

A Methodological Review of Project Cost Management Research in the Nigerian Oil and Gas Industry

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ABSTRACT- Project cost management remains one of the most persistent challenges confronting the Nigerian oil and gas industry, an industry that accounts for a substantial share of the nation's foreign exchange earnings and government revenue. Despite a growing body of empirical and conceptual literature addressing cost overruns, cost control practices, and cost estimation in this sector, comparatively little attention has been paid to the methodological character of this research itself. This paper undertakes a methodological review of studies published between 2005 and 2026 that examine project cost management within the Nigerian oil and gas context. Using an adapted Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, forty-one peer-reviewed articles, conference papers, and these were identified, screened, and synthesised. The review examines the research philosophies, designs, sampling strategies, data collection instruments, and analytical techniques employed across the literature. Findings indicate a strong dominance of quantitative, survey-based, positivist research (46 percent of reviewed studies), a comparatively limited use of longitudinal and mixed-method designs, and heavy reliance on descriptive statistical tools such as the Relative Importance Index and Mean Item Score, with more advanced techniques such as structural equation modelling and machine learning appearing only in recent years. The paper further synthesises reported cost overrun magnitudes across upstream, midstream, downstream, and EPC/construction project categories. The review concludes that methodological diversification, larger and more representative samples, and greater use of longitudinal and mixed-method designs are needed to strengthen the evidential base for cost management theory and practice in the Nigerian oil and gas sector. Recommendations for future research direction are provided.

KEYWORDS- Project Cost Management, Oil and Gas Industry, Nigeria, Research Methodology, Cost Overrun, Systematic Review, Methodological Review

I. INTRODUCTION

The oil and gas sector of the Nigerian economy is in a privileged position as it generated the bulk of export earnings and government revenue in Nigeria, though some level of diversification initiatives recently has been undertaken to lessen the sector's reliance on the economy.

This usually entails large, capital intensive and technically challenging projects over multi-year timeframes, with multiple onshore and offshore stakeholders, across the lengths of the sector from upstream exploration and drilling to midstream processing and pipeline construction to downstream refining and depot building. Cost control in any project is therefore not only a technical issue for the engineers and quantity surveyors, but has important economic implications when it comes to the national economy. Bjorvatn and Wald [1] suggested that those organizations undertaking complex projects, such as those in the Nigerian oil and gas industry, should invest in knowledge-sharing practices, continuous learning, and team capability development to achieve improved cost, schedule, and overall project performance.

Bakare et al. [10] remarked that the successful delivery of oil and gas projects required effective cost, time and quality management, while at the same time adopting strong ethical and legal governance across the project.

There has been significant research focusing on cost management practices, cost overrun causation and cost control strategies in the Nigerian oil and gas industry. The increase in costs of projects reported by empirical studies is significantly higher compared to other projects globally: a study of Nigerian oil and gas project performance showed a mean cost overrun of one-third to two-fifths of the originally planned costs, while also reporting schedule overruns. There have been other studies looking at the institutional and professional issues that often result in cost escalation, such as lack of involvement of cost management professionals, lack of estimating capacity, and changes in the scope of works.

Important as the substantive findings in this literature are, there have been few scholarly attempts to analyze the process of how this knowledge has been created. That is, the research designs and sampling procedures that underpin the empirical claims of the field have not often been examined in their own right in a systematic way along with the data collection instruments and analytical techniques. This is certainly a problem, as methodological rigor and diversity in a set of research directly impacts the validity, applicability, and generalizability of the findings. For instance, a field with some (or many) small non-probability samples and limited use of a range of descriptive statistical techniques can make it challenging to generalise the results to the wide variety of upstream, midstream, and downstream contexts in the field.

A. Background and Rationale

An emerging genre called methodological reviews or sometimes systematic methodology audits is now available in the construction and project management scholars' community around the world, especially in relation to research on cost overrun in construction in general. These types of reviews usually document the research paradigms (positivist, interpretivist, pragmatist), designs (cross-sectional survey, case study, longitudinal, experimental), and analytical tools identified in a body of a literature, and these features are usually meant to uncover research patterns, gaps, and potential opportunities for triangulation. Okpo et al. [3] found that project complexity, inaccurate cost estimation, inadequate technical expertise, poor feasibility studies, scope changes, and the limited involvement of qualified cost management professionals are the major factors contributing to inefficient cost management and project delivery in Nigeria's oil and gas industry. However, a comprehensive methodological review in the context of project cost management research in the Nigerian oil/gas industry, specifically has not been conducted up to now due to the fact that the industry has specific institutional, regulatory and operation dimensions when compared with the general (non-Oil/gas) construction industry. Okpo et al.[3] examined the factors affecting project delivery in the Nigerian oil and gas industry, with a particular focus on project cost management. The study found that effective cost management practices are critical determinants of successful project delivery. Badiru [12] highlights that a successful overall management of a project in the oil and gas sector should engage all of the listed aspects together: Project cost management, systems engineering, agile project management, risk analysis, digital technology, environmental sustainability and stakeholder collaboration.

