JCBM (2023) 6(1) 17-32

**University of Cape Town**
Journal of Construction Business and Management
http://journals.uct.ac.za/index.php/jcbm

# An Investigation into Construction Tender Price Inflation: A Documentary Review

[1]Moffat Tembo, [2]Charles Kahanji and [3]Erastus Misheng'u Mwanaumo

[1&2]Department of Civil and Environmental Engineering, University of Zambia, Zambia.
[3]College of Science, Engineering and Technology, University of South Africa.

Received 29 October 2022; received in revised form 06 December 2023, 09 February 2023 and 23 Apr 2023; accepted 20 May 2023
https://doi.org/10.1564/jcbm.6.2.1287

**Abstract**

The essentiality of public infrastructure delivery cannot be over-stressed. However, there is a need to challenge existing practices and poor performance and focus on the value of public infrastructure to attain sustainable improvement in the public construction sector. Like many developing countries, Zambia's public construction sector experiences numerous challenges that create a vicious cycle. This research provides a base for further investigations regarding construction tender-price inflation and highlights the urgent need to manage the phenomenon. The data generated by this baseline study is critical to measure the degree and extent of construction tender price change between 2008 and 2018. The multiple-case design allows the study to perform a documentary review and cross-case analysis regarding the tender-price phenomena. The study also adopts a pattern-matching analysis to identify behaviours and practices of case firms regarding construction project implementation. The paper finds inherent project management challenges associated with case firms, including late engagement of supervising consultants, delayed payments, poor contract or project management practices, poor quality of works, a lack of detailed engineering designs, questionable award of contracts, and delayed project implementation. By comparing the construction-project-management approaches of case firms, the study finds that construction tender prices increased by an average of 31.4% per annum for upgrading roads to bituminous standards between 2008 and 2018. In addition, the study finds areas requiring prioritization to address construction tender price inflation include late engagement of supervising consultants, delayed payments, and poor contract or project management practices. Other notable factors requiring attention include poor quality of work, lack of detailed engineering designs, delayed project implementation, and questionable contract awards. The study offers a practical implication: addressing tender price inflation adds economic value to public projects and enhances public institutions' appetite for construction infrastructure development.

**Keywords:** construction, public sector, road projects, tender-price inflation.

## 1. Introduction

The construction industry's contribution to economic growth and long-term national development is widely acknowledged (Isa, Jimoh & Achuenu, 2013; Lopes, Oliveira & Abreu, 2011; Berk & Biçen, 2018; Oladinrin, Ogunsemi, & Aje, 2012; and Khan, 2008) mainly to developing countries with the nature of construction industry and its importance in development being critical areas of primary concern (Oladinrin et al., 2012; and Osei, 2013). Elements of the process of construction industry development that include ways and means of improving the performance of construction firms, focusing on contractors, technology development, and the parameters of performance in the industry, such as productivity and environmental performance, are focal points in modern times. These areas of concern influence the formulation of policies and legislation for establishing construction industry management and process re-engineering development models. Historically, the construction industry has experienced continuous higher prices, a continued decline in productivity, and extremely high levels of waste. Actual socioeconomic needs to deliver a project with higher quality, lower cost, and quickly challenge the traditional way of managing construction projects (Soares, 2013). For the benefit of developing countries, it is crucial to investigate the nature, essential

[1] Corresponding Author
Email address: tembomoffat@yahoo.com

characteristics, and particular requirements of the construction industry and to use them to develop programs for its improvement.

The worldwide chronic problems associated with the construction industry include low productivity, poor safety, inferior working conditions, inadequate financing, and insufficient quality (Ramachandra & Bamidele-Rotimi, 2015; Proverbs & Cheok, 2000). Widespread problems in the construction industry in most developing countries also include project cost overruns and schedule delays, which affect the broader and general economy, ranging from poor allocative efficiency to total project abandonment (Gbahabo and Ajuwon, 2017). Wambui, Ombui, and Kagiri (2015) found that one of the significant factors affecting public-sector construction project completion is the availability of project funds. Several solutions relieve these problems in construction, with industrialization, prefabrication, and modularization being one direction of progress. Computer-integrated construction is a critical way to reduce fragmentation in construction, which is considered a significant cause of existing problems (Nawi, Baluch & Bahauddin, 2014). Other solutions include robotized and automated construction (Kamaruddin, Mohammad & Mahbuba, 2016), closely associated with computer-integrated construction. With several varying answers to the construction industry's challenges, all the long-standing solutions require developing a tailor-made methodology that constitutes problem identification, redesigning, implementation, and continuous change in the construction industry (Shakun & Deepa, 2018).

Higher construction prices have been one of the general challenges in the industry, which require devising methods by clients to control project cost from the onset of the project at the bidding stage (Zhang, Luo & He, 2015). As contractors develop strategies in pricing for projects, the clients are equally equipping themselves with capabilities to make informed decisions on individual prices (Stramarcos & Cattell, 2013). To that effect, Valence & Runeson (n. d.) researched to explore and understand decisive factors and contributory processes involved in pricing decisions by contractors. Research findings suggest that awarding construction projects follows a common criterion of price consideration. However, from an investment and project cost perspective, arguments support that tender competitions with a high focus on price by using the lowest bid criterion ironically result in the most expensive project (Meland, Robertsen & Hannas, 2011).

Like several developing countries, Zambia's public construction sector experiences numerous challenges that create a vicious cycle. The research has identified problems concerning the study country (Zambia), including marginal participation of local contractors, particularly on large projects; erratic funding of public infrastructure projects; and a lack of tangible results. Others include the multiplier effect in public projects, political interference, and general increases in bid prices (Tembo et al., 2020). The essentiality of public infrastructure delivery cannot be over-stressed. However, there is a need to challenge existing practices and poor performance and focus on the value that public infrastructure can deliver to attain sustainable improvement in the public construction sector. This research opines that the situation warrants developing a model that promotes ambitious performance targets in the delivery of public infrastructure by making radical changes to the process of public project delivery.

Successful construction project implementation requires making the right decisions during the tendering process by tightly managing tender procedures (Mohemad, Hamdan, Othman & Noor, 2010). The biggest problem at this point is attempting to execute a process holistically impacted by various factors. Some require judgmental projections into future broader markets and specific industry conditions. Since the construction industry is massive and highly competitive, the issues of contract pricing have become exceptionally complex matters to address (Akintoye and Skitmore, 1990). Broader economic conditions contribute to fluctuating construction tender prices, which increase expenditure uncertainties for clients who attempt to forecast construction prices in the sector (Kissi, Adjei-Kumi, Amoah, & Gyimah, 2018). In Zambia, negative perceptions of construction tender-price variableness threaten desirable infrastructure push in the public sector.

The damaging effects of escalating tender prices outweigh the socioeconomic benefits of such infrastructure. If not addressed, this harmful effect is destructive to construction sector productivity, causing it to lag behind other economic sectors, thereby decreasing the sector's value in the national economy. This paper addresses the issue regarding higher construction prices and allows for the devising of methods by clients to control project costs from the project's onset at the bidding stage. The paper correspondingly equips clients with the capabilities to make informed decisions on individual prices. Therefore, the study further aims to explore and understand decisive factors and contributory processes involved in tender pricing decisions by contractors.

This research aims to provide a base against which to investigate construction tender-price inflation and highlight the urgent need to manage the phenomenon. The data generated by this baseline study is critical to measure the degree and extent of construction tender price change between 2008 and 2018. In this case, the research collates the data from the documentary review and presents a case for further study. However, considering insufficient or incomplete data, the baseline study targets information that is already available, easy to access, and contrast. Thus, the study divided the collected data into two major categories relevant to the study to develop its case. These projects include upgrading roads to bituminous standards and periodically maintaining feeder roads.

## 2. Literature review

A construction company's strategy to establish its bid price and win in competitive tenders builds upon an analysis of the economic environment, the expected behaviour of competitors, and the contractor's capabilities (Jaśkowski & Czarnigowska, 2019). Contractors must ensure that the bid price is high enough to cover various costs, including profits, while being low enough to be considered the lowest priced among the competitors by the client.

## 2.1 The role of tender price in contractor selection in Zambia

Construction-sector uses construction cost indices or tender-price indices for monitoring price movements. It is achieved by measuring relative change over time in the prices of construction materials. Cruywagen (2014) argues that the establishment and the composition of the relevant tender price index are influenced by several factors, including the availability of data and selection of items to consider from the bills of quantities. Other significant factors include the base year or period selection, choices of weights, and construction method. All these factors begin to affect the accuracy of the index. Once established, the index works as a deflator for construction prices. In a free market, the bidder presents an item price uniquely dependent on the construction technique (Cattell et al., 2010). Historical data must be readily available to predict the bid price, coupled with necessary documentation and processes for adjusting unit costs. Underutilization of historical project cost data exacerbates cost control challenges during tendering (Zhang, Luo, & He, 2015).

