

Rationalizing Critical Cost Overrun Factors on Public Sector Housing Programmes

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Abstract

The cost overrun phenomenon on projects worldwide creates a major source of risk that warrants investigation. The prevailing factor school of thought provides strong empirical evidence that critical factors contributing to cost overruns are both context-specific and project-specific. Although many studies have been conducted identifying factors and causes of cost overruns, very few studies have investigated root causes. Additionally, a limited body of knowledge is available within the context of Small Island Development States (SIDS). To fill this gap, the objectives of this study were to identify and determine the main critical factors contributing to the cost overrun phenomenon in public sector social housing programmes (PSSHPs). These selected factors were thereafter categorized under leading root causes, and their severity was determined based on primary stakeholders' perspectives. One hundred and twenty-three factors were identified from the literature, of which forty-one critical factors were extracted and grouped under four root causes based on a pilot survey of relevant public sector housing experts in the Trinidadian and Jamaican construction sectors. These refined factors and root causes were formulated into a questionnaire survey. One hundred and five responses were obtained from professionals who had a minimum of five years' experience in various phases of public housing delivery. The severity of these critical factors was evaluated, ranked, and categorized using the relative importance index (RII) approach. The findings uncovered the leading root cause, which is political in nature. The top five critical factors are the selection of politically aligned contractors, the intentional design of inadequate contracts, the project actors' deliberately underestimating costs, the partisan project management team, and strategic misrepresentation. These findings are unique to SIDS and contribute to knowledge to reframe contemporary project management practices, which focus mainly on technical causes. Finally, as existing technical solutions are ineffective in curbing cost overruns in PSSHPs, these findings also inform public sector policymakers to focus on prioritization, control, and mitigation of political risks in formulating effective governance mechanisms.

Keywords:

Construction Projects;
Public Housing;
Root Causes;
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1- Introduction

Estimating the costs of construction projects is inherently difficult and woefully misleading [1]. Cost overruns are a global phenomenon in the construction industry, and billion-dollar overruns are not uncommon [2]. For example, the Channel Tunnel project was completed with an approximate £2.05 billion cost overrun, or 80% beyond budgeted costs [3]. Cost estimates for the London 2012 Olympic Games were traced from an initial estimate of £1.8 billion in 2002 to a revised budget of £9.325 billion [4]. Budget overruns on single megaprojects frequently exceed the annual revenues of the majority of the Caribbean Small Island Developing States (SIDS) [5]. Global research into this phenomenon has

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confirmed the thesis that project cost overruns are common [6, 7] and are even accepted as a standard in the public sector [8]. The acceptance of cost overruns is serious news for SIDS. SIDS, as defined by the United Nations, have unique economic structures and differ from those of developed and developing countries. These developing islands typically lack oversight, structure, procedures, processes, and regulatory frameworks [9] and depend on financial and technical inputs from developed economies [10]. The availability of funds to complete much-needed critical infrastructure is reduced by cost overruns on other inefficient projects [11], ultimately limiting infrastructure and economic development [12].

In Trinidad and Tobago, a Caribbean SIDS, the construction industry is relatively large, responsive, and can be used to manipulate the national economy [9]. Data from the Central Statistics Office of Trinidad and Tobago, shown in Figure 1, revealed a sharp decline in the growth rate of the construction sector, from 28% in 2008 to a negative (-ve) 31.4% in 2010, indicating a strong contraction attributable to the 2008 global financial crisis [13]. Adapting to these external economic shocks, a new government administration in 2010, and the implementation of policies to ease the global financial crisis, the construction sector steadily rebounded to 6.6% by 2013. However, between the periods 2013 and 2015, the construction sector steadily declined by 0.2%, and stagnated from 2015-2020 at a negative (-ve) 3% growth rate [14]. Further contraction in the construction industry is expected from mandatory government shutdowns due to the implications of the COVID-19 pandemic [15].

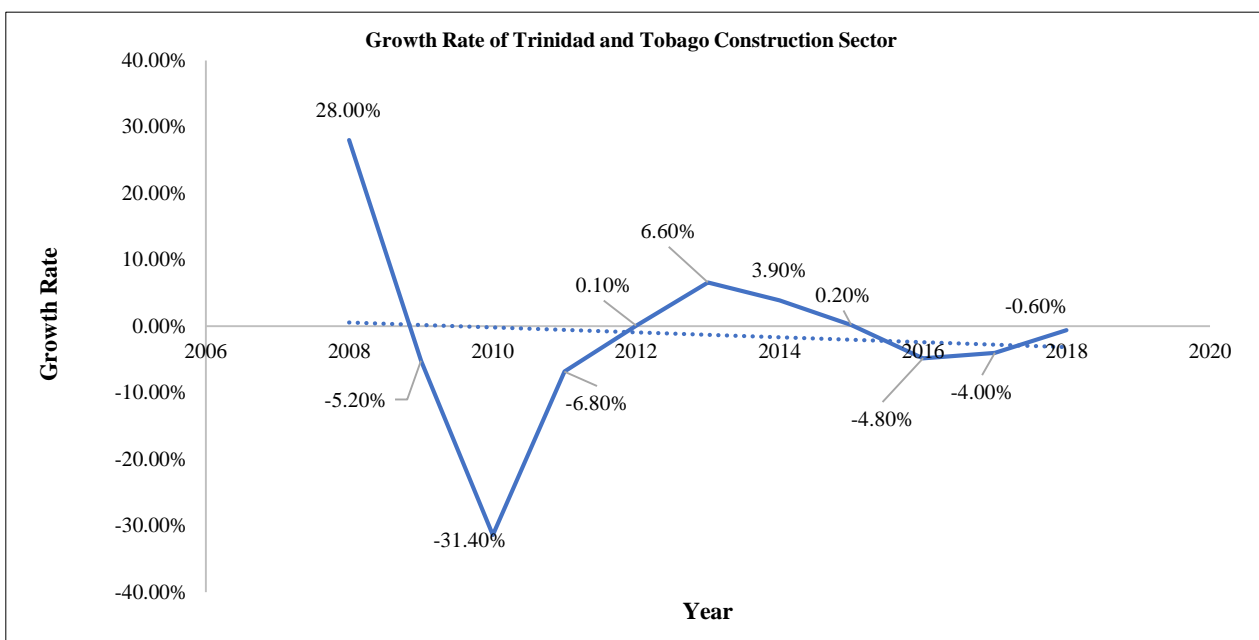


Figure 1. The 10-year rate of growth of the Construction Sector in Trinidad and Tobago (Central Statistics Office 2021)

Undoubtedly, the construction industry's contributions influence a country's gross domestic product (GDP) and overall economic development. Tangible benefits are derived from the provision of infrastructure, which can also be used as a measure to gauge a nation's wealth [16]. Thus, one of the main challenges of Caribbean SIDS is to provide sustainable infrastructure [17]. This is achieved through several infrastructure development program initiatives, one being public housing. Major programs, such as public sector social housing programs (PSSHPs), are strategic social change initiatives funded largely by taxpayers to improve the standard of living and self-development of a nation's citizenry [9]. These programs are complex, multi-billion-dollar transformative programs spanning several years in duration, with the aim of providing a beneficial outcome of subsidised affordable housing with associated utilities and amenities. Electricity, water and wastewater, and other amenities such as paved roads, streetlights, and community and commercial spaces, are usually added benefits provided by the state for citizens belonging to the lower income earning bracket. To promote affordability, the government subsidised costs related to infrastructural development [18, 19], and further subsidies are available which are dependent on the particular government's housing policies.

