accurate feedback to the research questions. I used the member checking technique to confirm the interpretation of the interview data aligns with the participant's intentions. A primary drawback to validity is a researcher's bias (Andrews & Oster, 2019). Researchers should avoid retaining any preconceived notions on the study that might skew the research validity (Andrews & Oster, 2019). I isolated the research bias by avoiding pre-assumed beliefs and findings of the study as Hayashi et al. (2019) advised.

Credibility refers to ensuring that the findings from the study are a true description of the phenomenon from the perspective of the participants in the research (Hessels et al., 2019). Participants may increase credibility by employing data collection methods, such as using an interview protocol and interactive interviewing, which have been tested and validated in advance (Abdalla et al., 2018). To ensure credibility, I interviewed the participants adhering to the interview protocol in Appendix A and spent adequate time in the interview process to understand the participants' case and meanings to the research question. Abdalla et al. (2018) also advised researchers to use a triangulation strategy by using diversified and multiple data sources to achieve credibility. Researchers should also compare individuals' points of view with experiences. I used the multiple case study strategy to improve the diversity of

perspectives and compare participants' points of view with the experiences shared to review alignment and determine the accurate interpretation.

Researchers' biases can impede the credibility of the study (Andrews & Oster, 2019). Keeping a reflective journal helps a researcher identify any personal subjective influence and increases the transparency of the research process by reducing the researcher's bias (Palaganas et al., 2017). I kept a reflective journal to record events that occur during the study and include my evaluation of how my background, conceptual lens, and any assumptions that affected decision taking at all phases of the study. The reflection process enabled the assessment of research decisions and data analysis in the context of any personal experiences or notions to ensure mitigation against researchers' bias.

Williams and Moser (2019) described coding as identifying and documenting topics, issues, connections, and variances that emerge from a researcher's interpretation of the data collected from study participants. To increase credibility in research, researchers should begin the transcribing and coding process immediately after interviewing to minimize memory bias resulting from the time gap between the interview and data analysis process (Sutton & Austin, 2015). I started the transcription and coding process immediately after the interview and data collection process to minimize personal bias affecting interview data interpretation and assure credibility in research findings. I compared underlying codes against the category constantly to ensure that the meanings attributed to the codes fit the assigned category throughout the data analysis process as advised by Sutton and Austin (2015). I also used the code and recode strategy by coding

the same data twice, allowing a 1-week lapse between the two coding activities to determine if the results will align or differ as advised by Sutton and Austin. The results enabled a more accurate representation of the data in data analysis and improve research credibility.

Transferability refers to how well researchers can apply the findings of a study to other studies involving a different population and similar context (Munthe-Kass et al., 2019). Smith and McGannon (2018) advised purposive sampling to identify and select participants with the relevant experience about a research topic as a technique to establish transferability. I used purposive sampling to identify four participants from four organizations in the oil and gas construction industry. I considered detailed information on the participants' professional backgrounds, unique industry experiences on construction cost overrun, and the organizational project management culture. I also provided readers with a detailed presentation of the description of context and culture, selection criteria for participants, and organizational context to enhance the transferability of the research, as advised by Smith and McGannon.

Confirmability refers to the degree to which the research results are free from bias, and other researchers can confirm that the study is an accurate representation of the information collected from participants and not based on the researchers' interests or imaginations (Ibiamke & Ajekwe, 2017). Korstjens and Moser (2018) advised researchers to keep a clear auditable record of the complete set of notes on decisions made during the research process, research team meetings, reflective thoughts, sampling, research materials adopted, the emergence of the findings, and data management strategy.

I kept a clear auditable record of the complete decisions made during the research process, reflective thoughts, sampling, research materials adopted, emerging themes, and data management strategy. The compilation of details in a reflective journal will aid confirmability in research and create an auditable trail of the research path (Korstjens & Moser, 2018). To ensure confirmability, I maintained objectivity, kept notes in a reflective journal, triangulated with available data, and stayed open to redirection from the doctoral study committee.

Researchers need to achieve data saturation and answer the research question through the selected trial sample size to enable the validity of the research (Braun & Clarke, 2019). Data saturation is the point during an investigation where no new codes emerge from additional interviews, or the new information is counterproductive to the study (Low, 2019). For this study, I conducted semistructured interviews with four participants and confirm data saturation when no new codes and themes emerge by the end of the fourth interview. I focused on obtaining quality data from the four participants during interviews to achieve data saturation. Fusch et al. (2018) highlighted triangulation of multiple sources of data as an approach to promote social change, mitigate bias, and achieve data saturation. I collected primary data during the interviews and secondary data through accessing publicly available documents and archival records related to the cases. I also studied patterns and justify data saturation when achieved.

Transition and Summary

In Section 2, I justified the research approach to conduct the study. I began with a purpose statement and a justification of the participant selection criteria. The next

sections were the choice of research method and design, the population's definition, and sample size. Subsequent sections were ethical research; data collection instruments, technique, and organization; and data analysis. The final part of Section 2 was reliability and validity considerations.

In Section 3, applying the study protocol described in Section 2, I review the collected data, present the data analysis, and present findings from data review and analysis. Section 3 also contains the application to professional practice and recommendations for further research. Finally, I include recommendations for action, implications for positive social change, personal reflections, and conclusions.

Section 3: Application to Professional Practice and Implications for Change

In Section 3, I describe the purpose of the study and the overarching research question. I also present the study findings, discuss the applications of this study to professional practice, and present the implications for positive social change. Finally, I discuss the recommendations for action and further research, provide a personal reflection, and give study conclusions.

Introduction

The purpose of this qualitative multiple case study was to explore strategies that successful project managers in the oil and gas construction industry employ to complete projects without cost overruns. The participants comprised four project managers with over 5 years of experience managing oil and gas projects, with a cost above $1 million in Nigeria. I collected and analysed data for this study from semistructured interviews, observation notes, and information from organizational websites. The organizational data I analysed included completed project activities, annual sustainability reports, and company publications. The emerging themes related to the successful delivery of oil and gas projects without cost overruns based on the data analysis were (a) selecting competent contractors, (b) developing accurate initial cost proposal, (c) applying project management principles, and (d) implementing strategic project leadership in managing projects. There are four subthemes included in Theme 1 and 2 and three subthemes in Theme 3, reflecting the multi-level nature of the findings. There is an emerging serendipitous theme in Theme 1 and 2, which is presented in the findings.

Presentation of the Findings

The research question for this study was, what strategies do some project managers employ to deliver oil and gas projects without cost overruns? To answer this research question, I conducted semistructured interviews with four project managers and reviewed publicly available organizational data from four oil and gas organizations located in Nigeria. I used an interview protocol as a guide to conduct the semistructured interview. The interview protocol included an explanation of the study objectives, a review of the consent form, an assurance of the confidentiality of information provided, and an approval to audio record the interview. As part of the data collection, I asked the preset interview and follow-up questions, reviewed the organizations' websites, and conducted member checking. The interview with each of the four participants lasted an average of 45 minutes and was conducted remotely using the virtual conferencing technology application chosen by each of the participants. I ensured the participants' privacy by identifying the four participants in the study data with pseudonyms P1, P2, P3, and P4, and their respective organizations with pseudonyms OA, OB, OC, and OD. I shared the summary of each research interview with the participants to confirm the accuracy of my interpretation of their statements. Applying the data and methodological triangulation approach, I used the documents obtained from the organizations to compare and confirm data collected from the semistructured interview method at the initial stages of the data analysis process. As described by Williams and Moser (2019), I employed thematic analysis as the overarching technique to guide the qualitative data analysis process. I used the Excel software tool to organize, sort, and analyse the interview data. I

identified certain sentences and phrases relevant to the phenomenon being investigated and attached different labels (open codes) using the Excel software. These codes were later grouped into categories (axial codes) based on similarities in meaning. The categories were grouped or merged to form themes (selective codes) based on patterns in meaning or overarching ideas identified across the categories. The themes I identified were (a) selecting competent contractors, (b) developing a realistic cost profile, (c) applying the project management principles, and (d) implementing strategic project leadership. Table 2 shows the frequency of the key themes.