Moreover, using pricing models is challenging for contractors because the models are unnecessarily complicated. Even the best-simplified and streamlined models involve the imposition of constants and price limits that are arbitrary and subjective (Cattell, Bowen, & Kaka, 2007). Using such arbitrarily chosen values fails to provide a scientific basis by which to construct the optimum price. Kissi et al. (2019) hypothesized the existence of a relationship between the different pricing strategies and the factors that influence the pricing of a tender. Evaluating bids is through a variety of criteria, but the key shared among the criteria is the total bid price; usually, considerations are that choosing a bidder with the lowest price is most beneficial to the client (Jaśkowski & Czarnigowska, 2019). Jaśkowski and Czarnigowska (2019) claim that the public sector is inclined to use the lowest-price bidding or low-bid model to make contract awards due to the perceived monetary benefits of transparency. In contrast, they overlook facts that the practice results in low quality of work, claims, disputes, time overruns, bid rigging, increased costs, unrealistically low price, and collusion.

Tender price management is the most crucial consideration for bid success; however, due to complex pricing interrelationships, it is much easier to generally express construction project success in terms of cost and budget variance (Yismalet & Patel, 2018). This trend, over time, has shifted the long-term focus to project cost management processes. In addition, research shows that project success depends on mitigating factors affecting tender pricing at the procurement stage. Aje et al. (2016) determined fifteen (15) factors that influenced the success rate of contractors in competitive bidding concerning tender price, which included material availability, labour productivity, and profit as the most significant. These factors significantly influence construction tender price (at tendering stage) and later affect how contractors perform exceptionally. The dilemma with competitive bidding is that the bid price must be low enough to win the bid yet high enough to ensure the contractor's profitability and reasonably sufficient to guarantee the quality of work. It is when the cost estimation function becomes essential, as it is the basis for most contractors to build their tender price (Akintoye & Fitzgerald, 2000). It is equally imperative to note that the availability of funds influences the client's decision to award a contract, the contractor's price, as well as prices of other contractors—excessively, the parties in construction view construction price through understanding and emphasizing the project cost. Hence, related pricing approaches are cost control measures through contracting delivery models. Clients resort to employing delivery models such as EPC to manage construction prices, which are slightly more regular (Zhong, 2011).

Tender price inflation is a severe problem in Zambia's public construction sector. It is propagated further by a situation in which contractors have become more informed than the client (government). As a result, contractors exaggerate their understanding of cost impacts and take advantage of the disproportionateness in information to skew unit prices in the bids and enhance their profits. Contractors do this by increasing the unit price of a quantity expected to go up and lowering the unit price of a quantity expected to decrease. It requires government as a client to optimize trend detection using already-developed models. However, this requires empirical studies that capture the magnitude of the problem in Zambia's context. Unbalanced bidding is one potential pitfall of unit price contracting (Nyström, 2015). Unit price contracting is used in Zambia's public construction sector. It manifests by the client/government paying too much for the final construction product.

## 2.2 Causes of Tender-Price Inflation in construction projects

Olawale and Sun (2010) establish that price inflation is one of the significant factors that affect cost control on a project. There are related factors in the pricing of each item in construction (Azizi & Aboelmagd, 2019). The main challenges to contractors come with identification methods by measuring the risk rate within an item price loading and achieving the highest profitability while accepting the most negligible risks (Azizi & Aboelmagd, 2019). Another concern when pricing for a bid is that the award of a construction contract depends on the total bid price without considering the variations in the item's unit price. This scenario leads to contractors deliberately manipulating unit prices (Nikpour et al., 2017).

Furthermore, they argue that price fluctuation and inaccurate estimates were the top variables causing cost overruns on a project. The ability to deploy strategies productively and effectively has a cost-decreasing impact. In the public-construction sector, developing and setting appropriate tender conditions following an in-depth investigation of how the factors affecting pricing mechanisms correlate enhance this ability.

When risk factors are uncertain on a project, contractors face the challenge or problem of deciding the bidding price for construction. The existing theoretical principles of project risk management lack more realistic considerations such that there is no transparent allocation and reasonable pricing of risks at the project onset (Zhang et al., 2006). At tendering stage, one of the main risks for consideration is the financial position of the client in such a manner as being unable to pay the contractor on time: A scenario often leading to project delays and wrong cost estimations (Naji & Ali, 2017). The failure of a construction firm to fully consider or estimate the risk event on a construction project could have a disastrous impact. Construction enterprises are mindful of this scenario, and due to a lack of appropriate knowledge on risk pricing and mitigation measures, they often subsequently overestimate their markups. It causes construction prices to escalate over time.

Laryea & Hughes (2008) establish no evidence suggesting that construction project pricing is systematic. Therefore, they doubt the justification of pricing models for contractors as their final price depends on a varying range of complex microeconomic indicators and risk factors. The argument is on efficient pricing for risk while encountering and estimating various contingencies. Contractors remain aware of the nature of the construction industry in which all competitors are "hungry for a job" such that if they were to consider and price for all realistic contingencies, they would remain uncompetitive. Table 1 shows some of the risk factors that contractors must contend with during pricing for a bid.

Paek & Lee (1993) propose a risk pricing method for analyzing and pricing construction projects, which consists of identifying risk factors and pricing for their consequences. They suggest using a fuzzy set approach to quantify and directly incorporate the implications into the bid price. They adopt a fuzzy set theory to present a risk-based pricing algorithm and computer-based software. However, since the selection of risk factors is project specific, the algorithm could not formulate generalizations. Therefore, it is advisable to ensure that all risk elements whose consequences might fatally flaw the project identification are accordingly priced for during the tendering phase (Paek & Lee, 1993). However, Laryea & Hughes (2008) argue that most models and pricing methods are desk-based and Lack knowledge of what contractors do during the bid pricing stage.

**Table 1** Risk-related factors during pricing in construction

| S/N | Risk factor(s) | Author |
|---|---|---|
| 1 | Value of liquidated damages | Towner & Baccarini (2012) |
| 2 | Clients' financial state | Naji & Ali (2017) |
| 3 | Project cost risk (range between 2.7% and 8.7% of project cost) | Xu (2014), Brokbals, et al. (2019) |
| 4 | Technical information or detailed specifications | Nketekete, et al. (2016) |
| 5 | Practical knowledge of the construction process | Akintoye & Fitzgerald (2000) |
| 6 | Contractor size | Dulaimi & Shan (2002) |
| 7 | Market competition | Laryea & Hughes (2008) |
| 8 | Contingency additions | Dada & Jagboro (2007) |
| 9 | Apportionment of contractual responsibilities | Al-Ajmi & Makinde (2018) |
| | • Material availability | Aje et al. (2016) |
| | • Labour productivity | |
| 10 | Project scope | Dziadosz, et al. (2015) |

## 2.3 Tender selection process in Zambia

Literature shows that the Zambian public sector uses the lowest bid selection method. The government's primary concern during tendering is controlling production costs and quality when using the lowest bid method, while even the lowest bidder is concerned about securing their profit. Eger and Guo (2008, p.290) argued that this process leads to tensions between the parties during execution due to asymmetric information, which involves "the problems of moral hazard and adverse selection." When a project suffers from both adverse selection and dynamic moral hazard, the likelihood of its success depends on the amount of work completed by the contractor. As a result, "firms can siphon a portion of the funds intended for the project and use the rest to create an illusion of productivity" because inefficient firms bid to siphon and create unnecessary-unproductive competition for efficient firms (Johnson, 2013, p.1). The lowest bid method does not enable public construction administrators to select the most qualified contractor. "Choosing a contractor based on the lowest bid alone is inadequate and may lead to the project's failure in terms of time delay and poor-quality standards" (Alptekin, O. and Alptekin, N., 2017, p.1).

## 3. Methodology

This study aims to define the behaviour of construction tender prices and determine the focus of corrective priorities. The study utilizes a directed content analysis of documents from single-case research to offer more compelling evidence and a robust data set (Sanda et al., 2021; Rose et al., 2015). Numerous construction-related studies, such as Letza (1996), Moatazed-Keivani, et al. (1999), Gyi et al. (1998), Barrett et al. (2005), Barlow & Jashapara (1998), and Gibb (2001) adopted the case study approach for various purposes. The single-case design adopted (Fig. 1) allowed the study to analyze the tender price phenomena. The study establishes practices and behaviours surrounding project implementation in the case firms without depending on the interviewee's personal experiences and biases. Therefore, detailed historical records were the best alternative to obtaining accurate behaviours and practices.

The institution reviewed is the Road Development Agency under the Ministry of Infrastructure, Housing and Urban Development (MIHUD). Within the Ministry of Infrastructure, Housing and Urban Development (MIHUD), the study focused on road infrastructure works under the Road Development Agency (RDA). The reasons for choosing the firm included:

1. Its mandate with road infrastructure provision in Zambia
2. Provision of detailed annual reports
3. readily available audit reports
4. on easily obtainable road lengths
5. The already classified system regarding interventions on roads (unpaved. paved, gravel, upgrading, maintenance, rehabilitation)
6. The already classified system, the gazette (Urban, Feeder, Main, and Trunk Roads).

