

## Research Article

# Evaluation of the Effects and Risks of Cost Estimation on Project Costs and Claims: A Study in Imo State, Nigeria

Tobechi B. Ejekwu<sup>1</sup>, Chioma P. Ekweani<sup>2</sup>, Ezinne J. Oha<sup>1</sup>

<sup>1</sup>Department of Quantity Surveying, Imo State University, Owerri, Nigeria

<sup>2</sup>Department of Quantity Surveying, Baze University, Abuja, Nigeria

*Received: April 4, 2022; Accepted: July 7, 2022; Published: August 18, 2022*

**Abstract:** The construction industry is challenged with project risks often resulting from cost estimating uncertainties. Previous research shows that 50% of construction disputes are estimating-risk related, leading to poor project performance. This study investigated the effects of charge evaluating risks on project cost overrun and resultant claims to improve project efficiency. The investigation was carried out using well-structured questionnaires addressed to construction professionals in Imo state to determine the critical cost estimating risks and identify principal evaluating risk-related claims contributing to cost overrun in construction project delivery. The results reveal that design issues (design complexity, preliminary design, and design errors) are the key contributors to cost estimating uncertainties. Inadequate cost data, estimator's expertise, and omission in contract documents are the principal causes of evaluating risk-related claims in construction projects. The study concluded that the inaccurate estimation of construction costs eventually leads to claims and cost overruns in the delivery of building projects. It's possible that the risk involved in cost evaluation is to blame for this. Estimators with sufficient efficiency, skill, and experience should be included in estimating to increase the likelihood that the estimates will be close to correct. The study recommends the availability of concise designs and specifications and details as well as updated market surveys to eliminate uncertainties and improve cost data before estimating a construction project.

**Keywords:** Claims; Cost Estimating; Project Efficiency; Risks; Uncertainties.

## 1. Introduction

### 1.1. Background to the Study

Due to its size and the potential role, it can play in the economy's development, the construction industry is a crucial component of any economy. Construction is frequently used as an indicator of a nation's socio-economic development and thus is essential to the development process [1]. The nature of the construction industry in Nigeria is such that significant construction project participants, owners, design professionals, and contractors tend to exhibit adversarial characteristics. This implies that each tends to seek ways to maximize self-gain

in the contractual gain. Given the inevitability of uncertainty and risks inherent to the construction process, one might be inclined to ask whether it is possible to extinguish claims by the growing tension and dangers.

Claims on construction projects involve significant parties (owners, contractors, and design professionals), and it is essential to plan for the unpredictability of construction project risks. Claims for loss and expense by contractors have long been a contentious issue in many construction contracts [2]. According to Cunningham [3], "claims are requests for the reimbursement for additional costs resulting from certain employer or employer's agents" acts delay or disrupt the contractor's progress,

**This article citation:** T. B. Ejekwu, C. P. Ekweani, E. J. Oha, "Evaluation of the Effects and Risks of Cost Estimation on Project Costs and Claims: A Study in Imo State, Nigeria," *Int. J. Environ. Eng. Educ.*, vol. 4, no. 2, pp. 36-47, 2022.

**Corresponding author:** Tobechi B. Ejekwu ([tobekjkw@gmail.com](mailto:tobekjkw@gmail.com)); **Digital Object Identifier (DOI):** <https://doi.org/10.55151/ijeedu.v4i2.75>

which otherwise would not be recoverable under the contract. Claims, therefore, by being a request for known but undetermined compensation inherently brew misunderstanding among the significant project participants. One way to effectively manage claim cases in project delivery consists of understudying the basis on which the construction contract that bonds the various participants is formed. The fundamental parameter for developing a valid contract is estimating the probable cost of executing the work. The process of deriving the estimate is engrossed in uncertainty (risks) for being an imprecise science [4].

Estimates are vulnerable to influence behaviors when allied to the desires of key parties to the construction contract in ensuring that a proposal secures funding and meets objectives [5]. These factors can undermine reliable cost estimation, represent risk and uncertainties, and affect project delivery. Assessment of project costs is, therefore, challenged by process risks. Dada and Jagboro agreed that related risks affect the cost estimating process and pose a great degree of threat to the price of a project [5]. A plethora of literature is available on risks in the building project delivery. According to Shapiro, each project risk may have uncertainty regarding the degree to which risk will manifest itself on a given project; identifying major risk factors is a relatively advanced science [6]. However, reducing the frequency and severity of claims is identifying these construction project risk factors, dealing with them, and providing for them in the construction or design contracts. Proper risk assessment is, therefore, an effective strategy to reduce claims incidences in construction contracts.

Estimating risk is inferred as 'risk involved with an estimate. This understanding is scaffolded from the premise that counting is an imprecise, scientifically engineered solution but the best guess of probability. Estimating risk exerts varying impacts on project design, including outstripping inclusions considered at the early stages of the project to mitigate unforeseen. Estimating risk can also impact construction processes by extinguishing the buffers for field conditions, thereby denying the project budget future allowance to unknown uncertainties. This implies that additional funding will be required for the project to proceed, or the scope of project design will be reduced; this is a significant source of claim and dispute. Project continuation is stiffened or even abandoned when additional funding is not met. Therefore, this study aims to evaluate the contribution of estimating risks on construction claims in building projects executed in Akwa Ibom State.

## 1.2. Statement of Research Problem

Estimating risks results in deviation, and these outcomes are obtained irrespective of the level of care and planning effort [7]. Younis, Wood, and Abdul-Malak [8] identified unfair and unclear risk allocation are root causes, and estimating risk (error) and exaggerated claims are proximate causes of disputes in construction. Estimating risk collectively leads to delay, poor design, and increased cost and quantities. According to Kululanga, Kuotcha, McCafer, and Edum-Fotwe [9], two of the four principal causes of disputes are estimating related risks: errors, defects, and omissions in contract documents underestimating the actual project cost in the beginning. Project risks can undermine reliable cost estimation, represent risk and uncertainties, and affect project delivery. Analysis of project costs is, therefore, challenged by process risks. Dada and Jagboro agreed that related risks affect the cost estimating process and pose a great degree of threat to the cost of a project. The contribution of the chance to cost overrun on project delivery globally is widely disseminated [5].