The PSSHPs are plagued by cost overruns [12]. Cost overruns exceeding 100% are not an uncommon occurrence during the construction and execution of these programs [20]. Despite the continuous poor performance of social infrastructure projects in terms of cost [21], the need for adequate basic infrastructure and the benefits derived through infrastructure provision voids formal financial feasibility projections. Overruns in the hundreds of millions of dollars on several large-scale projects can negatively affect the annual economic projections of emerging and developing economies. This risk is more pronounced in the small and volatile economies of SIDS due to their dependence on external economic interventions to finance and support infrastructure development [17, 22, and 23]. Thus, the monitoring, evaluating, and reporting of cost performance are necessary conditions to fulfill the accountability processes

in public sector projects. Although cost reporting is a fundamental part of the construction management process, PSSHPs infrequently achieve planned budgetary requirements. Consequently, the cost data's sufficiency and veracity come under scrutiny when projects suffer from cost overruns [9].

Based on the above challenges of cost inefficiencies in SIDS's PSSHPs, this research aims to uncover the leading root cause and determine the associated critical factors of cost overruns. The aim was achieved through two main objectives. First, critical factors are extracted from the vast international body of scholarly literature. A pilot survey identified applicable critical factors (or causes) of cost overruns and their subsequent groupings into root cause categories. A diverse panel of experienced professionals associated with PSSHPs was selected to review the general listing of international critical factors in an effort to reduce, extract, and validate factors applicable within the Caribbean SIDS context. The second objective was to rank and understand the leading critical factors and root causes. Critical factors or causes derived from the pilot survey were structured into a questionnaire, a popular survey tool used to gather perceptions from professional stakeholders involved in PSSHPs delivery (contractors, client PMs, and consulting professionals). The results of the questionnaire were used to answer the following research questions:

- *What are the critical factors contributing to cost overruns in PSSHP in Caribbean SIDS?*
- *What are the rankings of the severity of the selected cost overrun caused by the difference in perceptions among primary stakeholders (client, contractor, and consultant)?*
- *Are there differences in perceptions of cost overrun causation among the primary stakeholders in PSSHP, i.e., client representatives, consultants, and contractors?*

2- Literature Review

The worldwide popularity and acceptance of the "iron triangle" [24], identifying time, quality, and costs as the three key criteria to measure success in project and construction management, gives credence to the critical and potentially leading role cost estimation plays in construction. Cost is considered the most critical measure of performance [25] from a stakeholder's perspective and is used as a measure of efficiency [26]. Yet, a commonality in construction projects is a shortfall in cost performance, the leading cause of cost overruns. One view offered on the resistant nature of cost overruns stems from the lack of a universal theory in project management [27, 28]. Evidently, this view is justified by the variability of cost overrun definitions [2]. While there exists closer congruency on the transparency and acceptability of the final cost definition on projects as the actual cost expended, less consensus prevails on the definition of initial project costs. Specifically, what constitutes these costs and where the frame of reference is drawn [6, 29–34].

The lack of a reference frame and, more so, a universal theory explaining cost underestimation and overruns can give rise to the proliferation of critical risk factors (or causes) in the causal chain of events leading to cost overruns. Despite this, there is scholarly concurrence that cost overruns on projects cannot be universally generalized as several project characteristics are unique and context-specific, i.e., vary from country to country [35], and are based on contingencies such as size, type [29], location [36], time, and geography [37]. An acceptable approach to addressing cost overruns as a universal phenomenon is to investigate and rationalize the root causes of cost overruns within a given context [38]. The most prominent root causes of cost overruns debated in the last decade are technical, political, socio-economic and psychological.

2-1- Technical Root Cause and Causative Factors

Cost overruns can determine either the completion or termination of a project. Performance shortfalls on construction projects that lead to cost overruns are shown to be the consequence of a multiplicity of factors. Technical risks that arise throughout the project life cycle are the most common type of explanation. Technical risks, defined as risks involving "the issues associated with design, engineering, construction, and operation of projects" [39], are frequently investigated in scholarship. Leading authorities such as Morris & Hough (1987) [40], and Brunes & Lind (2014) [41] suggest that key technical factors contributing to the success or failure of a project have been identified as technical uncertainty (i.e., poorly defined project objectives), innovation (novel) projects, schedule duration (schedule error), and legal implications. Unknown risks lead to uncertainty, which consequently results in a lack of understanding, capturing and quantifying such risks. Merewitz (1973) [42] identified unknowns (e.g., natural disasters such as earthquakes) as a contributing factor to cost overruns on construction projects. According to Higgins & Perera (2018) [43], unknown risks include all those risks "that cannot be identified in advance". Some factors are difficult to predict, and this can lead to a certain level of uncertainty within any project [44]. Other factors such as client-initiated variation, sub-surface conditions, and inexperience [45-50] are among the leading technical risks contributing to cost overruns on public sector construction projects. Scope changes, omissions, rework/errors, conditions associated with project procurement, and variables and conditions propagating design errors are the leading critical factors contributing to cost overruns [51-53]. Such errors are believed to occur because of the independent work nature of structural engineers and architects, with limited design coordination within the diverse project teams.

Forecasting, planning, and decision-making theories support the influence of technical issues on project outcomes. Forecasting theory focuses on estimating uncertain future outcomes and predicting their success [54]. Accordingly, these forecasting models were utilized to better understand project issues and their accompanying errors. For example, a poor cost estimate can result from an inappropriate forecasting technique, but through an iterative due diligence approach, these errors can be addressed to improve the forecasting technique and cost estimate. Planning theory depicts how projects and their policies are established [55]. However, a common issue that occurs in tandem with cost overruns and mismanagement is that of inappropriate planning processes and the implementation of sub-par designs [54]. Decision-making theory, however, is quite arbitrary, with limited control. This theory reflects the governing body's ability or inability to execute a series of decisions based on its needs and interests. Each of these theories provides both an analytical and critical sense of the causal chain's cause-and-effect in construction cost overruns. All things considered, these factors explain and dictate the completion of a project or if it is hindered by obstacles such as cost overruns. The technical factors influencing SIDS are shown in Table 1.