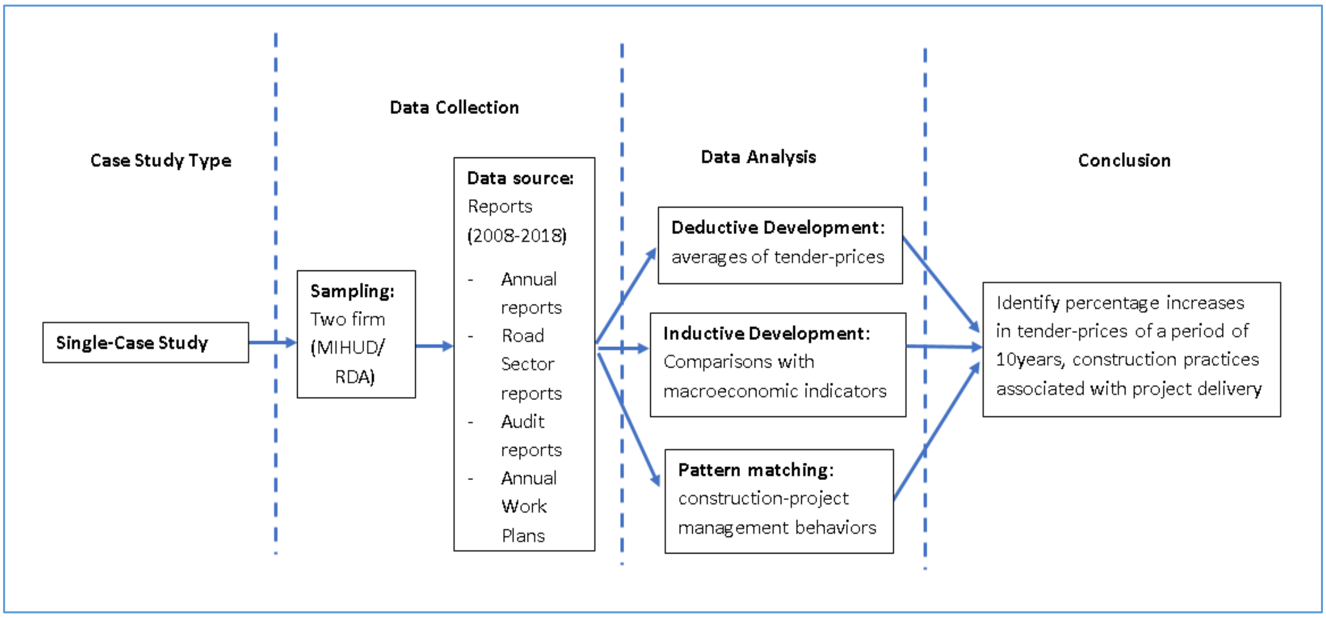


**Figure. 1**: Study research procedure and methods

The research utilizes a documentary review (Table 3) of the circumstances surrounding project implementation in case firms. Using a multiple-case study approach, the study holistically investigates project management behaviours and practices adopted by case firms between 2008 and 2018. The study employs a qualitative data analysis approach to construction projects within the case firm to develop averages of construction firms by examining various annual and audit reports. The analysis consists of directed, summative, and conventional content analysis. Based on existing information, the study identified 97 road construction projects from the case firm in directed content analysis.

**Table 2.** Details of the case firms and case project

| Case Firm | Main project types | Scope | Intervention |
|---|---|---|---|
| MIHUD/RDA | Paved Roads – Main, Trunk, Urban, and District roads | Infrastructure design and construction | Upgrading to bituminous standards |

The inquiry utilizes a conventional content analysis to identify project categories that comprised upgrading roads to bituminous standards and periodic maintenance of feeder roads. The study develops two coding categories of length and tender price at this analysis stage. Afterward, the investigation examines contracts based on these coding categories. The study adopts a summative analytical design to calculate averages and draw comparisons with macroeconomic trend lines. Due to limited literature, the design is appropriate in determining works of similar nature, type of intervention, and scope (Yin, 2009).

**Table 3.** List of documents reviewed

| Institution | List of documents reviewed | Number of contracts reviewed |
|---|---|---|
| **MIHUD/RDA** | • Annual reports (2013-2018) | 7 |
| | • Final audit report (2008) | 3 |
| | • Final audit report (2012-2015) | 4 |
| | • 2008 RDA-PAC report | 1 |
| | • Contracts | 92 |

The baseline study adopts the “before-and-after” activity method of measuring the change in tender prices across the study period. The comparisons include drawing out averages of tender price per kilometre of specific road categories per year, then contrasting to the preceding years to develop a trend line analysis. This analysis forms the basis for observing rises and falls in tender prices as part of the assessment of price inflation. The study achieves this by measuring the shift in tender prices for similar construction works or projects over time in the exact activity location (Zambia). The study focuses on a documentary review for replicability of the collected data, if necessary, for subsequent evaluations. This approach is critical in providing the minimum information required to assess and ascertain the reality or representativeness of construction tender-price inflation.

## 4. Findings

The study adopted a pattern-matching analysis to identify behaviours and practices of case firms regarding construction project implementation. By comparing construction-project management approaches of case firms, the study described in Table 4 provides an overall understanding concerning the implementation of project management and inherent contributing causes to tender-price inflation. The table indicates issues requiring prioritization, including late engagement of supervising consultant at 13.5%, ranked one, and delayed payments at 12.9%, ranked 2. Others are poor contract or project management practices at 11.9%, ranked 3; poor quality of works at 10.3%, ranked 4. Lack of detailed engineering designs at 8% ranked 5, questionable contract award at 7.1% ranked sixth, and delayed project implementation at 6.8%.

**Table 4** Circumstances surrounding construction-management practices (2006-2020)

| Observed Challenges | Frequency | Percentage (%) | Rank |
|---|---|---|---|
| Late engagement of supervising consultant | 42 | 13.5 | 1 |
| Delayed payments | 40 | 12.9 | 2 |
| Poor contract or project management | 37 | 11.9 | 3 |
| Poor quality of work | 32 | 10.3 | 4 |
| Lack of detailed engineering design | 25 | 8.0 | 5 |
| Excessive and questionable variations | 22 | 7.1 | 6 |
| Delayed project implementation | 21 | 6.8 | 7 |
| Questionable award of contract | 17 | 5.5 | 9 |
| Non-adherence to procurement procedures | 16 | 5.1 | 10 |
| Overpayment on claims | 10 | 3.2 | 11 |
| Failure to provide/renew contract bonds/guarantees | 10 | 3.2 | 12 |
| Interest claims | 9 | 2.9 | 13 |
| Unjustified single-sourcing | 8 | 2.6 | 14 |
| Poor quality materials | 6 | 1.9 | 15 |
| Lack of equipment | 5 | 1.6 | 16 |
| Questionable and uncompetitive rates | 4 | 1.3 | 17 |
| Inadequate budget provision | 4 | 1.3 | 18 |
| Irregular contract documents | 1 | 0.3 | 19 |
| Over procurement | 1 | 0.3 | 20 |
| Inconsistent application of evaluation criteria | 1 | 0.3 | 21 |

(Source: data from Auditor-General, 2015; NRFA, 2022; PAC, 2009).

Table 4 presents significant factors affecting construction tender pricing development as observed from the documentary review. The study lists 21 factors under this category. The study graphed information gathered in Table 4 into a Pareto chart in Figure 2 to indicate the frequency of a challenge and its cumulative impact. It helps find areas to prioritize interventions for the most significant overall effect. The chart suggests areas requiring prioritization include late engagement of supervising consultants, delayed payments, poor contract or project management practices, poor quality of work, a lack of detailed engineering designs, delayed project implementation, and questionable contract awards. The study further identifies general features of construction projects in the case of firms by analyzing tender pricing behaviours. Consequently, the study employed a deductive development approach to develop specific annual tender pricing averages (Table 5).

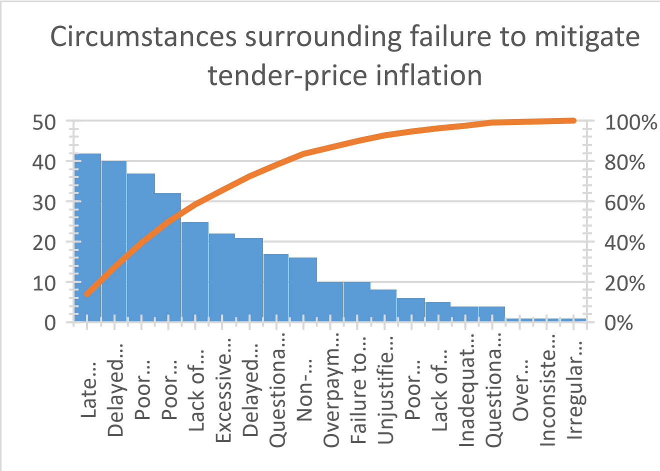


**Figure 2:** Pareto chart highlighting main challenges regarding construction tender-price inflation

Figure 2 indicates areas requiring prioritization, including late engagement of supervising consultant, delayed payments, poor contract or project management practices, poor quality of work, a lack of detailed engineering designs, delayed project implementation, and questionable contract award. The results show a steady increase in construction tender prices between 2008 and 2018. The study reviewed 92 contracts (N=92) for upgrading to bituminous standards between 2008 and 2018 (see Table 5). For upgrading roads to bituminous standards, construction tender prices increased from an average of ZMW1,438,825.8/km in 2008 to an average of ZMW14,395,749.5/km in 2018.