Table 2

Frequency of Emerging Theme

	Frequency			
Emergent Theme	P1	P2	P3	P4
Select competent contractor	3	3	3	2
Develop accurate initial cost estimate	3	2	3	2
Apply project management principles	4	3	4	3
Leadership	3	3	2	4

Theme 1: Selecting Competent Contractors

The first theme from data analyses was that selecting competent contractors helped project managers deliver projects without cost overruns. I conducted semistructured interviews with four project managers (P1, P2, P3, and P4) and found that

selecting the right contractor formed the basis for the early success of oil and gas projects, according to responses received from all four participants. All four participants revealed that the project management team considered contractor selection crucial to avoiding project cost overruns.

P1 explained competence as the skill set and capability required to deliver the project. The required skills and capability include financial capacity, local community knowledge, stakeholder management ability including contractor networks, technical competence, and experience of the contractor project management team. P1 added that a contractor might be financially capable but technically flawed. Knowing the capability gaps and developing mitigation strategies helped OA mitigate capability risks to enable the contractor to deliver complex projects without cost overruns. P1 stated,

> There are many aspects that a contractor needs to look at . . . stakeholder issues, inflation rates in Nigeria, unavailable materials, an exceptionally long lead time for these materials to arrive in-country, technical clarity on the project scope, which enable clear interpretation of the detailed engineering drawings. The contractor who is knowledgeable in the many aspects of the project can avoid cost overruns because he can plan to avoid the pitfalls early in the project.

P1 explained that the contracting team, in collaboration with the client project team in OA, usually carried out due diligence before selecting a contractor for a large complex project. Choosing the contractor with the most aligned capability for the specific project delivery is vital to optimizing contractor efficiency.

P2 explained that the skill level for contractors differed for different types of construction projects, and specialized contractors would predict the challenges that might ensue for a type of project based on the experience garnered by performing the same project type very frequently. P3 stated,

> The contractor selection process is similar but more rigorous than the personnel hiring process. The contractor's experience and competence usually improve the project teams' performance by adding and validating perceived risks, reliable risk mitigation strategy, and honest feedback on clients' expectations.

P3 also stated,

> The lowest bidder strategy is inept in the oil and gas climate. Oil and gas projects have too many uncertainties. If companies want to achieve their cost performance ambitions, the main contractor should have adequate experience in both the technical and non-technical aspects of the role. Moreso, the contractor should be aware and able to manage host community issues, governmental issues, regulatory challenges, and any unplanned events based on prior execution activities.

P4 also placed contractor selection as a priority and stated,

> The contractor performance goals should align with project cost performance goals and organizational culture. When the contractor and client teams have integrated their expectations, project delivery and cost performance are easier. So, select a contractor that understands the organizational imperatives.

P4 explained that contractor efficiency was so crucial that OD started a contractor development initiative to develop local contractors to improve contractor performance and availability. P4 stated,

> We realized that we needed efficient project delivery for our campaign maintenance projects, which were critical to sustaining and increasing production volumes. We partnered with local contractors to support capability development. After thorough contractor capability reviews and upskilling initiatives, we agreed on a call-off contractual strategy, where contractors were suppliers who could be called to deliver projects without any further evaluation. The strategy helped our team deliver many projects without cost overruns.

I conducted methodological triangulation with the data collected from several sources. I obtained the tender documents used by leaders in OA to invite contractors to bid for oil and gas projects from the advertisement website. I observed a detailed evaluation process for contractor selection. Contractors were required to complete detailed prequalification processes, which enabled registration in a qualification database. The database was specific to the project type and only prequalified contractors were invited to the tender stage. There were also clearly stipulated mandatory requirements for contractors operating with the local environment. Information obtained from the organizational website of OD also described the current partnership with local contractors for upskilling and engagement in some oil and gas projects. The details on the website revealed many completed oil and gas projects, with some projects still in the construction phase.

Strategies for Developing Contracting Strategy

All four participants stated that a clear, structured strategy for contractor selection underpinned positive cost performance. P2 stated that oil and gas projects required a contracting strategy best suited for the work scope. P2 explained,

> In the delivery of one of our complex projects, we realized we had many specialists' works scopes. Hence, we decided to employ many specialist contractors to do the different areas: dredging, piling, mechanical, and piping. The project management team performed an integration role between the contractors. The project was completed early and at the agreed cost because contractors worked as was described in the contract terms.

P1 also revealed that technical, financial, and safety capabilities were usually given priority in contractor selection. However, other subtle factors played significant roles in cost optimization for oil and gas projects. One of such factors was the knowledge of the local industry and the geographical location of the project.

The literature for oil and gas contractor selection encompasses contraction strategy. Awuzie and McDermott (2016) explained contracting strategy as the mode of governance in projects capable of impacting the project objectives. Client companies, therefore, should carefully select contracting strategies that were suitable for the project profile. de Jesus et al. (2019) recommended the analytical network process to select oil and gas contracting strategies. de Jesus et al. further stated that by leveraging the analytical network process, clients enable the evaluation and selection process to be more transparent and efficient, reduce environmental impacts, and optimize natural resources.

Mammeri et al. (2017) cited a structured contracting strategy as critical for managing the complexity of oil and gas projects. Oil and gas projects involve many different activities with many actors and a high degree of uncertainty (Mammeri et al., 2017). Mammeri et al. identified three challenges in designing a contracting strategy (a) identifying a relevant set of alternatives, (b) estimating and evaluating the alternatives, and (c) justifying the chosen alternatives. The three-step structured approach proposed by Mammeri et al. included domain mapping matrices and design structure matrices as methods for managing the selection of an effective contracting strategy.

Knowledge of Local Industry and Geographical Location

P1 explained that knowledge of the local industry and geographical location was necessary for desired contractor performance, to which OA allocated a high weighted index during the contractor selection process. P3 stated that for large projects, nontechnical risks may pose more serious cost issues than technical risks. P3 added that contractors with adequate experience and understanding of the specific challenges of working in a geographical location were more adept at delivering large oil and gas projects without cost overruns.

In studying the factors that should govern contractor selection for construction projects in Ghana, Sidik et al. (2020) identified location factors as the main consideration for contractor selection, especially mitigation for project cost overruns. Location factor in contractor selection comprises elements such as country of origin, location of company, local language, company's location, and litigation history (Sidik et al., 2020). Researchers use the term *location factor* to describe the effect of different geographical locations on

construction projects because of the associated cost implication (Sidik et al., 2020). P1 and P3 asserted that a leading indicator that signifies an opportunity for positive cost performance was a review of contractor track record on similar projects within the existing or similar localities. P4 also cited the contractor track record on other crucial parameters in the project requirements as a primary weighted element for contractor selection. Typical critical elements included schedule, cost, and technical performance.

Contractor Track Record

P3 and P4 were emphatic on the relevance of contractor track record on projects as a critical parameter in successful contractor selection for oil and gas construction projects. P2 explained,

> Our blending plant construction project was one of our successful projects delivered on time and within the agreed cost. The main differentiator was the meticulous selection process we embarked on before choosing the contractor. Many contractors sent in their proposals, but the project team developed objective criteria for selection, including an in-depth review of years of experience, cost and schedule track record, stakeholder management performance, alignment of goals, and organizational culture. We worked seamlessly with this contractor because we were able to get it right from the start.