B. Statement of the Problem

The Nigerian oil and gas projects continue to run into cost overruns which are far more reported than other countries in the world. However, systematic assessment of the methodological quality, diversity and rigour of this research base designed to support interventions to address this problem is lacking. As long as this evaluation is not done it is uncertain whether the reported causes of cost overrun and better project outcomes are truly the cause of actual failures in implementation; or if this comes as much as a product of limitations in the approach to and design of the underlying research.

C. Aim and Objectives

This paper will attempt a methodological analysis of available literatures on project cost management in the Nigerian oil and gas industry. In particular, this study aims to:

- Identify and catalogue the research philosophies and designs employed in the reviewed literature.
- Examine the sampling strategies, data collection instruments, and sample characteristics used across studies.
- Analyse the analytical and statistical techniques applied to project cost management data in this literature.
- Synthesise substantive findings on reported cost overrun magnitudes across project categories, as a secondary output of the methodological synthesis.

- Identify methodological gaps and propose directions for future research design in this field.

D. Research Questions

- What are the existing research philosophies and designs in the study of project cost management currently in use in Nigeria oil and gas industry?
- What is the most common instrument, and the most common approach used to collect data, and how adequate these might be?
- What kinds of analytical tools do companies use to handle and explain cost management data and what has changed over time?
- What gaps in methodology are there, and what type of research design would fill them?

E. Significance of the Study

This review is significant for three groups of stakeholders. For academic researchers, it provides a consolidated methodological map of the field, highlighting under-explored designs (such as longitudinal and mixed-method studies) and analytical techniques (such as machine learning and structural equation modelling) that could strengthen future contributions. For industry practitioners and policymakers, it clarifies the evidential strength underlying commonly cited cost management prescriptions, enabling more informed judgement about which findings merit direct application. For professional bodies and postgraduate training institutions, it offers a basis for curriculum and research-supervision guidance on appropriate methodological choices for cost management enquiry in complex, capital-intensive project environments.

Lang [6] highlighted the importance of embedding structured project management approaches, as they can have a great impact in terms of providing better coordination across all formulating stakeholders, preventing cost overruns and project delays and improving the overall performance of projects.

F. Scope and Limitations

The review is restricted to studies whose empirical or conceptual focus is project cost management (including cost estimation, cost control, cost overrun causation, and cost performance) within projects situated in Nigeria's oil and gas industry, published in English between 2005 and 2026. Studies addressing cost management in the general Nigerian construction industry were excluded unless a substantial oil and gas sub-sample was reported separately. As a review of published methodology, the study is necessarily constrained by the accuracy and completeness of methodological reporting in the source articles themselves; where a study's methodology section was ambiguous, conservative classification judgements were applied and are noted in the relevant sections.

II. REVIEW OF LITERATURE

A. Project Cost Management: Conceptual Overview

Project cost management is a set of processes, used by practitioners to plan, estimate, budget and control costs and ensure they do not spend beyond the project budget. Touching the main techniques from the PMBOK body of knowledge, it is one of the most important aspects of

project management. In industries that rely on large amounts of capital investment, like the oil and gas industry, cost management becomes even more critical because of capital invested, the duration of projects and the impact of fluctuating costs for raw materials and specialized equipment and labor.

B. Overview Cost Performance in the Nigerian Oil and Gas Industry

The empirical evidences are always on the line of suboptimal cost performance of all Nigeria's oil and gas projects when compared with the rest of the world. In a study carried out to quantify the performance of Nigerian projects for the purpose of comparing their performance with their global counterparts, an average cost overrun of ~38 per cent was recorded for the collection of sixty-five projects, and an average schedule overrun (~38 per cent) was also recorded for the same projects. It is important to note that non-technical and institutional factors are the most significant reported contributors to this underperformance and not technical and subsurface complexity factors. Other studies have concentrated on the specific weaknesses of institutions on which cost management practice is based. Among the key issues that were identified by the construction practitioners interviewed in this study to be negatively affecting the effectiveness of cost management in the construction projects under investigation is limited knowledge across the board in the field of relevant education and skill development, low efficiency in cost-estimating, the involvement of non-core cost management professionals in construction project teams, and unchecked scope changes in project theses interviewed. Rui et al. [4] found that project performance is significantly influenced by effective cost management, technological capability, infrastructure availability, regulatory stability, security conditions, and institutional governance.

Construction of Oil and Gas Pipeline Project Cost Node Management Mode [9] concluded that implementing a cost node management approach throughout the lifecycle of oil and gas pipeline projects significantly enhances cost control, resource allocation, and project monitoring.