Table 5 shows average construction tender prices for upgrading roads to bituminous standards. The results show a steady increase in construction tender prices between 2008 and 2018. For upgrading roads to bituminous standards, construction tender prices increased from ZMW1,438,825.83/km in 2008 to an average of ZMW14,395,749.54/km in 2018 (N=92). An example of calculation for the standards in Table 5 is as follows:

For 2010:

For tender-price-code:

Average tender–price:

(33,397,491+80,002,657+101,286,041+47,562,388)÷4 = ZMW65,562,144

For-length-code;

Average length: (23.5+65+50+52.4)÷4 = 47.725Km

Therefore, construction tender-price/km: 65,562,144 ÷47.725= ZMW 1,373,748.44/Km

Figure 3, a graphical representation of the observations in Table 5, compares the construction tender price incremental behaviour with each passing year. The observations indicate a positive upward trend, with tender prices steadily rising during the period under review between 2008 and 2018. This behaviour is observable from the sampled contracts, as not all were readily available for review. Figure 3 aggregates values of construction tender prices for the stated year. From the analysis, the average construction tender price from four observed contracts in 2008 is ZMW1,438,857.72/Km. The highest increment was in 2011 when tender prices rose by 95.4%.

The observations indicate that decreases of -24.5% in 2010 were the lowest during the period under review. This value increased by 71.3% in 2012 to ZMW4,599,107.96/Km. The incremental trend continued by another 2% in 2013 to at least ZMW4,690,770.68/Km. The study calculates the average construction tender-price increase over this period to be at least 31.4%. At the same time, the macroeconomic indicators (independent variables) are observed to increase minimally at 3.3% (interest rates), 11.8% (Forex), 2.6% (inflation rate), and 8.9% (FDI) apart from external government debt that is observed to increase by 45.1%.

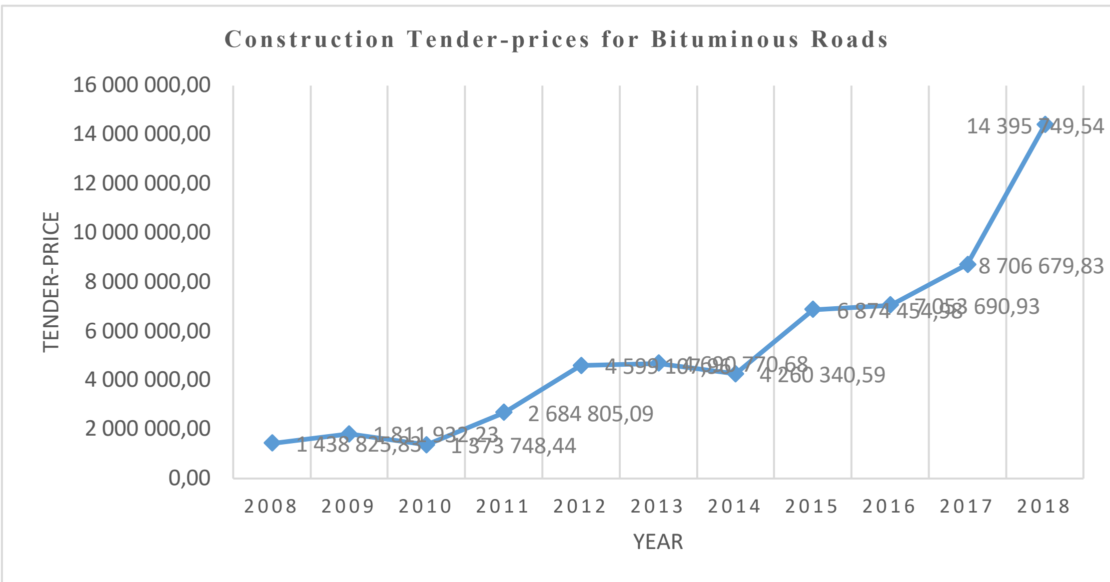


**Figure 3:** Average construction tender prices for upgrading roads to bituminous standards

**Table 5.** Construction Tender-Prices for upgrading roads to bituminous standard (2008-2018)

| Year | 2008 | | 2009 | | 2010 | | 2011 | | 2012 | | 2013 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Km | Tender Price | Km | Tender Price | Km | Tender Price | Km | Tender Price | Km | Tender Price | Km | Tender Price |
| | 14.4 | 14,143,540 | 52.4 | 47,562,388 | 23.5 | 33,397,491 | 90 | 213,805,420 | 402 | 1,797,195,724.20 | 54 | 221,212,397 |
| | 45 | 77,741,065 | 104 | 290,063,867 | 65 | 80,002,657 | 14.6 | 59,004,963 | 43.8 | 242,296,469.00 | 48.5 | 205,807,776 |
| | 73.19 | 90,097,344 | 96 | 192,695,237 | 50 | 101,286,041 | 171.9 | 180,000,000 | 14.6 | 59,004,963.00 | 16 | 208,241,515 |
| | 17.78 | 34,379,087 | 225 | 319,160,884 | 52.4 | 47,562,388 | 131.5 | 707,400,000 | 64 | 290,287,688.00 | 91 | 314,958,672 |
| | | | 82 | 164,112,515 | | | 171 | 421,706,455 | 34.47 | 165,827,800.00 | 45.5 | 561,813,606 |
| | | | | | | | 7 | 11,491,187 | 86 | 371,478,276.00 | 27.32 | 139,270,689 |
| | | | | | | | 131.5 | 332,939,624 | 115 | 466,731,196.00 | 65 | 175,787,988 |
| | | | | | | | | | 40 | 118,441,534.00 | 100 | 295,906,766 |
| | | | | | | | | | 70 | 278,824,387.00 | 158 | 385,583,452 |
| | | | | | | | | | 175 | 1,067,928,906.52 | 114 | 361,187,528 |
| | | | | | | | | | 15 | 72,236,835.00 | 105 | 529,047,639 |
| | | | | | | | | | 14.1 | 61,562,946.64 | 90 | 856,110,428 |
| | | | | | | | | | 22.6 | 51,427,095.02 | 18 | 118,370,863.31 |
| Average | 37.5925 | 54,090,259 | 111.88 | 202,718,978 | 47.725 | 65,562,144 | 102.5 | 275,192,521 | 84.35154 | 387,941,832 | 71.71692 | 336,407,640 |
| **ZMW/Km** | **1,438,857.72** | | **1,811,932.23** | | **1,373,748.44** | | **2,684,805.09** | | **4,599,107.96** | | **4,690,770.68** | |

| Year | 2014 | | 2015 | | 2016 | | 2017 | | 2018 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Km | Tender Price | Km | Tender Price | Km | Tender Price | Km | Tender Price | Km | Tender Price |
| | 98 | 690,958,848 | 84 | 585,556,978.00 | 270 | 2,061,451,626.00 | 85 | 959, 189,051.33 | 220 | 4,205,527,260.00 |
| | 8 | 41,999,823 | 84 | 417,108,471.00 | 109 | 546,877,969.00 | 257 | 1,839,580,493.66 | 179 | 3,994,919,827.00 |
| | 111.2 | 285,886,120 | 5 | 57,014,787.00 | 69.9 | 282,394,736.00 | 25.63 | 294,310,644.73 | 258 | 3,994,919,827.00 |
| | 94 | 264,798,761 | 56 | 417,108,471.29 | 78.2 | 291,105,602.00 | | | 103 | 784,279,480.62 |
| | 118 | 429,962,249 | 84 | 585,556,977.51 | 58.2 | 529,938,197.00 | | | 107 | 713,664,926.91 |
| | 93 | 396,624,924 | 83.9 | 367,218,609.29 | 194 | 1,695,918,648.00 | | | 88.3 | 1,162,942,884.00 |
| | 90 | 332,824,438 | 82 | 631,194,336.31 | 112 | 607,349,167.00 | | | 4 | 32,078,862.69 |
| | 71 | 229,969,700 | 15 | 123,936,213.56 | 10.65 | 160,270,962.37 | | | 95 | 289,105,667.00 |
| | 107.5 | 592,500,000 | 20.2 | 123,142,060.36 | 9.37 | 108,575,278.37 | | | | |
| | 115.7 | 500,040,614 | 11.4 | 109,660,183.91 | 15.04 | 250,374,945.86 | | | | |
| | 113 | 439,062,227 | 9.27 | 115,405,395.11 | | | | | | |
| | 117 | 540,831,955 | 20.5 | 220,867,715.90 | | | | | | |
| | 17 | 168417173 | 9.6 | 129,403,184.05 | | | | | | |
| Average | 88.72308 | 377,990,526 | 43.45154 | 298,705,644.87 | 92.636 | 653,425,713.16 | 122.5433 | 1066945569 | 131.7875 | 1,897,179,841.90 |
| **ZMW/Km** | **4,260,340.59** | | **6,874,454.98** | | **7,053,690.93** | | **8,706,679.83** | | **14,395,749.54** | |