In a study of decision criteria for assessing contractors in the prequalification phase of public projects, Khoso et al. (2020) advised experience and past performance within similar geographical locations as a major prequalification criterion that should be considered in the contractor selection process. From the analysis conducted in the public

sector in Malaysia, Khoso et al. revealed that though the financial capability is paramount to project success, clients consider the contractor's performance, including relationships with consultants and clients, schedule performance, and safety culture. Seyedeh et al. (2018) developed an artificial neural network model to enable project practitioners to monitor and predict cost, schedule, quality, and overall project performance in real-time and before construction is executed. Five of the input variables affecting cost performance were related to the contractor track record from previous project delivery. Seyedeh et al. generated the information on the variables affecting cost performance from owners, clients, and contractors practicing in the construction sector. Seyedeh et al. broadly classified the factors affecting the performance of a construction project into procurement and no procurement-related factors. Seyedeh et al. concluded the most important predictor of cost overrun on projects is the extent of claims and disputes on the project, hence corroborating Jagtap and Kamble's (2019) assertion that client and contractor relationship could influence project outcomes. Project managers should consider the opportunities in contractor client relationships as a strategy for averting cost overruns from claims and disputes by reviewing contractor track records in relationship management during complex projects (Seo & Kang, 2020). Another salient strategy successful project managers employ to select competent contractors is to maintain objectivity in contractor selection.

Objectivity in Contractor Selection

P2, P3, and P4 highlighted political influence and unethical practices as the bane in selecting a competent contractor. The four participants suggested that if organizations

are to retain their competitive edge, contracts should not be awarded based on human feeling, political influence, or any form of coercion. P3 advised business leaders to design a contracting strategy with the sole intent of achieving the business objectives. P2 and P4 stated bias and favouritism incited by political ambition as areas of improvement during the contractor selection process. Client teams should declare any conflict of interest before the selection process. At the end of the process, the client team should be able to answer "yes" to the question, "have we been objective in the contractor selection process?".

P1 described a certain frustration within the project team when owners or competitive contractors tried to influence the outcome of the contractor selection process using unethical means. P1 stated,

> The cost overrun problem starts when an incompetent contractor is imposed on the project team to manage. First, the contractors' allegiance is to the influencer, and project objectives have already been compromised. Some stakeholders forget that when projects fail, an entire nation can sometimes pay dire consequences. The strategy for minimizing unethical practices in contractor selection is for organizations to develop and engage employees, partner teams, and stakeholders on ethical policies that guide the contractor selection process. There should be consequence management for ethical offenses to deter future occurrences. Project leaders should realize that cost overruns are more likely to occur when the contractor is unable to manage the dynamics of the project, is determined to achieve personal cost ambitions even to the detriment of the project objectives,

and yet unfairly protected by a senior business stakeholder. Managing this type of contractor or owner is demotivating to the project manager.

Many researchers have developed different quantitative methods for contractor selection to eliminate or reduce bias in the selection process (Deshpande et al., 2020; Dissanayake, 2017; Semaan & Salem, 2017). The authors advocated for a model shift from traditional methods of contractor selection to more quantitative deterministic models. Semaan and Salem (2017) developed the contractor selection decision support system to enable clients to achieve a flexible yet comprehensive contractual framework, as required in the oil and gas business context. Dissanayake (2017) affirmed that the risk of human subjectivity or "fuzzy" decision making based on incomplete information drove the development of the fuzzy multi-attribute analysis model to manage inaccurate data, incomplete information and achieve the best value for the contract. Deshpande et al. (2020) posited using the contract award index and project performances index to achieve the best value in the contract selection process. Deshpande et al. further determined that project performance increased 23% when clients employed an effective selection process.

Correlation With Literature

Gharedaghi and Omidvari (2019) stated that contractor selection was a major concern for oil and gas industry leaders. Assessing contractors based on detailed criteria and selecting qualified contractors could mitigate losses in the oil and gas business (Gharedaghi & Omidvari, 2019). In the detailed study of causes and effects of project delays and cost escalations in the Iranian oil and gas sector, Sweis et al. (2019) cited experience and competence of the owners, consultants, and contractors played a vital role

in the project success. The elements of contractors' competence; including planning and scheduling; mitigating error in design, leveraging technology; and quality and performance control; are essential for oil and gas project success and cost control (Sweis et al., 2019). Based on the complexity involved in contractor selection specific to oil and gas projects, Deshpande et al. (2020) proposed a contract award framework with multi-faceted parameters to support project leaders in enhancing the performance of oil and gas projects. Deshpande et al. argued that for sustainability in oil and gas construction procurement, the contract award system should be holistic and capable of quantitative contractor performance monitoring.

In the 2016 study on contractors' prequalification criteria, Akinmusire (2016) stated that, irrespective of the criteria adopted during contractor selection, the appropriateness became apparent only during project execution. Hence, the attributes for contractor prequalification should be geared towards enhancing the reliability of the process to ensure the selection of the most suitable contractor for the specific project (Akinmusire, 2016). H. Karami and Olatunji (2018) opined that most models for contractor selection are generic and do not address the peculiarities of marine projects. Contractor selection models often emphasize financial and technical capacity, organizational management, and safety benchmarks. For oil and gas projects, selection protocols should correlate with actual performance, and competent assessors should evaluate evidence correlating performance qualitatively and quantitatively with selection protocols (H. Karami & Olatunji, 2018). H. Karami and Olatunji recommended developing a new model beyond conventional models that considered contractor

assessors' competence, contractor’s previous achievements and value system; and contractors’ alignment of delivery strategy with project objectives.

An emerging serendipitous theme within the contractor selection theme is ethical considerations during the contractor selection process. Ameyaw et al. (2017) stated that corrupt practices in the construction sector accounted for poor project performances especially in developing countries. Shan et al. (2017) identified collusion as a bane in the construction sector that impedes objectivity in the contractor selection process. Conflict of interest, payment of bribes, underbidding, and extortion are some common practices that create opportunities for cost overrun in oil and gas projects (Shah & Alotaibi, 2018).

Though project managers are subtle in addressing these themes, some researchers revealed that unethical practices in the construction sector erode profits margins significantly, and regulatory bodies may need to determine and implement policies that mitigate unethical practices in the construction sector to alleviate the impact of cost overruns in the oil and gas construction sector (Shah & Alotaibi, 2018). Wang et al. (2019) investigated the opportunity to leverage building information modeling to improve information transparency among construction stakeholders throughout the project's lifecycle. Although building information modeling improves the transparency of construction resources, cost, and time to construction stakeholders, some contractors are reluctant to adopt the application because of personal interests and discreet operations (Wang et al., 2019). The situation is dire because some project practitioners cannot distinguish between unlawful and unethical practices because of the many grey areas in the contracting process (Lohne et al., 2017). In Nigeria, Ogbu and Asuquo (2018)

reported a positive correlation between unethical tendering practices and the cost performance of projects in the Nigerian public sector. Specifically, Ogbu and Asuquo identified many variables consistent among 119 projects; competitors offering bribes to gain access to confidential tendering information, competitors overstating capability, same owners using different firms to tender for the same projects, clients providing leverage for the preferred bidder, and vague criteria for selecting the winner. The negative cost impact of unethical practices in the construction industry is prominent, especially within developing countries, yet there is a dearth of quantitative research on the exact influence on cost overruns, economic development, and social performance in the oil and gas construction sector (Lohne et al., 2017; Owusu et al., 2019; Shah & Alotaibi, 2018; Wang et al., 2019).

