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AIMS AND SCOPE

The Journal Of Construction (JOC) is the official journal of the Association Of Schools Of Construction Southern Africa (ASOCSA). ASOCSA has committed itself to foster excellence in construction communication, scholarship, research, education and practice and the JOC provides the medium to achieve this commitment. JOC is at this stage a bi-annual refereed journal serving all stakeholders and participants in the building construction and civil engineering sectors.

JOC publishes quality papers written in a conversational style aiming to advance knowledge of practice and science of construction while providing a forum for the interchange of information and ideas on current issues. JOC aims to promote the interface between academia and industry, current and topical construction industry research and practical application by disseminating relevant in-depth research papers, reviews of projects and case studies, information on current research projects, comments on previous contributions, research, innovation, technical and practice notes, and developments in construction education policies and strategies. Some issues might be themed by topic.

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EDITOR: Dr Nishani Harinarain, University of KwaZulu-Natal, Durban, South Africa.

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Dear Construction Industry Stakeholders,

Nelson Mandela, in his inaugural address, in 1994 said: "The youth of our country are the most valued possessions of the nation. Without them there can be no future. There needs are immense and urgent." 24 years later this need is even more urgent.

As stakeholders and participants in higher education in the construction industry we have a responsibility to empower the youth through education. As newly elected President of the Associated Schools of Construction of Southern Africa, it is an honour and privilege to follow in the footsteps of remarkable individuals like, Prof John Smallwood, Prof Theo Haupt, Prof Didi Thwala and Mr. Ferdi Fester, who as past presidents of ASOCSA, did not shy away from the immense challenge to create a sustainable future for our youth in the construction industry.

ASOCSA, in conjunction with higher education institutions, industry and government have made major strides to ensure the youth of our country has access to quality construction related education to prepare the future leaders of one of South Africa's most important industries. A shining point is ASOCSA's 11th Built Environment Conference that recently took place in Durban. The Conference not only produced 62 research papers (more than any of the previous conferences) but also provided a platform for students to take part in a student proposal competition. The increased levels of interest and participation by students, government and industry in conferences of this nature show that higher education in the construction industry is alive and well.

In closing, I want to congratulate the authors of the papers included in this edition of the journal for the quality and industry relevance of their papers.

Dr Hendrik Prinsloo
President
Associated Schools of Construction of Southern
Africa
(ASOCSA)



JOURNAL OF CONSTRUCTION



EDITORIAL

The 3rd issue of Volume 10 of the Journal of Construction (JoC) comprises four papers which cover various topics in construction contributed by African authors.

Firstly, Amoah and Shakantu look at public procurement reforms in Ghana and its impact on the growth of the local construction industry. Secondly, Mewomo, Aigbavboa and Lesalane investigated the factors influencing the choice of the standard forms of contract in the South African construction industry. Thirdly, Mollo and Emuze evaluated concrete decision analysis in South Africa. Finally, Harinarain and Ingraham examined cost overruns in the South African residential construction sector.

EDITOR: Dr Nishani Harinarain, University of KwaZulu-Natal, Durban South Africa.

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Department of Construction Management, Nelson Mandela Metropolitan University, South Africa

Corresponding Author: Christopher Amoah¹ Email: amokris2003@yahoo.co.uk1, Tel: +27834994156,

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Department of Construction Management and Quantity Surveying, University of Johannesburg, South Africa.

Corresponding author: Mewomo MC

Email: ¹modupemewomo@gmail.com

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Department of Built Environment, Central University of Technology, Free State, South Africa

Corresponding author: Lesiba George Mollo

Email: ¹lmollo@cut.ac.za

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Nishani Harinarain¹, Sean B. Ingham²

^{1,2} University of KwaZulu-Natal, School of Engineering, Construction Studies Discipline, Howard College Campus, Durban, South Africa.

*Corresponding Author: Nishani Harinarain

Telephone: +27(0)312602687; e-mail: harinarain@ukzn.ac.za

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PUBLIC PROCUREMENT REFORMS IN GHANA: IMPACT ON THE GROWTH OF THE LOCAL CONSTRUCTION INDUSTRY.

Christopher Amoah¹ and Prof Winston Shakantu

Department of Construction Management, Nelson Mandela Metropolitan University, South Africa

Corresponding Author: **Christopher Amoah**¹ Email: amokris2003@yahoo.co.uk1, Tel: +27834994156,

help grow the local construction industry. The study provides recommendations to all stakeholders in the Ghanaian construction industry and proposes that the procurement model produced by this study be used in the public procurement system to help grow the indigenous construction industry.

Key Words: Public procurement reforms, Ghana, Act 663.

ABSTRACT

PURPOSE:

The study investigates how the various procurement reforms instituted by the government of Ghana have impacted on the growth of the Ghanaian construction industry.

METHODOLOGY

The research instrument used is the interview guide made up of tick box and open-ended questions to interview 37 construction firms operating from Accra, Ghana. The Head of Public Relation Officer of the Ghana Procurement Authority was also interviewed. Other sources of data included archival records such as contracts awarded, the current public procurement regulations, and manuals.

FINDINGS

The findings show that, even though public procurement reforms have brought about improved procurement practices and increased the participation of the local contractors in the procurement processes, the reforms have failed to have a significant impact on the growth of the local construction industry.

RESEARCH LIMITATIONS

Out of 69 construction and consultancy firms targeted for interview, 37 were reached for interview and all the firms interviewed are operating in Accra.

PRACTICAL IMPLICATIONS

The findings of this study provide an opportunity to government to improve her procurement policies to help grow the local construction industry.

VALUE OF THE PAPER

The research has produced a procurement model with improved protective mechanisms that will

1. INTRODUCTION

All over the globe and over the years, nations and international bodies have been concerned with how to modernise, simplify and improve public procurement practices using public policy and legal reforms¹. The target for reforming public procurement systems has been to reap the associated reward of improved competition with the attendant efficiency and lowered contract costs². In particular, since the 1990's there has been a wave of reforms initiated in developing and developed nations alike in response to the plodding of international bodies such as the World Trade Organisation-Agreement on Government Procurement (WTO/GPA) of 1994, the World Bank and the Organisation for Economic Co-operation and Development (OECD)³. Having linked the fight against corruption in public procurement to economic development, many organisations have been encouraging reforms in public procurement systems, particularly in developing nations³.

Increasing the effectiveness, efficiency and transparency of procurement systems has therefore become an on-going concern⁶ of governments and the international development community. Many countries have recognized that increasing the effectiveness of the use of public funds, including funds provided through official development assistance requires the existence of an adequate national procurement system that meets international standards and that operates as intended⁴. Due to the essential role of public procurement in economic and social development, the World Bank specifies three thematic areas of public procurement for its funded projects. These are, ensuring that there is



fair competition among bidders, promoting transparency in awarding and execution of its contracts and finally, encouraging the development of indigenous contractors and suppliers⁵.

In Ghana, the Public Procurement Act (PPA) (Act 663) 2003, was enacted to harmonise public procurement processes in the public service, secure judicious, economic and efficient use of state resources, and furthermore, ensure that public procurement is fair, transparent and non-discriminatory⁶. This new Act was constituted after years of foul play and abuse as far as procurement was concerned in the country⁷. This therefore necessitated a thorough review of the existing procurements regulations. The enactment of the law in 2003 further ensured that modern trends in procurement were adopted to bring about the much-needed sanity to the local procurement system which had been flawed by bad procurement practices such as corruption and other malfeasances⁷.

In Ghana, public procurement accounts for 50%-70% of the national budget (after personal emoluments), 14% of GDP and 24% of imports. Public procurement therefore has both social and economic impacts on the country⁸. The impact of the public procurement system on construction industry is therefore important as the industry has effects on the country's Gross Domestic Product (GDP) and social needs, such as housing, in Ghana.

Even though the PPA (Act 663) of Ghana is reputed to be an integrity promoter and corruption resistant⁴, the implication that the Acts has on the local construction industry is largely unknown. This research therefore seeks to identify the impact of the public procurement reforms instituted by Ghana on the local construction industry.

Main Objectives of This Paper

The main objectives are as follows;

1. To find out the effectiveness of the public procurement reforms.
2. To find out how public procurement reforms have affected contractor/consultant selection for public works.
3. To find out the impact of these reforms on the growth of the local construction industry.
4. To identify the criteria to be used to measure the impact of these reforms on the Ghanaian construction industry
5. To identify the concerns of the

construction industry regarding the public procurement reforms.

6. To develop a public procurement model that would have positive impact on the growth of the indigenous construction sector.

Description of the case study country

Ghana is a West African country bordered by Cote d'Ivoire to the west, Burkina Faso to the north, Togo to the east and the Atlantic Ocean to the south. In 1957, Ghana became the first sub-Saharan country in colonial Africa to gain independence. In late 2010 Ghana was categorised as a lower middle-income country and now envisioned to become the first developed country in Africa between 2020 and 2029.

2. LITERATURE REVIEW

Why public procurement reforms

Various methods and strategies have been employed to ensure public procurement reform conforms to the international standard. The purpose of public procurement reform differs from country to country; however, reforms are generally aimed at a common goal. A study undertaken for the European Community in 1995 indicates that procurement has been used by governments to: stimulate economic activity; protect national industries against foreign competition; improve the competitiveness of certain industrial sectors; and remedy regional disparities⁹. It has also been employed to achieve certain more direct social policy objectives such as to: foster the creation of jobs; promote fair labour conditions; promote the use of local labour as a means to prevent discrimination against minority groups; protect the environment; encourage equality of opportunity between men and women; and promote the increased utilisation of the disabled in employment.

In most developed countries, public procurement reforms take place within a framework of international obligations, such as the World Trade Organisation's Agreement on Government Procurement or the Procurement Directives made under regional agreements such as the European Union or the North America Free Trade Agreement⁹. However, in recent years, the need for reform has increased, due to requirements set by the World Bank and other donor organisations as conditions for providing development aid and because the inefficiencies of the unreformed systems have become self-evident. Also, most donor countries consider a well-functioning procurement system an essential requirement if their funds are to be used effectively to promote



development and hence where well-functioning procurement systems are non-existent in the host country, donors may insist on using their own procedures⁹. As most developing countries prefer the flexibility that comes with receiving development aid through budget support, they have no alternative than to reform their public procurement and financial management systems.

Public procurement reforms in Ghana

The estimated annual value of public procurement for goods, works, and consultancy services, at six hundred million dollars (US \$600 million)⁸. This value is about 10% of the country's GDP. The bulk of the public procurement expenditure was spent on Municipal and District Assemblies (MDAs) and District Assemblies (DAs). The MDAs and DAs spent much on capital investment procurement¹⁰.

The procurement of construction works and services have been regulated mainly through circulars from the Ministry of Finance, which complement a set of procedures evolved by convention in connection with the control of procurement exercised by the ministry. The Central, Regional and District Tender Boards process and award contracts within thresholds defined by the World Bank Procurement Guidelines¹¹ and the World Bank Consultant Guidelines¹².

The traditional method of procurement is mainly used for public works with design separate from construction. There is a provision for mandatory registration and classification of contractors under guidelines administered by the Ministry of Water Resources, Works and Housing. However, the MDAs and many DAs maintain separate lists for the pre-qualification of contractors and use different standard conditions of contract for works procurement. World Bank-administered projects use the International Federation of Consulting Engineers (FIDIC) conditions of contract for works contracts and shortlists for the selection of consultants¹⁰.