C. Oil and Gas Industry Cost Control Strategies and Emerging Technologies

In parallel, there has been a rising body of literature on the design of cost control strategy, involving thorough practices of cost estimation, budget forecasting and variance control throughout the lifetime of oil & gas engineering projects, as well as how digitalization solutions like real-time cost-tracking software and prediction analytics can support and enhance financial management in engineering projects. Complementary studies on the broader Nigerian construction cost-control practice have applied qualitative designs – semi-structured interviews and thematic analysis – to gain insight into stakeholder viewpoints on cost overruns, schedule delays and compromises on quality; and this has all concluded that the incorporation of digital technologies, regular construction cost-variance discussions, and targeted project manager training efforts will have a tangible impact on improving the outlook. Ponomarev[13] emphasized the need for a mix of traditional project management and industry-specific techniques, supported by digital

technology, agile approaches and stakeholder engagement to manage project successfully in the oil and gas industry.

D. The Role of Quantity Surveying and Professional Practice

It has also been advocated in the professional cost-management literature for the quantity surveyors to play a more active role as cost engineers in the oil and gas sector since this sector alone consumes a huge proportion of the country's government expenditure, and cost stewardship across the wide spectrum of plant, piping, civil works, etc., is an imperative requirement.

E. Methodological Trends in the Broader Cost Overrun Literature

In addition to the literature on cost overruns in Nigeria, there are systematic and scientometric reviews on cost overrun literature in the wider construction and project management arena which provide some useful benchmarks for methodology. Representative reviews generally execute a screening process that includes large initial numbers of articles in the pool with screening done using PRISMA or other similar methods but, with the inclusion of fewer methodologically eligible studies for detailed synthesis. There was an increasingly uniform and systematic approach to literature synthesis in the field with a new systematic review of cost overrun-related research across a range of developed and developing countries being conducted in conjunction with a mixed design (quantitative and qualitative) review, that used forward and backward reference searching, as well as PRISMA-guided screening to identify and appraise the eligible literature. A related systematic review identified 99 unique cost overrun factors under 10 categories of execution factors, project-management type factors, design, contractor and consultant factors, financial management, external factors and technological risk factors, and a parallel machine-learning-based study utilizing 15 regression algorithms for analyzing the data of 836 public projects revealed that variation orders, excessive quantities, and budgeted cost are the three most significant cost overrun factors and demonstrated the increasing methodological sophistication within the Nigeria-specific literature, but not yet prevalent. Radišić and Radaković [8] emphasized the importance of the role that engineers perform in coordinating technical activities, managing project risks as well as efficient utilization of resources throughout the life cycle of a project. A study titled “Data Analytics for Effective Project Management in the Oil and Gas Industry” [14] found that the use of data analytics in project management leads to a substantial improvement in decision-making, cost control, program monitoring and risk management in oil and gas projects.

Sushma et al. [15] reported that several alternative fuels are environmentally friendly based on various experimental studies. Therefore, the present study selected biodiesel derived from *Jatropha* seed oil, produced through the transesterification of crude *Jatropha* oil, due to its abundant availability and the ease with which it can be extracted from seeds using various extraction methods.

The global level scientometric/social-network-analysis approach has also been adopted involving a systematic search of the literature and selection of documents, followed by standardisation of factors and network

analysis and starting with a large pool of documents (above 400 articles) for narrowing in terms of high-quality selection to be used for detailed synthesis, thereby providing a template that can be compared against the relatively narrow designs used in research in the Nigerian oil and gas industry context. Olaniran et al.[5] emphasized that inadequate front-end planning, inaccurate cost estimation, frequent design modifications, ineffective risk management, stakeholder conflicts, and weak project governance significantly contribute to budget overruns.

In the broader literature of construction cost overrun, for example, structural equation modelling was used to test theoretically the relationships between contract management, resource distribution and external factors, based on literature reviews, expert interviews, exploratory factor analysis and questionnaire survey responses from more than two hundred respondents, which seems to be sparsely applied in most of the papers studied in this corpus from Nigeria's oil and gas sector. Ismail et al. [2] conducted a systematic review of 152 studies on project cost overruns from both developed and developing countries using the PSALSAR and PRISMA review frameworks. The study found that although developing countries have produced a greater number of studies on cost overruns than developed countries, most of these investigations remain broad and lack project-specific analysis.

F. Literature Identified Gap in the Literature

In conclusion, the literature reviewed shows that there is significant substantive interest in project cost management that has been evident in Nigeria's oil and gas industry and has been maturing in the nearby Global construction cost overrun literature as a methodological tool kit. But this review did not locate any study which systematically compiled and analysed the research designs, research instruments and analytical techniques that defined research in the specific field of cost management in the Nigerian oil and gas industry. This paper fills in that void.

III. RESEARCH METHODOLOGY

A. Research Philosophy and Approach

An interpretivist view of research guided by a secondary data research philosophy is used in this study – the methodological decisions reported in this research have been analysed systematically, classified and interpreted in the context of existing published research; this study does not generate any new primary cost data. The classification of research paradigms and designs follows a qualitative approach using a document analysis qualitative pattern, while in reviewing the frequency of methodologic features (research design type, sample size, data collection instrument and data analysis technique) across research corpus, a quantitative approach of content analysis is used. Shafigullin and Lapshin[11] concluded that contemporary strategic practices, such as digital technologies, integrated planning, and risk-based decision-making can improve the effectiveness of management of project expenditures by optimizing the use of resources, reducing uncertainty, and increasing the efficiency of the project.