**Table 6.** Correlation between macroeconomic indicators and tender prices for upgrading of roads to bituminous standards

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Averages | Coefficient ( r ) Pearson's | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tender-price (ZMW'million/km)** | 1.438826 | 1.811932 | 1.373748 | 2.684805 | 4.59911 | 4.690771 | 4.260341 | 6.87446 | 7.053691 | 8.7066798 | 14.39575 | 5.262734 | - | - |
| **Forex rates** | 4.2 | 4.9 | 4.8 | 7.3 | 5.14 | 5.39 | 6.15 | 8.63 | 10.31 | 9.54 | 10.45 | 6.98 | **0.84** | strongly positive |
| **Inflation rates** | 12.5 | 13.4 | 8.5 | 8.7 | 6.6 | 7 | 7.8 | 10 | 18.2 | 6.6 | 7.5 | 9.71 | **-0.18** | no correlation |
| **Interest rates** | 19.1 | 22.1 | 20.9 | 18.8 | 19.1 | 16.3 | 18.7 | 21.1 | 28.1 | 26.9 | 24 | 21.37 | **0.54** | moderately positive |
| **FDI (US $ 'Bn)** | 0.94 | 0.69 | 1.73 | 1.11 | 1.73 | 2.1 | 1.51 | 1.58 | 0.66 | 1.11 | 0.41 | 1.23 | **-0.39** | weakly negative |
| **External Debt (US $ 'Bn)** | 0.91 | 2.25 | 1.72 | 1.68 | 0.92 | 2.13 | 5.02 | 8.08 | 9.21 | 12.45 | 12.1 | 5.13 | **0.88** | strongly positive |
| **% Change (forex)** | 0 | 16.7 | -2.0 | 52.1 | -29.6 | 4.9 | 14.1 | 40.3 | 19.5 | -7.5 | 9.5 | **+11.8%** | - | - |
| **% Change (Inflation)** | 0 | 7.2 | -36.6 | 2.4 | -24.1 | 6.1 | 11.4 | 28.2 | 82.0 | -63.7 | 13.6 | **+2.6%** | - | - |
| **% Change (Interest)** | 0 | 15.7 | -5.4 | -10.0 | 1.6 | -14.7 | 14.7 | 12.8 | 33.2 | -4.3 | -10.8 | **+3.3%** | - | - |
| **% Change (FDI)** | 0 | -26.6 | 150.7 | -35.8 | 55.9 | 21.4 | -28.1 | 4.6 | -58.2 | 68.2 | -63.1 | **+8.9%** | - | - |
| **% Change (Debt)** | 0 | 147.3 | -23.6 | -2.3 | -45.2 | 131.5 | 135.7 | 61.0 | 14.0 | 35.2 | -2.8 | **+45.1%** | - | - |
| **% Change(Tender-price)** | 0 | 25.9 | -24.2 | 95.4 | 71.3 | 2.0 | -9.2 | 61.4 | 2.6 | 23.4 | 65.3 | **+31.4%** | - | - |

The results in Table 6 indicate an average percentage increment per annum of 31.4% of construction tender prices for upgrading roads to bituminous standards between 2008 and 2018. It shows a tender price increment of 900.52% over the ten years under review.

Figure 3 shows that construction tender prices increased for upgrading roads to bituminous standards from ZMW1,438,825.83/km in 2008 to an average of ZMW14,395,749.54/km in 2018. Construction tender prices increased by an average of 31.4% per annum for upgrading roads to bituminous standards between 2008 and 2018. For paved roads, construction tender prices increased by ZMW12,956,923.7/km from ZMW1,438,825.8/km in 2008 to ZMW14,395,749.5/km in 2018. The data confirms a positive trend line or the steady increase in construction tender prices in the period (2008-2018). Moreover, results show a positive correlation between construction tender prices to foreign exchange rates (0.84), commercial interest rates (0.54), and external debt stock (0.88) (Trading-Economics, 2022). However, there is a negative correlation between construction tender prices and foreign direct investment of -0.39. At the same time, the results show a lack of correlation between construction tender prices and an inflation rate of -0.18. The correlation sign defines relationship direction such that a positive signal on the exchange rate correlation coefficient means that construction tender prices increase as the exchange rate value increases: and as it decreases, tender prices drop. It means that the variables change together in the same direction. At the same time, the correlation coefficient's absolute value indicates the correlation's magnitude such that the smaller the final value, the weaker the correlation.

**Table 7.** Summary of variables

| Year | Tender-price (ZMW'million/km) | Forex rates | Inflation rates | Interest rates | FDI (US $ 'Bn) | External Debt (US $ 'Bn) |
|---|---|---|---|---|---|---|
| **2008** | 1.438825829 | 4.2 | 12.5 | 19.1 | 0.94 | 0.91 |
| **2009** | 1.811932233 | 4.9 | 13.4 | 22.1 | 0.69 | 2.25 |
| **2010** | 1.373748439 | 4.8 | 8.5 | 20.9 | 1.73 | 1.72 |
| **2011** | 2.684805086 | 7.3 | 8.7 | 18.8 | 1.11 | 1.68 |
| **2012** | 4.599107964 | 5.14 | 6.6 | 19.1 | 1.73 | 0.92 |
| **2013** | 4.690770679 | 5.39 | 7 | 16.3 | 2.1 | 2.13 |
| **2014** | 4.260340586 | 6.15 | 7.8 | 18.7 | 1.51 | 5.02 |
| **2015** | 6.874454978 | 8.63 | 10 | 21.1 | 1.58 | 8.08 |
| **2016** | 7.053690932 | 10.31 | 18.2 | 28.1 | 0.66 | 9.21 |
| **2017** | 8.706679835 | 9.54 | 6.6 | 26.9 | 1.11 | 12.45 |
| **2018** | 14.39574954 | 10.45 | 7.5 | 24 | 0.41 | 12.1 |
| **Mean** | 5.263 | 6.9827 | 9.709 | 21.373 | 1.2336 | 5.1336 |
| **Std. Deviation** | 3.888 | 2.36470 | 3.6231 | 3.6519 | 0.53474 | 4.51533 |
| **Valid N (listwise) = 11** | | | | | | |

Table 7 summarizes the variables used in multinomial regression analysis. The variable values are annual averages, which may affect the significance and prediction level of the model. However, the investigation is in accordance and appropriate with regression model development. Table 7 presents averaged values for the stated variables. The second row, 'tender-price,' represents averages per annum of total tender prices divided by the entire length of contracts reviewed in each particular year. Other rows represent annual variable values as obtained from documentary reviews as well. The analysis presents respective means and standard deviations for all 11 valid observations.

Table 8 shows that out of all variables entered. The analysis considered all variables and removed no during the regression analysis.

**Table 8.** Model variables

| Model | Variables Entered | Variables Removed | Method |
|---|---|---|---|
| **1** | External Debt (US $ 'Bn), Inflation rates, FDI (US $ 'Bn), Interest rates, Forex rates | . | Enter |
| **a. Dependent Variable: Tender-price (ZMW'million/km)** | | | |

**Table 9.** Correlations of variables

| | | Tender-price (ZMW'million/km) | Forex rates | Inflation rates | Interest rates | FDI (US $ 'Bn) | External Debt (US $ 'Bn) |
|---|---|---|---|---|---|---|---|
| **Tender-price (ZMW'million/km)** | Pearson Correlation | 1 | .844** | -.183 | .538 | -.391 | .876** |
| | Sig. (2-tailed) | | .001 | .590 | .088 | .234 | .000 |
| | N | 11 | 11 | 11 | 11 | 11 | 11 |
| **Forex rates** | Pearson Correlation | .844** | 1 | .136 | .749** | -.491 | .918** |
| | Sig. (2-tailed) | .001 | | .691 | .008 | .125 | .000 |
| | N | 11 | 11 | 11 | 11 | 11 | 11 |
| **Inflation rates** | Pearson Correlation | -.183 | .136 | 1 | .449 | -.531 | .024 |
| | Sig. (2-tailed) | .590 | .691 | | .165 | .093 | .944 |
| | N | 11 | 11 | 11 | 11 | 11 | 11 |
| **Interest rates** | Pearson Correlation | .538 | .749** | .449 | 1 | -.651* | .779** |
| | Sig. (2-tailed) | .088 | .008 | .165 | | .030 | .005 |
| | N | 11 | 11 | 11 | 11 | 11 | 11 |
| **FDI (US $ 'Bn)** | Pearson Correlation | -.391 | -.491 | -.531 | -.651* | 1 | -.462 |
| | Sig. (2-tailed) | .234 | .125 | .093 | .030 | | .153 |
| | N | 11 | 11 | 11 | 11 | 11 | 11 |
| **External Debt (US $ 'Bn)** | Pearson Correlation | .876** | .918** | .024 | .779** | -.462 | 1 |
| | Sig. (2-tailed) | .000 | .000 | .944 | .005 | .153 | |
| | N | 11 | 11 | 11 | 11 | 11 | 11 |

****. Correlation is significant at the 0.01 level (2-tailed).**
***. Correlation is significant at the 0.05 level (2-tailed).**

The correlation between construction tender prices and macroeconomic indicators such as external debt and foreign exchange rate is +0.876 and +0.844, respectively, indicating both strong and positive (Table 9). The p-value results from a 2-tailed test significance are zero, thus $p<0.005$. It means that the two variables are significantly positive. Therefore, higher foreign exchange rates and government debt levels are strongly associated with higher construction tender prices.