The shortlists used on World Bank-administered projects for the selection of consultants have been observed to be repetitive, with the same firms recurrently selected in civil engineering and building works supervision¹¹. There were many instances where a single contractor was buying and pricing all the bidding documents, and a number of contracts awarded to the same contractor/supplier, under different contracting names have also been observed¹⁰.

It is suggested that conflict of interest, bribery,

embezzlement, kickbacks, tender manipulation and fraud are observed corrupt practices in the Ghanaian infrastructure projects delivery and procurement system¹¹. The severity of corruption practices has intensified the search for delivering infrastructure projects that will achieve value for money. To address corruption practices, it would require the constitution of a sound procurement system and pro-social equity policies that would foster good governance, corporate social responsibility transparency, accountability, judicious public expenditure and national progress. The introduction of new public law (Act 663) was therefore long overdue¹³.

The PPA, 2003 (Act 663 of 2003)

The Public Procurement Law (PPL), 2003 is a comprehensive legislation designed to eliminate the shortcomings and organisational weaknesses which were inherent in public procurement in Ghana¹³. The government of Ghana, in consultation with its development partners had identified the public procurement system as an area that required urgent attention in view of the widespread perception of corrupt practices and inefficiencies, and to build trust in the procurement system.

A study by the World Bank¹⁴ indicated that about 50-70% of the national budget (after personal emoluments) is procurement related. Therefore, an efficient public procurement system could ensure value for money in government expenditure, which is essential to a country facing enormous developmental challenges.

To ensure sanity and value for money in the public procurement landscape, the government of Ghana in 1996 launched the Public Financial Management Reform Programme (PUFMARP). The purpose of the programme was to improve financial management in Ghana as a result of weaknesses identified in the procurement system. These findings by PUFMARP led to the establishment of the Public Procurement Oversight Group in 1999. The aim of this group was to steer the design of a comprehensive public procurement reform programme which led to the drafting of a public procurement bill in September 2002.

In 2003, the Parliament of Ghana enacted the Public Procurement Act to help in procurement activities in the country and enhance the procurement reforms. Act 663 has contributed some level of sanity into the construction sector¹⁵.



Criticism of the PPL of Ghana (Act 663)

There are still various shortcomings leaving room for improvement in some areas of the PPL. There are various enumerated criticisms against the PPL¹⁶. Some of such criticism is that, there are difficulties in the application of the provisions of the law to very low value procurement items as participants in the sourcing of such items are unable or unwilling to satisfy the qualification criteria and also under section 60 the PPL, domestic suppliers and contractors may be given some preferential treatment upon approval by the PPA. But it is feared that giving advantage to local firms could perpetuate inefficiency and increased cost by compromising the principles of open competition and value-for-money.

The above enumerated criticisms¹⁶ are justifiable however; the inclusion of margin of preference does not necessary prevent competition. The margin of preference seeks to protect the local industry from unfair competition from the foreign firms and if implemented fairly by the procurement officials, it would bring about growth in the local industry.

A study investigating the effect of the public procurement law on the Ghanaian education sector revealed that out of 35 respondents interviewed, 33 agreed that they face many challenges¹⁷. Some of the challenges respondents stated were; cumbersome process thus delaying in the award of contract; no room for price negotiation; and delay in funds allocations thus leading to purchase price fluctuations. These bottlenecks hinder the day-to-day functioning of their school's procurement systems¹⁷. It is further stated that the main reasons for these bottlenecks are lack of database of suppliers; limited skilled personnel; and unnecessary levels of approval they have to follow¹⁷.

Overview of the construction industry in Ghana

The construction industry is defined as a group of firms with closely related activities involved in the construction of real estate, buildings, private and public infrastructure¹⁸. It also deals with all economic activities directed to the creation, renovation, repair or extension of fixed assets in the form of buildings, land improvements of an engineering nature and other such engineering construction such as roads, bridges and dams. The construction industry is important in Ghana because infrastructure facilities required for improved living conditions are relatively undersupplied¹⁹. In Ghana, the industry has a big potential to help accelerate economic growth.

Gold, timber and cocoa production are major sources of foreign exchange and the domestic economy continues to revolve around semi-subsistence and smallholder agriculture, which accounts for about 40% of GDP and employs 60% of the workforce²⁰. The construction industry is expected to grow by 30.60% by the end of 2016; outperforming all other areas such as petroleum, manufacturing, mining and quarrying according to the Budget Statement and Economic Policy of the Government of Ghana²¹ (see table 1). This trend shows how important the construction industry is to economic development.

The construction industry in Ghana is characterised by a multiplicity of small firms²². It was noted that the large construction firms consist mainly of foreign firms whilst the small firms are mostly Ghanaian indigenous businesses²³. Out of a total of 7095 construction firms registered in Ghana in 2002, 90% were small contractors who belong to classes D3 and D4 and undertake less complex construction jobs with tender sums up to one million US dollars²².

Table 1: Industry Growth Performance (%)

Activity	2013	2014*	2015	
			Target	Outturn
Industry	6.6%	0.8%	0.8%	9.1%
Mining and Quarrying	11.6%	3.2%	3.3%	-3.8%
Petroleum	18.0%	4.5%	3.0%	2.0%
Manufacturing	-0.5%	-0.8%	-1.8%	-2.0%
Electricity	16.3%	0.3%	0.5%	3.2%
Water and Sewerage	-1.6%	-1.1%	-0.7%	15.6%
Construction	8.6%	0.0%	1.7%	30.6%

It has been stated that the total amount of work executed by these small contractors' ranges between 10% and 20% of the total construction output²². However, these small construction firms could also be accounting for over 50% (cost-wise) of all building materials production and nearly 80% of all short-term employment, especially for unskilled workers in many deprived communities in Ghana²⁴.

Surprisingly, policy makers have not promoted this industry as a driver of economic growth. This is reflected in the lack of attention given to the construction industry in recent government policy and strategy documents published in November 2005²⁵. Indeed, in the industrial census



report released in June 2006 and commissioned by the Ghana Statistical Service, there were no data on the construction industry while comprehensive data were provided for thousands of firms in the utilities, manufacturing and mining industries. The importance of the construction industry as a major growth pillar in Ghana needs to be continuously publicised to policy makers, economic planners and the general public in order to accelerate sustainable economic growth.

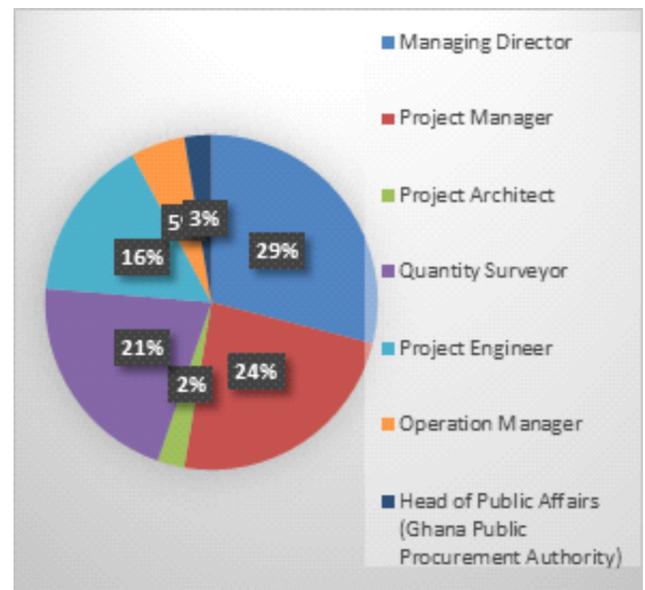
3. RESEARCH METHOD

The research method is the planned structure on which the study is carried so as to obtain answers to research problems. The plan constitutes the overall scheme of the research²⁶. Currently there are two broad research approaches in the social sciences, namely quantitative and qualitative research. However, the third identified approach is called mixed method approach²⁷. This research chose the philosophically rationalist approach, which is ontologically and epistemologically subjectivist. It uses the phenomenological (interpretivist) paradigm to collect qualitative data using intensive interview to seek people's perception of object reality. Participants in the construction industry (contractors and consultants) and a staff at public procurement head office were interviewed to verify and explore impact of procurement reforms on the local construction industry. Since the researcher aimed to gain maximum information from the participants, personal interviews (face-to-face interview) were used²⁸ with the aid of interview guide. Purposive sampling was adopted since the subject under investigation is of specialised nature. From the targeted population of 69, 37 reached for interview. The characteristics of the respondents interviewed are as follows:

Profile of the interviewees

The people contacted for the interviews are in the know of the past and current public procurement practices in the Ghanaian construction industry. They were authorised by their organisations to grant the interview as they are involved in both public and private tender processes for their respective organisations. Their views on the research topic are therefore very reliable and valuable. The figure 1 shows the profile of the respondents.

Figure 1: Profile of interviewees



Interviewee's construction industry profile

The analysis of the interviewee's industry profile has indicated 69% of them are in the building construction industry, 19% are consultants in the construction industry and 12% are in the road construction sector.

Experience of the interviewee's organisation in construction business

As shown in figure 2, 41% of the respondent's organisations have been in business for 1 to 5 years; 35% have been operating for 6 to 10 years; 11% for 16 to 20 years; 8% has been in business for 11 to 15 years and 5% have been in operation for 21 to 25 years. This indicates that most of the businesses came into operation after the introduction of the current procurement law. However, Figure 2 mitigates for this in that the individuals interviewed have experience from before and after the introduction of the procurement reform laws.

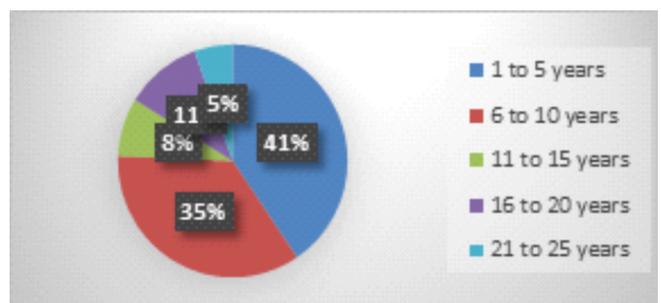


Figure 2: Profile of business experience of the organisations employing the interviewees

Interviewees work experience

Twenty-one (21) interviewees (representing 57%) have worked between 6 to 10 years, 8 of them (representing 22%) have worked for 11 to 15



years, 5 interviewees (representing 14%) have worked in the construction industry for 1 to 5 years, 2 of them (representing 5%) have worked for 16 to 20 years and 1 interviewee (representing 3%) has worked for 21 to 25 years. Thus, a substantial number of the interviewees have experience of working in the construction industry before and after the introduction of the current public procurement systems and hence are well placed to know the effect of the new public procurement systems.

Interviewee's educational background

An analysis of the interviewee's educational achievement indicates Bachelor's Degrees as a common qualification. Fifty one percent (51%) of the interviewees have Bachelor's Degrees. This is followed by Masters Degrees and Higher National Diploma with 22% of the interviewees respectively and 5% of the interviewees however, have Diploma Certificates.