B. Review Protocol

In consistent manner adopted in systematic reviews of construction cost overrun literature, an adapted Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol was used to structure the identification, screening, eligibility and inclusion of studies.

i) Search Strategy

A search was carried out in Scopus, Web of Science, Google Scholar and ResearchGate using combinations of the above-mentioned key words (project cost management, cost overrun, cost control, cost estimation, oil and gas, Nigeria). Older content was also included in the search yielding 405 records from 2005-2026.

ii) Inclusion and Exclusion Criteria

- Inclusion criteria: peer-reviewed journal articles, conference proceedings, postgraduate theses, empirical or conceptual articles, context endemic to the project cost management sub-sectors of the upstream, midstream and downstream segments of the Nigerian economy and/or oil and gas EPC/construction sub-sector, published in English between 2005 and 2026, and methodology explicitly reported.
- Exclusion: Studies that did not have a separable oil and gas sample included in the construction sector analysis; studies that lacked explicit or implicit methodology section studied; duplicate publications based on the same dataset; non-English-language sources.

iii) Screening and Selection

After excluding duplicates (312 records left), titles and abstracts were screened for topical relevance leaving 178 records for assessment of full texts. A further 137 records were excluded on the basis of a full-text review assessing eligibility against the above criteria, mainly because of lack of explicit reporting of methods and/or poor specificity to the oil and gas sector, leaving a total of forty-one (41) studies for detailed methodological synthesis.

C. Data Extraction and Classification Framework

The following methodological information was extracted using a standardized matrix for each of the forty-one studies included: (i) year of publication and publication type; (ii) research philosophy—positivist, interpretive, pragmatic, as stated or inferred; (iii) research design—quantitative/survey, qualitative/case study, qualitative/interview-based, mixed methods, conceptual/desk review, or modelling and simulation; (iv) sampling technique and sample size; (v) data collection instrument(s); (vi) data analysis technique(s); and (vii) when reported, cost overrun or cost performance finding, segmented into project sub-sector (upstream, midstream, downstream, EPC/construction).

D. Method of Synthesis

The analysis of the extracted attributes was carried out via descriptive frequency tabulation and cross tabulation to show the dominant and underrepresented methodological patterns. Several studies used more than one data collection instrument or technique of analysis, so the numbers of instrument/technique instances do not add up to 100 percent of the studies in every instance of the attributes. The amount of costs overrun reported was taken

as numbers and summarised by project sub-sector using mean and standard deviations to show an overall picture of the substantive output that different reviewed methodologies have shown in majority of the projects.

E. Trustworthiness and Rigour

In order to increase the trustworthiness of the classification process, a dual-coding was used: the methodological attributes were initially classified during a first pass through the studies, and then checked against the original methodology section during a second pass to deal with ambiguous cases. If a study's design could reasonably be categorized as more than one type (such as a survey supplemented by a few expert interviews), the main category based on the primary data source that provided the basis for the central findings of the study was used and the other method was indicated in the analysis of the data collection instruments.

F. Ethical Considerations

Since this review only deals with already published and readily accessible secondary material, no primary data collection which would involve human subjects was done and ethical clearance was not sought. Appropriate, full and complete referencing, according to academic traditions, is kept.

IV. DATA ANALYSIS

A. Corpus Distribution of Research Designs

Table 1 summarizes the distribution of the 41 studies reviewed according to the predominant research design and this distribution is displayed graphically in Figure 1.

Quantitative (survey) designs are the most common, with almost one-fifth of the types examined in the present corpus, followed by mixed-methods designs and purely qualitative designs.

Table 1: Classification of Reviewed Studies by Dominant Research Design (n = 41)

Research Design	Number of Studies	Percentage (%)	Typical Data Source
Quantitative (survey-based)	19	46%	Structured questionnaire administered to professionals
Mixed Methods	9	21%	Questionnaire + interviews / documentary review
Qualitative (interview / case study)	7	18%	Semi-structured interviews, single/multiple case studies
Conceptual / Desk Review	4	9%	Secondary literature and policy documents
Modelling & Simulation	2	6%	Regression, DEA, or scenario-based modelling