The strategies for managing unethical practices are primarily innovative methods and government regulations (Alkhatib & Abdou, 2018; Owusu et al., 2019; Xiong et al., 2019). As a mitigation to the grey areas presented in the literature by Lohne et al. (2017), Alkhatib and Abdou (2018) developed an ethical judgment framework consisting of descriptive approaches involving technical, professional, administrative, and miscellaneous terms, which provides a basis for judging actions as either ethical or unethical. The ethical judgment framework may also be used as a preventive strategy to avoid ethical dilemmas (Alkhatib & Abdou, 2018). Owusu et al. (2019) conducted a deep dive on 37 publications to identify the trend of causative agents for corrupt practices in the construction sector and determined five relevant constructs as psychosocial-specific, organizational-specific, regulatory-specific, project-specific, and statutory-specific

causes. Industry policymakers may leverage these constructs to develop appropriate regulations suitable for practitioners. Xiong et al. (2019) recommended using corporate credit scoring on construction contractors, including scores for integrity and compliance on previous construction projects that were considered before allocating future projects. In implementing the corporate credit scoring for contractors in China, Xiong et al. observed that contractors were motivated to continue improving performance and scores once rated as high performers in the credit scoring. Based on the participants' responses and literature review, there is an opportunity to reduce cost overruns in oil and gas construction projects by effectively managing unethical practices in contractor selection. All participants noted that incompetent contractors may struggle from the initial part of the project, which includes cost development.

Correlation with Chaos Theory

One of the chaos theory's attributes is the positive feedback mechanism (Olaniran et al., 2017). The positive feedback mechanism in chaos theory means actions to mitigate a phenomenon may amplify the same issue, thereby achieving an opposite effect (Olaniran et al., 2017). Therefore, the chaos theory correlates with the selection of a competent contractor early in the project because the contractor selection is one of the early designs for cost, schedule, and overall project performance. All four participants revealed that any mistakes made in the contractor selection process usually had a significant ripple effect on the project outcomes, including cost, which was difficult to manage later. All participants also highlighted that lack of experience and competence of the contractor might create opportunities for many changes. The response to these

changes may also be inaccurate since the contactor cannot foresee or predict the profile of the change and the parameters that the change impacts.

Another characteristic of the chaos theory Lorenz (1963) cited is the delicate dependence on initial conditions. The attribute of the chaos theory is that small changes in the initial plan may greatly influence the system leading to many different distortions. Hence, a contractor needs to understand the oil and gas system dynamics and specifics for each project. Clarity of understanding and experience may improve the contractors' ability to foresee change before the actual manifestation and determine opportunities for managing the change without creating a cost escalation. The ability to manage change quickly is a critical business skill for today's project manager.

Theme 2: Developing a Realistic Cost Profile

The four participants cited strategies related to developing a realistic or accurate cost estimate early to mitigate cost overruns during the interviews. P3 explained that the tandem of cost overruns was usually not an overrun, but the actual price revealed. P3 stated,

> Business owners make investment decisions based on available information such as cost, risk, schedule, and environmental considerations. Prices changes can disrupt the investment portfolio. Many oil and gas project ventures are executed in partnerships with government or third-party stakeholders, so a change in price after an agreed investment decision reflects poorly on the project team. Cost escalations can create more conflicts and increase tension in projects teams, which negatively impacts safety and can affect future partnership opportunities. So, the

> initial estimate should be accurate. The project team should only inform business leaders on price when available data can inform a credible price estimate.

P4 also shared the experience of developing a realistic cost estimate as an important step in planning and scheduling. P4 noted that cost and schedule were planned intricately on the final output from the engineering design. A robust engineering design was a strong foundation for realistic cost and schedule development. Developing a robust engineering design strategy included employing skilled labour, providing proper supervision, acquiring sufficient data, and conducting sufficient independent reviews. P4 concluded that it was cheaper to solve issues on paper than on site during execution. P4 explained,

> The first strategy for completing oil and gas projects without overruns is early planning to enable accuracy in the initial cost estimate. This careful planning of the cost and schedule involves acquiring and compiling the relevant data for developing an accurate cost and schedule plan.

P1 explained the importance of detailed engineering design in developing initial cost as mitigation to cost overrun as follows:

> The detailed engineering for oil and gas projects is important because it is critical for developing an accurate cost estimate. Cost estimation is a skill, and a project leader should understand that the correct initial cost estimate is a critical parameter for project success. The issues experienced in oil and gas projects executed in Nigeria include heavy dependence on imported materials whose prices are influenced by fluctuating local currency, insufficient local labour, and host community issues. For example, after completing an estimation on one of our

> projects, we realized that the contractor could not deliver the packaged equipment in six months, which significantly affected overhead site costs. Eventually, we had to bring in a new vendor. We learned from that experience and subsequently ensured that the initial cost estimation included accurate evaluation, effective stakeholder management, and competent contractors.

I performed methodological triangulation by comparing data collected from the interviews with the organizational website and found prescriptive details in the tender issued for contractors to bid for pre-construction services, including providing engineering design works. For example, OA and OD had a detailed description of the pre-activities and activities relevant for contractors to qualify for detailed engineering before construction in the tender. The activities required were feasibility studies, concept selection studies, front-end engineering design, detailed engineering design, and procurement support activities. The relevant procurement deliverables were specification, inquiries, evaluation and placement of long-lead orders, inquiries with vendors, follow-on engineering, and construction support services. The tender also included project support services and management support, including cost, planning, and related project services. The site information showed that the organizations OA and OD conducted thorough studies in developing initial cost estimates before deciding on on-site execution.

Strategies for Developing an Early Realistic Cost Estimate

The subthemes that emerged during the data collection process for building a realistic cost estimate were managing optimism bias, developing a robust front-end and detailed engineering design, performing early stakeholder engagement, and designing a

change management strategy that includes cost management. Braukhane (2020) noted that though concurrent and systems engineering had been useful in managing complex schedule-driven projects, project managers should perform cost estimations with considerations for the project complexity, incomplete data, customer expectation, rapid schedule, and unexpected changes. Prater et al. (2017) also cited optimism bias as a widely accepted major cause of unrealistic scheduling in project management, creating cost escalations. The solution advised by Prater et al. for mitigating optimism bias was to rely on an independent assessment of the cost and schedule estimations, which are usually interrelated. Khan and Umer (2020) agreed that cost and schedule overruns were related and studied the impact of delays on the cost of a construction project. Using Pearson's correlation technique, Khan and Umer linked schedule delays to construction costs from the client, contractor, and consultant perspectives. Specifically, the causes of delay related to design and procurement impact significantly on cost performance, and both the client and contractor play significant roles in mitigating overruns (Khan & Umer, 2020).

Managing Optimism Bias. P4 informed that optimism in project cost estimation started with the need to have a project. P4 stated,

> Many client companies cannot pay overhead costs and sustain in business if viable projects are not available. Hence, unconsciously, there is a subtle pressure on staff to conceptualize and agree on the viability of some projects that ideally would not pass the business criteria. Once the business leadership is informed, it becomes more difficult to explain any errors in delivering the project. In some

> cases, mistakes are found when key investors and stakeholders have been informed.

P4 explained that the strategy for mitigating optimism bias was to remove the pressure to identify viable projects quickly. P4 stated that project leadership should encourage sufficient time for conceptualization and only make investment decisions after clarifying uncertainties.

P2 also confirmed that the initial excitement of a prospective project was vast because of the perceived opportunities for all parties; including financial derivatives to the client, infrastructural development to host communities, economic benefits for the government, and business opportunities for contractors. P2 explained that when team members perceived a downside that may hamper the project delivery, many team players and business leaders quickly identified a solution that may not solve the problem entirely. P2 stated,

> Business leads are willing to take more financial risks when the rewards are enormous. Everyone on the team is entirely hopeful that the project will succeed, so the mindset is optimistic, reducing the appearance of threats and even cost-related ones.