4. FINDINGS AND DISCUSSION

Effectiveness of the public procurement reforms

The respondents were asked to assess the current public procurement as against the past public procurement regulations in terms of promotion of growth in the local construction industry. Fifty four percent (54%) of the respondents stated that the current procurement law is better than the former procurement regulations in terms of assisting the local construction industry. Thirty two percent (32%) of the respondents were uncertain whilst 14% of them do not agree. Most of the respondents also stated that, they do not have any problem with the procurement law because if implemented by the procurement officials, it would assist them to grow but in reality; they do not see any compliance with the law. The public procurement authority also agreed that the current law seeks to promote the growth of the local construction industry as compared to the previous procurement regulation hence it is an improvement made. Generally, the results show that, public procurement reforms in Ghana have been effective in terms of correcting anomalies in the past procurement systems. Currently, future projects to be put on tender are advertised on the website of the public procurement authority ahead of time and tenderers are able to challenge the outcome of the bidding process. However, the implementation of the law to achieve the desired result has not been effective as implementation

challenges of the past regulations still persist.

Effect of public procurement reforms on contractor/consultant selection for public works

Even though the majority of the respondents (54%) agreed that the current procurement regulation is better in assisting them to grow, when asked whether public procurement reforms over the years have improved the selection of the local contractors and consultants for public works, 57% of the of them answered in negative whilst 43% answered in affirmative. This result was not surprising as majority of the respondents accused public procurement agencies of not implementing the local content policies in the law. However, the public procurement authority stated that the various reforms have assisted in awarding contracts to the local construction industry. Whilst it is undeniable fact that the public procurement reforms in Ghana have increased opportunities for local contractors and consultants to participate in the tendering processes for public projects, the reforms have not had any positive effect on the contractors and consultant's selection for major government projects as foreign contractors still dominate in the execution of major government projects.

Impact of Public procurement reforms on the growth of the local construction industry

An analysis of the contracts awarded to the local contractors in the past two years indicates that most of the contracts are in the housing and road sectors. However, the values of these contracts are relatively small and the nature of the projects seems to be small scale construction projects devoid of complexities. This may be as result of lack of capacity of the local contractors to execute large and complex government buildings.

In the road sector however, all the contracts awarded to the local contractors were through restrictive tendering procedure. Restrictive tendering procedure only allows certain contractors to tender for those projects. The disadvantage of this procedure is that, it does not allow even all the local contractors to tender for the project and therefore prevents some local contractors from the tendering processes. Again, a careful observation of the project descriptions shows that these projects are minor road works which involve mainly resurfacing and upgrading of already existing road mainly in the townships and between communities and all these road works are less than 50 kilometres long. This also shows that huge road projects such as high ways and overpass bridges are still in the hands of foreign contractors. The issues of lack of capacity



of the local contractors to execute complex works in the housing sector also exist in the road sector. This clearly indicates that public procurement reforms in Ghana have hardly had any positive impact on the growth (ability to execute all government projects) of the local construction industry as the industry is still dominated by foreign contractors and consultants. As indicated above, most of the works done by the local contractors are through subcontracting arrangements with the foreign contractors and/or for minor works such as school building and road resurfacing or upgrading with relatively small contract amount.

Criteria to be used to measure the impact of these reforms on the Ghanaian construction industry

The result in table 2 indicates that, the stakeholders in the Ghanaian construction use criteria such as (a) Prompt payment for work done, (b) Efficiency in the procurement process, (c) Financial support for local contractors/consultants for public contracts, (d) Set aside policies in public contracts in favour of local contractors and consultants, and (e) Restrictive policies in favour of local consultants and contractors; to measure the impact of the procurement reforms on the local construction industry.

.Other factors they may consider are; (a) Number of public contracts awarded to local contractors and consultants, (b) Mentorship policies in the public procurement contracts, (c) Equal opportunities and equal treatment for both local and foreign contractors and consultants and (d) Localisation policies (where only contractors located in projects locations are considered). When they see procurement reforms addressing these issues, then they would consider the reforms as having good impact on the local construction industry. The procurement model developed in this study incorporate these criteria stated above.

Concerns of the construction industry regarding the public procurement reforms

The result in table 3 reveals that, the challenges the local construction industry is facing currently are the same challenges they faced before the reforms. The major challenges are (a) Funding issues, (b) lack of capacity, (c) Bribery and corruption, (d) High interest rate, (e) Foreign competition, (f) Political influence, (g) Payment delays, and (h) lack of transparency.

Table 2: Factors to be considered when setting criteria to measure the impact of public procurement reforms on the Ghanaian construction industry

Criteria	Total Number	Dis-agree	Neu-tral	Agree	Ran-k
Prompt payment for work done	37	5%	0%	95%	1
Efficiency in the procurement process	37	5%	11%	84%	2
Financial support for local contractors and consultants for public contracts	37	11%	22%	67%	3
Set aside policies in public contracts in favour of local contractors/consultants	37	22%	5%	73%	4
Restrictive policies in favour of local consultants/contractors	37	16%	8%	76%	5
Number of public contracts awarded to local contractors and consultants	37	19%	8%	73%	6
Mentorship policies in the public procurement contracts	37	8%	32%	60%	7
Equal opportunities and equal treatment for both local and foreign contractors/consultants	37	32%	11%	57%	8
Localization policies, where only contractors located at projects area are considered	37	22%	32%	46%	9

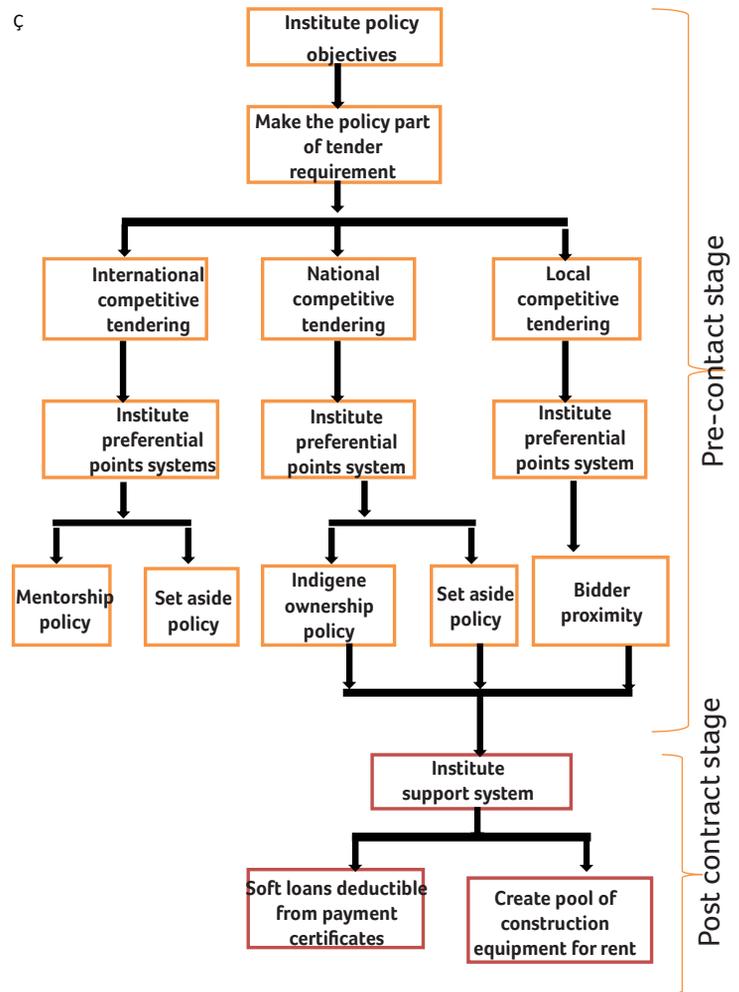
Other concerns identified are (a) No law to enforce local content, (b) Sole sourcing, (c) Cumbersome tender processes, and (d) High taxes. It can therefore be concluded that public procurement reforms in Ghana have failed to address the challenges of the local construction



industry. The procurement model developed in this study when implemented would address all these challenges enumerated by the respondents.

Proposed public procurement model that will have positive impact on the growth of the indigenous construction sector

The proposed procurement model shown in figure 3 is divided into two phases, namely the pre-contract stage and post contract stage. At the pre-contract stage, a policy objective must be put in place by government and the policy must be made as part of tender requirements. Government procurement should be divided into three categories, namely international, national and local competitive tendering. Government should then implement the policy objectives in the tender evaluation process. Points should be awarded for each preferential policy based on the requirement stated in the tender documents and these points should be paramount in awarding the contract. At the post contract stage, government should then institute and implement support systems in the form of soft loans or provision of construction equipment to the local contractors to help them execute their part of the project successfully. The implementation of this model would help local contractors have access to public works as it would eliminate unfair competition from the foreign contractors whilst boosting employment opportunities in the communities.



5. CONCLUSIONS AND RECOMMENDATIONS

The study aimed to investigate the impact of the public procurement reforms in Ghana on the growth of the local construction industry. Interviews were conducted among the stakeholders in the construction industry including the Public Procurement Authority in Ghana. The stakeholders in the Ghanaian construction industry (Contractors and Consultants) believe public procurement reforms in Ghana have been effective in the attempt to resolve the anomalies and deficiencies in the past procurement practices. There are however, still, implementation challenges that need to be tackled. There are situations where procurement officials have refused to give feedback with respect to tender outcome to the participants upon request. The public procurement reforms have also increased the participation of the local contractors and consultants in the tendering processes for government projects. In most cases however, local contractors are only appointed for contracts with low values, devoid of complexities. It was also revealed from the study that public procurement reforms have not had any significant impact on the growth of local construction

Table 3 Respondent's challenges with the current public procurement systems

	Challenges	Frequ-ency	Percen-tages	Rank
1	Funding issues	16	30.77%	1
2	Lack of capacity to tender for some projects	12	23.08%	2
3	Bribery and corruption	7	13.46%	3
4	Foreign competition	3	5.77%	4
5	High interest rates	3	5.77%	4
6	Payment delays	2	3.85%	5
7	Cumbersome tender processes	2	3.85%	5
8	Political influence	2	3.85%	5
9	Lack of transparency	2	3.85%	5
10	Sole sourcing	1	1.92%	6
11	No law to enforce local content	1	1.92%	6
12	High taxes	1	1.92%	6



Ghana. The over reliance on foreign aid, donors and loans, by government is also seen as a major contributory factor to the influx of foreign firms in Ghana. Most of the donor and aid countries stipulate terms and conditions regarding who to execute the projects they are funding. This hampers the government actions in terms of engaging the local contractors and consultants on those donor/aid funded projects.

It is therefore recommended that, the margin of preference as stated in section 60 of the current PPA (Act 663) should be strengthened and enforced. This would assist overcome the unfair competition from the foreign contractors as margin of preference policy serves as a restrictive measure in favour of the local construction industry. The mentorship policy should be incorporated in the tender evaluation criteria for international competitive tendering procedure. This would make it compulsory for foreign contractors tendering for government projects; especially where the local contractors and consultants lack expertise, to submit mentorship proposals as part of the tender requirements. This would ensure the foreign contractors train the local contractors during the project execution phase and by so doing transfer skills and modern construction technology to the local contractors. The public procurement authority should ensure that the officials who are involved in the procurement processes comply with the rules. Construction professional associations should engage government on regular basis to raise their concerns about the procurement practices and suggest ways of addressing these challenges to government. This would help them follow up with government when these challenges are not being addressed by the authorities.