Table 1. Technical causes/factors of cost overruns

| Critical factors (CRFs) | Authors Reference |
|--|--------------------------|
| Natural Unknown events (e.g., Earthquake) | [42,43] |
| Poorly defined project objectives | [40, 41, 56] |
| Innovative (Novel) project | [40, 57] |
| Schedule duration (Schedule error) | [40, 58-62] |
| Legal implementation | [40, 63] |
| Design change | [51, 61, 64-71] |
| Client initiated variation | [45-47, 60,72] |
| Sub-surface conditions | [45, 46, 48, 49] |
| Project procurement array of conditions variables and conditions propagating design errors | [27, 53, 61] [52, 53] |
| Underestimation | [27, 32, 49, 68, 73] |
| Omission | [52, 74] |
| Scope Change | [38, 52] |
| Rework/Errors | [52, 60, 75-77] |
| Poor Project Control | [20, 35, 50] |
| Communication | [61, 78, 79] |
| Inexperience/Inadequate Skill | [20, 50, 68, 79-82] |
| Materials | [60, 61] |
| Equipment and machinery | [61, 62] |
| Poor resource management | [50, 69, 83] |
| Severe weather conditions | [84, 85] |
| Unrealistic contract durations and requirements | [50, 86] |
| Slow inspection of completed works | [67, 82, 87] |
| Price fluctuations | [78, 88] |
| Poor project design and implementation | [54, 62] |
| Incomplete/Inaccurate estimations | [54, 79, 89] |

2-2- Political Causative Factors

Cost underestimation goes beyond technical factors and includes influences of a political nature. From an outside view, beyond project and organisational perspectives, unexpected changes in the political system of the relevant host country's foreign policies account for political risks of a macroeconomic nature [39]. An alternative explanation for political risks are based on Machiavellianism and Agency theory, such as strategic misrepresentation or questionable practices intended to deceive the client or principal. This explanation suggests that project actors strategically underestimate costs to improve the likelihood of project acceptance and funding [90]. In developing economies such as Nigeria, Dada and Jagboro [91] identified direct political influences, together with financial risks, as the leading factors causing cost overruns in the construction industry. This finding aligns with a conclusive statement that cost underestimation is more prevalent in developing nations than in North America and Europe [32]. Critical causative factors such as ministerial interference or public sector client interference [92] usually manifest in the form of changes

to decisions, policies, and approvals. An instance of the direct influence of politics on projects captured a 23% higher cost for projects receiving funding commitments during an election campaign [93]. Love et al. (2018) [53] observed that politicians use rudimentary project estimates in advance in order to fulfill pre-election commitments to attract voters. They argued, however, that the primary definitions accepted internationally to measure cost overruns vastly affected the percentage of overrun on a project. Thus, using the "decision to build" as a point of reference, i.e., when the project is first announced in parliament and selected for commencement, instead of the "contract award" point of reference, i.e., when contracts are officially signed off by contracting parties, to measure initial costs against total final costs, leads to higher cost overrun once the project is executed.

With agency and self-interests at play, construction contracts can be intentionally designed with flaws, such as deliberate omissions, errors, and imposed requirements [50]. In the absence of thorough due diligence verification, agents are able to gain financially at the expense of the project, and ultimately, the public. Imposed requirements, such as unrealistic duration and over-specification of plants, materials, and equipment, are examples of significant factors affecting final construction costs. Flyvbjerg et al. (2018) [6] stated that the intentional distortion of truth, i.e., lying, by planners and forecasters is the practice of strategic misrepresentation. This deceptive practice of underestimating costs and overestimating benefits leads to the approval of sub-optimal projects over more socially beneficial and viable ones. Consequently, strategic misrepresenting of project feasibility can lead to the act of "early commitment" of resources and finances. This results in negative outcomes once the early commitment turns into "escalating commitment" of resources, a known indicator of lock-in [94] on projects. The main political and causal factors contributing to cost overruns on public sector construction projects are summarised in Table 2.

Table 2. Critical Risk Group (Root Cause) - Political

| Cost overrun factors (CRFs) | Authors Reference |
|--|---------------------------|
| Strategic Misrepresentation e.g., Underestimating cost | [3, 6, 30, 32, 95-98] |
| escalating commitment | [30, 99] |
| Pre-election commitments | [53] |
| Ministerial interference | [92] |
| Direct political influences | [91, 100] |
| Project actors underestimating cost | [27, 32, 40, 53, 97, 101] |
| Selecting politically aligned contractors | [100, 102] |
| Political business cycles (Election cycles) | [93] |
| Governance shortfall in the organisation | [103-105] |
| Contract Poorly designed (intentionally) | [50, 54] |
| Selection of political aligned PM team | [106] |
| Project actors overestimating benefits | [32, 97] |
| Inappropriate Government Policies | [107, 108] |

2-3- Socioeconomic Root Cause and Causative Factors

Social and economic risk factors for cost overruns overlap and are rooted in terms of welfare and economic rationality. Chan et al. (1997) [39] explained social risk causation via unforeseen social and cultural behaviours or customs and economic risk through changes in the external market conditions of the local community and wider nationality. On a construction project, there are risk factors that are within the control of the project team and shareholders, and strategies can be quickly formulated to mitigate against potential unwanted impacts on the project. Then there are uncontrollable factors that reside beyond the control of primary stakeholders. Social and cultural behaviours influence economic considerations, and explanations for cost overruns, which reside within the public interest, can be either controllable or uncontrollable. Issues such as lengthy bureaucratic processes (i.e., excessive bureaucracy in project-owned operation), acquiring regulatory approvals (i.e., permits) [58, 81, 109], delayed payments [88], financial shortfall, and community involvement [40] are controllable socioeconomic factors. Other primary cost overrun factors in the Middle East region include exchange rate fluctuations, price fluctuations, market financial instability, strikes, external or internal military actions, and border closures. Labour strikes and shortages contribute greatly to project delays and cost overruns [110, 111]. Additional uncontrollable socioeconomic factors such as the global financial crisis, economic business cycles [6, 112] and exploitation [113] have negatively affected construction projects' costs and overall performance. Table 3 summarises critical socioeconomic factors applicable to the Caribbean SIDS.

