

AN ASSESSMENT OF CONSTRUCTION PROJECTS COST OVERRUNS IN THE PUBLIC SECTOR

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The purpose of this study was to identify factors that influence project cost overrun within public sector construction projects with specific reference to Gauteng Province of South Africa. The primary data was collected by means of structured questionnaires which were distributed to practicing construction professionals who are engaged in various dimension in public sector construction projects. The secondary data was derived through reviewed literature. Out of 120 questionnaires sent out, 119 were received, which represented 99% response rate. Data received from the questionnaires was analyzed using descriptive statistical procedures. Findings from questionnaire survey revealed that the most dominant factors of cost overruns in public sector project include: variation orders, change in scope of the project, cash flow and financial difficulties faced by contractors, delays in decision making by professional consultants representing the clients, inadequate planning, frequent design changes, lack of coordination between parties, amongst others. The study thus revealed that it is necessary to identify factors that influence construction cost overruns at the start of the project in order to minimize cost overruns and to improve the cost performance on public sector construction projects. This is because of the high level of accountability necessary required for the management of tax payers money.

Keywords: Schedule overruns, Mitigation, Construction industry, Gauteng, South Africa.

1 INTRODUCTION

Cost overrun occurs when the contract sum at project completion is greater than what was originally budgeted at the inception stage. However, there are fluctuations in costs during the life of the project. Avots (1983) shows the significance of producing a thorough estimate of the project during the planning stage to avoid any additional work which may lead to cost overruns. It is important to identify cost-effective measures to avoid cost overruns (Rahman *et al.* 2012). Various projects encounter cost overruns and construction projects are no exception (Baloi and Prince 2003). Cost overruns are a main challenge in different countries (Angelo and Reina 2002). In developing countries, the challenges are worse when the cost overruns are twice as much as the initial budget (Durdyev *et al.* 2012). Cost overruns have negative impact on all parties involved in the project for example the client loses trust on the design team and the design team earns bad reputation (Park and Papadopoulou 2012). Is it significant to understand cost overruns so that they can be avoided in the future (Angelo and Reina 2002). Hence the aim of this paper was to ascertain the factors that have an impact the project cost overrun within public sector construction projects in South African.

2 CAUSES OF COST OVERRUNS

Generally, the causes that influence project cost performance and cause cost overruns exist from the initial phase to the final project phase (Baloi and Price 2003). Winch (2010) identified common causes of cost overruns as follows: main organization's strategic priorities not being aligned with the project, including established successful procedures; non-existent top management and ministerial ownership and governance; no-existent effective stakeholders' involvement; non-existent expertise and established methodology to project management and risk management; assessment of proposals determined by preliminary estimates rather than long-term value for money; a lack of understanding of, and agreement with the supply industry at top management in the organization; and a lack of effective project team integration between clients, the supplier team and the supply chain.

According to Memon *et al.* (2010) the most severe factors that affect cost overruns in Malaysia include: contractor's cash flow problems, contractors' poor site management and supervision, inexperienced contractors, lack of site workers, inappropriate planning and scheduling by contractors while project scope changes and frequent design changes are the least factors affecting construction cost. Tat-fai (1999) identified major causes of cost overruns at the post-contract stages in mega infrastructure projects in Hong Kong as the following: design changes, scope changes, financial claims, poor client's project management, and unforeseen site conditions, poor interface between contracts, inaccurate pre-tender estimates, and late instructions. Fugar and Agyakwah-Baah (2010) revealed the causes of cost overruns in Ghana as the following: delay in honoring certificates, underestimation of the costs of projects, underestimation of the complexity of projects, difficulty in accessing bank credit, poor supervision, underestimation of time for completion of projects by contractors, shortage of materials, poor professional management, fluctuation of prices or rising cost of materials and poor site management. According to Mukuka *et al.* (2014) the causes of cost overruns in South Africa include: contractors' project inexperience, poor project management, inadequate planning, contractors' inefficiency, and inadequate financial provision, a shortage of skilled site workers, poor workmanship, inaccurate estimates, project complexity and site conflicts. These findings should encourage substantial pre-tender design completion as far as possible in order to alleviate the relatively high likelihood of subsequent post-contract cost overruns.