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FACTORS INFLUENCING THE CHOICE OF THE STANDARD FORMS OF CONTRACT IN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

Mewomo MC¹, Aigbavboa CO² and Lesalane P³

Department of Construction Management and Quantity Surveying,
University of Johannesburg, South Africa.

Corresponding author: Mewomo MC
Email: ¹modupemewomo@gmail.com
¹Tel: +2744870101

ABSTRACT

PURPOSE

The selection of an appropriate standard form of contract for a construction project is one of the key elements in ensuring successful project management. Adopting an unsuitable form of contract can increase the likelihood of disputes and, as such, defeat the realisation of project objectives in terms of cost, time and quality. It is therefore important to choose a suitable form of contract that can cater for the contracting parties' requirements and expectations, and can also offer a pragmatic approach to deal with general construction matters that may arise. Consequently, this paper investigates the factors that influence the professionals' choice of standard forms of contract for a given project in the South African (SA) construction industry.

METHODOLOGY

This study adopted a quantitative research approach. A questionnaire survey was administered to 140 construction professionals who are usually involved in the selection of contract forms for the clients in the Gauteng Province of SA. A total of 102 were returned, forming the basis of the analysis for the study. The professionals were requested to rank the factors that usually influence the decision for a particular form of contract for a given project. Utilising the mean item score technique and taking into account each item's frequencies as being the perceived significant criteria influencing the professionals' decision, a mean score was determined for each of the factors identified.

FINDINGS

Results indicate eleven critical factors that influence the professionals' choice of forms of contract. These factors are; allocation of risk; level of familiarity with the standard form; payment arrangements; procurement method; person responsible for the design; type of client; legislation; type of project; measure of control by the client or his representative; complexity of the project; and completion agreement.

VALUE

The study contributes to knowledge by revealing important factors to be considered in the selection of appropriate standard form of contract conditions for a given project.

Keywords: Standard forms of contract, contracting, GCC, FIDIC, NEC, JBCC.

1. INTRODUCTION

The construction process and interactions between construction participants are complex issues. Dealing with these complexities requires that the form of contract guiding a particular contract execution is suitable. Such a form should adequately define the rights and obligations of the contracting parties and also set out a mechanism to deal with common construction issues that may arise during the project execution¹. Agreeing on a specific form of contract goes together with agreeing on the terms and conditions stipulated within that specific form of contract chosen. As such, it is important that the conditions of contract chosen do not constitute barriers to the effective participation of any of the parties to the construction contract.

In the business world, transactions are made between two or more parties who have a common aim, but different interests. The transaction can take the form of making purchases, rendering services, making payments or receiving cash. Whichever form it takes, the fact is that a transaction involves an exchange of an entity (such as money) for another (such as a product or



service) between two parties. The time between when an agreement is reached for the transaction to be made and the time when the transaction is completed lie uncertainties. These uncertainties usually engender an abundance of questions. For instance, some of the questions arise from the fear of a breach of contract in relation to the agreement made in terms of quality, specification, time and performance. It will only be reassuring if terms and conditions are put in place prior to the commencement of any contract. Written terms and conditions help to create certainty as to the agreement as well as helping to enforce a party's agreement².

Similar to business transactions, the construction industry involves projects that require two or more parties to come to an agreement in order to ensure the execution and completion of proposed projects. The terms and conditions to guide the operation of the project are usually incorporated in a written agreement called a contract³. Most often, the task of making the choice of the contract form to be adopted on a particular project lies with the employers or their representatives, who are often viewed as the professionals in this area^{4, 1}. Adequate attention is expected to be given to selecting the form of contract that is most suitable and that can adequately enhance effective performance in terms of time, quality and cost. Literature suggests that there are dangers associated with the use of inappropriate conditions of contract for a project⁵. Utilising unsuitable conditions of contract on construction projects will increase the likelihood of dispute occurrence and also jeopardise the achievement of the project objectives⁵. The construction professionals must therefore have adequate knowledge of the various standard conditions of contract and ensure that appropriate choices are made. They must also be able to justify the reasons for, and the implications of the choices they made¹. Consequently, this paper discusses the various standard conditions available to the SA construction industry and examines the factors that usually influence the professionals' choice of a particular form of contract for a proposed project.

2. STANDARD FORMS OF CONTRACT IN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY

The importance of choosing an appropriate form of contract conditions cannot be overemphasized. The standard forms of contracts are primarily developed to provide formal, predetermined

arrangements and mechanisms that can provide pragmatic approaches to handling construction processes and situations⁵. They have various advantages to both contracting parties. Cost saving, standardisation and uniformity are some notable benefits⁴. The economic aspect of using standard forms on business transactions has also been considered. The standard forms of contract make economic sense in that the terms and conditions are usually well-established before the conclusion of contract and this allows for certainty in legal relations and business transactions⁴.

Globally, the standard forms of contracts are considered an indispensable element of day-to-day commercial life. They are used in different circles such as in business organisations, companies, industries and by business persons to contract with individuals and other juristic persons⁴. The fundamental purpose of standard forms of contract is to provide a basis on which transactions can be conducted. It promotes standardisation, uniformity and may lead to greater confidence and certainty of the relationship between the contracting parties. There are various forms and designs of the forms of contract. On the one hand are the standard forms of contract used in commercial transactions which can be considered as the commercial transactions' standard forms of contract. On the other hand are the standard forms of contract used in the execution of construction projects. The commercial transactions' standard form contract is designed and presented to the consumer on a take-it-or-leave-it basis⁴. As such, it incorporates terms and conditions beneficial to the business persons at the detriment of the consumer. However, unlike the standard forms of contract for business transactions, standard conditions of contract used in construction transactions are perceived to be fair owing to the fact that they are widely recognised by the expert bodies representing the client interest, the construction industry and the construction professions^{1, 6}. This wide recognition resulted from what is perceived as a balanced allocation of risks between the building contracts. Moreover, because the construction standard conditions of contract are tried and tested, they are believed to enjoy industry recognition⁵. Therefore, the frequent usage of construction standard forms of contract allows all parties to become familiar with the documents and also to become aware of their rights and obligations under the contract and this provides clarity in the event of disputes. As opposed to the commercial standard forms of contract which are believed to



be one-sided in favour of the business organisations, the standard forms of contract used in construction projects fix agreement between parties and systematically specify the obligations and liabilities of contracting parties¹. Construction processes are complex owing to the interaction of many activities. The unique nature and diverse characteristics of each construction project make the use of a single standard forms of contract unrealistic⁷. Consequently, there are various forms of contracts available for use in the construction industry. A particular standard form of contract is a reflection of specific priorities underlining its design. In the context of the South African construction industry, there are many forms of contract: however, the CIDB recommends the use of only four for construction procurement on public sector projects, namely the Joint Building Contracts committee (JBCC), the General Condition of Contracts (GCC), the New Engineering Contracts (NEC3), and the International Federation of Consulting Engineers (commonly called FIDIC). The main purpose of these forms of contract is to promote standardisation and uniformity of documentation. While the JBCC is restricted to building works, the other three recommended forms can be used in all types of construction contracts and engineering projects. The Construction Industry Development Board (CIDB)⁸ has emphasised the fact that the four recommended forms of contract conditions collectively cover the frequently encountered contracting strategies that are presently being pursued both locally and internationally. Notwithstanding, literature suggests that no single form of contract is always better than another but the choice depends on the circumstance in which it will be used¹. Therefore, it is important for the design team to recommend a suitable contract form that can offer the greatest value for the client and can effectively be used to deal with common construction issues.

3. RESEARCH METHODOLOGY

This study aimed to identify the factors that influence the choice of a standard form of contract in the Gauteng Province of SA. Having recognised that this research is explorative in nature and therefore demands a quantitative answer, the quantitative research approach was found most suitable. The study employed the quantitative research method using a questionnaire as research tool for data collection. The study sample was randomly drawn from the

construction professionals in the Gauteng Province of SA. The Gauteng province was selected because it is widely recognised for its dynamic economic and social circumstances. For example, it is the only province which contributes (34%) more than one third of total Gross Domestic Product (GDP) of South Africa in 2014. Hence, the Real Economic Bulletin considered it the fastest growing and richest province of SA. The targeted respondents were professionals within the construction industry who are usually involved in the selection of standard forms of contract conditions for their clients. These professionals include quantity surveyors, construction managers, construction project managers, structural engineers, and architects who provide professional services relating to their field of expertise in a given project.

The questionnaire was intended to serve as a comprehensive source of data. Consequently, its design was based on the findings arising from the review of related literature. One hundred and forty (140) questionnaires were administered out of which only 102 were returned, forming the basis of the analysis for the study. In the questionnaire, twenty factors were presented to the professionals for confirmation of their influence in the selection process. The factors presented were established from the literature and they were denoted by SLF1, SLF2, SLF3...SLF20. The questionnaire design consists of two main sections. The first part of the questionnaire is the introductory section to establish the respondents' knowledge and usage of standard forms of contract in project execution. The second section is the principal part dealing with the ranking of the identified factors.

The professionals were requested to rank their perception of the importance of the suggested factors on a five-point Likert scale. Table 1 reveals the demographic data of respondents. The analysis shows that respondents are involved in both private and public construction sectors and have used different forms of contract conditions in project execution. The years of experience of the various respondents, their usage and knowledge of different forms of contract and their level of involvement in the selection process made their contributions of great value to the study.



Table 1: Demographic data of the respondent

	Frequency	Percentage %	Cumulative Percentage
Profession of the respondents N = 102			
Engineers	15	14.71	14.71
Quantity surveyors	41	40.20	54.91
Construction/project managers	33	32.25	87.16
Architects	11	10.78	97.94
	02	1.96	100
Working experience			
1-5	63	61.76	61.76
6-15	23	22.54	84.30
Above 16 years	16	15.70	100
Construction industry sector			
Private	34	33.33	33.33
Public	68	66.67	100
Forms of contract previously used by respondents			
FIDIC	53	51.96	-
NEC3	64	62.75	-
GCC 2010	21	20.59	-
JBCC	65	63.73	-

3. DATA ANALYSIS

The fundamental aim of the data analysis was to establish a mean score for each factor which will be representative of its overall importance in the context of choosing appropriate standard conditions of contract. An item with a higher mean item score is ranked as the highest, since it represents its dominance among other items ranked. Moreover, standard deviation was also used to assist in ranking those items that have the same mean item score⁹. The final determination of the significance of each of the factors was based on the mean score obtained for each factor. The mean scores was measure by inviting the respondents to rank the identified factors on a scale of 1-5. The response was scored on 'very great influence', 'some influence', 'neutral', 'little influence' and 'no influence'. The mean score for each factor for the analysis of this study based on the Likert scale of 1 to 5 was determined as follows:

$$\frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{n}$$

where n_1 = the number of respondents for 'no influence', n_2 = the number of respondents for 'little influence', n_3 = the number of respondents for 'neutral', n_4 = the number of respondents for 'some influence' and n_5 = the number of respondents for 'very great influence'. The mean score (MS) for each variable was established and ranked from highest to the lowest as shown in Table 2.

