

Factors Contributing to Construction Costs in Botswana – Perspective from Construction Contractors

Adeyemi, Yakeen Aderemi^{1*} Nduna, Kagiso²

1. Department of Construction Engineering, Gaborone University College, Gaborone, Botswana

2. Graduate, Department of Civil Engineering, University of Botswana, Gaborone, Botswana

Abstract

This study investigated and reported on factors contributing to construction cost in Botswana from the perspective of construction contractors operating in the country. Major problems (factors) facing the construction industry worldwide were captured from the literature review. These factors were the subject of ranking by the construction contractors operating in the county. The results revealed that the five cost factors that ranked highest in descending order of contribution are construction management factors (0.668), construction item factors (0.603), cost estimating factors (0.535), environmental factors (0.515) and financing factors (0.406). The five factor variables that ranked highest in descending order are: cost of materials (0.858), incorrect project planning, (0.806), frequent design changes (0.754), lack of coordination between designers and contractor (0.753), contract management (0.742). the main factor contributing to high cost of construction in Botswana is cost of materials. Government the major client of the construction industry in Botswana was advised to train manpower in construction management and embark on diversification policy that would reduce inflation to which the problem of high cost of construction materials could be traced.

DOI: 10.7176/CER/11-12-05

Publication date: December 31st 2019

1. Introduction

In general the Botswana construction sectors can be roughly categorized into real estate (housing, industrial parks, plants, office, malls, hotels) and infrastructure comprising roads, rail, bridges, airports, hospitals, schools, universities (Gorgenlander, 2011). The sector strives for steady growth on account of urbanization, economic development and people's rising need for improved quality of living. The construction industry is a complex environment in which each organization is faced with numerous opportunities and threats (Walker, 1995). Higher construction costs have been the concern on projects undertaken for the government of Botswana over a period of time. The majority of the projects that have been delivered were either delayed in terms of completion time or exceeded the budgeted project amount. This has an effect on the development budget for government and leads to reallocation of the scarce financial resources to projects that have exceeded their budgeted amounts. It is therefore important to identify the main dominating factors leading to high construction costs so that efforts can be put in place on these factors in order to reduce construction costs in Botswana.

The aim of the study was to find out the factors contributing to construction cost in Botswana and the associated objectives were to: (i) identify the main factors affecting construction costs in Botswana; (ii) determine the severity rank of each cost factors; (iii) suggest solutions that could minimize construction costs in Botswana.

2. The Construction Industry and Factors Affecting Construction-Costs

The most significant unbudgeted costs on many construction projects are the financial impacts associated with delay and disruption to the works. Owners and subcontractors have one common objective; to complete the project in time and within budget. It is the failure of this objective of time which leads to failure of budget and ultimately gives rise to disputes. There is no consensus in the literature on the identification of factors which affect stipulated, planned or achieved construction times of buildings. One reason for this is that researchers have largely viewed the subject from diverse prospective. Such viewpoints include identification of discrete factors which affect productivity on site and taking a systems view of the construction process and end product (Nkado, 1995).

Chan and Kumaraswamy (2002) concluded in a research conducted to measure the success of construction projects that, cost, time and quality are the three basic and most important performance indicators in construction projects. Other measures such as safety, functionality and satisfaction etc. are also currently attracting increasing attention. Sidwell *et al.* (2002) accentuated that accurate construction planning is a key factor in ensuring the delivery of a project on schedule and within budget. As almost all projects comprise a large number of interdependent items of work and involve many participants, reliable plans and accurate progress-recording mechanisms become essential to project success.

Mbachu and Vinasithamby (2005) discovered the sources of strategies for minimizing risks in the construction projects and categorized the results into internal and external sources. The internal sources of risks, which fall under the control of clients, contractors, consultants and Subcontractors, include those risk elements emanation from their acts or omissions in the project development process. They noted that, the most frequently

mentioned risk elements under client sources include frequent and late changes at critical stages of the design and construction process, poor leadership and inadequate supervisions on the part of Contractors and subcontractors, low productivity, re-work and losses, delays in supplying equipment, materials and components.