Table 3. Critical Risk Group (Root Cause) - Socio-Economical

| Critical factors (CRFs) | Authors Reference |
|--|-----------------------|
| Financial Shortfall | [14, 40] |
| Community involvement | [40, 99] |
| Labour strikes | [88, 105, 110] |
| Shortage of labour | [72, 110] |
| lengthy bureaucratic processes | [41, 50, 81, 111-115] |
| Economic business cycles | [6, 112] |
| Acquiring regulatory approvals | [81, 109] |
| Exploitation | [99, 113] |
| Global financial crisis | [58, 81] |
| Delayed Payments | [88, 116, 117] |
| Delayed materials and equipment | [118-120] |
| High interest rates/ inflation | [35, 88, 121-123] |
| Abandonment of Project | [118] |
| Machinery and Equipment failure | [88, 105] |
| Transportation cost for labour, equipment and materials to and from site | [70, 124, 125] |
| Failure and availability of equipment | [126] |
| Price fluctuations | [127-129] |
| Shortage of skilled and unskilled labourers | [130] |

2-4- Psychological Root Cause and Associated Causative Factors

Psychological factors have roots in the social sciences and behavioral schools of thought. Authorities in cognitive psychology assert that decision-makers are not always rational, and risk attitudes and behaviours deviate from what are perceived as optimal. However, errors in judgement were found not to be random but predictable, based on a series of cognitive biases shared by both professionals and laypeople. Cognitive bias (e.g. heuristics) during decision making was deemed to be an influential variable affecting the processes of estimating and establishing contingencies on projects [131–135]. Prospect theory captures biases in human judgment under risk and uncertainty [136]. Prospect theory shows that decisions under risk are framed as gains and losses, and these decisions are based on an arbitrary individual reference point. Risk-seeking behaviours for losses were found to be more pronounced than risk-averse behaviours for gains. This leads to the planning fallacy [137, 138], where decision-makers underestimate key metrics of cost, time, and risks and overstate benefits by focusing on the components of a specific planned action, also known as taking the "inside view" [139]. Such appraisal optimism and the presence of cognitive biases among project planners and promoters [41, 140] also account for cost overruns and benefit shortfalls.

Furthermore, Cantarelli et al. (2010) [30] investigated over commitment/lock-in and its influence on project performance. The escalation of commitment to ineffective decisions on sub-optimal projects leads to "lock-in" on a project, and funds are committed beyond budgeted sums to ensure the completion of the project. Lock-in can occur at the decision-making and project level and is likely based on either a psychological explanation, such as the "monumental complex" of politicians and builders to construct magnificent time-tested structures, or a political explanation, such as strategic misrepresentation, or the complementary power of both psychological and political explanations. Similarly, prejudices, such as personal preferences and favouritism, can be accounted for under the psychological or political root causes of cost overruns. Table 4 summarises critical psychological factors applicable to the Caribbean SIDS.

Table 4. Critical Risk Group (Root Cause) - Psychological

| Cost overrun factors (CRFs) | Authors Reference |
|--|----------------------------------|
| Optimism bias/ appraisal optimism | [6, 30, 32, 33, 41, 97, 98, 141] |
| Overcommitment/ lock-in | [9, 30, 54, 142, 143] |
| Cautious attitude towards risks | [54] |
| Cognitive biases (e.g., anchoring, framing, Dunning–Kruger effect) | [3, 27, 31, 54, 134-136] |
| Prejudices (discrimination, favouritism) | [81, 144-146] |

3- Research Methodology

This study is fact-finding in nature and aligns with the contingency and factor schools of thought. That is, the cost overrun phenomenon is context-specific, based on geographic location, economic outlook, and industry conditions [35, 36]. The study adopted a positivist theoretical perspective, i.e., reality exists independently of the phenomenon under investigation, by first determining the critical factors and root causes contributing to cost overruns on PSSHPs. Secondly, the study ranks the severity of these factors based on the industry's practices unique to SIDS.

To achieve these objectives, a three-stage deductive approach formed the research design. This encompassed a To achieve these objectives, a three-stage deductive approach formed the research design. This encompassed a qualitative literature survey to gather data, a pilot survey using an expert panel to select factors applicable to SIDS, and the final quantitative closed-ended questionnaire to collect, analyse, and rank data from practitioners' perspectives. A comprehensive literature survey was undertaken as the first stage to gather peer-reviewed secondary data on critical factors and root causes of cost overruns on construction projects. The following keywords were utilised to search relevant databases (Emerald, Elsevier, and Google Scholar): construction, projects, public sector, social housing, infrastructure, cost overruns, underestimation, critical factors, and root causes. Three verification steps were carried out to improve the reliability and validity of the results. Abstracts and conclusions of potential articles were reviewed and screened to ensure scope alignment. One hundred sixty-four articles were selected from this initial screening process. Based on an additional verification criterion of the minimum requirement of double-blinded peer-reviewed articles, together with the inclusion of relevant indexing of the respective article's journal, the 164 initially selected articles were further screened and limited to 81 articles. Critical factors were then extracted from these articles and thereafter subjected to a further verification stage. This step entails removing duplication (i.e., same reported factors) and merging conflating factors (i.e., factors with similar meanings). This first step identified 142 critical factors and nine root causes of cost overruns.

The second step of the research approach was to select and extract from these 142 critical factors from the literature survey those which are applicable to SIDS, and in particular, factors influencing contemporary issues in public housing projects in the Caribbean. It should be noted that there was a scarcity of literature for Caribbean SIDS [12]. Since the assumption of context specificity for the cost overrun phenomenon was adopted, a pilot survey using experts in social housing programmes was undertaken to review the 142 critical factors extracted from authorities in developed and developing nations, and to select those factors considered applicable within the Caribbean context. The pilot survey was deemed the preferred tool to reduce critical factors identified in the international literature for further purposive sampling. The pilot survey panel was comprised of eight experts: a senior quantity surveyor with over 40 years' experience in social housing; three senior project managers from Jamaica and Trinidad and Tobago, each with more than 18 years of public housing experience; an attorney at law specializing in construction and contract law with 15 years' experience; a retired consultant with over 40 years' experience in designing and administering public housing, and two contractors' representatives with over 20 years of successfully constructing public housing and related infrastructure works. A first draft of the questionnaire was developed to include critical factors and probable root cause groupings. A qualitative comment section was included to capture tacit knowledge from the experts and as a measure of self-correcting inquiry. Through a refinement and methodological coherence process [147], the outcomes of the pilot survey yielded 41 critical factors and 4 root causes of cost overruns for PSSHPs.

Results from the pilot survey were subsequently used in the formulation of a closed-ended survey questionnaire, which consisted of two sections. The closed-ended questionnaire is one of the popular research survey instruments adopted in construction management research to collect and collate the industry's perception of critical factors influencing the success or failure of projects [68, 69, 82, 119, 148-150]. The first section introduced the respondents to the aim and purpose of the survey, clearly indicating that participation in this survey was entirely voluntary and they could withdraw at any time in the process. Demographic information was requested, such as location, job position, education background, experience, sector of employment, nature of the company, number of employees, number of projects, and size of projects (in contract value). The second part of the questionnaire required the respondents to rate each of the 41 critical factors in terms of the severity of such an occurrence of cost overruns. A 7-point Likert scale allowed each respondent's rating to be organised in order of priority. The 7-point scale for severity rating was ordered, where 1 = extremely low, 2 = very low, 3 = low, 4 = moderate, 5 = high, 6 = very high, and 7 = extremely high.