Table 2: Factors influencing the choice of contract form

Variables	Factor Label	N	Mean Item Score	SD	Rank	Implications
Allocation of risks	SLF5	102	4.36	0.97	1	Very important
Client or client representative's familiarity with the standard form of contract	SLF1	102	4.35	0.77	2	Very important
Payment arrangements (pricing strategy)	SLF7	102	4.34	0.87	3	Very important
Procurement method	SLF20	102	4.27	0.94	4	Very important
Person responsible for the design	SLF12	102	4.26	1.12	5	Very important
Type of client (public or private)	SLF19	102	4.01	0.76	6	Very important
Legislation	SLF2	102	3.98	0.92	7	Very Important
Type of project	SLF4	102	3.91	0.90	8	Very Important
Measure of control by client or client representative	SLF6	102	3.89	0.76	9	Very Important
Complexity of the project (simple, normal or complex)	SLF13	102	3.86	1.01	10	Very Important
Completion arrangement	SLF3	102	3.82	0.87	11	Very Important
Size of the project	SLF14	102	3.47	1.09	12	Important
Control over sub-contractor	SLF15	102	3.43	1.03	13	Important
Client or client representative's expertise in the construction industry	SLF9	102	3.37	1.03	14	Important
Type of contract documentation being used	SLF11	102	3.32	0.99	15	Important
Client or client representative's involvement in the standard form of contract selection process	SLF16	102	3.31	1.06	16	Important
Nature of the project (alterations or new work)	SLF8	102	3.26	0.97	17	Important
Clarity of the contract	SLF18	102	3.16	0.99	18	Less important
Project duration	SLF17	102	3.01	1.09	19	Less Important
Need for clear remedies	SLF10	102	2.99	0.94	20	Less important



The mean item score technique utilised in the data analysis process takes into account each item's frequencies as being the perceived significant criteria influencing the professionals' decisions. The analysis was carried out to establish whether the population considered a particular factor to be influential. For the purpose of clarity and better presentation of the agreement reached by the respondents, the mean item score and ranking of each factor were tabulated. A summary of the analysis results is shown in Table 2. In addition, the mean item score for each factor, including the associated standard deviation, is also reported in Table 2. The significant agreement or otherwise of the factors being tested was determined by adopting a population mean of 3.5^{10,11}. Consequently, based on the five-point Likert scale, an influencing factor was deemed very important or critical if it has a mean item score of 3.5 and above. In the situation where two or more factors have the same mean item score, the factor with the lowest standard deviation was allotted the highest importance ranking^{11,12}. The standard deviation and the mean are used to create z-scores, which assist a researcher to compare two or more distributions or groups⁹. Therefore, in this paper, the standard deviation helps in the analysis of data in terms of the ranking of the influential factors. The influential factors were in three categories. Any factor that falls within the range of 5.00 and 3.50 were classified as very influential and therefore marked as "very important". The factors that fall between range of 3.49 and 3.25 are significant and as such falls under "important" categories while all the factors below the mean limit of 3.25 are regarded as less influential and therefore are categorised under "less important" groups.

The summary from the Table 2 reveals eleven influential factors that are critical in the selection of appropriate standard forms of contract in the Gauteng Province of SA. Based on the overall ranking, these eleven factors are (i) "allocation of risks" (SLF1) which rank highest with a mean item score (MIS) of 4.36; (ii) "client or client representative's familiarity with the standard form of contract" (SLF2 with MIS of 4.35); (iii) "payment arrangements" (SLF3 with MIS of 4.34), (iv) "procurement method" (SLF4 with MIS of 4.27); (v) "person responsible for the design" (SLF5 with MIS of 4.26); (vi) "type of client" (SLF6 with MIS of 4.01); (vii) "legislation" (SLF7 with MIS of 3.98); (viii) "type of project" (SLF8 with MIS of 3.91); (ix) "measure of control by client or client

representative" (SLF9 with MIS of 3.89); (x) "complexity of the project" (SLF10 with MIS of 3.86); and (xi) "completion arrangement" (SLF11, with MIS of 3.82).

While the order in which these factors are rated suggests priorities and levels of relevance attributed to the factors by the professionals when selecting the forms of contract to be adopted on a particular project, it is important to note that all the eleven factors have very high MISs and the MISs are close to each other. This is an indication that there is possibly no discernible difference in the level of influence attached to the identified selection criteria factors. This suggests that though the selection criteria can be prioritised, the consideration of all these eleven factors in the selection process is not negligible. Therefore, all eleven factors are perceived by the professionals to be very important. Another point worth noting is that nine of the 11 critical factors have a standard deviation of less than 1.0 while only two have standard deviations that are slightly more than one. The two factors with a standard deviation slightly greater than 1.0 are (i) "person responsible for the design" with SD of 1.12, and (ii) "complexity of the project" with SD of 1.01. The fact that nine out of the eleven critical factors constituting 82 per cent have a standard deviation less than one is an indication of little variability in the data and consistency among the respondents. The two factors with the standard deviation slightly more than one suggest that there might be differences as to how these factors were interpreted by the respondents. Notwithstanding the slight increase in the standard deviation, the high mean score ascribed to each of the two factors indicates their level of significance while deciding which forms of contract to adopt.

At first glance, the summary of the findings in Table 2 shows that "allocation of risks" emerged as the most influential factor when choosing a standard form of contract. This finding is largely justified by some earlier studies. For instance, a Royal Institution of Chartered Surveyors (RICS) survey reveals that the choice of procurement route is a critical factor that has a major bearing on the balance of risk within a project, which will in turn have an impact on the chosen construction contract¹³. Similarly, literature reveals twelve clients' risk positions ranging from design flexibility, maximum price competition to design control and contractor insolvency¹⁴. These clients' risk positions and requirements are ranked in order of priority and form the basis for the selection of contract procurement strategies and inform the form of contract to employ¹. It is therefore not strange to observe that payment



arrangements, procurement methods, types of client, complexity of the projects, and completion arrangement all have high mean scores and are perceived as critical factors influencing the choice of form of contract.

Generally, the chosen procurement method and payment arrangement will limit the contract options and usually impact the contract selection. The nature of the client, which includes the type and the experience in dealing with standard forms of contract in the construction industry, is one of the factors that influence the choice of standard form of contract that can be regarded as valid¹. The issue relating to the complexity of a proposed project, the nature of the project and the clarity of the contract require high levels of consideration when selecting a form of contract. The CIDB had noted that complexity, type and size of the projects should be taken into account when deciding on which form of contract to use. Moreover, the complexity of a particular project; whether there will be staged practical completion; and whether the owner, an architect or engineer will administer or supervise the project are important factors when considering the appropriate forms of contract to use for a particular project⁶.

The familiarity with a particular contract choice emerged as the second highest mean score. This is very significant because it is very easy to develop a mindset to recommend a familiar form of contract¹. Literature suggests that familiarity with the standard forms of contract leads to acceptance and a sense of comfort¹⁵. Further, better agreement is achieved by using a form of contract with which the contracting parties are already familiar⁶. While it is true that familiarity with certain types of contract forms is one of the driving forces influencing the selection of a standard form for a contract project, there is need to choose the most suitable contract forms that can serve the interest of clients rather than just a convenient or familiar one¹. Disputes are found to prevail in such projects where clients preferred to use a particular type of standard form of contract on the basis of familiarity and convenience even though such a contract form was not appropriate for the type of projects to be executed. In certain circumstances some clients make amendments to forms of contract to suit their contract. This action can make the contract situation worse and lead to contrary and contradictory clauses⁷.

A similar research previously conducted in Australia reveals that amendments to the standard forms of contract were perceived as leading to an increase in understanding between parties and efficiency in project administration¹⁶.

However, there is serious warning that this practice must be kept to the minimum, as the form would no longer be standard and its benefits may be reduced¹. It is therefore necessary to take the influential factors revealed by the professionals in this study seriously in order to ensure that appropriate forms of contract choices are made.

1. CONCLUSION

Various factors that can influence the selection of forms of contract have been presented to professionals in the Gauteng Province of SA for confirmation and determination of their level of significance. The result of this study may assist practitioners in taking good decisions during the selection of forms of contracts for a new project. Considering the overall ranking of the identified factors, eleven factors were found to be very relevant to the selection of a form of contract for a proposed work as explained under the results and discussion. The standard forms of contract have various options which suggest the payment method together with the procurement method to be adopted in the execution of a proposed project. As such, payment arrangements and procurement methods are part of the primary factors that drive the selection of a particular contract form. The same applies for the allocation of risks and familiarity with a standard form of contract. Although familiarity is ranked as one of the eleven critical factors influencing the selection of contract conditions, it is important to choose an appropriate form rather than a convenient one. A particular form of contract chosen on the basis of familiarity may not necessarily be suitable for all other projects owing to the varying nature and different characteristics of construction projects. It is vital that when executing a new project, one should pay attention to minor characteristics of new projects, which may appear to be different from other projects whereby the same contract form has been used. The professionals should first establish the payment and procurement strategies which will be suitable to a new project in order to be able to select an appropriate standard form of contract for that project. In addition, it is important that clients or clients' representatives should scrutinise the characteristics of a new project before taking a decision on the choice of contract form to be adopted.



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CONCRETE DECISION ANALYSIS IN SOUTH AFRICA

Lesiba George Mollo¹ and Fidelis Emuze²

Department of Built Environment, Central University of Technology, Free State, South Africa

Corresponding author: Lesiba George Mollo

Email: [1lmollo@cut.ac.za](mailto:lmollo@cut.ac.za)

ABSTRACT

PURPOSE

In certain parts of the world, especially in a developing country such as South Africa, the determinant of either project failure or success is found in the quality of decisions and actions. In particular, project team decisions often lead to poor project performance. The procedure used to make project decisions has come under scrutiny on many occasions, especially in relation to concrete work. The purpose of this study to report on how to reduce the manifestation of poor decisions that always produce defects and rework in concrete tasks.

RESEARCH METHOD

The case study research design was used in the study with the aim of understanding how choosing by advantages (CBA) would chart a pathway for solutions to poor decision-making. The case studies were developed on actual projects and had multiple team perspectives. The data analysis involves triangulation of multiple sources of evidence from interviews and on-site observations.

QUESTIONS

The research sought answers to “what are the causes of defects and rework in the concrete task; and how the decision-making mechanism is defining the completion of the concrete task?” To answer the research questions, multiple case studies were adopted to gain an in-depth understanding regarding the decision-making method chosen when working with concrete tasks while introducing the application of CBA method.

FINDINGS

The results show that decision-making process among the project team often leads to poor project performance regarding concrete tasks. The results also show that lack of experience (poor working experience), and lack of education in concrete task influences poor performance, although team decisions are influenced by the concrete placement methods, specification, cost, quality and time.

LIMITATIONS

Future research is needed to monitor and evaluate the project team decision-making process through the CBA frame model.

IMPLICATIONS

The study proposes that it is time to expose site management and workers to structured decision-making tools such as CBA. Such exposure through education and training will revise negative concrete task completion outcomes in the near future.

VALUE OF PAPER

Project teams keen on improving their concrete decisions can use the CBA frame model.