Construction project estimates may be the product of 'countless' historical cost data and based on bills of quantities precisely measured according to rules, but the frequency of claim is most timeous, like going to war during settlement. The impact of claims can threaten the viability of a project and cause severe financial and reputational damage to the organization. Delay claims and their attendant impacts are amongst the most insidious threats to the construction business. They lurk on any and every job done in a project, with serious legal, financial, and reputational consequences. Risks and claims are fundamental causes of disputes. According to Asuquo and Ogbu, claims involve significant time in preparation, assessment, and negotiation; the claim's outcome antagonizes the contracting firm's reputation and further inhibits project delivery in terms of standard of delivery and team integration. Faced with the dissatisfaction of making additional payments where successful claims cases generate unpleasant emotion in the client organization, communication breakdown, and subsequent disputes [10].

A way to resolve the complex problem lurking around claims and uncertainties in estimates is to understand the relatedness of these variables. This study, therefore, seeks to investigate the relationship between cost estimating risk, cost overrun, and project claims.

## 1.3. Aim and Objectives of the Study

To improve efficiency, the study investigates the relationship between cost estimating risks, project claims, and cost overrun in construction project delivery. The objectives of the study are to:

- a. Determine the critical cost estimating risks affecting claims in construction project delivery;
- b. Identify principal estimating risk-related claims contributing to cost overrun in construction project delivery; and
- c. Evaluate the effect of cost assessing risks on project claims and cost overrun in construction project delivery.

To achieve the goal of the study, the following research questions are set-out:

- a. What significant cost estimating risks influence claims and cost overruns in construction project delivery?
- b. What is the cost estimating risk-related project claims affecting project overrun?
- c. What is the relationship between cost estimating risk, project claims, and cost overrun in construction project delivery?

To achieve the aim of the study, the following hypothesis was set up There is a significant relationship between cost estimating risks, project claims, and cost overrun in construction project delivery.

The significance of this study is to provide practical information on the effects of the cost estimating risks on the budgeted cost during construction projects and their delivery. When delivered, this information will be helpful to estimators in determining what risk factors they are bound to encounter while estimating and the possible solutions to reduce their effects on the predetermined budget to a bearable limit.

This study focuses on the effect of construction cost estimating risks on project cost overrun and claims in Imo State. The study is limited to public building projects carried out in Owerri Municipal areas of Imo State. The reason for choosing these locations is that major general construction works are ongoing in those areas.

## 2. Literature Review

### 2.1. Nature of Construction Projects and Industry

The construction project includes everything that goes into building houses, offices, highways, and bridges and electricians, plumbers, and masons [11]. It can be subdivided into significant activity regions, including construction and civil engineering. Many building contracts, including some civil engineering work and vice versa, tend to complement each other. Generally, construction satisfies man's need for shelter and includes diverse structures such as residential offices, schools, and hospitals. [12].

Roads, bridges, reservoirs, and power plants are examples of civil engineering works. Civil engineering encompasses all the essential services required to make buildings functional. Public and private sectors undertake

construction projects, with the proportion shifting over time. Site acquisition, design, contract site operation (construction), and management are all aspects of construction projects. It has a significant impact on a country's economy. Because of the nature of construction business activities, processes, environment, and organization, construction projects are associated with a high level of risk [13], [14].

Construction project planners are often confronted with the challenge of maximizing the use of resources to compromise between different and usually conflicting issues and aspects of the project [15]. Close coordination is necessary among many specialized but independent organizations and individuals to achieve a construction project's cost, time, and quality goals [16].

### 2.2. Cost Estimating

According to Butcher and Demmers [17], a well-formulated prediction of the probable construction cost of a specific building project is referred to as cost estimating. Planners use cost estimates during the design process to provide detailed information about the facility and the project's budget. The first goal of a cost estimate is to inform you of the likely cost of construction work Budgeting, cost or value analysis, decision making, project planning, or project cost and schedule control processes all make use of cost estimates. Costs are estimated by calculating and forecasting future prices of resources and methods over a specified time [18]. Butcher and Demmers [17] believe that all projects begin with an idea and end by filling a need. Most conceptual design projects necessitate changes to produce a workable solution. Owners, architects, and builders increasingly rely on conceptual cost estimates as a starting point. Using it to determine how much a project will need and how much it will cost. During the project's design phase, this tool is constantly being improved.

All items in the general contractor's bid are included in the cost estimates. The cost estimate is created by breaking down the work items into standardized categories and calculating the cost of each item. Cost estimates are divided into components, elements, or divisions. For cost estimates, quantity surveyors will typically use a component format. Components are fundamental building parts or groups of building systems that perform specific functions. For comparison and analysis, construction costs are broken down by component.

Estimating costs predicts how much money, time, and resources will be required to complete a project, activity, or investment [19], [20]. The process of predicting the cost of a facility through quantitative analysis of the work required by the design documents is known as cost

estimating. Although clients do not always need detailed cost estimates, they can be critical to overall cost management and budget adherence [21]. The cost estimate produced by the estimating process is typically used to establish a project budget. However, it can also be used for other purposes, such as determining the economic feasibility of a project, evaluating project alternatives, and providing a foundation for project cost and schedule control.

### 2.2.1. Scope of Cost Estimating

Cost analysts must identify the customer's needs to determine an estimated scope. The cost estimator must determine whether the estimate is voluntary or mandated by law or policy. The Project Manager (PM) and the cost estimating team should collaborate to determine the scope of the cost estimate [22]. The size will be determined by factors such as the time required, which elements of the work must be estimated, who will develop the cost estimates, and the level of cost evaluating detail included [23].

The stage of the program's life cycle will affect the specificity of the cost estimate and the quantity of data to be collected. For instance, during the early stages of a project's life cycle, there may be no solid definition of the work involved. A life cycle cost estimate will likely not require extensive detail. As the program becomes more precisely defined, assessments should become more specific. Once cost analysts understand the estimate's context or the customer's requirements, they can estimate the project's scope based on its intended use and the availability of data [24].

### 2.2.2. Purpose of Cost Estimating

A cost estimate's scope and detail level are set by the context in which it will be used. There are two main functions of cost estimates [25]:

- a. To assist management in making informed decisions regarding the relative merits of potential systems and solutions, including their costs and how well they perform; and
- b. Estimates of the resources needed to implement a program effectively to aid the budgeting procedure.