This questionnaire was subsequently administered to relevant construction and public housing stakeholders. These stakeholders were segmented into 3 groups, namely client representatives, contractor representatives, and consultants. Client representatives are comprised of managers, engineers, quantity surveyors, and other professional-related staff from the state agency (Ministry of Housing and Urban Development) and all regulatory agencies associated with public housing approvals. Contractor representatives selected were owners, directors, senior engineers, and project managers involved in the various delivery phases of infrastructure and housing. Consultants consist of architects, engineers, quantity surveyors, and project managers. Figure 2 provides a flowchart of the research process.

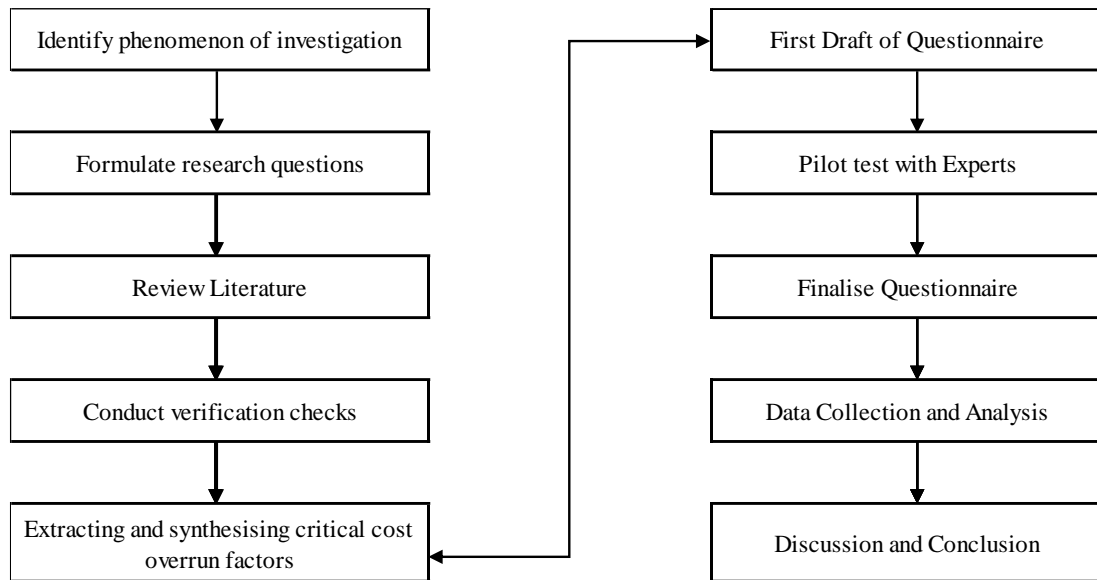


Figure 2. Flowchart of research activities

4- Results

4-1- Demographics

Questionnaire responses from 159 participants were determined to be representative for further analysis. However, for the critical factors selected for SIDS, tacit knowledge and experience from participants are key assumptions in understanding the effect of these critical factors (for example, political cycles) and their root causal influences on PSSHPs. Consequently, responses from participants with less than 5 years’ experience were deemed unsuitable for the purposes of this study as they would not have been adequately exposed to various contracting strategies, organizational influences, interactions, and communication with all the primary stakeholders throughout the life cycles of various projects. As such, fifty-four participants were eliminated, bringing the final sample size to 105. Respondents included 49 client representatives, which comprised 47% of the final sample size. The remaining 53% of the sample size includes 26 consultants (25%) and 30 contractor representatives (28%), respectively, as displayed in Figure 3. These percentages are also indicative of public sector (47%) and private sector (53%) inputs into this study.

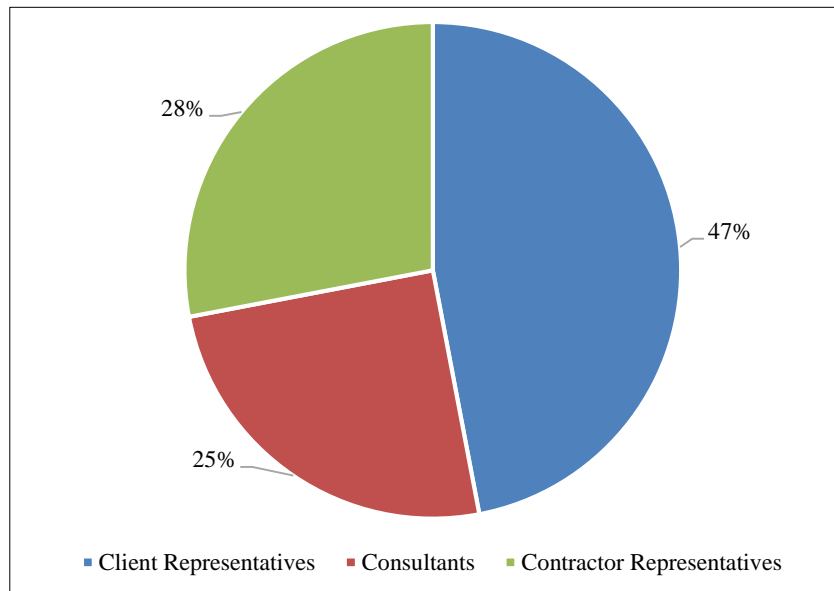


Figure 3. Percentage of responses from primary stakeholders

The background of the respondents’ qualifications are illustrated in Figure 4. The sample size is considered highly qualified, with 90 (86%) of the 105 participants awarded a minimum of a Bachelor of Science (B.Sc.) degree, while 14% obtained qualifications at a diploma level and possessed other professional certifications.

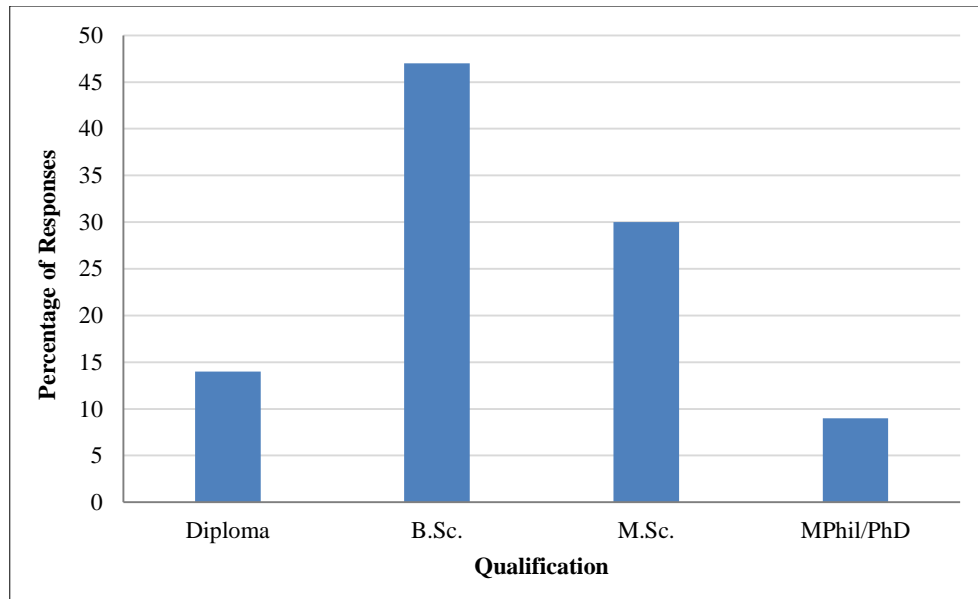


Figure 4. Education demographic of survey participants

Table 5 provides an overall summary of the demographics surveyed.