KEYWORDS

Concrete Task, Decision-Making, Defects and Rework, Performance, Project Team

1. INTRODUCTION

The economic development of either developed or developing country is influenced by the construction industry because developments set the benchmark for business operation¹. For instance, businesses depend intensely on the infrastructure projects such as buildings, roads, bridges, water supply and energy supply to operate¹. However, infrastructure projects are often a victim of poor performance related to scope, period and process difficulties since the most persuasive and common component is



change in construction². The construction industry is determined or influenced by change or innovative thinking initiated by the project team. Innovation has been defined as the invention of new knowledge in the construction industry, made up of new projects, new construction methods, social change and structural change³.

Change or innovation in construction has encouraged clients to seek projects, which are large and complex in scope and in most cases; large and complex projects are designed and executed by competitive project team⁴. In the fast-growing construction development, most projects are constructed through the adoption of international methods, which are introduced with the aim of improving local construction methods. The problems come as the result of failure to apply international methods appropriately because in most cases, the project team fails to reach the standard of the adopted international methods and this affects project performance negatively⁴. For example, concrete defects continue to be the unavoidable existence of poor performance that continues to be one of the primary causes of schedule and cost overrun in construction⁵.

The project team, especially the construction site manager, is responsible for the concrete quality management and often fails to address the project challenges⁵. Poor performance in construction is influenced by the project team decisions when project complexity increases⁶. In terms of opportunities for project performance improvement, this study proposed to eliminate or reduce the impact of poor decisions that always produce defects and rework in the concrete task with the use of CBA method.

2. CONCRETE TASK RESULTS

Innovative construction materials are used by the project team to improve and simplify construction methods and outcome, but concrete work remains a task with possible failure in expectation despite the evident change in construction⁶. More so, the quality of concrete in a structural project is designed by the structural engineer, and will impact the long-term performance of the structure⁷. Furthermore, the durability of concrete is explained, and that it should be cast or placed in a manner that will minimise defects such as honeycombing and internal shrinkage to provide a durable structure⁷. The explanation of 'Love'

regarding concrete reinforce the notion that defects still occur on site in construction⁸.

Either through manual work or automated processes, a concrete task involves the preparation of construction materials such as sand, cement, aggregates, water and reinforced steel bar. The process of casting concrete starts when the site manager or foreman who supervise how to install the reinforced steel bars, then set the formwork around the reinforced bars, then pour concrete, and allow the concrete to cure, and remove the formwork. While in most cases, the concrete process ends with a durable product, there have been instances where the product is unwanted. In fact, it has been stated that the construction industry is producing common waste with timber formwork and unused concrete, and is further causing pollution to the environment⁹. Accordingly, 15% of construction cost and one-third of the structural cost for reinforced concrete works are influenced by formwork, payroll and material cost¹⁰. A study further explains the state of production with the results of poor project delivery, quality and cost because formwork operation depends on skilled workers, and skilled workers are aging¹⁰. As an illustration, Figure 1 shows the operational process of formwork. The installation and removal of formwork that is required for the concrete task to proceed are not without its problems.

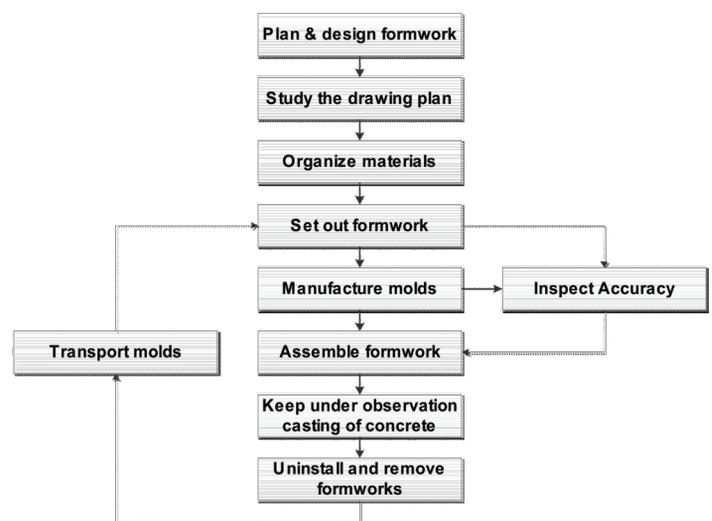


Figure 1: Formwork operational flows¹⁰

It is difficult for the project team to avoid wastage (both process and physical waste) and rework on projects because every project is unique and unpredictable due to the scope of work⁷. However, it is important for the project team to reduce concrete waste, as explained, waste reduction increases the production capacity because the sum of work and waste in the system is the same as the total capacity of a production system¹¹.



Moreover, it is further explained that concrete wastage does not add value and is unnecessary for clients to spend money for uncertain work¹¹.

appropriate criteria, valid facts, and suitable viewpoints for the decisions

3. THE PRINCIPLES OF CHOOSING BY ADVANTAGES

The CBA technique is a decision-making method used to define alternatives, and escalate the number of ideas, examine the modifications of alternatives explicitly, determine the importance of those modifications, appropriately consider cost modifications, and anchor information to the relevant facts^{12,6}. The method is gaining traction in terms of adoption among construction professionals in the United States of America (USA) because larger companies are exposing their workers to the five stages of the complete process^{12,13}. In brief, the five stages of a typical CBA method are described in Table 1.

4. RESEARCH METHOD

The study aimed to understand the decision-making process executed by project teams when choosing the concrete type to be used for their project. The focus of the research was on the choice between two concrete alternatives namely; ready-mixed concrete and site-batched concrete. To understand the problems around the study purpose, a case study research was adopted¹⁴. A case study research design is defined as the practical reviews that explore an existing issue in detail and within its actual setting, particularly when the border between the phenomenology settings is not apparent¹⁵. The use of case studies is to construct new theories and that researchers apply an inductive logic, with an objective of exploiting a variety of methods to collect the primarily qualitative data¹⁶.

Table 1: Five Stages of CBA method Source¹³

Three case projects were selected for this study in Bloemfontein with the aim of answering two research questions, which include, “what are the causes of defects and rework in the concrete task and how is the decision-making mechanism defining the completion of the concrete task”? The case studies were developed on actual projects. The cases had multiple team perspectives from members of the construction and consulting engineers team who were interviewed. Table 2 shows the case projects.

Stage	Definition
Settings	Explaining the purpose and establishing the problems, criteria, of the decision and who should be involved.
Innovation	Establishing the alternatives and evaluating the difference between them visibly and physically.
Decision-making	Listing the advantages of each alternative, choosing the importance of each alternative and selecting the alternatives that have higher score points
Reconsideration	Examining the draft decision to inspect if it serves its purpose effectively and does not create a collision
Implementation	Putting the decision practically to solve speeding up the construction

5. DATA AND DISCUSSION

Based on the data collected from all three case projects through semi-structured interviews and on-site observation, cross-case synthesis was adopted to analyse the data. Three case projects were selected for this study, the project teams made up of the member of construction, and the consulting engineer's team were interviewed. The members of the project team involved in each case were based on their concrete exposure and their role when making concrete work decisions.

Table 2: Cases of the study

Case type	Project Description	Project Type
Case project 1	New waste water treatment works	Civil Engineering Project
Case project 2	Road rehabilitation that include multiple bridges	Civil Engineering Project
Case project 3	Artisan training facility	Building Project

- Source¹³
- The purpose of CBA method, which a project team should understand include¹²:
- CBA is a problem-solving method, not a weapon to be used by project teams for their own benefit.
 - CBA is a sound system of description, principles (value), models and methods of construction project.
 - CBA allows a project team's decision to peacefully bridge the gap between data and the decisions.
 - A sound decision must be based on the



The project team for case project 1 was made up of two teams the members of the construction and the members of the consulting engineer's teams, for case project 2, was also made up of two teams also, the members of the construction team and the members of the consulting engineer's teams. Case project 3 was made up of one team as the project was a turnkey contract.

6. CBA APPLICATION ON CONCRETE TASK

This study proposes the application of CBA methods to improve the project team decisions, which often lead to concrete defects and rework. The impact of the CBA method of project delivery and performance, and how CBA method affects the performance of the project team were studied.

researcher and the interviewees, but their job titles have been retained for reference purpose. After a CBA presentation, semi-structured interviews were conducted with the project team to investigate their decision-making process when choosing the concrete type: specifically, within their project and to answer the two research questions.

From the meeting with the project team of all three cases, two concrete alternatives were identified, namely; ready-mixed concrete and site-batched concrete. Furthermore, the project team identified the relevant factors, criteria, and attributes for this study. The project team determined the importance of advantages score (IofA) though a scale of 0 to 100.

The project team are the key drivers in the concrete decision-making process between two concrete alternatives when using the CBA method. Figure 2 shows the CBA application process used in the study to choose the concrete alternatives.

Table 3: Research sample

Project Cases	The Project Team		Response (No)	Rate (%)
	Members of the construction team	Members of the consulting engineer's team		
Project Case 1: New waste water treatment works	Construction Managers (2) Site Engineer (2) Quantity Surveyor (1) Foreman (1)	Resident Engineers (3)	9	41.0
Project Case 2: Road rehabilitation that include multiple bridges	Construction Managers (2) Foreman (2)	Resident Engineers (4)	8	36.0
Project Case 3: Artisan training facility	Project Manager (1) Construction Manager (1) Resident Engineer (1) Quantity Surveyor (1) Foreman (1)		5	23.0
Total interviewees			22	100.0

The project team was introduced to a CBA application through discussions and questions aided by presentations. In addition, the relevant information for the decision-making process was presented, and the process for obtaining the information, and assumptions behind the data. Table 3 illustrates the background information of 22 interviewees for all three case projects. The names of the participants are not mentioned because of a confidentiality clause signed by the

Notations relevant to Figure 2 highlights the CBA Frame Model constituting the outline of the research process. Step 1 in the figure, which is a green boundary; represents the project team problems about poor performance influenced by



7. CONCRETE DEFECTS AND REWORK

The project team from all three case projects answered the research question “what are the causes of defects and rework in the concrete task?”, by defining the term concrete defects and rework, identifying the causes of defects and rework and methods which could be adopted to prevent concrete defects and work. concrete defects and rework as the outcome of the project team decisions when placing or casting concrete. Step 2, which is the yellow boundary, represents the decision-making methods that provided the guidance to reduce and eliminate concrete defects and rework. The subsequent steps (3,4,5 and 7), which is the blue boundaries, were carried out or developed by the project team, while the CBA practitioner's analysed the results as outlined in Step 6,8, and 9. These constitute the red boundaries carried out by the researchers. These steps were also examined and discussed by the project team.

through the effect of incorrect quality control and mix design which might be influenced by the project team decisions during the mixing and placing of concrete'. However, in literature concrete defects are defined as the damages of concrete structures produced as the results of the incorrect workmanship, unsuitable materials and inappropriate construction methods¹⁷. Judging from these definitions it could be argued that the project team understand the concept of concrete defects.