### 2.2.3. Types of Estimates

Different estimates are prepared at various stages throughout a project's life. The phases of the project progress from the initial step to the final phase based on the information available at the time estimates are prepared. With the availability of more detailed information and an increase in project definition, the

expected accuracy range narrows as the project progresses and estimates are refined at successive stages [26].

For an estimate to be as precise as possible, it relies not only on the information about the project at hand but also on the knowledge, skill, and discretion of the person making the estimate. It is common practice to separate construction cost estimates into two broad categories: approximate and detailed.

- The Initial Approximate Estimates are created at the start of a project. These projections, called rough guesses or ballpark figures, are made to calculate a project's direct expenditures. After reviewing the estimated costs, the project owner will know if it is feasible to proceed with the project given the available funds. Depending on factors like site specifics and the building in question, there could be a few different ways to design a project. Using the designer's rough sketches and the estimator's knowledge of the project's budget, they can arrive at an estimate for the various options and choose the most cost-effective one [27].
- The complete set of contract documents serves as the basis for detailed estimates. As previously stated, contractors review the contract documents in detail to prepare estimates before submitting bids for the project. To pinpoint project cost factors, contractor personnel may visit the work-in-progress site and revise the estimate accordingly [28]. The bid price is the amount the owner will pay the contractor to complete the project following the contract documents, so a detailed cost estimate is vital for both the owner and the contractor.

### 2.2.4. Cost Estimating Risks

In the budget development phase of a project's lifecycle, estimating construction costs is one of the most critical tasks. However, it is frequently conducted under uncertain conditions. The preparation and precision of any cost estimate will depend heavily on the information and tools available during the various phases of the project. Due to their lack of accuracy, traditional cost estimation techniques have proven unsuitable for decision-making, particularly in the feasibility or evaluation phase [29]. During this phase, most budgets are created based on "cost per gross floor area" regardless of the impact of project risks on cost and time parameters.

Various cost estimation techniques exist, ranging from order of magnitude to artificial intelligence (AI). The estimator obtains cost rates from references, manuals, or databases in most of these techniques or methods. Typically, these are derived from previous projects or bids and must be modified for use [30].

According to previous research, 35% of federal construction projects in the United States experienced

budget-related issues [31]. However, there was a considerable variation (positive or negative) between the actual and contract costs of public projects in the United Arab Emirates, ranging from -28.50% to +36%, without any apparent pattern. These experts argued that using pre-design risk assessment techniques will improve cost estimation and thus improve decision making [30].

The project's cost efficiency will be enhanced by identifying potential sources of uncertainty in the cost estimate. Uncertainty about the risk is expressed in terms of the construction costs. A literature review uncovered the factors influencing construction project costs and assessed them as potential risks to estimating construction costs [5], [32]. The work classified cost estimation accuracy as financial issues, bidding situations, project characteristics, and the estimation process among previous studies on factors affecting construction costs [33]. According to Ashworth [34], The availability of design information, the type and quality of cost data, the type and size of the project, the number of bidders on competitive projects, the stability of market conditions, and individual factors all have an impact on how accurate construction cost estimates are.

### 2.3. Project Risks

Risks have been defined in different ways depending on the domain of human activity. In the construction project context, the US-based project management institute (PMI) [35] defines risk as "an uncertain event or condition that, if it occurs, will have a positive or negative effect on one or more of the project's objectives which are usually cost, time, scope and quality." Risk in construction has come to attention as a vital aspect to be considered because of the occurrence of cost and time overruns in a construction project [36].

#### 2.3.1. Fundamental Concept of Risk and Uncertainty

According to Odeyinka, there is a relationship between risk and uncertainties, as observed in the definitions of risk by the project management institute of America [37]. He said, in the opinion of Wideman [38], that risk is a measurable uncertainty. This then suggests certainty is a concept than risk. According to Odeyinka [39], the risk is when an event's probability and consequences can be estimated from historical records. In contrast, uncertainty is when there is a lack of knowledge about the likelihood of occurrence due to a lack of reliable data (known-unknown). The risk or possibility of oneself (unknown). These distinctions aid in the identification and development of suitable risk management measures. Puts it that sees risk and uncertainty as [40]:

a. Known-Knowns: The psychological condition of risk in which a risk source has been identified and a

probability of a risk event occurring given that source can be assigned;

- b. Known-Unknowns: The risk source has been identified, but it is impossible to assign a probability to the risk event occurring in this cognitive condition of uncertainty.;
- c. Unknowns-Knowns: is the cognitive state of uncertainty in which someone is aware of the risk source and associated probabilities but keeps that knowledge private.;
- d. Unknowns-Unknowns: is the cognitive state of uncertainty where the risk source has not been identified; consequently, the risk event cannot be predicted.

#### 2.3.2. Risk Theory in Cost Estimating Decision Making

Making decisions requires considering risk. The fact that it has been considered in decision theory, economics, behavioral and cognitive psychology, and management has confirmed its importance. Risk decision-making studies have adopted various methodologies over time. However, the rationalist, behavioral, cultural, and cognitive perspectives predominate.

Probability, mathematics, and economic theories are the foundation of the rationalist worldview [41]. Decision-making guidelines are provided by von Neumann and Morgenstern's modern utility theory in the context of project risk management. In expected utility theory, individuals are assumed to be rational and to maximize utility [42]. To put expected utility theory into practice, one must have accurate information about the probabilities of future outcomes. The breakthrough in understanding provided by the subjective expected utility theory provided the answer. Rather than being a given in the universe, all probabilities are considered a product of the individual's internal state. In addition, the mathematics of objective probabilities can be applied without issue if individual probabilities are ranked.

The behavioral perspective is a response to the limitation of the rational perspective. Proven to be a seminal study in the field of predicament analysis, according to Tversky & Kahneman [43], In making many intuitive judgments, research has shown that people use a variety of rule-of-thumb 'heuristics. This lessens the burden of processing information but can lead to skewed results. This literature review showed that asking respondents to rate their likelihood of an event was difficult. Heuristics and biases studies analyzed how decision-makers misused available information to assess possibilities. Despite this criticism, this study area explains poor probability judgments, which have implications for the risk management process assessment phase.