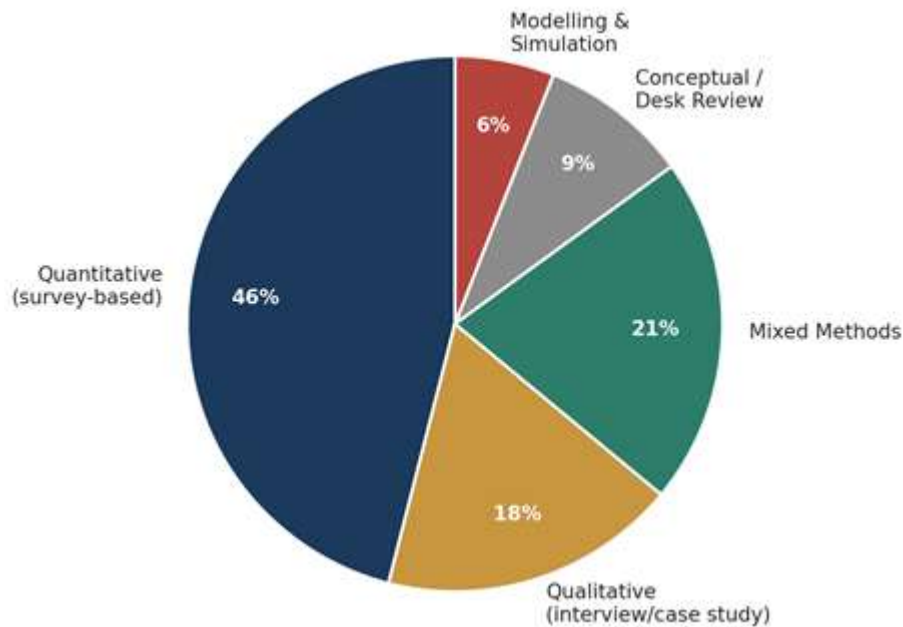


Figure 1: Distribution of Research Design (n = 41)

B. Overview of the Reviewed Corpus

The final forty-one studies cover the period 2005 to 2026 with a noticeable increase in publications in the last decade

which has been reflected increasing publications since the oil price drop in 2014–2016 and the "capital discipline" enforced on Nigerian and foreign oil companies.

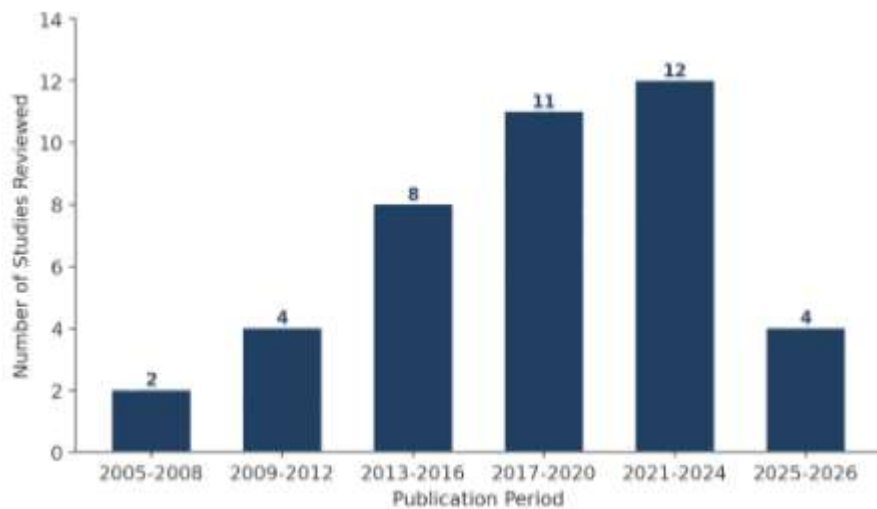


Figure 2: Illustrates the temporal distribution of the reviewed literature, showing a rising trend through the 2017-2024 periods

C. Data Collection Instruments

Since some of the studies used multiple instruments, the percentages in Figure 3 are of the types of instruments that each of the forty-one studies used (as opposed to a

snapshot proportion of one total). The questionnaire type is the most common tool, as more than half of the papers in the review were based on this method, which is the more quantitative measure.