Frimpong *et al.* (2003) conducted a survey on the causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study and the main conclusions of the survey were; monthly payments difficulties from agencies, material procurement, poor technical performance, escalation of material prices according to their degree of influence and these were considered as major factors. The other factors that emerged as not very important, but of interest were bad weather, unfavorable geological conditions.

When a project is delayed, the owner, Contractor, or both may incur added costs. The determination of the amount of these costs is based on the results from the delay analysis and the determination of liability once the critical delays have been identified Mbachu and Vinasithamby (2005). There are many possible factors that can cause actual labour costs to exceed estimated costs such as engineering errors and omissions, excessive changes, delay and acceleration and weather. These factors may require contractors to work out of sequence, hire more manpower than planned, work scheduled overtime and utilize more costly methods of construction Mbachu and Vinasithamby (2005).

Koushki and Kartam. (2004) identified the main factors affecting cost and time overrun as inadequate or inefficient equipment, tools and plants; unreliable sources of materials on the local market and site accidents. Le-Hoai, *et al.* (2008) identified the three top causes of cost overruns in Vietnam as materials cost increases due to inflation, inaccurate quantity takeoffs and labour cost increases due to environmental restrictions. In their research, Kaliba *et al.* (2009) concluded that cost escalation of construction projects in Zambia was caused by factors such as inclement weather, scope changes, environmental protection and mitigation costs, schedule delays, strikes, technical challenges and inflation.

In a study of the Nigerian construction industry, Omoregie and Radford (2006) sampled the opinions of contractors, consultants and clients and they discovered 15 factors responsible for project delays and construction cost escalation in Nigeria. Their survey revealed price fluctuation as the most severe cause of project cost escalation which is attributed to the limitation in exchange rate and which in turn affects construction material prices and general price level. In another study, Elinwa *et al.* (1993) identified 31 essential factors causing high cost of buildings with fraudulent practices and kickbacks ranking in the second position as the most important factor in Nigeria. Hussseini (1991) noted that fraudulent practices and kickbacks occasioned by greed are perpetuated by some major players in the construction industry. Frimpong, *et al.* (2003), in a review of developing countries such as Ghana, identified some factors as underlying causes of delay and cost overruns in ground water construction projects. The five most important factors agreed by clients, consultants and contractors were monthly payment difficulties from agencies, poor contract management, material procurement, poor technical performances and escalation of material prices. Furthermore, a study of the relative weight of ten major causes of business failure in the United States of America revealed construction cost related factors as mostly contributing to business failure (Kangari, 1989). The factors included: Bad profit, management incompetence, lack of experience, inadequate sales, loss of market and economic decline. In their study of factors contributing to construction-cost in Saudi Arabia, Bubshait and Al-Juwairah (2002) compiled 42 variables of construction-cost from literature and categorized them for ranking into five factors as follows:

Environmental related factors (14); construction management related factors (6); construction items related factors (7); cost-estimating related factors (11); and, financing related factors (4).

This study showed that cost of materials ranked as the highest contributor to construction-cost as perceived by the contractors in Saudi Arabia

3. The Construction Industry in Botswana

Botswana is located in the southern part of Africa. It is a relatively large country covering an area of 582,000 km² with a small population of over 2 million inhabitants. It is therefore a sparsely populated country with approximately three inhabitants per km². Its workforce is estimated at 389,665 employees, of which approximately 47% work in the public sector (Central Statistics Organization, 2013). During the same period, the construction industry constituted 6.0% of the workforce. The construction industry in Botswana has gone through very dramatic stages of fluctuation since 2003/4 because of completion of huge infrastructure projects and due to the fact that Botswana is a developing country. This has also lead to the fluctuating contribution to the GDP of Botswana. Nonetheless the construction sector has been one of the fast growing sectors in recent past, showing a growth of about 14.4 percent, with the potential to create employment.