The cognitive perspective came because of the deficiencies of the rational and behavioral perspectives. The cognitive viewpoint acknowledges the significance of individual mental states. Additionally, it recognizes how little information a decision-maker can process. It considers the information processing and interpretation methods decision-makers use in their organizational context. Using a mental model of risk and uncertainty, they put the cognitive perspective into practice. This model distinguishes between risk (known, known) and delay (lack of knowledge – known unknown, unknown knowns, and unknown unknowns). It is cognitive because the perception of the possibility of future events lies within the individual decision-maker. It is, therefore, subjective as the decision-maker makes sense of their environment, processes the available information, and mentally constructs possible future states [40].

The cultural perspective considers the social and cultural context of the decision process and issues affecting the individual's responses to risk. Although studies in this area focused on understanding how power, social status, and political views influence an individual's group or organization's view of risk.

### 2.3.3. Cost Estimating Risks Associated with Cost Overrun

According to Winch [40], finding a project in which the initial contract sum is not exceeded at the end is difficult. This could be due to the inherent risks of construction. Under-estimation, the inadequacy of cash flow, completion delay, poor site investigation, change in scope of work, contractor default, defective construction work, and payment delay were identified as the eight most significant risk factors to focus on in traditionally procured projects [44]. Their research showed that the eight identified risk factors were responsible for 74.60% of the risk effects on the budgeted cost that led to a cost overrun. This means that the other 25.40% difference between the actual and budgeted costs would be due to additional risks. Different kinds of contracts have their chances. Lump sum contracting risks underestimating or overestimating the amount of work to be done. Unit price contracting carries the risk of underestimating or overestimating the amount of work to be done and missing or misjudging the subsurface conditions [45], [46].

### 2.4. Project Claims

Cost management and contract administration literature broadly recognized three categories: common law claims, ex-gratia claims, and contractual claims [22], [47], [48]. Common law claims arise from the breach of general contract under common law principle, and the causes of the related violations are unconnected with the express terms of the construction contract, and pecuniary

damages are often awarded in violations [2], [49]. Proper contract drafting to address foreseeable breaches addresses potential concerns arising from common law claim problems.

Ex-gratia claims are hitherto referred to as ex-contractual claims and are a form of discretionary payment based on sympathy with no strict legal obligation [3]. According to Ashworth, Hogg, and Higgs, the critical driver of payment on ex-gratia claims is a long-term relationship, exceptional level of satisfactory performance, project completion on time, and within specified standard and agreed price [22]. The cause incurred must be no fault of the contractor [48].

Contractual claims are the most problematic perspective with the pedigree of lingering disputes and detrimental effects of contractual relationships. Contractual claims arise from the contract's expressed provisions [3]. This implies that no claim in this category would succeed without necessary contractual clauses back-ups. Frequent clauses driving contractual claims include 'fluctuations, variations, an extension of time and loss or expense due to issues affecting regular progress of works. However, these clauses explicitly state the condition under which contractors are entitled to additional payment and extension of time. Murdoch and Hughes add that these clauses entitled a contractor to pay for loss of expense and a right for damages at the common law precinct [48]. However, the amount paid is never dictated by the "choice of action" adopted by the contractor, as the court's decisions in this regard are interpreted akin to common law damages. Cunningham [3], citing provisions in traditionally procured contract agreements in the Republic of Ireland, noted that loss of expense is a distinct form of common law damages based on three grounds: contractual claims are settled by the contract administrator (architects); there are requirements to comply with specified contractual guidelines, and claims under named provision can be submitted immediately the event occurs. Claims arising from specific contractual provisions of the prescribed contract form, and the contractor must have suffered a loss not reimbursed under the contract.

### 2.5. Cost Overrun

Cost performance means construction within budgeted cost as a fundamental criterion for any project to be successful [50]. In both developed and developing nations, the construction industry faces a significant challenge regarding per-cost performance. It is uncommon for construction projects to be completed within budget. This can be attributed to the multidisciplinary nature of the construction industry, which involves numerous parties such as internal experts, professionals, contractors, and suppliers, all impacting construction costs. [51]. Thus Azhar,

Farooqui, and Ahmed [52] list overrun as a common occurrence in the construction industry because nearly all projects in the building industry experience cost overruns.

Many factors contribute to cost overruns in the construction industry, which, if not properly managed, can lead to various unfavorable challenges and outcomes. Inadequate cost management in constitutional projects results in a massive charge, negatively impacting the country's physical and economic development, making it critical to complete construction projects within the estimated cost [50].

A few studies have identified factors of cost overall Mansfield, Ugwu, and Doran [53], state that price fluctuations, in the accurate estimate, delays, and additional works were the top variables causing construction cost overruns. Kaming, Olomolaiye, Holt, and Harris [54], seven factors relating to material cost increased by inflation, inaccurate quantity take-off, and lack of project type experience, among other factors, were identified as factors causing cost overruns. Cost performance is measured by comparing final cost against budget in initial cost and is posited as a primary criterion of the building project. Multiple inputs were used in his model, and all were successfully expressed in monetary terms.

A survey of contractors, consultants, and clients in Nigeria revealed 15 factors responsible for project delays and construction cost increases [55]. According to Omoregie and Radford, price fluctuation is the most severe cause of cost escalation [56]. This is attributable to the rising exchange rate, which affects the prices of construction materials and overall expenses. Identified 31 essential factors contributing to the construction cost in Nigeria, with project fraud and corruption ranking second. [57].

Some significant construction industry players perpetuate fraudulent practices and kickbacks occasioned by greed. Profitable firms may generate revenues from eliminating waste at professional and trade practice levels [34]. The project's requirements and features must be firmly established before beginning as one of the cost control measures. Additionally, it entails getting the project team ready to ratify roles and responsibilities, remaining enthusiastic about keeping the project on track, and effective human resource management via inspiring motivation and project tracking. Project tracking entails spotting potential trouble spots or dead ends early and taking appropriate corrective action [58].

## 2.6. Mitigation Cost Estimating Risks and Project Claims to Improve Cost Performance

### 2.6.1. Value Management

Value management can reduce the risk of an estimate by generating design options that can either increase the value or decrease the cost.