Table 10 indicates an R-Squared value of 0.742. The variance of the macroeconomic indicators under study defines at least 74.2% of the construction tender-price variance.

**Table 10** Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | 0.933[a] | 0.871 | 0.742 | 1.9739 |

**a. Predictors: (Constant), External Debt (US $ 'Bn), Inflation rates, FDI (US $ 'Bn), Interest rates, Forex rates**

**Table 11** Analysis of Variance

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 131.670 | 5 | 26.334 | 6.759 | 0.028[b] |
| | Residual | 19.480 | 5 | 3.896 | | |
| | Total | 151.150 | 10 | | | |

**a. Dependent Variable: Tender-price (ZMW'million/km)**
**b. Predictors: (Constant), External Debt (US $ 'Bn), Inflation rates, FDI (US $ 'Bn), Interest rates, Forex rates**

The analysis of variance (ANOVA) summarizes information regarding multiple correlations to test the significance of the model regarding the extent to which asset of macroeconomic indicators (independent variables) predict construction tender prices (Table 11). The null hypothesis states that macroeconomic indicators are not significantly related to construction tender prices. The Sig. column represents the p-value for the test of significance of the model. Since $p<0.05$ for a p-value of 0.028, we conclude that the indicator variables are significantly related to construction tender prices. The other columns provide the detail from which the p-value is determined. The sum of squares for regression (26.334) is the mean of the square for regression. The sum of squares labelled residual (19.480) is the sum of differences between the predicted values and the actual values of y, which is the sum of squared deviations of the data around the regression line. The square root of the variance of residuals, 3.896, is 1.974, which is the standard error of the estimate.

To estimate the regression equation, the coefficients table, Table 12 presents the least squares estimates of the intercept and slope of the regression line. Five values of regression weights (b, 0.638, -0.241, -0.334, -1.561, 0.577) are listed in column headed B, while the regression intercept is (a, 9.255). Respectively, the equation of the least squares is the therefore: $y=9.255+0.638x_1-0.241x_2-0.334x_3-1.561x_4+0.577x_5$. In which x1 = forex rates, x2 = inflation rate, x3 = interest rates, x4 = FDI and x5 = government debt. The negative sign of the regression coefficients (on inflation rates, interest rates, and FDI) indicates negative correlations between each indicator variable and construction tender price. Positive coefficients regarding forex rates and government debt indicate that as their values increase, the mean of the construction tender price also tends to increase. On the other hand, the p-values in the Sig. Column of Table 12 is much greater than the significance level of 0.05.

It indicates insufficient evidence in the data set sample to conclude that a non-zero correlation exists between independent and dependent variables. Keeping variables that are not statistically significant thereby reduces the precision of the model. Considering all other model-fit criteria, this finding may create a possibility of either type I or type II statistical error that could lead to a false rejection or acceptance of the null hypothesis. Increasing the sample size would address the risk of encountering type I and type II statistical errors. Larger sample sizes allow the stud to increase the significance level of the findings as higher sample sizes have a higher possibility of accurately mirroring the population's behaviour. The research suggests using more samples to draw out the model since the regression line appears not flat and many points fall within. The correlations of some variables are not small ($r = 0.876$, $r = 0.538$, and $r = 8.44$) and significant ($p = 0.000$ and $p = 0001$), and more than 70% variability is attributable to macroeconomic indicators. Therefore, the study argues that there is significance in predicting construction tender prices from macroeconomic indicators.

Areas requiring prioritization when addressing construction tender-price inflation include late engagement of supervising consultants, delayed payments, and poor contract or project management practices. Others include poor quality of work, lack of detailed engineering designs, delayed project implementation, and questionable contract awards. Figure 4 of the study presents a continuously improving construction-tender price management process developed through a relevant literature review on the subject matter. The study argues that the process includes at least five separate steps:

1. Step 1: involves identifying all factors affecting construction-bidding price. This step starts from identifying predetermined objectives of bidders to existing economic conditions at a particular time. This step allows an institution to develop an understanding of both internal and external factors.
2. Step 2: This step draws down the most significant project-specific risk-pricing factors, which according to (Baccarini, 2012), may include the type of contract, type of procurement method used, value of liquidated damages, completeness of documentation, and current workload.
3. Step 3: involves deriving cost-per-unit information for setting prices to generate profits adequately. This step allows the bidder or client to derive variable and fixed costs. During this step, Oberholzer & Ziemerink (2004) perfectly underscores the significance of the "high-low method" in determining cost levels. Consideration of direct material costs, greater-volume discounts, and additional capacity constitute prudent choices.
4. Step 4: Literature findings by Laryea (2018) and Ekung et al. (2013) best prescribe essential issues of concern regarding this step to include flexibility, quality requirements, payment certainty, price-competition, problems of autonomy and responsibility, dispute resolution procedures and project duration.
5. Step 5: This requires a government economic policy of imposing floors (minimums) and ceilings (maximums) to public construction prices at both materials and services levels to make them affordable and reflective. A study by Majumdar (2003) discusses this step in detail and proposes using and adopting price controls as incentive mechanisms to achieve social-economic benefits.

**Table 12** Regression coefficients

| **Model** | | **Unstandardized Coefficients** | | **Standardized Coefficients** | **t** | **Sig.** | **95.0% Confidence Interval for B** | |
|---|---|---|---|---|---|---|---|---|
| | | **B** | **Std. Error** | **Beta** | | | **Lower Bound** | **Upper Bound** |
| **1** | (Constant) | 9.255 | 8.105 | | 1.142 | .305 | -11.581 | 30.091 |
| | Forex rates | 0.638 | 0.699 | 0.388 | 0.913 | .403 | -1.158 | 2.435 |
| | Inflation rates | -0.241 | 0.262 | -0.225 | -.920 | .400 | -.915 | .433 |
| | Interest rates | -0.334 | 0.385 | -0.314 | -.868 | .425 | -1.325 | .656 |
| | FDI (US $'Bn) | -1.561 | 1.661 | -0.215 | -.940 | .390 | -5.831 | 2.709 |
| | External Debt (US $ 'Bn) | 0.577 | 0.447 | 0.670 | 1.290 | .253 | -.573 | 1.727 |

**a. Dependent Variable: Tender-price (ZMW'million/km)**

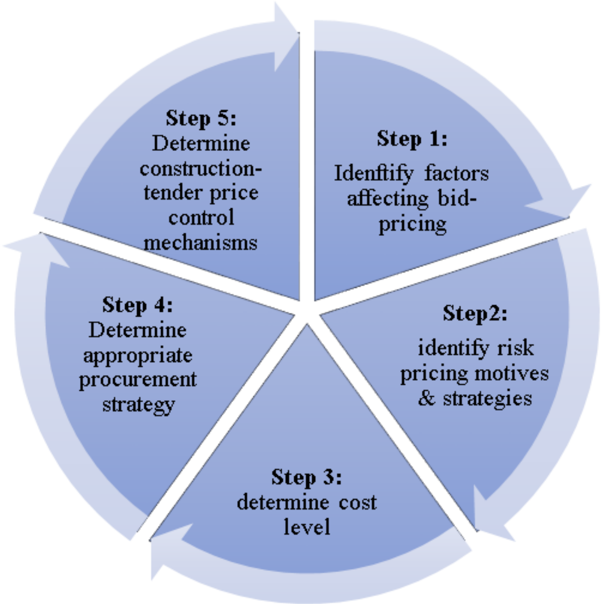


**Fig. 4:** Construction-price management process (by the authors: based on previous studies by Paek & Lee, 1993: 743-756; Gudienė et al., 2013: 392 – 397)

## 5. Discussion of Findings

The results suggest inherent poor project management practices in the Zambian public construction sector, constituting process need areas within case firms that could benefit from implementing strategic planning. It implies a need to identify and manage country-specific factors affecting construction infrastructure management and weaving together country-specific strategies for addressing tender-price variability and perceived overpricing. Occurrences of late engagement of supervising consultants indicate management negligence and a lack of strategic planning. It also confirms the existence of interference and indecision by top management.

The study demonstrates that least-price bidding does not ensure maximum value in construction. Therefore, evaluating bids solely based on the lowest-bid system creates challenges in achieving a value-based procurement system. Khan and Khan (2015) found the lowest-bid procurement approach to be undesirable due to; "inferior quality of constructed facilities, high incidence of claims and litigation, and frequent cost and schedule overruns."