3 RESEARCH METHODOLOGY

The data used for this study was derived from both primary and secondary sources. A structured data collection approach was used to collect primary data, while the secondary data derived from the review of related literature. The primary data was collected by means of structured questionnaire survey. This was distributed to 120 construction professionals such as architects, contractors, project managers, construction project managers, construction managers, quantity surveyors and other professionals who worked on public sector construction projects in Gauteng Province in South Africa. This was a yardstick considered significant for the study in order to obtain a clear reflection of the causes and effects of cost overruns, measures to mitigate their impact and the critical success factors for public sector construction projects in Gauteng Province, South Africa. From the 120 questionnaires distributed to respondents, 119 participated in the main survey, which equals a 99% response rate. The questionnaires consisted mostly of closed-ended questions and a few open-ended questions. The data presentation and analysis made use of frequency distributions and percentages of all the respondents.

3.1 Mean Item Score (MIS)

A five point Likert scale was used to determine the causes and effects of cost overruns in Public Sector construction projects in South Africa with specific reference to Gauteng Province with regard to the factors identified from the related reviewed literature. The adopted scale for causes of cost overruns in public sector construction project was: 1 = Extremely unlikely (EU); 2 = Unlikely (U); 3 = Neutral (N); 4 = Likely (L) and 5 = Extremely likely (EL).

The five-point scale was transformed to a mean item score (MIS) for each of the factors of causes and effects as assessed by the respondents. The indices were then used to determine the rank of each item. These rankings made it possible to cross-compare the relative importance of the items as perceived by the respondents. These rankings made it possible to cross-compare the relative importance of the items as perceived by the respondents. Data collected from the questionnaires survey was analyzed by the use of this method. The mean item score (MIS) was derived from the following formula:

$$MIS = \frac{1n1 + 2n2 + 3n3 + 4n4 + 5n5}{\Sigma N} \quad (1)$$

Where n1= number of respondents for 'extremely unlikely'; n2= number of respondents for 'unlikely'; n3=number of respondents for 'neutral'; n4= number of respondents for 'likely'; n5=number of respondents for 'extremely likely' and N= Total number of respondents.

Following mathematical calculations, the criteria are then ranked in descending order of their relative importance index (from the highest to the lowest).

4 FINDINGS AND DISCUSSIONS

Findings from 119 respondents revealed that 61% of respondents were male while 39% of the respondents were female. In relation to respondents' age group revealed that 8.4% were 25 years or younger, 15.1% were between 26 and 30 years of age, 26.9% were between 30 and 35 years, 30.3% were between 36 and 40 years, 13.4% were between 41 and 45 years, 3.4% were between 46 and 50 years and 1.7% were 56 years or older. Findings further revealed that 64.7% of the respondents were black, 17.6% were white, 2.5% were colored and 14.3% were Indian or Asian. In relation to their position in the company, findings revealed that 12.6% of the respondents were architects, 42% were quantity surveyors, 10.1% were project managers, 0.8% were construction managers, 14.3% were construction project managers, 10.9% were civil engineers and 8.4% held other positions in the company. These included architects/construction project managers working in rural areas, candidate architectural technologists, chief quantity surveyors at the National Department of Public Works, commercial managers, electrical technicians, junior quantity surveyors, lecturers, mining engineers, professional quantity surveyors, program managers, project supervisor, at executive level, quantity surveyors, senior quantity surveyors, specialist trainers New Engineering Contracts (NEC) conditions and lastly, students.

Regarding years of experience, findings further indicated that 5% had less than one year; 16.8% had between one and five years; 30.3% had between five and ten years; 35.3% had between 10 and 15 years, 8.4% had between 15 and 20 years and 3.4% had more than 20 years of working experience. The results of the level of education revealed that 0.8% had a post-matric certificate, 14.3% had a post- matric diploma, 65.5% had a bachelor's degree and 17.6% had a master's degree. Furthermore, in relation to work entity, findings revealed that 51.3% worked for public sector clients, 10.1% worked for private sector clients, 21.8% worked for consultant quantity surveying firms, 4.2% worked for consultant project management firms, 1.7% worked for consultant mechanical and electrical engineering firms, 2.5% worked for consultant civil

engineering firms, 2.5% worked for main contractors and 5% selected other entities such as consultant architects, Development Bank of Southern Africa (DBSA) architects, Department of Public works (DPW), facilities management firms, multi-disciplinary consultants, private companies and public sector implementing agents for other public sector departments.