### 2.6.2. Effective Project Needs Analysis

Before committing to a particular delivery method, each construction project necessitates a thorough analysis. Before conflicts escalate, the parties on each project must assess specific characteristics and develop a collaborative, creative, and practical strategy for addressing and resolving them [6].

### 2.6.3. Effective Contract Strategies

Using contracts to achieve our goal of reducing the likelihood of legal conflict requires us to participate in various dispute prevention techniques. These include the following [59]:

- Equitable risk sharing; and
- Examples of such innovations are constructability analysis, cost and time controls, incentive programs, and new methods of awarding and delivering projects.

Owners often see the costs associated with implementing these methods as extra expenses. Despite this, the benefits to owners in the long run far outweigh the expenses.

## 3. Research Methods

### 3.1. Research Design

A research design is a comprehensive approach to integrating the various study components coherently and logically, ensuring that the research problems are successfully addressed. It acts as a manual for gathering, measuring, and analyzing data. This exploratory study employed quantitative techniques for research. Cooper and Schindler explained that Exploratory studies are a tool that permits a researcher to clarify concepts, establish priorities, develop operational definitions, and enhance the final research design [60]. It was therefore used in this study to generate a framework to address the problems of the study. The quantitative survey approach involved the use of structured questionnaires.

### 3.2. Location of the Study

The research covered Owerri metropolis in Imo state, where public construction works were ongoing. Imo state is in the southeastern part of Nigeria; It has a population of over 5 million. The essence of choosing Owerri metropolis was because the capital city hosts such ongoing public projects, which were all accessible.

### 3.3. Population

The population of this study consisted of cost management and estimating professionals in the construction industry in Imo state. Four professions were therefore found most suitable and currently perform cost estimating functions: builders, Architects, Engineers, and quantity surveyors. The list of professionals was obtained from their respective professional bodies: giving a total of 300 professionals. The samples were drawn from the above list using relevant sampling techniques and Taro Yamane.

### 3.4. Sample Size and Sampling Techniques

Sampling is the selection of items at random from a population and is used to test hypotheses about the people. Few models had been developed to estimate sample sizes. Therefore, to avoid error in data collection, the whole population could not be studied; hence the choice of selected population size was determined by simple random sampling. This technique employed a random distribution of the questionnaires to the professionals with an estimated sample size of 20% of their population. This gave a total of 60 sample sizes. Twenty percent (20%) was sampled due to time constraints.

### 3.5. Data Collection

Data were collected from primary sources based on the quantitative research methodology chosen for this study. The primary data were collected through questionnaire-based field surveys. For data collection, a self-administered questionnaire was utilized. Following a comprehensive literature review, the questionnaire was created by incorporating aspects from the reviewed literature.

A questionnaire is a carefully crafted instrument for collecting data according to the research questions specified. There were no open-ended questions among questions. Closed-ended questions consist of multiple-choice questions that require the respondent to select the correct response from a list of alternatives. The questions were simplified and structured so that respondents could provide relevant responses without being influenced by bias or unwillingness to answer. The questionnaires were divided into two sections. The first aimed to collect preliminary information about respondents, such as their names and the location of the respondent's organization, gender, academic qualifications, designation in the respondent's organization, years of experience, number of completed projects, project type, and professional level of qualification. The second section used a 5-point Likert scale to sample the expert opinion of the construction mentioned above industry professionals regarding construction cost estimating risks and their sources.

### 3.6. Data Analysis

The percentages and Relative Importance Index (RII) analyzed the survey data. Data analysis involved Statistical Package for the Social Sciences (SPSS), and obtained results were exported to Excel Worksheet for further data analysis.

## 4. Result and Discussions

### 4.1. Questionnaire Distribution Analysis

Sixty (60) copies of the questionnaire were distributed to the sample population, and fifty-four (54) were returned. This indicates an 88.52% response level.

**Table 1.** Questionnaire Distribution

Description	Total number	Percentage (%)
Questionnaires sent out	60.00	100.00
Questionnaires received	54.00	88.52

### 4.2. Respondent Characteristics

The respondent that completed the questionnaires were drawn from the construction companies.

**Table 2.** Type of Establishment

Establishment	Freq. (n=54)	Percentage (%)
Consultancy Firm	17.00	31.50
Contracting Firm	14.00	25.90
Client Organization	11.00	20.40
Public Organization	2.00	3.70
Academic	10.00	18.50

Table 2 shows the type of establishment to which the respondent belongs. It shows that 17 respondents (31.50%) belong to a consultancy firm, 14 respondents (25.90%) belong to a contracting firm, 11 respondents (20.40%) belong to a client organization, two respondents (3.70%) belong to the public organization, and ten respondents (18.50%) belong to academic.

**Table 3.** Academic Qualification

Academic Qualification	Freq. (n=54)	Percentage (%)
OND	5.00	9.30
HND	10.00	18.50
B.Sc./B.Tech.	24.00	44.40
M.Sc./M.Tech.	10.00	18.50
Pg.D	2.00	3.70
Ph.D	3.00	5.60

Table 3 indicates that five respondents had an academic qualification of OND with a score of 9.30%, 10 had HND with a score of 18.50%, and 24 had B.Sc./B.Tech. With a score of 44.40%, 10 had M.Sc./M.Tech. With a score of 18.50%, 2 had Pg.D. with a score of 3.70%, and 3 had Ph.D. with a score of 5.60%.

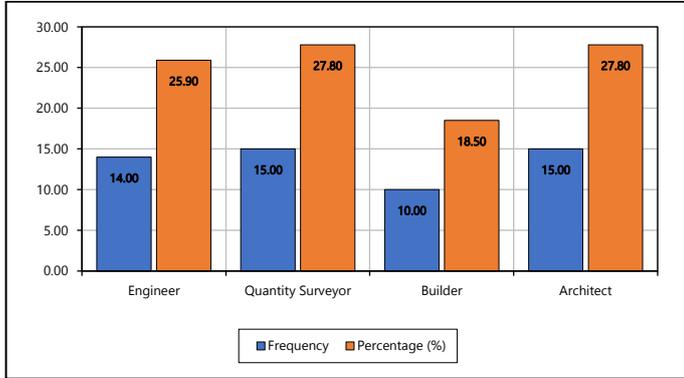


Figure 1. Designation of Respondent in the Establishment

Figure 1 shows that 14 were Engineers with a score of 25.90%, 15 were Quantity Surveyors with a score of 27.80%, 10 were Builders with a score of 18.50%, and 15 were Architects with a score of 27.80%.