Results in Table 4 confirm the existence of cost and schedule overruns. The study finds excessive and questionable variations in implementing projects in the Zambian context. An optimal bid price is significant in winning a construction contract. However, Wang et al. (2012) affirm that making accurate pricing in a bid is enormously expensive and time-consuming. Hence, contractors determine the bid price by maximizing expected profit while assessing the probability of winning, underlying conditions on bid items, client characteristics, and competition level.

Table 4 highlights the dangers of this simplified approach to bidding as it leads to questionable and uncompetitive rates. The trend contributes highly to price volatility and uncertainty. Price volatility is a significant risk in construction projects (Abdulrazaq, 2017). Every construction industry is unique and thus requires the development of industry-specific strategies to address price volatility. Abdulrazaq (2017) argues that managing price volatility must ensure the "inclusion of price adjustment clauses, fast track and Lean project delivery method, risk management method, contingencies, early procurement method, and use of price cap contract and use of ICT."

Second, poor-quality projects confirm inadequacies in detecting contractor malpractices at the procurement stage. Unbalance pricing strategies are illegal methods that reduce the client's position and contractors' incentive to complete the project as they lose their financial motivation. Research regarding unbalanced bidding dates back to 1959 when Martin Gates proposed an alternative model to the then-balanced model by Friedman (1956). These unbalanced pricing strategies usually result in client overpayment on the project as contractors aim to increase profit and cash flow (Nikpour et al., 2017). Nikpour et al. (2017) found that unbalanced pricing methods are challenging to detect, posing significant consequences on the client's cost liability of implementing a project. Unbalanced bidding hurts competition by getting rid of genuine bidders by placing extremely low bids. Low-priced bids may earn the contractor huge profits.

There are models capable of identifying a combination of item prices to generate high profit for the contractor at the client's and the project's expense. On the other hand, should they turn negative, they put the client under a significant financial burden by challenging the economic stability of the project through poor quality work and increased corruption (Prajapati & Bhavsar, 2017: 159). In agreement, this study establishes significant procurement-related challenges, including the questionable award of contracts, non-adherence to procurement procedures, unjustified single sourcing, over-procurement, inconsistent application of evaluation criteria, and irregular contract documents. The study further argues that these factors significantly influence construction tender-prices development. In Table 5 and Table 7, the study finds that, on average, construction tender prices increased by an average of 31.4% per annum for upgrading roads to bituminous standards between 2008 and 2018.

Third, delayed payments confirm a lack of financial planning, ring-fencing practices, and benchmarking due to poor utilization of technology and record-keeping on other projects (Table 4). Initiating procurement quality controls generate improved competitiveness from a price viewpoint through the value-added competencies of the procurement function. In construction, procurement quality controls allow for significantly high procurement performance leading to the best possible price to meet the client's needs (Munyimi, 2019). However, procurement functions in the public face numerous challenges. Extraordinary challenges include a significant lack of empirical research on the impact of public procurement systems on price or cost levels in the construction sector. Gray et al. (2020) argue that current procurement decisions are too focused on cost minimization at the expense of stakeholder value. They propose a new approach known as "total value contribution" as an extension of "total cost of ownership" methods that broaden the factors during a procurement exercise. They argue that putting value first through procurement would increase organizational outcomes.

Fourth, the lack of detailed engineering designs and questionable project awards are evidenced by increased project costs during construction via variations (Table 4 and Figure 2). An evaluation of literature findings shows the complexities of establishing adequate controls for managing construction-tender pricing. Nový et al. (2016) argue that a precise determination of construction-tender price is essential for project success. However, the process is tedious and insists on developing correct tools for pricing based on the specific situation and detailed designs for the project. Literature relating to investigations into factors affecting tender-price determination in construction, current tender price controls in practice, and effects of public procurement warrants a particular focus on how contractors' price for construction at tendering and highlighting significant risk-related factors. However, a lot of research explores project risk-related issues from a project implementation perspective, thereby ignoring the implementation of procurement strategies that consider price reduction implications at the tender stage. The trend leads to the development of contract delivery models that inadequately address the potential value of pricing in construction projects and fail to establish possible strategies to overcome overpricing.

## 7. Conclusion

The impact resulting from rising prices in the construction industry establishes matters of principle applicable to sustainable development and the general economics of the country. The government requires the development of practical policies that could significantly curtail construction prices while incentivizing the public construction sector by establishing a more rational tender pricing system that meets all stakeholders' needs. In developing countries like Zambia, governments emphasize the cost of construction projects and the price of construction contracts. One of the principal achievements in that regard has been implementing the lowest bid selection/or procurement approaches. However, the client's attitude towards cost-benefit analysis remains an important influence on whether a project comes with an acceptable price tag. In this regard, construction price is critical in delivering public-sector construction projects.

Construction tender overpricing is a commonplace practice contributing to tender price inflation and variability during the procurement phase of public sector projects. The building process itself is uncertain, particularly concerning ground conditions. Construction tender-price inflation reduces public investments' effectiveness and requires governments to raise additional finance to execute a similar quantum of private construction works. This negatively affects the general economy as public works contract overpricing diverts funds from other projects. Developing nations such as Zambia fund additional construction overpricing from reserves or borrowed funds to meet their planned developmental obligations. In extreme cases, this may lead to the contraction of enormous domestic and foreign debts. Therefore, construction overpricing is a significant problem for developing nations and construction sectors. It is a source of political disagreements, frustrates project intentions, and strains public confidence. Therefore, preventing construction overpricing is a crucial objective during contracting construction projects.

### 7.1 Recommendations

This study recommends further investigations into common causes of overpricing on public sector projects. The inquiry should include a detailed analysis examining how contractors prioritize projects and identifying critical factors preventing construction project overpricing. Considering that there are various solutions to the construction industry's challenges, the long-standing solutions require developing a tailor-made methodology that constitutes problem identification, redesigning, implementation, and continual change in the processes in the construction industry. Thus, there is a need to provide a model that proposes a collective practical solution to eminent and country-specific construction sector challenges.

The study recommends designing a tailor-made industry-specific model prescribing a country-specific key to improving tender prices. It entails the government identifying country-specific factors affecting tender prices to develop a better-managed and more controlled tender–price inflation model.

### 7.2 Limitations

The lack of detailed project data from the case firm led to the use of limited factors such as length and tendered prices only. More specific information regarding road width; layer thickness; loading capacity; number and type of culverts; number and type of bridges are required. It would have permitted better project categorization for analyzing more similar projects and improved model prediction significantly. However, the study took caution in using such available data to successfully demonstrate the model's operational principles.

## References


Abdulrazaq, M. (2017). Prioritization of Strategies for Managing Price Volatility of Civil Engineering Projects in the Nigerian. *Environ Journal of Environmental Studies, 4*(3), 154-165.

Aje, I. O., Oladinrin, T. O. & Nwaole, A. N. C. (2016). Factors influencing success rate of contractors in competitive bidding for construction works in South-East, Nigeria. *Journal of Construction in Developing Countries, 21*(1), 19–34.

Akintoye, A. & Fitzgerald, E. (2000). A survey of current cost estimating practices in the UK. *Construction Management and Economics, 18*(2), 161-172.

Akintoye, A. S. & Skitmore, M. R. (1990). A Conceptual Model of Construction Contractors' Pricing Strategies. s.l., Salford University, pp. 31-47.

Al-Ajmi, H. F. & Makinde, E. (2018). Risk Management in Construction Projects. *Journal of Advanced Management Science, 6*(2), 113-116.

Alptekin, O., & Alptekin, N. (2017, October). Analysis of criteria influencing contractor selection using TOPSIS method. In *IOP conference series: materials science and engineering* (Vol. 245, No. 6, p. 062003). IOP Publishing.

Auditor-General (2015). *Report of the Auditor General on the Road Projects under the Road Development Agency for the Period January 2012 to December 2015*, Lusaka: s.n.

Azizi, F. & Aboelmagd, Y. M. (2019). Integration between different construction bidding models to improve profitability and reduce prices. *Alexandria Engineering Journal, 58*, 151-162.

Baccarini, D. (2012). Risk Pricing in Construction Tenders -How, Who, What. Australasian *Journal of Construction Economics and Building*, *7*(2), 12-25.

Berk, N. & Biçen, S. (2018). Causality between the Construction Sector and GDP Growth in Emerging Countries: The Case of Turkey. *Athens J. of Mediterranean Studies, 4*(1), 19-36.

Cattell, D. W., Bowen, P. A. & Kaka, A. P. (2010). The risks of unbalanced bidding. *Construction Management and Economics, 28*(4), 333-344.

Cattell, D. W., Bowen, P. & Kaka, A. (2007). Review of Unbalanced Bidding Models in Construction. *Journal of Construction Engineering and Management, 133*(8).

Cruywagen, H. (2014). Towards the establishment of a relevant national tender price index for the South African building industry. *Acta Structilia, 21*(2), 22-43.