The gross domestic product (GDP) contribution of the construction industry was estimated in 2012 at P448 (US\$ 56) million, constituting 4.2% of total GDP (CSO, 2013). While in previous decades the construction industry in Botswana recorded high growth rates, ranging from 5% to 8%, surpassing most industries in sub-Saharan Africa (CSO, 2013). The performance in recent years has shown a decline due to the downturn in the global economy; the impact of reduced global demand for diamond (the countries major export) and the

inefficiencies of the construction industry itself.

The construction industry in Botswana is comprised of small, medium and large contractors including international companies. The construction companies fall into large, medium and small size contractors and classified for project procurement purposes as shown in Table 1.

Table 1: Categorization of Contractors in Botswana by Contract limit x 10⁶ BWP*

Sub-Code	Grade OC	Grade A	Grade B	Grade C	Grade D	Grade E
01	0.30	0.9	1.8	4.0	8.0	Unlimited
02	Nil	0.9	1.8	4.0	8.0	Unlimited
03	Nil	0.9	1.8	4.0	8.0	Unlimited
04	Nil	0.05	1.0	0.25	5.0	Unlimited
05	Nil	Nil	Nil	Nil	4.0	Unlimited
06	Nil	NIL	Nil	Nil	4.0	Unlimited

*10BWP (Botswana Pula) ≈ 1USD

The government of Botswana is the major client of the industry; therefore, public works are the most prevalent projects procurement in the country. This situation also creates complications for projects execution as any government project involves many different departments, each with different funding, design and user requirements. Thus, even though consultants represent the government there is often confusions and conflicts exacerbated by the continued adoption of the low-bid procurement system. Construction project performance problems manifest as time overruns, cost overruns and low quality standard.

The method of contractor selection for public infrastructure delivery in Botswana has been the low-bid system with its attendant involvement in time and cost overruns (Motlakase and Adeyemi, 2016; Adeyemi and Masalila, 2016). Currently contractors face serious problems of breaking even with the government shifting procurement base to ‘performance-based contracting’ on major public infrastructure. This new procurement structure is a litmus test to the business savvy of the large and medium size contractors while it threatens the continued existence of the small contractors. To survive in the performance-based procurement regime, contractors need to prioritize factors contributing to construction cost under the low-bid system in order of severity from their own perspectives.

4. Methodology

Forty two factor variables contributing to construction-cost as identified by Bubshait and Al-Juwairah (2002) from literature review were considered comprehensive enough and suitable for the research. These variables under their various categories were adopted and included in the questionnaire for ranking by the contracting firms. Only the contractors in grades D and E were targeted for the survey because they are the one who delivered major public infrastructure in the country and hence have wealth of experience. Prior to distributing the questionnaire, a pilot survey was conducted on the contracting firms by telephone and the questionnaires later hand delivered. The relevance of the pilot study was to verify the number of contracting firms willing to participate in the survey and to determine the completeness of the questionnaire in capturing the factors relevant to construction-cost in Botswana. Questionnaires were then distributed by convenience sampling to the contractors to rate on a five-point Likert-type scale of 0 to 4 the established factors impacting negatively on construction-cost in Botswana in order of severity. The questionnaire contained essentially a demographic section and ranking of forty two variables associated with each of the five categories of construction cost factors.

4.1 Ranking

For scoring, the options were given on a five point Likert-type scale. Each factor for its case has a severity index. Severity index is calculated by the following equation:

$$RII = I_s = \sum_{i=1}^5 \left[\frac{w_i x_i}{4} \right] 100 \quad (1)$$

$RII = I_s$ is the severity index of a factor

w_i is the weighting given to each factor by the respondents (ranging from 0 to 4),

5. Analyses of Results and Discussion

During the pilot survey, only 20 of the Grades D and E contractors contacted were willing to participate in the survey. A total of twenty questionnaires were therefore distributed to these contracting firms in Gaborone. Gaborone is the capital city of Botswana and nearly all the big and medium sized contracting organizations have their headquarters there. A total of 16 useful responses were received, representing 80% effective response rate and the analysis was based on this percentage.