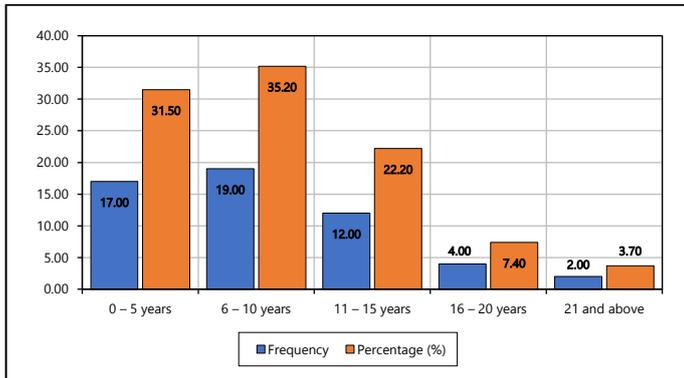


Figure 2. Work Experience

Figure 2 indicates that workers with 0-5 years post-qualification experience were 17 respondents with a score of 31.50%, 6-10 years post qualification experience were 19 respondents with a score of 35.20%, 11-15 years post qualification experience were 12 respondents with a score of 22.20%, 16-20 years post qualification experience were four respondents with a score of 7.40%, and 21 and above years post qualification experience were only two respondents with a score of 3.70%.

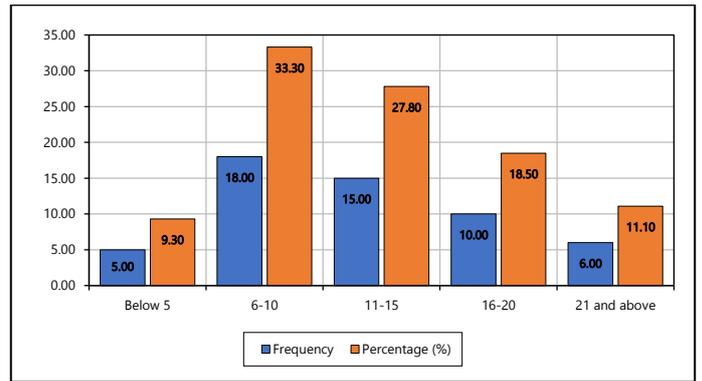


Figure 3. Number of Executed Projects Involved

Figure 3 shows that 9.30% of the sample population have participated in construction projects below 5, 33.30% participated between 6-10, 27.80% between 11-15, 18.50% between 16-20, and 11.10% participated in 21 and above construction projects.

Table 4. Type of Building Project Engaged In

Building Type	Freq. (n=54)	Percentage (%)
Residential	21.00	38.90
Religious	9.00	16.70
Commercial	12.00	22.20
Educational	10.00	18.50
Industrial	2.00	3.70

Table 4 shows that 38.90% of the respondents participated in residential buildings, 16.7% participated in religious building projects, 22.20 participated in commercial building projects, 18.50% participated in educational building projects, and 3.70% participated in industrial building projects.

Table 5. Type of Building Project Engaged In

Professional Institution	Freq. (n=54)	Percentage (%)
NIA	15.00	27.80
NSE	16.00	29.60
NIQS	13.00	24.10
NIOB	10.00	18.50

Table 5 shows that 27.80% of the respondent population are affiliated with NIA, 29.60% belong to NSE, 24.10% belong to NIQS, and 18.5% belong to NIOB.

Table 6. Type of Building Project Engaged In

Membership Level	Freq. (n=54)	Percentage (%)
Graduate Member	29.00	53.70
Corporate Member	25.00	46.30

Table 6 shows that 53.70% are graduates, and 46.30% are corporate members of their institutions.

#### 4.3. Presentation and Analysis of Questionnaire

Table 7 shows the results of the ranking show that the most significant cost estimating risk factor is design complexity with a relative importance index of 0.789, followed by preliminary design and specification with a relative importance index of 0.767, followed by an error in design specification with relative importance index of 0.748.

**Table 7.** Cost Estimating Risk Factors

Cost estimating risk factors	RII	Rank
Design complexity	0.789	1st
Incomplete design and specification	0.767	2nd
Error in design specification	0.748	3rd
Wrong source of cost estimating data	0.707	4th
Estimator's deficiency	0.704	5th
Quality of cost data	0.681	6th
Incomplete scope definition	0.667	7th
Inadequate time for estimating	0.663	8th
Unavailability of design information	0.644	9th
Error in judgment	0.630	10th

Table 8 shows the results of the ranking show that the most significant principal estimating risk-related claim is cost data with a relative importance index of 0.830, followed by defects in the project with a relative importance index of 0.781, followed by the estimator's expertise with relative importance index of 0.748

**Table 8.** Principal Estimating Risk-Related Claims

Principal Estimating Risk-Related Claims	RII	Rank
Cost Data	0.830	1st
Defects in the project	0.781	2nd
Estimator's expertise	0.748	3rd
Omissions in contract documents	0.711	4th
Poor design	0.659	5th
Organizational factors	0.656	6th

From Table 9 above, the results of the ranking show that the most significant effect of cost estimating risks on project claims and cost overrun is delay claims with a relative importance index of 0.859, followed by project delay with a relative importance index of 0.826, followed by a change in project scope with relative importance index of 0.767.

**Table 9.** Effect Of Cost Estimating Risks on Project Claims and Cost Overrun

Effect of Cost Estimating Risks	RII	Rank
Delay claims	0.859	1st
Project delay	0.826	2nd
Change in project scope	0.767	3rd
Over budgeting	0.722	4th
Poor site investigation	0.719	5th

The result reveals that design-related problems are the critical cost estimating risk factors resulting in project delays and contractual claims. Design complexity, Incomplete design specification, and error in design specification were ranked among the first three factors. This suggests that design plays a vital role in the accuracy of cost estimating and project delivery [61].