Dada, J. O. & Jagboro, G. O. (2007). An evaluation of the impact of risk on project cost overrun in the Nigerian construction industry. *Journal of Financial Management of Property and Construction, 12*(1), 37-44.

Dulaimi, M. F. & Shan, H. G. (2002). The factors influencing bid markup decisions of large- and medium-size contractors in Singapore. *Construction Management and Economics, 20*, 601–610.

Dziadosz, A., Tomczyk, A. & Kapliński, O. (2015). Financial risk estimation in construction contracts. *Procedia Engineering 122*, 120 –128.

Eger, R. J. & Guo, H. (2008). Financing Infrastructure: Fixed Price vs. Price Index Contracts. *Journal of Public Procurement, 8*(3), 289-301.

Ekung, S., Siriwardena, M. & Adeniran, L. (2013). Optimized Selection and Use of Project Procurement Strategy in Nigeria: A Practical Case Study. Ethiopian *Journal of Environmental Studies and Management, 6*(6), 661-669.

Gbahabo, P. T. & Ajuwon, O. S. (2017). Effects of Project Cost Overruns and Schedule Delays in Sub-Saharan Africa. *European Journal of Interdisciplinary Studies, 3*(2).

Gray, V. J., Helper, S. & Osborn, B. (2020). Value first, cost later: Total value contribution as a new approach to sourcing decisions. *Journal of Operations Management, 66*, 735–750.

Gudienė, N., Banaitis, A., Banaitienė, N. & Lopes, J. (2013). Development of a Conceptual Critical Success Factors Model for Construction Projects: a Case of Lithuania. *Procedia Engineering 57*, 392–397.

Isa, R. B., Jimoh, R. A. & Achuenu, E. (2013). An overview of the contribution of construction sector to sustainable development in Nigeria. *Net Journal of Business Management, 1*(1),.1-6.

Jaśkowski, P. & Czarnigowska, A. (2019). Contractor's bid pricing strategy: a model with correlation among competitors' prices. *Open Engineering, 9*, 159–166.

Johnson, T. R. (2013). *Procurement with Adverse Selection and Dynamic Moral Hazard. Notre Dame, 917 Flanner Hall*, University of Notre Dame.

Kamaruddin, S. S., Mohammad, M. F. & Mahbuba, R. (2016). *Barriers and Impact of Mechanisation and Automation in Construction to Achieve Better Quality Products*. s.l., s.n.

Kissi, E., Adjei-Kumi, T., Amoah, P. & Gyimah, J. (2018). Forecasting Construction Tender Price Index in Ghana using Autoregressive Integrated Moving Average with Exogenous Variables Model. *Journal of Construction Economics and Building, 18*(1), 70-82.

Laryea, S. (2018). Procurement strategy and outcomes of a new universities project in South Africa. *Engineering, Construction and Architectural, 26*(9), 2060-2083.

Laryea, S. & Hughes, W. (2008). How contractors price risk in bids: theory and practice. *Construction Management and Economics 26*, 911–924.

Lopes, J. P., Oliveira, R. & Abreu, M. I. (2011). *The Construction Industry and the Challenges of the Millennium Development Goals*, Amsterdam, The Netherlands: Management and Innovation for a Sustainable Built Environment.

Meland, O. H., Robertsen, K. & Hannas, G. (2011). *Selection Criteria and Tender Evaluation: The Equivalent Tender Price Model (ETPM)*. Amsterdam, The Netherlands, s.n.

Mohemad, R., Hamdan, A. R., Othman, Z. A. & Noor, N. M. M. (2010). Decision Support Systems (DSS) in Construction Tendering Processes. IJCSI International *Journal of Computer Science Issues, 7*(2).

Munyimi, T. F. (2019). The role of procurement quality controls in procurement performance in the energy sector in Zimbabwe. *Cogent Engineering, 6*, 001-018.

Naji, H. I. & Ali, R. H. (2017). Risk Response Selection in Construction Projects. *Civil Engineering Journal, 3*(2), 1208-1221.

Nawi, M. N. M., Baluch, N. & Bahauddin, A. Y. (2014). Impact of Fragmentation Issue in Construction Industry: An Overview. In *MATEC web of conferences* (Vol. 15, p. 01009). EDP Sciences

Nikpour, B., Senouci, A. & Eldin, N. (2017). Detection Tool for Unbalanced Bids. *Open Journal of Civil Engineering, 7*, 409-422.

Nketekete, M., Emuze, F. & Smallwood, J. (2016). Risk management in public sector construction projects: Case studies in Lesotho. *Acta Structilia, 23*(2), 001- 024.

Nový, M., Nováková, J. & Bartoš, M. (2016). Pricing in Construction Project Management Performed by the Self-employed. *Procedia Engineering, 161*, 759 – 764.

NRFA, (2022). *2021 Road Sector Annual Report*, Lusaka: s.n.

Nyakalale, P. & Madimutsa, C. (2021). Challenges Facing the Implementation of The Green Movement in Residential Areas in Lusaka, Zambia. *AJPSDG, 4*(1), 128-142.

Nyström, J. (2015). The balance of unbalanced bidding. *Procedia Economics and Finance 21*, 97-103.

Oberholzer, M. & Ziemerink, J. (2004). Cost behaviour classification and cost behaviour structures of manufacturing companies. *Meditari Accountancy Research, 12*(1), 179–193.

Oladinrin, T. O., Ogunsemi, D. R. & Aje, I. O. (2012). Role of Construction Sector in Economic Growth: Empirical Evidence from Nigeria. *Journal of the Environment, 7*(1).

Olawale, Y. & Sun, M. (2010). Cost and time control of construction projects: Inhibiting factors and mitigating measures in practice. *Construction Management and Economics, 28*(5), 509–526.

Osei, V. (2013). The Construction Industry and Its Linkages to the Ghanaian Economy-Polices to Improve the Sector's Performance. International *Journal of Development and Economic Sustainability*, *1*(1), 56-72.

PAC (2009). *PAC Audti Reoprt on RDA for the period 2006 and 2009*, Lusaka: s.n.

Paek, J. H. & Lee, Y. W. (1993). Pricing Construction Risk: Fuzzy Set Application. Journal of *Construction Engineering and Management, 19(*4), 743-756.

Prajapati, R. R. & Bhavsar, J. J. (2017). Unit Quantity Contract as a Mitigation of Unbalanced Bidding. *Kalpa Publications in Civil Engineering, 1*, 157-162.

Proverbs, D. G., Holt, G. D. & Cheok, H. Y.(2000). *Construction industry problems: the views of UK construction directors*. Glasgow Caledonian University, ARCOM, pp. 73-81.

Shakuni, M. & Deepa, J. (2018). Business Process Re-Engineering In Construction Industry: Present Scenario. *International Research Journal of Engineering and Technology, 5*(7).

Soares, R. (2013). Re-engineering Management of Construction Projects. *International Journal of Business and Social Science, 4*(7).

Stramarcos, A. & Cattell, D. (2013). The Ethics of Item Pricing. Auckland, New Zealand, 38th AUBEA Conference.

Tembo, M., Mwanaumo, E. M., Chisumbe, S. & Aiyetan, A. O., 2020. Factors Affecting Effective Infrastructure Service Delivery in Zambia's Local Authorities: A Case of Eastern Province. *In:Supporting Inclusive Growth and Sustainable Development in Africa: Vol II Transforming Infrastructure Developmt. 65-81*

Trading-Economics, 2022. *Trading Economics*. [Online] https://tradingeconomics.com/zambia/indicators [Accessed 12 March 2022].

Valence, G. & Runeson, G. (2015). Graham Ive and the Methodology of Construction Economics. *Construction Management and Economics*, *33*(2), 126-133.

Wambui, D. N., Ombui, K. & Kagiri, A. (2015). Factors Affecting Completion of Road Construction Projects in Nairobi City County: Case Study of Kenya Urban Roads Authority (KURA). *International Journal of Scientific and Research Publications, 5*(11).

Wang, W.-C., Wang, S. -H., Tsui, Y.-K. & Hsu, C.-H. (2012). A factor-based probabilistic cost model to support bid-price estimation. *Expert Systems with Applications, 39*(5), 5358–5366.

Xu, Q. -Y., 2014. The Cost of the Construction Project Risk Management and Optimize the Allocation of Resources. In *2014 International Conference on Mechanics and Civil Engineering (icmce-14)* (pp. 550-555). Atlantis Press.

Yismalet, A. G. & Patel, D. (2018). A Critical Literature Review on Improving Project Cost Management Practice and Profitability of Domestic Contractors. *International Journal of Engineering Technologies and Management Research, 5*(1), 51-58.

Zhang, S., Zhang, L. & Yuan, G. (2006). Risk allocation in construction projects: A Comparison of China's Standard Form of Construction Contract and FIDIC Conditions of Contract for Construction. *Surveyors Times*, 35-40.

Zhang, Y., Luo, H. & He, Y. (2015). A system for tender price evaluation of construction project based on big data. *Procedia Engineerng, 123*,606-614.

Zhong, J. (2011). Study on Cost Management under EPC General Contracting Model. *Advanced Materials Research*, *181*, 49-53.