P3 explained the experience of mitigating optimism bias using validated data and stated that decision-making should be tied to a quantitative assessment for a suite of projects. If business leaders encourage a fact-based decision and delay the investment commitment until more data is available, there is evidence that the cost premise is valid. P1 added that project leaders required a certain discipline to decide to quit a project early on and advise

the business that further investments may be unprofitable. According to P2, a certain business environment encouraged difficult conversations and prevented overruns by terminating investment opportunities as soon as it was clear that the project would not meet the organizational goals.

Denney (2020) explained that optimism bias was the reason for underestimating risks in project management. Denney argued that although risks could be threats or opportunities, project leaders underestimated threats and overestimated opportunities. Opportunities were assumed as part of the expected benefits for most projects instead of a prospect that may be realized if managed adequately (Denney, 2020). Cheung and Li (2019) highlighted the human factor in project management decision making as a determinant for managing efficiency and sustainability in construction projects, especially during dispute resolution and decision making (Cheung & Li, 2019). According to Cheung and Li, a flexible approach and attitude towards project conceptualization will alleviate optimism bias in estimation and decision making.

The strategies for managing optimism bias are innately linked to developing a data-centric culture for determining costs and cost-impact items instead of taking business decisions based on assumptions yet to be validated. To determine actual costs before execution, many project teams will require a robust front-end engineering design that details the actual execution strategy as a premise for the cost estimation. While many teams perform engineering designs, in some cases, the designs are not robust and may be subject to change during the execution stage – an opportunity for cost overruns. Another

strategy for avoiding cost overruns occurring from unrealistic cost estimation is to perform a robust front-end design.

Managing Robust Front-End and Detailed Engineering Design. All four participants highlighted a thorough front-end and detailed engineering design crucial to mitigating cost overruns in oil and gas projects. Engineering design is a process where engineers create models, examine ideas, evaluate data, and construct new knowledge to optimize design solutions (J. Zheng et al., 2020). During engineering design, engineers manage projects as a hypothesis to determine if the assumptions made in the conceptualization will hold true and deliver the expected gains (Picciotto, 2020). Hence, self-regulation is a critical discipline in developing engineering designs to ensure that the design for project delivery is adaptive, flexible, and accurate (Picciotto, 2020; J. Zheng et al., 2020).

P1 explained that the cost estimate was as accurate as the design data used to generate the cost. P1 stated that "though cost estimators add contingency sums to account for some changes that may ensue during the actual project execution, providing sufficient information regarding all cost aspects of the project before the final investment decision was a better strategy." P1 explained that if project engineers did a thorough job during the front-end and detailed engineering of the project, many issues that would arise in the future would be eliminated, mitigated, or added to the contingency planning and costing.

P2, P3, and P4 also agreed that front-end design was a major part of the planning for the project. The front-end design was a prototype of what would be built, and project engineers should not rush the process since the outcome was an execution solution. P1

and P2 advised that the finished engineering design should include considerations from all stakeholders to minimize changes in the later stages. The project team should ascertain if the engineering solution is adequate to fulfill business goals based on all premises. Hence, detailed front-end and detailed engineering designs are levers for developing the final cost elements in oil and gas projects and play a significant part in legitimate project cost estimation.

A serendipitous theme within the subtheme of developing a realistic cost estimate was the issue of project engineers allotting a cost and schedule impact to a project before front-end design. P1, P3, and P4 cited that, in many cases, business leaders had already assigned the expected duration and cost to the project based on earlier discourse and sometimes benchmarked with previous similar projects. There existed some pressure on design engineers and estimators to subtly align the final cost and schedule estimates to expected values. The estimator was part of the team that wanted the project to secure approvals and proceed to execution. The strategy for mitigation was to use an independent assessor for the cost and schedule estimates and for leadership to embrace negative feedback that differed from initial costs as a positive sign of progress. Early and frequent stakeholder engagement also created a safe space for flexibility and innovation relevant to optimal solutions.

Strategies for Early Stakeholder Engagement. All participants cited early stakeholder engagement as a subtle area that reduced unrealistic cost estimations for oil and gas construction projects. An important skill for project engineers was integrating all stakeholders' needs, prioritizing, and managing the different demands. P2 alluded that

community stakeholder expectations had the unlikely effect of escalating costs. P2 stated that “project leads should identify every stakeholder and design engagement strategy during the project development. Many cost escalations on projects are linked to stakeholders that were earlier assumed docile and later became aggressive.”

P4 also added that project leads should engage specialists where necessary. Some issues like environmental issues may require expert opinion. The stakeholders critical for technical delivery included manufacturers, third-party vendors, and suppliers. P1 and P3 added that long lead items were usually on the critical path and may cause cost escalations if the vendors were not properly engaged on the budget and schedule. With the advent of social media, Pizzi et al. (2020) advised oil and gas companies to re-strategize stakeholder engagement, especially CRS. Pizzi et al. discovered that social media communication could influence stakeholder perception and actions, affecting project objectives. Oguzie et al. (2021) specifically cited poor stakeholder engagement as a bane in project management, leading to abandoned projects and cost escalations for construction projects. Project leads should identify all critical stakeholders and ensure adequate communications from the project conceptualization till the execution phases (Oguzie et al., 2021). Tung (2020) stated that the impact of poor stakeholder management was not limited to the projects alone but to the entire oil and gas industry. Proper stakeholder engagement can improve project success through cost reduction, schedule improvement, and foster better relationships (Tung, 2020). Tung, however, noted that the stakeholder landscape differed across locations, and project practitioners must tailor their engagement philosophies to suit the different stakeholder landscapes.

Luo et al. (2019) revealed that poor stakeholder interaction led to inaccurate cost estimation and was a prerequisite for chaos. Stakeholders confirmed that low interaction with vendors in the engineering and procurement stages created opportunities for poor cost performance in projects (Luo et al., 2019). Vendor engagement is crucial in planning project costs because vendors have a clear insight into the market and material logistics cost management, primal for cost performance (Luo et al., 2019). Although many projects include a contingency cost at the start of the project, Islam et al. (2019) argued that most cost engineers in projects determined the contingency estimates related to vendor parameters from a deterministic instead of a probabilistic plan. A deterministic method of determining costs is insufficient because projects are prone to errors of omission or commission, and some projects hardly follow the typical causes and effects rules and linearity applicable to smaller projects (Islam et al., 2019). Vendors and other procurement stakeholders may bridge the information gap and reduce the risk of an overrun (Luo et al., 2019). There is a limit to the capacity of project managers to determine changes in vendor parameters, and real-time vendor interaction may provide information on the dynamic cost parameters and reduce overruns (Islam et al., 2019). An appreciation of this system is an opportunity for project managers in the oil and gas industry to manage the risks in oil and gas projects and design a suitable method for managing projects without cost overruns (Islam et al., 2019).

Correlation With Literature

Seddeeq et al.(2019) conducted a comprehensive study on the causes of cost overruns in the Saudi Arabian oil and gas construction sector and cited underestimation

of cost and schedule as a primary cause for cost overrun. Ironically, the other leading causes identified by Seddeeq et al. were also innately related to inaccurate cost estimation; including design and scope changes, inadequate comprehension of work scope at the bidding stage, and poor planning and scheduling of projects. Rui et al. (2017) agreed that cost underestimation frequently occurred in oil and gas projects and advised project managers to incorporate impeding risks' costs as part of the project costs to alleviate cost overruns. Gbahabo and Ajuwon (2017) observed that cost overruns resulting from initial cost underestimation were more prevalent in developing countries and recommended that business leaders working in developing countries improve their project cost estimation capability-building toolkit.