Availability of cost data was identified as the principal cost estimating risk-related claim. This finding underscores the importance of documentation and updating of cost data from projects as they occur to enrich the cost databases of projects. Furthermore, the estimator's ability to access current cost data from approved sources during estimation will significantly reduce cost estimating risks while improving project cost and delivery time.

Based on the field survey and the result presented above, the following point can be concluded: Cost estimating, like every other activity in the construction industry, is risk-filled. These risks were identified as: Design complexity, Incomplete design and specification, error in design specification, wrong source of cost estimating data, estimator's deficiency, quality of cost data, incomplete time for evaluating, and unavailability of design information and error in judgment.

This study also identified principal estimating risk-related claims, including cost data, project defects, estimator's expertise, omission in contract documents, poor design, and organization factors. The effect of cost estimating risks on project claims and cost overrun in construction project delivery was also identified. These were delay claims, project delays, project scope changes, budgeting, and poor site investigation.

## 5. Conclusion and Recommendation

### 5.1. Conclusion

This research sought out cost estimating risk factors, principal evaluating risk-related claims, and the effect of cost assessing risk on project claims and cost overrun in construction project delivery. To achieve the findings, professionals in the construction industry were visited to have a straight understanding of the experience. Various work from past authors was also consulted.

The inaccuracy in construction cost estimating gradually leads to claims and cost overruns in construction project delivery. This may be due to the risk involved in cost evaluation. To ensure that estimates are near accurate, estimators with adequate efficiency, proficiency, and experience should be involved in the estimating process.

## 5.2. Recommendation

The following recommendations were made:

- a. To reduce the risk involved in cost estimating, estimating should only be carried out by trained professional estimators.
- b. Ensuring proper market surveys on material and labor prices before estimating.
- c. Estimating should be done with well-completed drawings and details
- d. The estimators should understand the scope of construction projects before commencing estimating work.

## Acknowledgments

This research was thoroughly carried out with the support of Imo State University and Baze University, Nigeria

## References

- [1] O. C. Narh, E. E. Owusu, K. Oduro-Apeatu, and T.-W. J. Narh, "An exploratory study of professional conflicts and disputes within the construction industry," *Int. J. Manag. Stud. Res.*, vol. 3, no. 12, pp. 44–65, 2015.
- [2] W. Hughes, R. Champion, and J. Murdoch, *Construction contracts: law and management*. Routledge, 2015.
- [3] T. Cunningham, "Contractors' claims for loss and expense under the principle 'traditional' forms of Irish building contract," 2014.
- [4] A. F. Chalmers, *What is this thing called science?* Hackett Publishing, 2013.
- [5] J. O. Dada and G. O. Jagboro, "An evaluation of the impact of risk on project cost overrun in the Nigerian construction industry," *J. Financ. Manag. Prop. Constr.*, 2007.
- [6] B. S. Shapiro, "Construction claims and contracting strategies," 2004.
- [7] J. Adafin, J. O. B. Rotimi, and S. Wilkinson, "Risk impact assessments in project budget development: Architects' perspectives," *Archit. Eng. Des. Manag.*, vol. 12, no. 3, pp. 189–204, 2016.
- [8] G. Younis, G. Wood, and M. A. A. Malak, "Minimizing construction disputes: the relationship between risk allocation and behavioural attitudes," *Women's career Adv. Train. Dev.*, vol. 728, 2008.
- [9] G. K. Kululanga, W. Kuotcha, R. McCaffer, and F. Edum-Fotwe, "Construction contractors' claim process framework," *J. Constr. Eng. Manag.*, vol. 127, no. 4, pp. 309–314, 2001.
- [10] C. P. Ogbu and C. F. Asuquo, "Ethical and cost performances of projects: a canonical correlation," *Int. J. Ethics Syst.*, 2018.
- [11] P. Szymański, "Risk management in construction projects," *Procedia Eng.*, vol. 208, 2017.
- [12] I. H. Seeley, "The Construction Industry," in *Quantity Surveying Practice*, Springer, 1997.
- [13] I. Mahamid, "Contractors perspective toward factors affecting labor productivity in building construction," *Eng. Constr. Archit. Manag.*, 2013.
- [14] I. Mahamid, A. Al-Ghonamy, and M. Aichouni, "Major factors influencing employee productivity in the KSA public construction projects," *Int. J. Civ. Environ. Eng. IJCEE-IJENS*, vol. 14, no. 01, pp. 16–20, 2013.
- [15] A. Rezaian, "Time-cost-quality-risk of construction and development projects or investment," *Middle-East J. Sci. Res.*, vol. 10, no. 2, pp. 218–223, 2011.
- [16] T. M. Toole, "Information technology innovation: a view of large contractors," in *Construction Research Congress: Wind of Change: Integration and Innovation*, 2003, pp. 1–8.
- [17] N. Butcher and L. Demmers, *Cost estimating simplified*. Libris Design Project, 2003.
- [18] P. Christensen, L. R. Dysert, J. Bates, D. Burton, R. C. Creese, and J. Hollmann, "Cost Estimate Classification system-as applied in engineering, procurement, and construction for the process industries," *AACE Int. Recomm. Pract.*, pp. 1–30, 2005.
- [19] L. R. Dysert, "Sharpen your cost estimating skills," *Cost Eng.*, vol. 45, no. 6, p. 22, 2003.
- [20] L. R. Dysert, "An introduction to the certified estimating professional (CEP) certification," *Cost Eng.*, vol. 49, no. 8, p. 13, 2007.
- [21] M. D. Dell'Isola, "Detailed cost estimating," *Excerpt from Arch. Handb. Prof. Pr.*, pp. 1–13, 2003.
- [22] A. Ashworth, K. Hogg, and C. Higgs, *Willis's practice and procedure for the quantity surveyor*. John Wiley & Sons, 2013.
- [23] M. Brook, *Estimating and tendering for construction work*. Routledge, 2016.
- [24] A. Ashworth and M. Skitmore, "Accuracy in estimating," *Cost Model.*, 1999.
- [25] R. Flanagan and G. Norman, "Risk management and construction. Victoria, Australia." Blackwell Science Pty Ltd, 1993.
- [26] R. Flanagan and L. Marsh, "Measuring the costs and benefits of information technology in construction," *Eng. Constr. Archit. Manag.*, 2000.
- [27] C. Black, A. Akintoye, and E. Fitzgerald, "An analysis of success factors and benefits of partnering in construction," *Int. J. Proj. Manag.*, vol. 18, no. 6, pp. 423–434, 2000.
- [28] A. Akintoye and M. Beck, *Policy, management and finance of public-private partnerships*. John Wiley & Sons, 2009.
- [29] S. AlKass and A. Jard, "A conceptual cost estimating computer system for building projects," in *28th World Congress on Housing Challenges for the 21st Century*, 2000, pp. 15–19.
- [30] A. Abdou, J. Lewis, and S. Alzarooni, "Modelling risk for construction cost estimating and forecasting: a review," in