Table 5. Demographic of Respondents

| Experience (years) | Participants | | |
|--------------------|--------------|-------------|-------------|
| | Client | Consultants | Contractors |
| 6-10 | 20 | 12 | 11 |
| 11-15 | 9 | 8 | 6 |
| 16-20 | 10 | 1 | 3 |
| > 20 | 10 | 5 | 10 |
| Total | 49 | 26 | 30 |

4-2- Relative Important Index (RII)

The results were tabulated in a spreadsheet and ranked using the relative importance index (RII) [45], as follows:

$$RII = \frac{\sum w}{A \times N} \quad (0 \leq index \leq 1) \quad (1)$$

where w = weighting given to each factor by the respondents and ranges from “1” (Extremely low) – “7” (Extremely high); A = highest weight (7), and N = total number of respondents (Overall: 105).

The RII for the top 20 critical factors, ranked by severity, are summarised in Table 6.

Table 6. Severity of cost overruns causes

| Factors | Client Representative | | Contractor | | Consultant | | Overall | |
|---|-----------------------|------|------------|------|------------|------|---------|------|
| | RII | Rank | RII | Rank | RII | Rank | RII | Rank |
| Intentional inefficiencies in Contract drafting and formulation. | 0.872 | 1 | 0.945 | 1 | 0.844 | 1 | 0.866 | 1 |
| Deliberate underestimating cost to gain management approvals | 0.870 | 2 | 0.912 | 8 | 0.820 | 3 | 0.850 | 2 |
| lengthy bureaucratic processes | 0.857 | 4 | 0.901 | 11 | 0.818 | 4 | 0.842 | 3 |
| Strategic Misrepresentation i.e., lying | 0.86 | 3 | 0.923 | 5 | 0.81 | 6 | 0.841 | 4 |
| Direct political influences (i.e., politician influences, location & type of project) | 0.827 | 10 | 0.945 | 1 | 0.827 | 2 | 0.838 | 5 |
| Selection of politically aligned contractors | 0.85 | 5 | 0.879 | 13 | 0.818 | 4 | 0.837 | 6 |
| Ministerial (senior public servant officials) interference | 0.840 | 7 | 0.934 | 4 | 0.803 | 7 | 0.831 | 7 |
| Deliberate overestimating the project benefits | 0.842 | 6 | 0.912 | 8 | 0.801 | 8 | 0.829 | 8 |
| Selection of political aligned project management team | 0.840 | 7 | 0.923 | 5 | 0.797 | 9 | 0.827 | 9 |
| Pre-election commitments | 0.835 | 9 | 0.945 | 1 | 0.79 | 11 | 0.824 | 10 |

| | | | | | | | | |
|---------------------------|-------|----|-------|----|-------|----|-------|----|
| Underestimation | 0.815 | 12 | 0.912 | 8 | 0.779 | 12 | 0.807 | 11 |
| Escalating commitment | 0.82 | 11 | 0.923 | 5 | 0.773 | 13 | 0.807 | 11 |
| Design change | 0.805 | 13 | 0.791 | 16 | 0.792 | 10 | 0.797 | 13 |
| Labour strikes | 0.799 | 14 | 0.89 | 12 | 0.74 | 19 | 0.779 | 14 |
| Political election cycles | 0.754 | 17 | 0.78 | 18 | 0.766 | 14 | 0.763 | 15 |
| Rework/Errors | 0.764 | 15 | 0.758 | 20 | 0.755 | 16 | 0.759 | 16 |
| Governance shortfall | 0.739 | 19 | 0.813 | 14 | 0.764 | 15 | 0.758 | 17 |
| Technical uncertainty | 0.764 | 15 | 0.78 | 18 | 0.747 | 17 | 0.757 | 18 |
| Optimism bias | 0.734 | 20 | 0.736 | 23 | 0.745 | 18 | 0.739 | 19 |

4-3- Spearman Rank Correlation

The Spearman's rank correlation was implemented to investigate the relationship between two sets of measurements and test the hypothesis of no agreement between the two groups while ignoring the third group [151]. The rank correlation coefficient (r) is calculated using the formula:

$$r_s = 1 - \frac{6 \sum d^2_i}{n(n^2-1)} \quad (2)$$

where " r_s " is the Spearman's rank correlation coefficient, " d " is the difference between the rank indicated by each group, and " n " the number of factor.

The correlation coefficient represents the strength and direction of agreement between two groups for an individual critical cost overrun factor. The value of the correlation coefficient varies between +1 (a perfect positive relationship) and -1 (a perfect negative relationship), while a value close to zero indicates no relationship. The main advantage of Spearman's rank correlation as a non-parametric test, i.e., it does not require the assumption of normality or homogeneity of variance [152]. Hence, for a given level of significance and two-tailed test, the null hypothesis (H_o) of no agreement is rejected if the calculated value exceeds the critical value (r_o). Thus, the Spearman's rank correlation test was carried out on the severity of the factors between pair groups "Client and Contractor", "Client and Consultant", and "Contractor/Consultant," and the results are shown in Table 7.

Table 7. Spearman rank correlation coefficient for severity

| Groups | r | Significance level |
|---------------------------|-------|--------------------|
| Client and Contractor | 0.919 | 0.95 |
| Client and Consultant | 0.962 | 0.95 |
| Contractor and Consultant | 0.925 | 0.95 |

A 96.2% degree of agreement was observed between the client and the consultant grouping, while the lowest degree of agreement was 91.2% between the client and the contractor grouping. The high values of the rank correlation coefficient indicate a very strong agreement between group pairs in ranking cost overrun causes and provide an indication that the results can be dependable [152].

5- Discussion

To address the continued increase in demand to supply cost-effective quality public housing in Caribbean SIDS, this study provides an intervention mechanism to focus on the true identity and nature of root causal influences contributing to cost overruns in PSSHPs. Root causal influences were structured into four groupings: political, technical, socioeconomic, and psychological. The data obtained from 105 experienced project/construction management professionals provided sufficient evidence to support political influences, and not technical ones, as the leading root cause of cost overruns within the context of PSSHPs in SIDS. Overall, eleven out of the top twelve factors are politically motivated. These findings are unique to SIDS and substantially differ from most of the literature on cost overruns in construction management. It exposes the vulnerabilities of the construction profession associated with the malleability of professionals' behaviours to political will and pressures. The above findings expose gaps in the current theoretical focus in construction management. Contemporary solutions, processes, practices, and bodies of knowledge derived to treat the cost overrun phenomenon are heavily technically focused and structured to reduce technical influences compared to much-needed solutions to treat political influences.