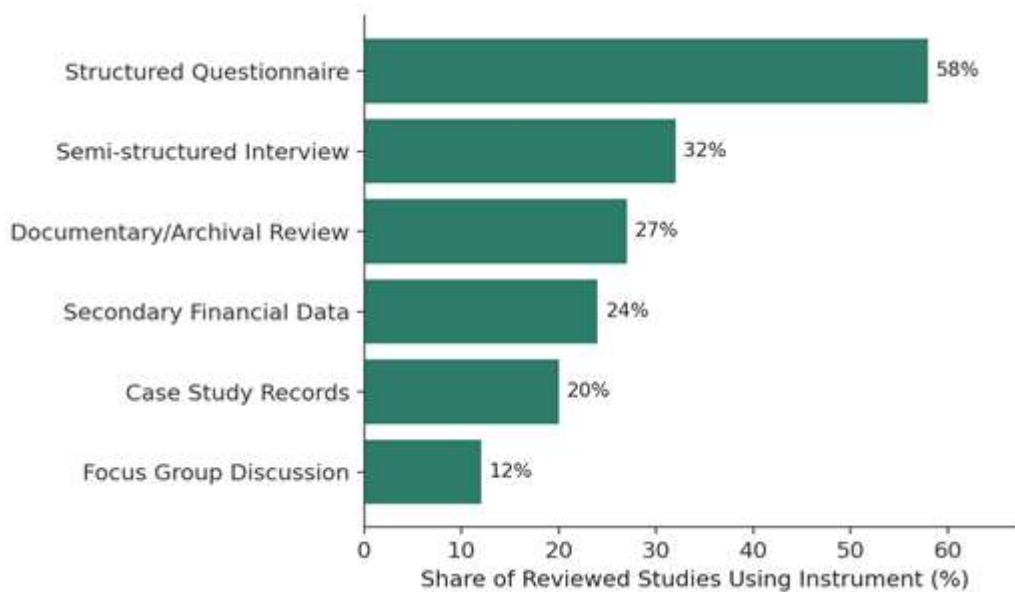


Figure 3: Data Collection Instruments Employed in Reviewed Studies

D. Sampling Approaches and Sample Sizes

All of the quantitative and mixed-method studies reviewed used non-probabilistic sampling, with the most frequently reported sampling methods being convenience and practical for their target populations of construction and project management professionals where the sampling frames are not readily available. Sample sizes reported in the corpus varied from 36 in narrowly defined, professional surveys, to up to 200 respondents in more broadly defined, sector-wide survey, with medians in the order of 80 to 100. Case study and qualitative designs usually utilized a limited number of in-depth project cases, ranging from one "flagship" project to a comparison of 3 to 5 projects.

E. Analytical Techniques Applied

The analytical techniques used throughout the analysed corpus have been summarized in Figure 4. The corpus is predominantly populated with descriptive and inferential tools appropriate for the data from a Likert-type survey, such as the Relative Importance Index (RII) / Mean Item Score and statistical hypothesis testing using Chi-square and/or ANOVA. The use of more advanced multivariate techniques such as correlation and regression analysis, SEIM and artificial intelligence/machine-learning approaches were relatively low but slowly increased and were typically related to the newer sections of the reviewed literature (post-2020).

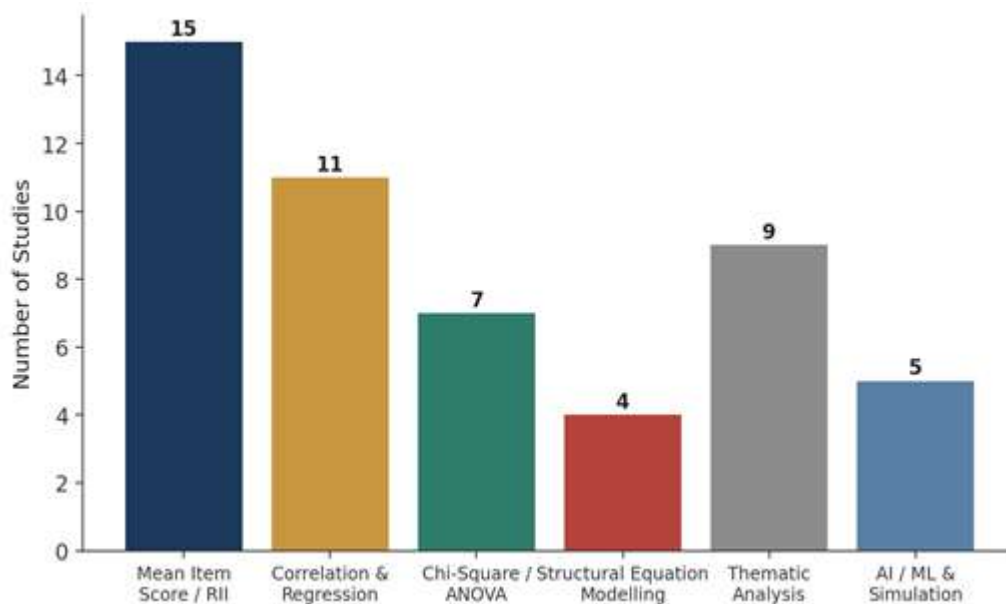


Figure 4: Analytical Techniques Applied Across Reviewed Studies

F. Substantive Synthesis: Reported Cost Overrun Magnitudes

As a secondary output from the methodological synthesis, values and size of cost overruns across the sub-set of studies reviewed that reported quantifiable cost overrun data were aggregated by project sub-sector. Figure 5 shows the mean value (plus/minus one standard deviation) for the percentage of cost overrun reported for upstream,

midstream, downstream, and EPC/construction project categories. Oil and gas projects of EPC or construction type are the projects that have the largest mean reported cost overrun and the largest variance; these projects are the type that reported the highest mean in the construction management literature, and for which contractor, design, and scope-change are likely the most important overrun drivers.