9. Concrete rework:

The project team from case project 1, defined rework 'as the rectification of blunders which might either be cracks, voids, blisters, and honeycombing', while from case project 2 it was defined 'as the rehabilitation of the concrete surface which failed to meet its designed standard according to the design specifications'

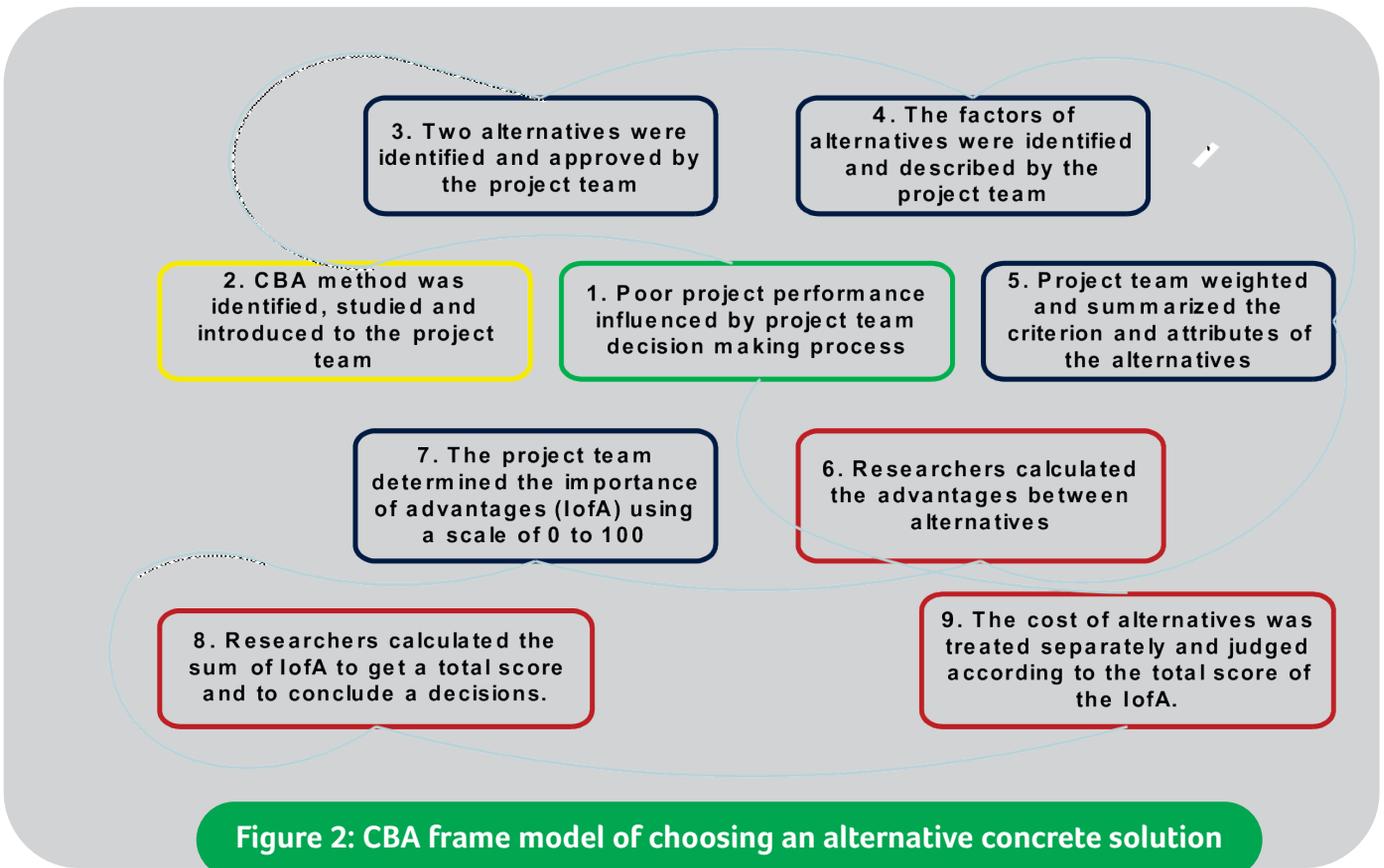


Figure 2: CBA frame model of choosing an alternative concrete solution

8. CONCRETE DEFECTS:

The project team from case project 1 defined concrete defects 'as the blunders which shows up on the concrete surface as a result of poor concrete management, and examples of blunders are either, cracks, voids, blisters, and honeycombing'. For case project 2, it was defined 'as the results of inadequate concrete produced

and for case project 3 it was defined as 'reconstructing of the placed concrete task in order to rectify the concrete errors'. These descriptions align with Love who says rework is the inessential determination of redoing an activity or damaged concrete structure because it was inaccurately done the first time⁸.



10. Causes of concrete defects and rework:

The results show that the project team from all three cases understood the causes of defects and reworks, and methods that could be adopted to prevent concrete defects and rework. The project team identified factors, which lead to concrete defects as poor leadership skill within the construction team, handling of concrete on site, and formwork installation. Some of the responses say: "Concrete defects are produced by the foreman and labourer decisions or actions when working with concrete through either, poor concrete mix design, poor concrete vibration and curing, and long hours of handling concrete before placing it, and poor programme planning (rushing to complete the task or to reach the deadline of the project), and team member who does not know how to read the drawing plans and design formwork according to specifications."

Furthermore, the project team explained that concrete defects and rework could be prevented by 'designing effective method statement for the project in advance, designing concrete mix design to meet the standard and purpose of the project, and testing the concrete on site through slump tests and cube tests to keep the consistency of the concrete'. They further explained that the construction teams working with concrete must regularly attend concrete training or workshops provided by accredited concrete institutions, reputable companies, and universities. The project team working with the concrete task should be trained to make sound decisions through CBA method. CBA is a decision-making method, which helps the project team to improve their decisions because CBA separates the lofA score and the cost of alternatives that influences the concrete decisions. It is transparent and is based on the specific questions replicated in the criterion to explain the lofA score¹⁸.

11. Observation results for concrete defects and rework:

The observation checklist results from case project 1 and 2 surpassed the results of case project 3. The reason why case project 3 did not produce the same results as case projects 1 and 2 is because the construction manager and foreman neglected the concrete work procedures on site, which resulted in concrete defects on the column and the foundation as indicated in Figure 3. The types of defects that were discovered were

concrete cracking, voids and honeycombing. These defects are the results of poor formwork installation, neglecting to apply thin oil on the formwork, failing to vibrate the concrete properly and to cure the concrete properly. In the curing process, water was spread on the concrete in the morning and evening to increase the moisture in the concrete, which proved to be an unsuitable or reliable method to be used on a site.



Figure 3: Observation pictures case project 3

12. THE PROJECT TEAM DECISION-MAKING MECHANISM

This section shows the results of the second research questions which asks, 'How is the decision-making mechanism defining the completion of the concrete task'. From all three case projects, the results show that the project team was not using a defined decision-making method to make concrete decisions. Their project decisions were influenced by various factors. Some of their responses include "Concrete decision was influenced by concrete quality, money and period of the project, and also project specification and method statement plan designed by the company' and 'The engineer's team stated that they don't have a specific or defined decision method, but concrete decisions were influenced by the load applied to the structure, for example, the total weight of the vehicle to travel across the bridge and also the purpose of the bridge." However, the decision theory can be explained using an analogy relating to a Christopher Columbus' decision to sail off westwards across an unknown ocean¹⁹. It states that decision theory is the theory of rational decision-making and that the decision outcome depends on the true state of the world, which was partially known by Columbus when he sailed to the west¹⁹. For example, the project team's decision to use ready-mixed concrete would be judged by the project outcomes.

The results from all three case projects show that the most important factor influencing the project team decisions is the cost of concrete. The project team chooses ready-mixed concrete over site

batched concrete because they wanted to avoid unforeseen cost. The supplier of the ready-mixed concrete was responsible for factors such as mix design, concrete strength, and quality. Furthermore, the ready-mixed concrete supplied to the site helped the construction team to avoid construction risks. Examples of mitigated risks include the reduction of the number of workers, concrete specialist, site managers, and plants. There is also the opportunity to reduce security and physical waste on site.

13. CONCLUSIONS

This study reveals that the project team decision-making process often leads to poor project performance, especially when working with the concrete task. The case study research design was selected for this study to understand the problems around decision-making by the project team and to develop the CBA framework to answer the research questions. The findings show that the members of the project team working with concrete must have sound concrete knowledge; an effective method statement must be designed well in advance, for instance, the quality of concrete delivered to the site must be tested through a slump and cube test. Moreover, the formwork must be assembled according to the drawing, design and the concrete must be vibrated slowly. The concrete must be cured correctly by adopting a method which will prevent the moisture of the concrete from evaporating instantly. The foreman must inspect the concrete delivered to the site by creating a checklist of items to handle the concrete on site. CBA methods should be used by the project team when making the project decisions.

The study further reveals that the decision-making mechanism of the project team is influenced by the construction method, the specification, and performance parameters. From the contractors' point of view, the cost of the project determines all the decision-making of the project. This perception should be meticulously addressed because cost is not an excuse for inconsistent decisions that could negate the intentions of task completion in projects.

The project team in the cases explained that should a contractor fail to address quality in a project; it would result in rework that is accompanied by penalties from the client. The project team from all three case projects have not adopted a defined decision-making method, although, they all agreed that it is useful for construction teams to use a decision-making method, especially when working with the concrete task. The construction team said

that their reason for choosing ready-mixed concrete was based on the risk assessment plan and method statements because site-batched concrete has critical factors that can be avoided through ready-mixed concrete. Such factors include the quality of the concrete (concrete strength), the number of workers, concrete specialist, plants (trucks and batch plant), plant operators, material wastage and material security, especially for cement. These factors require costs to maintain them and can be eliminated by using ready-mixed concrete. More research work is however required to gain additional comprehension of the intricacies of decision-making by the project team in South Africa.

14. ACKNOWLEDGMENTS

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COST OVERRUNS EXPERIENCED BY CONTRACTORS IN THE SOUTH AFRICAN RESIDENTIAL CONSTRUCTION

Nishani Harinarain^{1*}, Sean B. Ingham²

^{1,2} University of KwaZulu-Natal, School of Engineering, Construction Studies Discipline, Howard College Campus, Durban, South Africa.

*Corresponding Author: Nishani Harinarain
Telephone: +27(0)312602687; e-mail: harinarain@ukzn.ac.za

ABSTRACT

PURPOSE OF THIS PAPER

A key parameter for the success of a construction project is cost. Cost overruns in all spectrums of the construction industry have been a major problem throughout the world and South Africa is no different. The focus of this paper was on the residential sector within the construction industry. The main objectives of this paper were to discover the main factors influencing cost overruns as well as the most effective remedies that can eliminate or control the causation factors in residential construction projects in KwaZulu-Natal.

DESIGN METHODOLOGY

The objectives for this study were achieved through a structured research process that entailed an indepth national and international literature review and a quantitative survey distributed to 60 residential building contractors registered with the National Home Builders Registration Council (NHBC). Twenty five contractors responded indicating a 42% response rate. The Relative Importance Index was used to rank the various factors.

FINDINGS

The study revealed that 8 projects out of 10 experienced cost overruns within the residential construction sector. Results showed that the important factor that is likely to cause a cost overrun is variation/change orders, followed by extra work and delays in the project schedule. The most effective remedies for cost overruns were identified as effective site management and supervision, comprehensive cost planning /

monitoring during pre-and-post contract stage and good workmanship.

PRACTICAL IMPLICATIONS

These findings are able to help project stakeholders identify the most severe factors and be able to apply the most effective measures that can in turn output better value projects.