The deliberate preparation and drafting of contractual documentation to allow for weaknesses in contract administration (RII = 0.866) was the top-ranked factor among the three primary stakeholders. Weaknesses are created in the terms and conditions of the contract, structured with either ambiguity or inefficiencies to allow for exploitation

via claims and variations. Such structural tactics lead to complacency in enforcing employer claims, and this action can also be recognized as a causal effect during the execution of these types of construction contracts. For example, claims for liquidated damages for work delayed by partisan contractors are either ignored or incentivised through the determination, or granting of, prolongation time and costs. Traditionally, in developing nations, the project team's experience, knowledge, or competence are questioned (overall RII = 0.605, rank = 37/41) [20, 150]. This is not the case in the administration of PSSHP, where all project team members are technically trained, and the leadership of these projects is experienced-based. Individuals with less than five years' experience are typically not assigned to any form of leadership role based on the state agency's organizational hierarchy. Given the prevalence of cost overruns in the administration of PSSHPs, there is reason to question whether experienced professionals understand and exploit weaknesses and loopholes in public sector project administration, such as lengthy bureaucratic processes (RII = 0.842, rank = 3rd).

The second overall ranked factor is "project actors deliberately underestimating the cost to gain management approval" (RII = 0.85). This type of cost misrepresentation was identified over thirty years ago, and the title of this seminal work, "When Planners Lie with Numbers" [95], holds true to modern practices. The rationale for underestimating costs is to increase acceptance when alternative projects compete for scarce funding. Sensitivity analyses such as benefit-cost analysis are typically performed, and projects with the highest benefit-cost ratio signal that more benefits are derived at a lower cost. To improve the favorability of a particular project, project actors deliberately overestimate the benefits a project provides for the community and, by extension, the island nation, to justify its viability (RII = 0.829, rank = 8th). These two factors can also be incorporated into strategic misrepresentation (RII = 0.841, rank = 4th) or the use of deceptive practices by project planners and forecasters to gain the favorability of a project [11]. However, there was a need to identify and prioritise cost underestimation separate and apart from benefit overestimation, and the results showed precedence in cost manipulation as against the need to inflate justification of the benefits derived from the project to society. To create a veil of transparency, selecting a politically aligned project management team (RII = 0.838, rank = 5th), for example, design consultants, team leads, directors, and managers, is a necessary input as this technical support is required for the justification of project type, location, size, scope, cost, contractors, and contracting strategy.

From the contractors' perspectives, three factors were first ranked (RII = 0.945): intentional inefficiencies in contract drafting and formulation, direct political influences (i.e., politician influences, location and type of project), and pre-election commitments. These factors are closely followed by ministerial interference (RII = 0.934) by key senior public servants. Contractors and politicians may have existing social interactions and, coupled with interferences by public servants wielding positional power, create an agency relationship that strongly influences the public organization's procurement process. This agency relationship can potentially sway the likelihood of the successful award of public housing projects to partisan-aligned contractors. Several contractors' representatives openly discuss the campaign financing of both government and opposition parties as a business continuity mechanism due to the limited availability of projects executed annually in the Caribbean SIDS. Campaign financing is not a guarantee for contractors to win contracts; it is a mechanism not to be sidelined from participating in the selected tendering process within state agencies.

It is acknowledged that these findings are from a small sample size and perceptions drawn from the rank priority of political influences are circumstantial. This suggests that caution is warranted when generalizing these findings and drawing conclusions for the project population. However, the pattern of deception in decision-making cannot be ignored. Getting more experts to openly talk about actual intentional strategic acts to favour a flawed project outcome can strengthen these findings and promote policy reforms in the award and administration of PSSHPs. For example, as stated by one PSSHP expert (postgraduate training with 20 years of experience), contracts can be used as ammunition to remove nonpartisan contractors who were successful in obtaining contracts based on financial and technical merit. These contractors are used to commence and progress works to a certain point or milestone on a project. Thereafter, the partisan project team will issue notices to these contractors to suspend work based on non-compliance with contractual terms and conditions such as quality assurance and quality control, specifications, and schedule commitments. Payments are also intentionally withheld for the actual value of work completed. Without formal contract administration support, unaware contractors will either be frustrated out of the contract or terminated without payment. These same contracts are then awarded to partisan contractors at a similar initial contract amount, even though substantial elements of the work were previously completed to acceptable quality levels. This type of cost overrun is hidden as a new contract is awarded for the project under a different budgetary heading. Some of these contractors are unable to seek remedies in the courts because of outstanding money for work completed being withheld by the state agency. Those who can afford to seek redress through the courts will typically wait between five and ten years for the high court to award a judgement. Meanwhile, they may suffer the ill fate of being "blacklisted" from other jobs due to the ongoing legal battle with the organization or being statute barred from expired claims. Blacklisting is not limited to one state organization, and contractors have to weigh this option within their mitigation strategy as compared to the probability of being successful in other tendering processes among state organizations. These types of experiences shared by experts do not help to build credibility within PSSHPs in SIDS, and scholarship from developed nations is silent on this issue.

Consultants also recognized intentional inefficient contracts (RII = 0.844), direct political influences (RII = 0.827), and the deliberate underestimation of costs to gain project acceptance (RII = 0.820) as the top three leading causes of cost overruns. These politically-driven factors place a herculean burden on independent consultants to steer contracts toward meeting performance-driven objectives. Notwithstanding this, underestimating costs and weak contractual frameworks are formulas for failure, and subsequent technical remedies have little impact on controlling overruns in costs and time. Generally, fierce competition for engineering (conceptual and design) and management work is often the scenario in the consultancy business. Those who follow directives, no matter how unethical or inefficient they may be, increase their chances of being chosen and/or retained for future work. Inadvertently, the continued compliance of political and organizational directives without the necessary critical analysis and resistance to stymie sub-par results shifts the transparency and independence values required of the consultants to those of translucence and partisanship. Decisions made are meant to justify political and organizational directives and do not necessarily have viability for project optimization. This misalignment of decision-making due to political and organizational pressures versus project and societal needs can be attributed to agency issues among the primary project actors (client representative–consultant–contractor). When left unchecked, interests, influence, and power [6, 32] supersede societal needs for affordable and safe public housing. Similar sentiments were conveyed by a senior consultant; once you are in the organization's favour, a constant stream of future work is guaranteed, thus bypassing competition. A conflict of interest occurs when, for example, the award of both retainer contracts to individual consultants for advisory roles and contracts to the same consultant's company on individual projects. Without any immediate governance control, or more so, the erosion of existing governance controls, the above has become a common practice, or cultural norm, of consultancy in several state agencies. Not surprisingly, out of the 41 applicable factors for SIDS, the politically aligned project management team was ranked fifth by contractors (RII = 0.923), seventh by client representatives (RII = 0.840) and ninth by consultants (RII = 0.797).