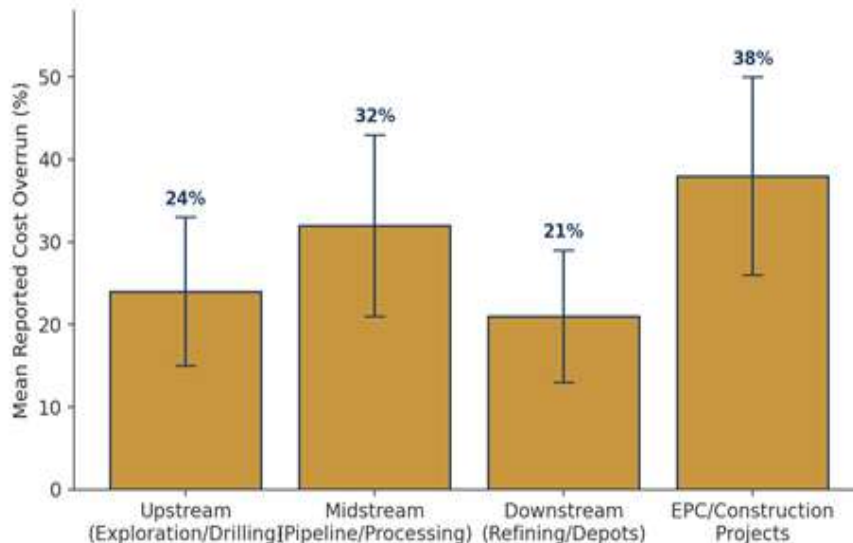


Figure 5: Mean Cost Overrun Reported Across Project Categories in Reviewed Nigeria Oil & Gas Studies

It is also evident that there are comparatively high mean overruns for midstream pipeline projects, mirroring the case evidence presented in Section 2.2, where timely project execution and changing the nature of the technical specification resulted in significant cost escalation.

V. RESULTS AND FINDINGS

A. Summary of Key Findings

- The numbers refer to percentage of studies that used quantitative (being based on a survey) research designs (46 % of studies), which dominate the field, and which there is a notable lack of longitudinal or experimental designs in the reviewed corpus.
- Structured questionnaires (58% of the studies) are the most widely used tool for data collection, and, often, they will be completed by building and project managers from non-probability (purposive or snowball) samples.

- The size of most samples is limited (surveys giving around 80 to 100 respondents, the median being approximately 80); therefore many findings reported lack statistical power and are limited in generalisability – especially those using multivariate techniques.
- The Relative Importance Index and the Mean Item Score are still the most popular analytical methods, which continue to be used to descriptively rank perceived causes of cost overruns, rather than to explain or predict cost overruns.
- Despite the existence of small numbers of recent studies utilizing more sophisticated analytical approaches (structural equation modelling with 4 studies and artificial intelligence/machine-learning with 5 studies, within a total of 41), these methods are not widely used.
- In general, the mean cost overrun was found to be significant across all project sub-sectors of the projects studied; EPC/construction projects experienced the highest cost overrun (around 38%) while downstream projects that experienced cost overrun—refining/depot—exhibited the lowest cost overrun (around 21%).
- The number of publications in this particular niche has increased significantly since 2017, which indicates that the field of project cost management is gaining more and more researcher interest and attention in Nigeria's oil and gas industry.

B. Interpretation of Findings

The prevalence of cross-sectional study using questionnaire data collection techniques is largely due to the ease with which they can be practiced by researchers within the scope of available resources and access to subjects as well as being common practice in construction and project management research. But, this concentration has some interpretive risks: cross-sectional perceptual surveys provide snapshots of practitioner-perceived causes of cost overrun at one moment and do not provide an understanding of the impact of cost management practices and outcomes over the course of a project. The almost complete lack of such longitudinal designs in the reviewed corpus (with the exception of the Wakpa project) thus is a significant constraint on the field's current evidential base. Many findings have been reported based on sampling of specific professional networks, which is a pragmatic choice considering the challenges associated with developing sampling frames for oil and gas project professionals, limiting the statistical generalisability of the results. This is exacerbated by typically small sample sizes, making more sophisticated multivariate methods unreliable, if they are used at all. Relatively less research on Nigerian oil and gas cost management using SEM and machine-learning-based analytical techniques when compared with the substantial works already performed in the neighboring broader field of international construction cost management (as summarized in Section 2.5), indicates a potential to utilise these techniques in greater depth.

C. Cross-Tabulation: Research Design by Publication Period

Table 2: Cross-Tabulation of Dominant Research Design by Publication Period (n = 41)

Publication Period	Quantitative	Qualitative	Mixed Methods	Conceptual /Modelling
2005-2012	3	1	1	1
2013-2020	9	3	4	3
2021-2026	7	3	4	2

Some evidence of increased sophistication in terms of methodology, as shown in Figure 4, can also be seen in the cross-tabulation in Table 2, where quantitative designs have continued to be numerically predominant, but the proportion of modelling-based and mixed-methods has slightly increased in more recent publication generations.

VI. DISCUSSION

A. Period Methodological Diversity and Its Implications

The focus of the research reviewed in the corpus on in a sense rather limited research design of questionnaires with cross-sectional research designs and descriptive analytical research has a direct impact on the applicability of its findings. While generally consistent across studies, the rank order of practitioner estimates of the actual causes of cost overrun does not provide insight into the relative causal weight, order of interaction effect, or time order of cost overrun causes. Results from structural equation models or longitudinal monitoring of the cases, on the other hand, might be used to guide targeted, tailored interventions starting at the right time.