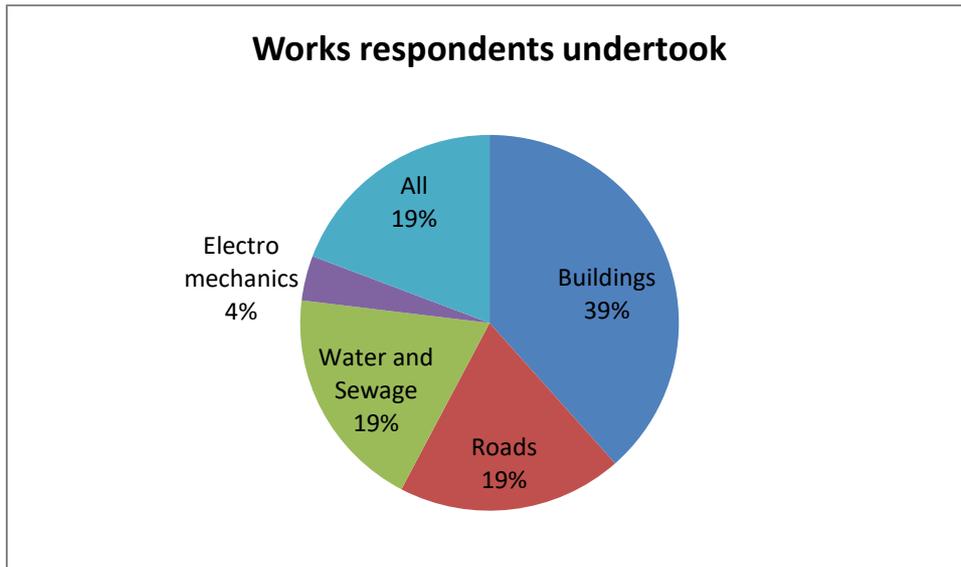


Figure 1: Type of works respondents Undertaken

Figure 1 shows the works the respondents were involved in or undertaken. The figure shows that most respondents were involved in buildings, with roads, water and sewage both coming in second at 19% and last electro mechanics contractors with 4%. The group of respondents who claimed to undertake everything represents 19% also.

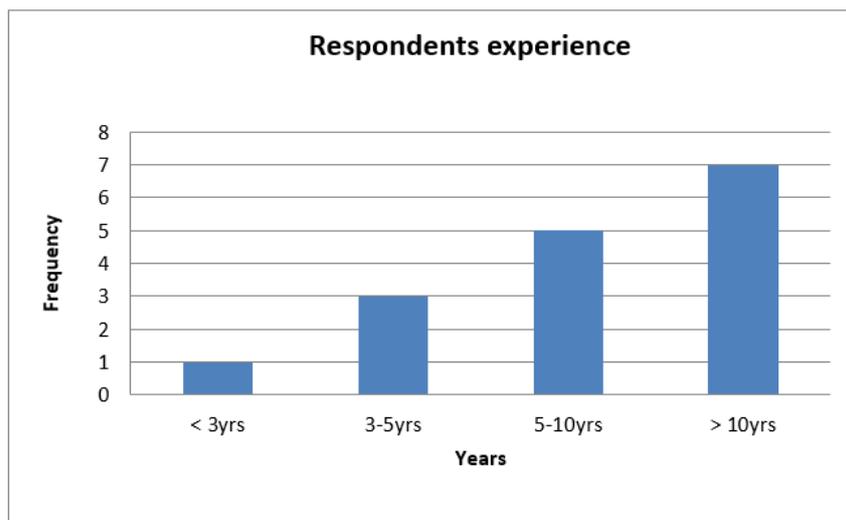


Figure 2: Relevant working experiences of respondents

Figure 2 shows that most of the respondents possess working experience ranging from five to ten years and more. However, those in the ten years plus category are more. The period of working experience was therefore relatively long enough to provide a reliable data.