Furthermore, findings related to respondents' company size revealed that 13.4% worked for a very small company, 19.3% worked for a small company, 15.1% worked for a medium-sized company and 49.6% worked for a large company.

4.1 Causes of Cost Overruns in Public Sector Construction Projects.

Based on the ranking (R) using the calculated standard deviation (SD) and the mean item score (MIS) for the listed causes of cost overruns in public sector construction projects in South Africa as shown in Table 1, findings revealed the most dominant factor as: variation orders, followed by change in scope of the project and cash flow and financial difficulties faced by contractors, delays in decision making, inadequate planning, frequent design changes, lack of coordination between parties, policy in accepting lowest tender, inaccurate time and cost estimates, errors and omissions in design, inaccurate quantity take-off and contractors' project inexperience. The findings from the current study were similar to the findings by Kadir *et al.* (2005), where change in project scope, cash flow and financial difficulties faced by contractors and inexperienced contractors were revealed as the major causes of cost overruns in construction projects. The findings from the current study were further in agreement with to the findings by Mukuka *et al.* (2014) and Memon *et al.* (2010), where inadequate planning and inexperienced contractors were identified as the major factors of cost overruns. However, these results did not agree with those of the study by Frimpong *et al.* (2003), Fugar and Agyakwah-Baah (2010) and Tamakloe (2011) where monthly payment difficulties from agencies, poor contract management, and material procurement were revealed as the major causes of cost overruns in construction projects. Further the results of the current study were not in agreement with the study by Baloyi and Bekker (2011) where material cost and price fluctuations, shortage of skilled labor and the client's late contract award were identified as the major causes of construction cost overruns. Causes of cost overruns share common characteristics in projects worldwide, and they are also affected by country-specific conditions (Olawale and Sun 2010).

5 CONCLUSION

The reviewed literature revealed the following causes of cost overruns in construction projects: scope change, contractor's cash flow problems, contractual claims, design changes, increase in material cost, inaccurate material estimates, inaccurate financial provision, inadequate planning, inexperienced contractors and fraudulent practices.

Findings from the survey outcomes indicated the following as the major causes of cost overruns in public sector construction projects in South Africa: variation orders, change in scope of the project and cash flow and financial difficulties faced by contractors, delays in decision making, inadequate planning, frequent design changes, lack of coordination between parties, policy in accepting lowest tender, inaccurate time and cost estimates, errors and omissions in design, inaccurate quantity take-off and contractors' project inexperience. It is therefore recommended that all team members must understand and be strongly committed and dedicated to achieve, maintain and fulfill project goals. Additionally, the plan should be prepared with as much detail as possible, including during the design process and throughout the project development.

Table 1. Causes of cost overruns in public sector construction projects.

CAUSES OF COST OVERRUNS	σX	MIS	R
Variation orders	1.070	4.26	1
Change in scope of the project	0.844	4.24	2
Cash flow and financial difficulties faced by contractors	1.000	4.24	2
Delays in decision making	0.881	4.18	3
Inadequate planning	0.950	4.05	4
Frequent design changes	1.070	4.03	5
Lack of coordination between parties	0.963	4.02	6
Policy in accepting lowest tender	1.059	4.01	7
Inaccurate time and cost estimates	0.991	3.98	8
Errors and omissions in design	1.042	3.97	9
Inaccurate quantity take-off	1.028	3.95	10
Contractors' project inexperience	1.007	3.95	10
Extension of time claims	1.039	3.92	11
Change in material specification and type	1.006	3.88	12
Poor contract management	0.943	3.87	13
Delay in progress payment by the owner	1.126	3.85	14
Poor project management	0.979	3.82	15
Fluctuations in material prices	0.899	3.82	15
Poor workmanship	1.013	3.80	16
Lack of communication between parties	0.972	3.79	17
Mistakes and discrepancies in contract document	0.973	3.75	18
Late delivery of materials	1.060	3.72	19
Incomplete design at the time of tender	1.181	3.72	19
Incompetent sub-contractors	1.047	3.71	20
Mistakes during construction	1.044	3.70	21
Slow information flow between parties	1.009	3.70	21
Unforeseen ground conditions	1.033	3.69	22
Delay in payment to supplier/sub-contractor	1.127	3.68	23
Delay in preparation and approval of drawings	1.027	3.68	23
Poor site supervision	1.017	3.68	23
Strikes	1.091	3.67	24
Poor site management	1.057	3.65	25
Financial difficulty by owner	1.267	3.60	26
Fraudulent practices (kickbacks, corruption)	1.384	3.59	27
Labor disputes	1.004	3.55	28
Inadequate funding of the project	1.179	3.48	29
Schedule delay	0.990	3.46	30
Delay in inspection and approval of completed works	1.128	3.43	31
Site conflicts	0.998	3.43	31
Lack of executive capacity by employer	1.184	3.41	32
Negative effects of weather	1.130	3.40	33
High cost of labor	1.126	3.37	34
Shortage of site workers	1.172	3.32	35
Lack of experience of technical consultants	1.117	3.34	36