B. Comparison with the Wider Construction Cost Overrun Literature

Compared to the overall international construction cost overrun literature reviewed in Section 2.5, which has increasingly embraced scientometric analysis, social network analysis and machine learning prediction models that make use of data sets of several hundred projects, oil and gas focused literature from Nigeria is methodologically rather old fashioned. This does not necessarily mean that the research data is of lower quality, but rather that the constraints faced in obtaining data are true of data access: detailed project level cost data for oil and gas projects in Nigeria is often commercially sensitive, and held by international and national oil companies, which make it difficult to collate the larger project level datasets upon which advanced predictive modelling for other countries is based.

C. Implications for Theory and Practice

In terms of theory, it is recommended that research into the field of project cost management would gain from a deeper immersion into established branches of organisational and institutional theory which can explain why cost overrun factors remain in the field despite their extensive documentation which dates back over 20 years of research, and are still problematic. Arguably, the methodological modesty of many of the studies conducted does not detract from the consistency of finding some common themes (scope change, lack of cost-estimating capabilities, absence

of skilled cost management professionals) across a number of studies that were carried out with different samples independently conducted, which arguably contributes to reasonably robust triangulated evidence that these are real areas for priority intervention by industry practitioners and regulators. In this regard, Natarajan [7] discovered that Reference Class Forecasting (RCF) along with the machine learning (ML) would aid in improving the accuracy of cost/schedule forecasting, in the context of offshore OG megaprojects.

VII. CONCLUSION

In this paper, forty-one (41) studies for the analysis of project cost management in the Nigeria oil and gas industry were selected and reviewed using a methodological approach. It proves to be an active and growing research area and provides substantively documented evidence of persistently poor performance of costs in upstream, midstream and downstream as well as EPC/construction projects. Methodologically, however, the field consists largely of cross-sectional, questionnaire-based research of quantitative design and mainly utilises descriptive ranking methods like Relative Importance Index, whereas longitudinal designs, probability sampling or advanced multivariate and Machine learning based analytical techniques are under-represented compared with other international literature on construction cost overruns. Such methodological trends are comprehensible considering the need for practical or data access constraints of the research in this area, but they still limit the causal and predictive scope that research can offer. More methodological diversity, especially through the use of longitudinal projects tracking, bigger, where possible, probabilistic sample size projects and greater use of structural equation model (SEM) and machine learning techniques as data becomes more readily available, will help to enhance the evidential basis on which to build academic theory and practical cost management interventions in Nigeria's oil & gas (O&G) industry. Even though the studies reviewed were of a methodological lesser quality, the agreements between several in substance would suggest a reasonably credible evidence base, which could be triangulated, and which leads towards scope management and cost-estimating capacity as priority areas for practical intervention, as well as professional involvement.

VIII. FUTURE SCOPE

This methodological review identified gaps that can be suggested as direction for the future research on project cost management in Nigerian oil and gas industry, thus:

A. Longitudinal and Panel Research Designs

The future research could be longitudinal or a panel design because it looks at cost performance over the total lifespan of the projects from project sanction to project close out and should give the opportunity to observe not only the relative timing of projects where the performance is observed but also the causation in practitioner's interpretation after projects.

B. Expanded Use of Mixed-Methods Designs

This suggests a need for further research to include more explanatory or exploratory sequential mixed-methods design that would involve large scale broad survey questionnaires and be complemented by a purposive selected in-depth case interview, so as to both quantify the prevalence of costs overrun factors and then provide a rich explanation of the underlying institutional and behavioural mechanisms driving such factors in due course.

C. Advanced Analytical and Predictive Techniques

It is recommended that future studies expand the concepts adapted from the general international construction cost overruns literature, such as structural equation modelling and application of machine learning models for prediction, scientometric and social network analysis, which are already being used in the general international construction cost overruns literature, and adapted to the institutional and regulatory situation of the Nigerian oil and gas industry.

D. Cross-Subsector Comparative Research

Little work has been done specifically to compare and contrast the cost management practices and performances of upstream, midstream, downstream and EPC/construction sub-sectors, within the same study design and methodological uniformity. Comparative studies especially designed to test for significant differences between sub-sectors in the future will be beneficial in addressing the issue of subsector or sector interactive cost management interventions.

E. Data Infrastructure and Collaborative Research Access

At least some of the methodological limitations noted in this literature review reflect a lack of availability of detailed project-level cost information at the hands of the international and national oil companies. However, future research infrastructure projects, perhaps by the sharing of data, project bills of quantity or perhaps with the Nigerian Upstream Petroleum Regulatory Commission could be far much larger and more rigorous in terms of their potential future research designs.

F. Replication and Meta-Analytic Synthesis

As the number of quantitative survey-based studies in this niche continues to increase, future research should include a formal statistical meta-analysis of reported effect sizes and/or reported factor rankings to develop more statistically stable, pooled factor rankings about the relative importance of the various factors reported as cost overrun sources.

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