5.1 Discussion of Results

Table 2: Main factors contributing to construction-cost in Botswana and their rankings

		RI	Average	MS	R	Comment
I	Environmental factors		0.515	2.58	4	Severe effect
1	Effects of weather	0.319				
2	Number of construction going on at the same time	0.272				
3	Social and cultural impacts	0.387				
4	Project location	0.41				
5	Lack of productivity	0.515				
6	Level of competitors	0.584				
7	Number of competitors	0.452				
8	Supplier manipulation	0.625				
9	Economic stability	0.698				
10	Inadequate production of raw materials in the country	0.733				
11	Absence of construction data	0.623				
12	Domination of construction industry by foreign firms	0.501				
13	Government laws and policies	0.65				
14	Labour nationality	0.445				
II	Construction management factors		0.668	3.34	1	Severe effect
1	Incorrect project planning	0.806				
2	Relationship between management and Labour	0.523				
3	Lack of coordination between designers and contractors	0.753				
4	Poor financial control on site	0.724				
5	Previous experience of contract	0.685				
6	Disputes of site	0.515				
II	Construction item factors		0.603	3.02	2	Severe effect
1	Fraudulent practices and kickbacks	0.589				
2	Contract management	0.742				
3	Additional work	0.553				
4	Duration of contract period	0.516				
5	Contractual procedure	0.51				
6	Frequent design changes	0.754				
7	Inadequate labour availability	0.559				
I	Cost estimation factors		0.535	2.68	3	Severe effect
1	Cost of materials	0.858				
2	Fluctuation of prices of materials	0.61				
3	High cost of labour	0.6				
4	High cost of machinery	0.592				
5	High cost of machinery maintenance	0.447				
6	High transportation cost	0.43				
7	Insurance cost	0.308				
8	Long period between design and time of tendering	0.682				
9	Bureaucracy in tendering method	0.492				
10	Waste on site	0.276				
11	Wrong method of estimation	0.594				
V	Financing factors		0.406	2.03	5	Somewhat Severe effect
1	High interest rates charged by banks on loans received by contractors	0.364				
2	Mode of financing, bonds and payment	0.554				
3	Inflationary pressure	0.452				
4	Currency exchange fluctuations	0.252				
	Overall score	0.547	0.545	2.73		Severe effect

From Table 2, the contractors ranked the five cost factors in descending order as construction management

factors (0.668)), construction item factors (0.603), cost estimating factors (0.535), environmental factors (0.515) and financing factors (0.406). The five variables that ranked highest in descending order are: cost of materials (0.858), incorrect project planning, (0.806), frequent design changes (0.754), lack of coordination between designers and contractor (0.753), contract management (0.742).

It is shown in this study that construction management competency is the most serious problem among contractors in Botswana. And by the same token, that the cost of construction materials is the most cardinal issue in the construction industry in Botswana and elsewhere in the world because it also corroborates the findings of Bubshait and Al-Juwairah (2002) in the case of Saudi Arabia.

The most effective method of minimizing cost of construction in Botswana as perceived by contractors is proper project management, planning and good designs. This is similar to the recommendations of Iyer and Jha (2005) where they observed that effective monitoring and feedback by the project manager and project team members; coordinating ability and rapport of PM with top management; positive attitude of PM, project participants; project manager's technical capability can reduce cost of construction. They recommended cost reduction measures including: establishing firmly the requirements and features of the project at the onset before getting started, preparing the project team to do its best by getting members to sign off on capabilities and responsibilities, staying diligent about keeping the project on the right path through contract clauses that disallow significant changes once the project is underway, effective human resource management through effective motivation, project tracking involving discerning early what area or paths are leading to dead ends, monitoring and feedback and applying early corrective actions.

6. Conclusions and Recommendations

The study has a cardinal objective of determining in ranked-order, the viewpoint of construction contractors operating in Botswana on significant problems facing the construction industry in the country. Questionnaire administered on a cross section of the contractors revealed that the main factor contributing to cost of construction in Botswana are management related factors while the cost of materials ranked highest among the factor variables. It appeared that high cost of construction materials was a common denominator around the world as this is corroborated in the case of Saudi Arabia. As a measure to reduce high cost of construction materials in the country, it might worth the while to stem the tide of inflation to which the problem can be traced by embarking on production policy rather than relying on mono-product occasioned by the sale of diamond. Secondly there is urgent need to train indigenous construction personnel to man construction projects efficiently.