The key question that now remains unanswered is how project professionals can stymie the pervasive nature of political influence. Firstly, literature over the last thirty years heavily favored the technical school of thought, and thus technical-related factors [40, 52, 62] dominated scholarly debate. Technical factors are indeed contributors, but not root contributors. Wachs' (1989) [95] seminal work was one of the first documented instances of interviewing planners who admitted to strategically misrepresenting cost estimates to improve the favorability of a project's acceptance for implementation. Over the next two decades, Flyvbjerg's subsequent works paved the way for the behavioral school of thought, uncovering cost overruns through political and psychological lenses [3, 6, 11, 21]. However, within the last decade, there has been a growing trend of authorities diving deeper into corrupt practices, incorporating principal-agent factors, politics, and partisanship [100, 102, and 146]. This is a very sensitive topic in Caribbean SIDS, and expressing it publicly is considered a form of malfeasance. The culture of acceptance and adapting to the inferior resultant outcomes of critical societal infrastructural issues and social threats by adopting a "brushing issues under the rug" or "out of sight, out of mind" mind-set is typical among public sector professionals. Secondly, although there are numerous allegations and several legal indictments in the Caribbean, with an increase in reported cases during election campaign periods, none has led to a successful conviction. For registered engineers, reviews of professional practices and conduct are seldom undertaken, even though ethical infractions have been reported by a Commission of Enquiry [154]. Engineering associations are not rigorously advocating this topic. Behaviours are based on the trust and rectitude of the professional. There are minimal incentives and penalties for registered professionals to conduct themselves with the ethical standards ascribed by the membership codes of conduct. Currently, minimal effort is placed into establishing formal mentorship programmes to build a framework of guidance and advice for young professionals.

It is acknowledged that issues discussed in the findings provide circumstantial evidence based on perceptions gathered and analysed by professionals with a minimum of five years' experience in delivering different facets of PSSHPs. More research is needed to understand why the root causes of cost overruns are so common. Deeper inquiries and reflections into both the systematic and systemic nature of the cost overruns phenomenon, through different theoretical lenses and methodologies, are warranted. To supplement these findings, it is suggested that investigations into actual PSSHP performance over 5-year political cycles be conducted to determine whether different administrations and their political policies influence the nature and outcomes of cost overruns. Critical case studies are also recommended to extract contextually grounded emic views, process traces, cost creep and leakages to rationalize how the planning and implementation of PSSHPs can influence society and social interactions. To further add to the body of knowledge on cost overrun causation in SIDS, the development of a decision risk-based strategy can be incorporated into PSSHPs and extended to add value to public social infrastructure policies. This can be initiated through the extraction of critical cost risks and root influences from experienced practitioners' perceptions and the utilization of complex risk evaluation tools, such as Fuzzy Synthetic Evaluation (FSE), to convert fuzzified perceptions into crisp numbers and develop an overall critical risk index [36, 155]. This will provide an empirical guide for public policy administrators to demonstrate the risks of trusting the original cost estimates for PSSHPs. However, due to the resistant nature of decades of cost overruns documented in the literature [6, 21, and 153], decision-making theories on risk and uncertainty, such as Prospect Theory and Expected Utility Theory, should be revisited as knowledge is continually being updated in various contexts of cost overrun studies. The above approaches will narrow the theoretical gap and allow knowledge to be generalized in the interest of public sector projects worldwide.

6- Conclusion

There is consensus within project and construction management that the cost overrun phenomenon is context-specific and contingent on but not limited to, the geographic location and economic structure of the country. The necessity of uncovering and understanding cost overruns is justified as it negatively affects society and planned public infrastructure development. This study adds a unique grouping of Caribbean SIDS to the body of knowledge to make international comparisons and generalizations possible. The first objective was to identify factors contributing to the cost overrun phenomenon from leading authorities and to determine the critical factors applicable to PSSHPs in the Caribbean. Of the 142 salient factors identified, 41 were deemed critical factors or causes applicable to Caribbean SIDS through a pilot survey of eight experts. Secondly, as listing critical factors has limited praxes, these 41 critical causes were further analysed and segmented under four root causes. Thirdly, based on primary stakeholders' (client, consultant, and contractor) perspectives, critical factors were ranked by their corresponding severity ratings to uncover the true root causes and influences.

The findings revealed that the leading critical causes, and ultimately, the leading root cause category for cost overruns, were political in nature. The Spearman's rank correlation coefficients obtained showed a strong positive agreement between groups; a 92% correlation between client and contractor, 96% between client and consultants, and 93% between consultants and contractors. "Intentional inefficiencies in contract drafting and formulation" and "project actors deliberately underestimating the cost of gaining management approval" are the most severe factors, with an overall RII of 0.866 and 0.85, respectively. The main construction contract stakeholders are aware of active practices to award PSSHP contracts based on partisanship and strategic misrepresentation (RII = 0.841). Underestimation of costs (RII = 0.85) and scope (RII = 0.807) and overestimation of benefits (RII = 0.829) are common methods used by client representatives and consultants to justify the viability of projects. These findings are context-specific, thus limiting the generalizability of the results. In this regard, the findings are unique to Caribbean SIDS and are contrary to the multitude of authorities from developed and developing nations, which primarily suggest cost overruns originated from technical causes. However, a comparison can be drawn from similar results in transportation projects, where the data supports Wach (1989) [95] and Flyvbjerg et al. (2002) [32] claims that the root causes of cost overruns are not technical in nature but political in nature. Consequently, these findings have far-reaching policy implications that require further investigations into reframing contemporary project practices derived from technical inputs to solutions based on political and social causes. Future research is warranted to regulate the cost overrun phenomenon because, without immediate intervention, the culture of cost overrun acceptance will continue unchecked and unabated.

7- Declarations

7-1- Author Contributions

Conceptualization, A.C. and H.M.; methodology, A.C., and H.M.; software, A.C.; validation, A.C., F.O. and H.M.; formal analysis, A.C.; investigation, A.C.; resources, A.C.; data curation, A.C.; writing—original draft preparation, A.C.; writing—review and editing, A.C. and H.M.; visualization, A.C.; supervision, A.C. and A.M, and H.M.; project administration, A.C., F.O and A.M.; funding acquisition, A.C. and A.M. All authors have read and agreed to the published version of the manuscript.

7-2- Data Availability Statement

The data presented in this study are available upon request from the corresponding author.

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7-5- Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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