σX = Standard deviation, MIS = Mean item score, R = Rank

References

- Angelo, W. and Reina, P., Mega Projects Need More Study Upfront to Avoid Cost Overruns, 249(3), 2002.
 Avots, I., Cost-Relevance Analysis for Overrun Control. International Journal of Project Management, 1(3): 142-148, 1983.

- Baloi, D. and Prince, A., Modelling Global Risk Factors Affecting Construction. Cost Performance, International Journal of Project Management, Volume 21: 261-269, 2003.
- Durdzey, S., Ismail, S. and Bakar, N., Factors Causing Cost Overruns in Construction of Residential Projects: Case Study of Turkey. International Journal of Science and Management, 1(1): 3-12, 2012.
- Frimpong, Y., Oluwoye, J., and Crawford, L., Causes of Delay and Cost Overruns in Construction of Groundwater Projects in Developing Countries: Ghana as a Case Study). International Journal of Project Management, Volume 21: 321-326, 2003.
- Fugar, F. and Agyiakwah-Baah, A., Delays in Building Construction Projects in Ghana. Australasian Journal of Construction Economics and Building, 10(1/2): 103-116, 2010.
- Kadir, A., Lee, W. P., Jaafar, M. S., Sapuan, S. M., and Ali, A. A. A., Factors Affecting Construction Labour Productivity for Malaysian Residential Projects. 23(1): 42-54, 2006.
- Memon, A., Rahman, I., Abdullah, M., and Azis, A. Factors Affecting Cost in MARA Projects: Perspective of Project Management Consultants. International Journal of Sustainable Construction Engineering and Technology, 1(2): 41-54, 2010.
- Mukuka, M., Aigbavboa, C., and Thwala, W., 2014. ppml.url.tw. Retrieved from <http://www.ppml.url.tw/EPPM/conferences/2014/download/Construction%20Experts%E2%80%99%20Perception%20on%20the%20Causes%20and%20Effects%20of%20Cost%20Overruns%20in%20Johannesburg,%20Gauteng%20Province,%20South%20Africa.pdf> on 20th November 2015.
- Olawale, Y. and Sun, M. Cost and Time Control of Construction Projects: Inhibiting factors and Mitigating Measures in Practice. Management and Economics, 28(5): 509-526, 2010.
- Park, Y. and Papadopoulou, T., Causes of Cost Overruns in Transport Infrastructure Projects in Asia: Their Significance and Relationship with Project Size. Built Environment Project and Asset Management, 2(2): 195-216, 2012.
- Rahman, I. A., Aziz, A. A. A., Memon, A. H., Nagapan, S, and Latif, Q. B., Time and Cost Performance in Construction Projects in Southern and Central Regions of Peninsular Malaysia. International Journal of Advances in Applied Sciences, 1(1): 46-51, 2012.
- Tamakloe, Y., Assessment of Cost and Time Impacts of Public Sector Construction Projects in Ghana, MSc Thesis Kwame Nkrumah University of Science and Technology, 2011.
- Tat-fai, M. 1999, theses.lib.polyu.edu.hk., Retrieved from <http://theses.lib.polyu.edu.hk/handle/200/1358> on 18 July 2014..
- Winch, G., Managing Construction projects: An Information Processing approach. UK: Blackwell Publishing Ltd, 2010.