References

- Adeyemi, A. Y. and Masalila (2016). Delay Factors and Time-Cost Performance of Construction Projects in Gaborone City Council, Botswana. *Journal for the Advancement of Performance Information & Value (JAPIV)*, **8**(10), 1 – 18.
- Motlakase B. T. and. Adeyemi, A. Y. (2016). Delay Study of Road Construction Projects in Botswana. *BIE Journal of Engineering and Applied Science*, **6**(2), 2-10.
- Bubshait & ALJuwairah, Y. A. 2002. Factors Contributing to Construction Costs in Saudi Arabia, *Cost Engineering*, **44**(5), 30-34.
- Chan, D W. M. and Kumaraswamy, M. M 2002. Compressing the construction durations. *International Journal of Project Management*, **20**, 23-35.
- Central Statistics Office (2013). Government portal, Republic of Botswana Available on: <http://botswana.opendataforafrica.org/data#source>
- Elinwa, U., Buba S. 1993. Construction Cost Factors in Nigeria. *Journal of Construction Engineering and management*, **119**(4)
- Frimpong, Y., Oluwoye, J. and Crawford, L. 2003. Causes of delay and cost overruns in construction of groundwater projects in developing countries: Ghana as a case study. *International Journal of Project Management*. **21**(5), 321-326.
- Gorgenlander, V. 2011. *A Strategic Analysis of the Construction Industry in the United Arab Emirates*. Hamburg: Diplomica Verlag GMBH.
- Higuchi, S and Macke, M. 2008. Cost-benefit analysis for the optimal rehabilitation of deteriorating structures, *Structural Safety* **30**(4), 291-306.
- Iyer, K. C., & Jha, K. N. 2005. Factors affecting cost performance: evidence from Indian construction projects. *International Journal of Project Management*, **23**(4), 283-295.
- Kaliba, C., Muya, M. Mumba, K. 2009. Cost escalation and schedule delays in road construction projects in Zambia, *International Journal of Project Management* **27**, 522–531.
- Kangari, R. 1989. Business Failure in Construction Industry. *Journal of Construction Engineering and Management*, *Journal of construction Engineering and Management* **114** (2), 172-190
- Koushki P. A. and Kartam L., 2004. Impact of construction materials on project time and cost in Kuwait",

- Engineering, Construction and Architectural Management, **11**(2), 126-132
- Lee-Hoai, L. Lee, Y.D. and Lee, J. Y. 2008. Delay and cost overrun in Vietnam Large Construction Projects: A comparison with other selected countries. *KSCE Journal of Civil Engineering*, **12**, 367-377.
- Mansfield, N.R, Ugwu, O.O. and Doran, T. 199. Causes of delay and cost overrun in Nigeria construction projects. *International Journal of Project Management*, **12**(4), 203-272.
- Mbachu, J.I.C, and Vinasithamby, K. 2005. Sources of risk in construction project development.: An Exploratory Study. Proceedings of the Queensland University of Technology Research Week Brisbane, 13pp
- Nkado, R. N. 2006. Construction time-influencing factors: the contractor's perspective, *Construction Management and Economics*, **13**(1), 81-89.
- Omoregie, A. and Radford, D. 2006. Infrastructure Delay and Cost Escalations: Causes and effects in Nigeria. *Proceedings of the 6th International Postgraduate Research Conference in the Built and Human Environment*, School of Architecture, De Montfort University, 3-4 April.
- Sidwell. A. C., R. J.Kennedy and Chan A.P. C. 2002. Re-engineering the Construction Delivery: Process –report and case studies. Australia: *Construction Industry Institute*.
- Walker, D. H. T.(1995). An investigation into construction time performance. *Construction Management and Economics*, **13**(3), 263-274.