The successful or unsuccessful delivery of an oil and gas project will significantly impact many diverse stakeholders: the government, host communities, investors, shareholders, associated industries, and academia (Udie et al., 2018). In the Niger Delta area of Nigeria, where many hydrocarbon exploration and drilling activities occur, the application of an effective multi-stakeholder approach supports sustainability in the oil and gas business (Udie et al., 2018). However, Scott (2018) observed that voluntary and deliberate engagement with all stakeholders did not guarantee a reduction in citizen complaints in oil and gas projects. Therefore, deliberation weakened the relationship between the adoption of voluntary engagements and the odds of a claim (Scott, 2018). Scott inferred that the application of voluntary commitments in stakeholder management did not guarantee satisfaction for the stakeholders. Barnett et al. (2018) supported this rationale and stated that selective response to the most potent and legitimate demands of

stakeholders would not necessarily yield sustainable results because of self-interested stakeholders. Barnett et al. further proposed that government intervention and regulations were apt for solving complex stakeholder issues. Without government intervention, self-interested stakeholders may pressure organizations away from the project goals. However, stakeholder pressure was essential to ensure that industries do not take undue advantage of the opportunities presented (Barnett et al., 2018).

Correlation With Chaos Theory

The theme of developing a realistic cost profile correlates with the chaos theory in the description provided by Mbengue et al. (2018) as an edge of chaos in organizations. Organizations may operate at the edge of chaos with a flexible system that allows some degree of freedom in change management (Mbengue et al., 2018). While leaders should understand and accept chaos as a form of self-organization, implementing a new system is a critical management role in ensuring that the change is not continuously evolving and never achieving any resolution (Mbengue et al., 2018). The four participants explained the importance of realistic and accurate cost estimation at the start of the project. This initial estimate will change over time as more information becomes available as the project progresses (Project Management Institute, 2017). The strategy proposed by Mbengue et al. is to leverage chaos theory concepts and embrace change even without assurance of preferable outcomes; yet, acutely aware that innovation, growth, and development are parameters consistent with evolution. However, P1, P2, and P3 noted that for cost management, the closer the earlier prediction, the less the probability of change in cost agreement.

Öztürk and Kızılkaya (2017) described the dependence on initial conditions in chaos theory as a butterfly effect where changes were sudden, unpredictable, and unexpected. Öztürk and Kızılkaya explained the gradual development of chaos theory into a chaos-complexity theory. The implication of chaos theory was for project managers to have a learned skill on complex adaptive systems where project organizations adapt to changing circumstances by acquiring valuable information (Öztürk & Kızılkaya, 2017). From P3 and P4's observations, sudden changes rarely occur in projects, and most changes are already risks noted in the project charter. Hence a realistic cost estimate should account for the cost implication of realized risks and include alleviation plans if the risks materialize. P3 and P4's assertion deviates from Öztürk and Kızılkaya recommendations of managing issues within a flexible space to a more preventive method of managing and controlling the impact of changes.

Theme 3: Applying Project Management Tools

All participants cited different project management tools relevant for curtailing construction cost overruns in the oil and gas sector. The concepts highlighted were competence development for the project team. The competence skills related to mitigating cost overruns were planning, budgeting, cost estimating, project controls, and scheduling. The four participants noted that these project management strategies were useful for mitigating cost overruns and achieving organizational cost ambitions. P1 explained,

> The project management discipline has particularly useful tools . . . managers should ensure the use of project management tools, including budgeting,

> scheduling, identifying critical path, and ensuring clear initial definition. Projects should be deployed with project management techniques and without guesswork.

P2 also explained that the project management praxis was relevant throughout the life cycle of the project. P2 stated,

> Many project teams start the projects using budgeting, planning, and scheduling tools. The project's management principles are best practices but there is a temptation to ignore the tenets as the project becomes more challenging. For example, in cases where sometimes schedule becomes more critical, and changes begin to surface. Project managers should maintain the discipline of tracking and revising baselines throughout the project lifecycle to minimize loss of control.

I conducted methodological triangulation by reviewing a publication on project success and found that OB had created strategic processes for deploying projects using the project management tools. OB developed methods to determine projects performance using the independent project analysis benchmark. The chief executive officer at the time, after seeing the results of benchmarking, enforced the requirement for practitioners to use the processes, believed in the processes, and saw the value created by the process to projects. In the publication, OB leaders procured services of an independent project analysis company as a partner in benchmarking projects. The independent assessor measured performance on front-end loading; cost; schedule, including pre- and post-execution; and other key project attributes, such as multifunctional teams to the organization. Some project management tools on the website included decision review boards, peer reviews, and project execution planning. The four participants agreed that to deploy project

management principles, project practitioners should be knowledgeable in the project management discipline.

All participants suggested that the technical and leadership skills required for oil and gas projects were dynamic. P1 affirmed that business leaders in OA provide training on delivering competitive projects; including technical skills on project principles, stakeholder management, costing, estimation, controls, proper project definition, commissioning, and start-ups. Project managers in OA also understand the continuous monitoring of cost and schedule performance and the variables that affect these parameters. The related technical skills for cost management, such as accurate estimation management and scheduling, were important, and the software was useful. However, certain other competencies, such as managing deviation from the expected, were essential in the application. P2 confirmed that while the experience was significant, training and knowledge sharing meetings provided a bridge in the experience gap to enable project managers to deliver business targets in OB. P3 and P4 clarified competence development as critical in delivering oil and gas projects without cost overruns. P4 specifically explained that active coaching and partnership with other project practitioners were crucial in developing competent and confident project practitioners to deliver projects without cost overruns.

Correlation With Literature

In investigating the requisite competence requirements for project managers in developing countries, Y. Li et al. (2020) identified competencies that lead to efficiency in project delivery; including fundamental knowledge and skills, goal-oriented

competencies, and stakeholder management competencies. Y. Li et al.'s assertion corroborate this study's findings that competence development, leadership, and stakeholder management are fundamental skills required by project leadership. Marcelino-Sádaba and Perez-Ezcurdia (2020) emphasized change management skills as critical for conventional project managers in the current dynamic business environment. Marcelino-Sádaba and Perez-Ezcurdia recommended a holistic approach to competence development that is self-regulated, reflective, and based on experience. Project leaders should pursue knowledge transfer from skilled individuals to project teams and organizations requiring the skill set (Marcelino-Sádaba & Perez-Ezcurdia, 2020).

Correlation With Chaos Theory

The four participants' concept of implementing the project management principles and leveraging project management tools to mitigate project cost overruns adequately correlates to Raisio and Lundström's (2017) perspective on chaos theory. Raisio and Lundström examined chaos theory from both the science and modern perspectives to interpret the technical content from a novel view. By analyzing movies with concepts on the chaos theory, Raisio and Lundström developed ideal models for chaos management and opined that managers should act as mediators by steering the chaotic system between the review and self-organizing dynamics. All participants explained that the application of project management tools and principles was apt for delivering projects. Project managers should develop project engineers with these skills; however, the project leaders should understand the role of leadership in softer issues like stakeholder management, teams' dynamics, and collaboration.

Theme 4: Using Strategic Project Leadership

All participants agreed that strategic project leadership played a critical role in delivering oil and gas projects without cost overruns. The focus for strategic leadership in preventing cost escalations on projects included developing soft skills, managing people, managing change, forming healthy team dynamics, and managing safety. Other relevant concepts were managing challenges, applying emotional intelligence, and dealing with suspicion.