- [31] 20th Annual ARCOM Conference, 2004, vol. 1, pp. 141–152.
- [32] National Research Council, *Improving the accuracy of early cost estimates for federal construction projects*. National Academies Press, 1990.
- [33] N. J. Smith, *Appraisal, risk and uncertainty*. Thomas Telford, 2003.
- [34] A. A. Shash and N. H. Abdul-Hadi, "Factors affecting a contractor's mark-up size decision in Saudi Arabia," *Constr. Manag. Econ.*, vol. 10, no. 5, pp. 415–429, 1992.
- [35] A. Ashworth and S. Perera, *Cost studies of buildings*. Routledge, 2015.
- [36] Project Management Institute (PMI), "Driving Success in Challenging Times." 2012, [Online]. Available: <https://www.pmi.org/learning/thought-leadership/pulse/driving-success-in-challenging-times-2012>.
- [37] A. S. Akintoye and M. J. MacLeod, "Risk analysis and management in construction," *Int. J. Proj. Manag.*, vol. 15, no. 1, pp. 31–38, 1997.
- [38] H. Odeyinka and J. Lowe, "An analysis of the impacts of risks and uncertainties on construction cash flow forecast," in *RICS COBRA Conference*, 2001, pp. 37–47.
- [39] R. M. Wideman, "First principles of project management," *AEW Serv. Vancouver, BC Corp.*, 2000.
- [40] R. Eadie, M. Browne, H. Odeyinka, C. McKeown, and S. McNiff, "A survey of current status of and perceived changes required for BIM adoption in the UK," *Built Environ. Proj. Asset Manag.*, 2015.
- [41] G. M. Winch, *Managing construction projects*. John Wiley & Sons, 2009.
- [42] B. Bernstein, *Pedagogy, symbolic control, and identity: Theory, research, critique*, vol. 5. Rowman & Littlefield, 2000.
- [43] J. Von Neumann and O. Morgenstern, "Theory of games and economic behavior," in *Theory of games and economic behavior*, Princeton university press, 2007.
- [44] D. Kahneman and A. Tversky, "Prospect theory: An analysis of decision under risk," in *Handbook of the fundamentals of financial decision making: Part I*, World Scientific, 2013, pp. 99–127.
- [45] H. A. Odeyinka, J. Lowe, and A. Kaka, "An evaluation of risk factors impacting construction cash flow forecast," *J. Financ. Manag. Prop. Constr.*, 2008.
- [46] L. O. Oyewobi, A. D. Ibrahim, and B. O. Ganiyu, "Evaluating the impact of risk on contractor's tender figure in public buildings projects in Northern Nigeria," 2012.
- [47] J. E. Isimemen, "A Study of Risk Management Practices in the Nigerian Construction Industry,," 2014.
- [48] J. Ramus, S. Birchall, and P. Griffiths, "Contract Practice for Surveyors (Forth Edition)," *Elsevier, Gt. Britain*, 2006.
- [49] J. Murdoch and W. Hughes, *Construction contracts: law and management*. Routledge, 2002.
- [50] C. E. Mitchell, *Contract law and contract practice: bridging the gap between legal reasoning and commercial expectation*. Bloomsbury Publishing, 2013.
- [51] A. H. Memon and I. A. Rahman, "SEM-PLS analysis of inhibiting factors of cost performance for large construction projects in Malaysia: perspective of clients and consultants," *Sci. World J.*, vol. 2014, 2014.
- [52] S. L. Chan and M. Park, "Project cost estimation using principal component regression," *Constr. Manag. Econ.*, vol. 23, no. 3, pp. 295–304, 2005.
- [53] N. Azhar, R. U. Farooqui, and S. M. Ahmed, "Cost overrun factors in construction industry of Pakistan," in *First International Conference on Construction in Developing Countries (ICCIDC-I), Advancing and Integrating Construction Education, Research & Practice*, 2008, pp. 499–508.
- [54] N. R. Mansfield, O. O. Ugwu, and T. Doran, "Causes of delay and cost overruns in Nigerian construction projects," *Int. J. Proj. Manag.*, vol. 12, no. 4, pp. 254–260, 1994.
- [55] P. F. Kaming, P. O. Olomolaiye, G. D. Holt, and F. C. Harris, "Factors influencing craftsmen's productivity in Indonesia," *Int. J. Proj. Manag.*, vol. 15, no. 1, pp. 21–30, 1997.
- [56] A. Omoregie and D. Radford, "Infrastructure delays and cost escalation: Causes and effects in Nigeria," 2006.
- [57] A. Omoregie, O. J. Ebohon, and D. Radford, "Modelling in ranking procedures: a case study of infrastructure failures in Nigeria," 2005.
- [58] A. U. Elinwa and S. A. Buba, "Construction cost factors in Nigeria," *J. Constr. Eng. Manag.*, vol. 119, no. 4, pp. 698–713, 1993.
- [59] F. P. Eshofonie, "Factors affecting cost of construction in Nigeria," *Unpubl. M. Sc. thesis, Univ. Lagos, Akoka*, 2008.
- [60] L. E. Shapiro, *Mengajarkan Emotional Intelligence Pada Anak*. Jakarta, 1998.
- [61] D. R. Cooper, P. S. Schindler, and J. Sun, *Business Research Methods*, vol. 9. Mcgraw-hill New York, 2006.
- [62] A. A. Aibinu and G. O. Jagboro, "The effects of construction delays on project delivery in Nigerian construction industry," *Int. J. Proj. Manag.*, vol. 20, no. 8, pp. 593–599, 2002.