P1 explained that good project managers were effective leaders skilled in engaging at all levels. Strategic project leadership in OA meant that the project manager could negotiate and engage in critical matters with top leadership and lower-level staff. P1 also linked leadership with the ability to make the right decisions quickly and pull everybody in the same direction. P1 explained, “in Nigeria, sometimes, things can get tough; a strong project leader can pull the team in the same direction and keep the team motivated through difficult times.”

P2 enforced the need for project leaders to enforce project management precepts throughout the project's lifecycle. P2 explained that a certain discipline is required to stay ahead of constant monitoring and controls necessary to deliver a project on time and within budget. A project manager should set the project team with a balance of discipline and care to ensure clarity on the expectation from project leadership and relevant stakeholders. P3 also explained that good leadership encompasses effective supervision at all levels. P3 stated,

> With effective supervision, project managers can manage change more easily to reduce cost implications because the change does not just show up; change is usually an already present risk that suddenly begins to materialize. With good supervision, frequent monitoring, and effective engagement at all levels of the project organization, project leaders may influence all aspects of the project that lead to project success.

P4 added that project leadership was partly technical and partly leadership. P4 confirmed the importance of safety culture as mitigation for cost overrun and asserted that strategic leadership in OD enabled a safe culture. There was also a leadership emphasis on safety. Though cost performance was not the primary goal of safety leadership, the safety culture also enabled a safe space for speaking up, contributing to project delivery.

Correlation With Literature

Maqbool et al. (2017) discovered that project managers with high emotional intelligence, managerial competencies, and transformational leadership had a high success rate in project delivery than project managers without the same competencies. Maqbool et al. advised project sponsors to select project managers with the appropriate leadership style for specific project delivery. Many scholars also noted essential benefits of strategic leadership, including integration management items, such as the development of a project charter, knowledge integration, change management, and supply change management on project performance (Demirkesen & Ozorhon, 2017b; Meng & Boyd, 2017; Zhang et al., 2018).

The skills required to achieve quality integration of the technical process and the people management are more leadership skills than technical skills (Demirkesen & Ozorhon, 2017b). Zhang et al. (2018) noted that leadership style played a mediating role in the project's collaborative performance, impacting business goals. Meng and Boyd (2017) observed a gradual paradigm shift to broaden from traditional project management monitoring project control tools like planning and monitoring to more relationship management skills, which became more important in conventional project delivery. The project manager is at the center of relationship management in projects and plays a pivotal role in the project performance since modern projects now have diverse stakeholders critical to project performance (Meng & Boyd, 2017). The outcomes of reviewing the literature specifically detail the positive influence of emotional intelligence and leadership abilities on collaboration, stakeholder management, and project success.

Correlation With Chaos Theory

Chaos theory represents the way organizations are complex, and leadership seeks to balance rigid order and random chaos (Galacgac & Singh, 2016). Galacgac and Singh (2016) also identified the leadership role to accept and acknowledge uncertainty in projects and recommended that leaders develop an organizational structure where team members at different levels of the organization provided input into the final decisions (Galacgac & Singh, 2016). The four participants highlighted the need for project managers and teams to use hard and soft skills to manage oil and gas projects. The technical or hard skills are the project management skills related to science, and the soft skills are managerial skills.

Applications to Professional Practice

The purpose of this research was to explore the strategies that project managers use to complete oil and gas projects without cost overruns. Oil and gas sources are a significant part of world energy consumption and drive many economies (Hastings & Smith, 2020). Despite increasing demand for renewable energy sources, Pan et al. (2020) argued that oil and gas would play a critical role in the next three decades. Rui et al. (2018) stated that the cost challenges in the oil and gas project delivery are related to the risk of the business environment and cause significant challenges for all the stakeholders associated with the business delivery. A clear understanding of successful project managers' strategies will benefit project stakeholders who must operate in a sensitive industry.

The findings may be useful to business leaders, the academic community, and project practitioners because implementing these findings in projects could provide a road map for delivering oil and gas projects without cost overruns and value erosion. Business leaders might apply the finding in practice by improving contractor selection, implementing training programs that support project engineers to make informed decisions, and providing strategic leadership for project team performance. The academic community may include the students' and learners' curriculum as an improvement measure and align practice with theoretical solutions. The project management associations and institutes responsible for developing project standards and policies may include the considerations in the findings for further development and revision to some project management standards. Project practitioners could implement and communicate

the strategies shared by the four participants to curb the risk of the project cost. Project leaders may also use these findings to improve the taxonomy of knowledge for large complex projects that differ from smaller projects regarding the challenges faced and management strategy (Olaniran et al., 2017).

The findings apply to governmental organizations, environmental bodies, nongovernmental organizations, and community stakeholders who partner with client companies to deliver oil and gas projects and provide energy for communities. Government organizations can improve understanding of how project teams create value for stakeholders and the role of government policies in preventing cost overruns and value erosion for business units and investors. Government organizations can also enhance government policies and improve partnerships with business units in the oil and gas sector. In practice, environmental bodies and nongovernmental organizations can benefit from the knowledge from strategies for mitigating project cost overruns in oil and gas by understanding the grey areas in projects and the effect of slight requests for amendments on the entire project space, including a decrease in overall project benefits. The findings from the study can support environmental organizations and nongovernmental bodies to take more informed decisions regarding oil and gas projects.

Community stakeholders and host communities may apply in professional practice the knowledge from the oil and gas project delivery strategies to improve partnership with client communities, fostering better working relationships with investors. Mayer (2017) opined that oil and gas development provided economic growth for host communities through job creation and tax revenues, and local communities could

implement policies to mitigate the problems caused by oil and gas extraction. The findings on strategies that project managers deploy may clarify roles and responsibilities between project teams and communities to minimize cost overruns and abandoned projects for communities.

Implications for Social Change

From the emergent Theme 2, the successful build-up of a realistic cost profile involves effective stakeholder engagement. Project managers may become aware of the potential for implementing CSR and facilitate community development initiatives to the neighbouring communities of oil and gas projects. If project managers complete oil and gas projects without cost overruns, there is a reduction in financial wastes, which encourages client companies to execute more oil and gas projects in the future, making more resources available for CSR activities, including funding community development projects in the host communities. From my study findings, the contribution to social change includes value creation in the oil and gas sector and associated partners by developing indigenous construction capability, developing local labor competencies, and funding community development projects under the community social responsibility initiatives.

A significant aspect of the contributions to social change is the involvement of the community stakeholder interest groups in the community development projects. The partnership between host communities and project teams to deliver the associated community development work can foster a healthier working relationship between primary stakeholders in delivering oil and gas projects. The partnership between the

community, client, and government may also provide opportunities for the project to impact individuals in the communities directly and for the local representatives of the host communities to develop project management skills. A noteworthy aspect of the implications of social change is that host communities benefit from the monies invested in community development projects by client companies in host communities because the contractors that deliver the projects are usually from the neighbouring communities, with the investor project team providing support. The social benefits from the development projects to the individuals and the communities might enhance economic activities in the communities within the project location, contributing to more employment opportunities, poverty alleviation, crime, and violence reduction.

Recommendations for Action

The findings from this study may benefit the energy sector and project executives involved in the construction of oil and gas projects. Project executives experiencing construction cost overruns would find these findings beneficial in understanding the challenges, complexities, or deficiencies in the system and then develop a new project management strategy leading to improved performance of the organization's projects. Based on the findings of the study, I recommend the following actions by project executives. Project executives should develop a quantitative methodology for unbiased, competent contractor selection. Specifically, project managers should leverage quantitative methods that include assigned weights to the relevant parameters related to contractor competence, including technical experience, financial capacity, familiarity with project locations, previous safety performance, and stakeholder management

protocols. Project leaders should mandate the contracting and procurement team to leverage quantitative methods for contractor selection. Project team members involved in the client selection process should register and declare a conflict of interest if there exists a bias that may influence the assessment of a particular contractor by a project team leader. In general, business leaders and project team leaders with very close relationships or business relationships with contractors bidding for a project in the organization should not be included in the assessment protocols.

Project executives should develop a robust framework for the project scope development before construction. The project scope should include details on project purpose, cost, schedule, premise, milestones and deliverables, risks, assumptions, acceptance protocol, and leadership requirements. Project executives should ensure project teams review project historical data, lessons learned, and analysis of project environment using applicable management analysis tools to provide information relevant for building a realistic cost profile. Project executives should develop a reliable process for managing and setting limits for relevant changes during project execution to manage cost overruns during construction.

Business leaders should provide leadership training for project managers and teams. Project managers can benefit from leadership training specific for managing project teams. Leadership training should be geared towards improving communication, people management, and decision-making skills. Improved leadership skills will enable project leaders to create a working environment that enables the free flow of information at different hierarchical levels, which is beneficial to selecting a competent contractor,

building a realistic cost profile, and deploying project management principles throughout the project's life cycle. Oil and gas organizational leaders should encourage and fund project team members to register with project management institutes and similar professional institutions organized training to improve cost estimating skills. Starting a project based on a realistic project cost and project schedule projection is vital for success. Oil and gas organization leaders need to develop agile project management processes to respond to challenges in the organization's environment that may impact project implementation. These issues include host community requirements, conflict with government agencies, environmental pollution issues, local contractors' capabilities, and current demand for cleaner energy sources. The results of this study will be published via Walden University's scholarly works, thereby enabling scholars and students interested in studying project management practices in the construction industry to access this study. I will share the results of this study with the four participants of this study and other interested parties through project forums, professional journals, seminars, conferences, and training programs.

Recommendations for Further Research

The interview data for the qualitative multiple case study was limited to a sample size of four participants from four oil and gas organizations located in Nigeria. This limitation in the sample size of the study impacts the transferability of the findings to other populations. Future researchers could explore the research focus using more than one participant per organization and increasing the number of participating oil and gas organizations to more than four organizations. The qualitative multiple case study can

also be conducted on participants from oil and gas organizations across geographic boundaries. The project executives who participated in this research study are project managers at their respective organizations responsible for overseeing projects and managing project team members in the organization. In the future, researchers can investigate workers at the coal face or construction managers and project superintendents to collect data and compare the perspectives of different project management levels on methods to reducing project cost overrun. The study can also be conducted using a different research method. Future researchers could use the quantitative research method to assess whether any of the emerging themes correlate significantly to oil and gas project cost performance.

Reflections

My first research intention was to conduct a quantitative research study on the causes of project cost overruns in the construction industry. During the initial literature review, I discovered that many prior studies focused on the causative agents of construction cost and schedule overrun in different projects. Most of the studies leveraged data collected through quantitative survey tools or from secondary sources. Hence, I changed the strategy to qualitative research to decipher project managers' strategies to deliver oil and gas projects without cost overruns. Conducting qualitative research enabled me to explore the topic under focus from another perspective by gathering in-depth information from participants who directly experienced oil and gas project delivery without cost overrun. My constructivist worldview and professional background in the oil and gas industry are possible areas of bias in the study. I made a

conscious effort to ensure any preconceived views and perceptions that I may hold based on my worldview and industry experience did not affect the interviews, and analysis of the interview responses was as limited as possible. I avoided making leading inquiries and asked for explanations for grey areas instead of making assumptions. I applied the research guidelines and protocols as planned at all stages of the study, implemented field notes and reflective journals, and conducted member checking processes. Implementing this study was quite challenging due to difficulty accessing participants meeting the study criteria at the initial stages. With persistent and targeted communication and inquiry in the project management network, participants interested in adding to the body of knowledge on cost overruns and meeting the required criteria showed up. This study has also been worthwhile because the study improved my understanding of the procedure for conducting a qualitative study, boosted my academic writing skills, and enhanced my critical analytical skills in qualitative research. Conducting the study also enabled me to converse with project managers in the oil and gas industry, confirm some issues that I suspected were important, and discovered new issues impacting the project management practice in the industry. Further, conducting the study enabled me to appreciate the complexities of the oil and gas project environment and extend my perspective on the applicability and adaptability of standard project management methodologies to different construction projects.

Conclusion

Project management researchers have conducted several studies to identify causes of project cost overrun, but the scope of the study was usually limited to causative agents

and not specific to the strategies that might avert the occurrence of cost overrun. I explored the project cost overrun phenomenon within the oil and gas sector using the following research question: What strategies do successful project managers in oil and gas organizations employ to deliver construction projects without cost overruns? Using data collected from the project managers that participated in this study, I answered the research question. I determined from the analysis of the interview data that project managers in oil and gas corporations can improve project cost performance in construction projects by applying the following four strategies: (a) selecting a competent contractor, (b) developing an initial realistic cost profile, (c) applying project management tools, and (d) applying strategic leadership. Oil and gas projects are usually capital intensive, with many stakeholders benefiting from the project's success, from the design phase to construction and project completion. The high cost of the oil and gas investment makes it crucial for client organizations to achieve a high project management performance and ensure organizations avoid waste or expending more resources than necessary to achieve an adequate return on investment. The findings and recommendations presented in this study provide oil and organizations with information that organizations can apply to achieve high project performance levels for construction projects.

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Appendix A: Interview Protocol

The purpose of the interview is to explore strategies that project managers use to complete oil and gas projects without cost overruns. Four project managers from oil and gas companies (two from client companies and two from contractor companies) are interviewed, and each participant is asked the same questions in the protocol below:

1. Introduce self to the participant as a doctoral student at Walden University and explain the purpose and time of the interview.

2. Verify participant has read, understood, and signed the consent form before the interview process.

3. Remind the participant the interview will be audio-recorded. Begin the interview by collecting the following background information: a. Education background. b. How many years of project management experience do you have? c. How many years are specific to the oil and gas construction sector as a project manager?

Interview Questions

1. What is your experience of construction projects that involved successful managers who reduced cost overruns?
2. What strategies do you use to complete oil and gas projects without cost overruns?
3. How have you implemented the strategies that prevent cost overruns in projects?
4. What were the key challenges of developing and implementing the strategies?
5. How did your organization address the problems or barriers to implementation?
6. How do you measure the effectiveness of your approaches to achieve the stated objective of completing projects without cost overruns?
7. What else can you share with me about your organizations' success in developing and implementing strategies for reducing construction project cost overruns?

Appendix B: Letter of Invitation

Doctoral Research Study

My name is Tamunoemi Efebeli, and I am a doctoral student at Walden University. My field of focus is Doctor in Business Administration. Dr. Jonathan Schultz of the faculty of management is the supervisor of this research.

The remainder of this email will provide information so that you can make an informed decision concerning participation.

Purpose of the Study

The purpose of this study is to explore strategies project managers in the oil and gas construction industry employ to complete projects without cost overruns.

What Does Participation in This Research Study Involve?

Participation in this study is limited to 4 individuals but could be increased if required to achieve data saturation. Should you initially agree to participate, you also can withdraw at any time through the study.
The expected time for this interview is 40-45 minutes.

Confidentiality

All information obtained in this study is completely confidential unless disclosure is required by law. None of the individual interview results are made available to participating organizational leaders or the organization. The study results may be used at an aggregate level in reports, presentations, and publications.
Individual participants will not be identified.

I am happy to respond to any questions or concerns you have about the research. I can be reached at [redacted]