VALUE OF THE PAPER

Research in the residential housing sector has not received much attention in South Africa. This ranked the main factors influencing cost overruns as well as the most effective remedies that can eliminate or control the causation factors in residential construction projects in KwaZulu-Natal.

KEYWORDS

Cost, Cost Overrun, Construction Projects, Remedies, Residential sector, South Africa

1. INTRODUCTION

The construction sector worldwide and in South Africa in particular is a multibillion Rand industry that directly impacts communities and the environment^{1,2}. The construction industry runs in a very exclusive project-related and multifaceted environment, bringing together different contracts, professionals, clients and investors¹. The construction industry is large, composite, unpredictable, risky, and it requires huge outlays of capital while dealing with restricted budgets. There is also the challenge of having to maintain budgeted costs, suitable quality and planned time constraints³.

South Africa's property market has a number of components with the residential segment being the largest, encompassing the bulk of property



assets within the country, and it is a significant part of wealth for households⁴. While there are many segments in the residential property market the industry still runs on the basis of willing buyers and sellers. A lot of people and companies operate in this market to create income⁴.

The residential construction sector is extremely valuable and is a huge contributor to private sector investment⁵ but the construction of the private housing sector has not received much attention from researchers due to the size and scope of the projects⁶.

The research objectives of this paper were therefore to determine the factors contributing to the cost over runs in residential construction projects and to determine the possible control or mitigation measures that could minimise cost over runs in the residential construction industry.

2. LITERATURE REVIEW

The residential construction sector is subject to the majority of the problems faced by the

construction industry as a whole, which effects the growth of the industry and stakeholders. One of the problems frequently affecting stakeholders is cost and it plays a huge part in the dynamics of the industry⁶.

2.1. Construction Project Costs

Cost is described as the most critical factor of a project and is significant in determining project success⁷. In general, cost is the value for all goods and services consumed in order to complete an operation in monetary terms⁸. In construction projects, the different participants namely, owner, designer, contractor, user and society all have varying concerns in terms of building costs.

2.2. Construction Project Cost Overruns

A cost overrun is described as being the difference between the final costs of a construction project at its completion and the agreed upon contractual amount when it was signed⁹. Projects in the construction industry characteristically overrun their estimates¹⁰ and has indefinite effects on project stakeholders¹¹. For example a cost overrun to the client results in extra costs; for the end user, added costs could

result in an increase in rental or lease prices; and for the contractor it means a loss in profit and a possible negative reputation.

The delay of clients in payments due to contractors is also a major concern as it creates severe cash flow problems to contractors, which in turn can possibly have an adverse effect along the contractual payment chain, to the extent that companies can possibly close down. Furthermore, contractors and subcontractors can suspend works until the full balance is paid hence escalating project duration and costs¹².

The size of the construction projects has a huge influence on the frequency of cost overruns¹¹. Larger projects are generally more complicated, essentially exposing the project to more cost influencing factors resulting in more common cost overruns. The residential construction sectors projects are not as large and complex in terms of building size, required resources, planning and capital compared to commercial, industrial and civil projects, however these projects are affected by the same or similar factors influencing cost overruns.

2.3. Factors Influencing Construction Costs

An extensive international literature review was conducted to understand the factors influencing construction cost overruns, which is discussed in chronological order below.

A study in Kuwait in 2004 ranked a number of owner reported causes of cost overruns as contractor related, material related, financial constraints, change orders, weather related, labour related and owner's lack of experience⁶. The importance of the relationship between time delays and cost increases was also noted.

The factors influencing construction cost overruns in Sri Lanka in 2006 were variations, extra work, increase or decrease in the value of bills of quantities (BOQ) items, price fluctuations, currency fluctuations, day works, compensation and terminations³.

In Ethiopia in 2008, the most common and important factors influencing cost overruns were inflation, increase in material prices, poor project planning and coordination, client's variation orders and site wastage due to excess material¹¹.



The top ten of forty causes of cost overruns in Nigeria in 2008 were materials costs, incorrect planning, incorrect method of estimating, contract management, fluctuations in prices of materials, lack of contractor experience, lack of cost data for construction, additional costs, financing for projects and transportation costs¹³.

The study conducted in Nigeria in 2010 and 2012 grouped the factors causing cost overruns according to environmental factors, political factors, financial related factors, factors associated with construction parties and construction related items for example design changes^{14,15}.

It was found in 2011 in South Africa that the factors influencing cost overruns were an increase

in material costs, incorrect estimates of materials, shortages of skilled labour, client awarding contracts late, complexity of project, increases in labour costs, incorrect take offs of quantities, variances in the contractors bid and consultants estimates, variation orders during construction and a shortage of labour for works¹⁶.

A study conducted in Palestine in 2013 discussed factors such as the political situation, fluctuation of prices of materials, economic instability, currency exchange and level of competitors¹⁷.

A further study in South Africa in 2013 grouped the cost overrun factors according to construction project stages; design phase (for example inadequate planning, incomplete design at time of tender); construction phase (for example additional work at owners request, delays in issuing information to the contractor); completion phase (for example poor workmanship, delay in resolving disputes)¹⁸.

Table 1. Compilation of factors causing cost overruns

Critical Cost Overrun Factor	Charan Al	3	Knuke K:	Al-Rashid 6	Fc 13	Ma 11	Ralo 16	M: 17	M: 18	Rahr 19	Karir	Mh 2	Amr -Abbe 9	Ahi: -Dag 10	Low
Desian Phase															
1	Incomplete/poor planning				X	X		X	X	X		X			
2	Lack of Contractor experience				X			X	X	X					
3	Unforeseen site conditions								X				X		
4	Incorrect project cost estimating				X		X	X					X		
5	Project financing problems				X			X		X					
6	Contractor frontloading on rates											X	X		
7	Insurance Costs												X		
Construction Phase															
8	Variation/Change Orders	X	X			X	X	X	X	X					
9	Delays in project Schedule								X	X					
10	Lack of communication between parties							X	X						
11	Project duration							X					X		
12	Project Complexity						X						X		
13	Improper site management		X					X		X					
14	Site wastage					X				X					
15	Contractor financial/cash flow problems		X						X	X			X	X	
16	Fluctuation in Material Prices	X	X	X	X	X	X	X	X	X			X	X	
17	Poor Contract Management				X			X	X						
18	Contractual disputes between parties	X						X	X						
19	Weather		X						X						
20	Inflationary pressure							X					X		
21	Project Location							X	X				X		
22	Labour shortages		X				X	X	X						
23	Currency Fluctuations	X						X							
Completion Phase															
24	Extra Work	X			X				X						
25	Delayed payments due to contractor								X					X	
26	Poor quality of work								X						



The top ten factors identified in Malaysia in 2013 were price fluctuations in construction materials, cash flow management and financial problems experienced by the contractor, improper site management, lack of experience, delays in the project schedule, insufficient planning and scheduling, incompetent subcontractors, faults and errors in design, common changes in design and a lack of financial control on site¹⁹.

The front-loading of rates by contractors and handing in tenders with incomplete design resulted in cost overruns in 2104. Front end loading is a practice in which a bulk of fees or payments on a project are charged upfront or in the early stages of the project even though they may not have yet been earned²⁰.

The fundamental project costs in Ghana in 2014 were land costs, material and equipment costs and labour costs. Labour costs were relative to the region and location of the where the project was constructed.

The fundamental costs were affected by the following factors: project specification, location of the project, new buildings being done or refurbishments, time duration, characteristics of the site, inaccurate or a poor estimation of original project costs, inflationary project costs, raw materials fluctuating in price, unforeseen site conditions, insufficient funds, underestimation of project costs⁹.

The top three causes of cost overruns in 2015 were the fluctuation in prices of materials, cash flow problems on the contractor's side and clients delaying payments due to contractors¹⁰.

The reviewed international literature was used to compile Table 1, which indicates the factors that have occurred through the years in the different countries. The compilation of the table allows one to see the commonly occurring factors resulting in cost overruns.

2.4 Possible mitigation and control measures to address project cost overruns

Owners that spend more time in the pre-planning phase, had less change orders, chose more experienced contractors and hired a consultant to

supervise had less cost increases and time delays. The more time and finance that was spent planning in the design phase allowed for a smoother implementation phase resulting in a better value for money project leaving stakeholders better satisfied and minimising the effects of project cost overruns⁶.

Other measures for mitigation in order to improve cost performance include effective strategic planning; performing a preconstruction planning of project tasks and resource needs and proper project planning and scheduling which can be used to overcome factor that occur in the design phase. Whereas effective site management and supervision; frequent progress meetings; proper emphasis on past experience; use of experienced sub-contractors and suppliers; appropriate construction methods; use of up to date technology; clear information and communication channels; frequent coordination between the parties; comprehensive contract administration; systematic control mechanism and timely resolving of disputes can assist in reducing cost overruns in the construction phase. Finally, to mitigate cost overrun factors in the completion phase, one can developing human resources in the construction industry and improve contract award procedure in terms of less weight to price and more weight to capabilities and past performance of contractors^{7,11,18}.

Having reviewed the international and national literature the next section discusses the method utilised for this research.

3. RESEARCH METHOD

This quantitative study²¹ involved the distribution of questionnaires to residential building contractors. There has not been many studies conducted on the topic of residential construction project cost overruns especially in South Africa. Factors causing cost overruns were gathered from national and international sources, which included published journals, websites and conference papers. The most commonly occurring factors causing cost overruns supported by literature were imputed into a table, which provided a foundation for the primary research to be conducted through a survey to fulfil the objectives of the study.



Purposive sampling²², which is a type of non-probability sampling was used to distribute the survey questionnaire to sixty residential contractors registered with the National Home Builders Registration Council (NHBC) in KwaZulu-Natal. The NHBC is a regulatory body of the home building industry that ensures registered companies are up to standards and operate with a quality that uplifts the industry. Participants were emailed or physically hand delivered the survey. Twenty five contractors responded indicating a 42% response rate.

The Relative Importance Index (RII) was used to rank the Likert Scale cost over run factors and remedies. The following relative importance index (RII) equation was used²³:

$$RII = \sum W / AN$$

W = the weighting given to each factor which comes from the respondents and it ranges from 1 to 5 according to the Likert scale used.

A = the highest point on the scale.

N = the total number of respondents in the sample. The researchers applied for and were granted an ethical clearance certificate. All the participants signed an informed consent form and confidentiality and anonymity of all participants were maintained at all times.

4. DISCUSSION AND ANALYSIS

The analysis indicated that according to the respondents, the amount of times cost overruns occurred on projects averaged of 7.52 times out of 10. This is a relatively high rate and showed that this is a prevalent problem in the industry.

The analysis of the respondents showed that 46% were owners or managing directors of the companies. Twenty five percent were construction managers, 17% were architects, 8% engineers, and 4% were quantity surveyors. The average industry experience of respondents amounted to 16 years indicating that the responses received were from experienced individuals.

In order to determine the factors contributing to cost overruns in residential projects, the factors were broken down and ranked according to degree of impact, frequency and severity.

The degree of impact for all the factors causing construction cost overruns was calculated using the relative importance index equation. The factors were ranked in according to the RII values in Table 2. The top three factors of cost over runs were variation/change orders with an RII=0.832, lack of contractor experience with an RII=0.776 and incomplete/poor planning with an RII=0.760.

Table 2. Ranking of cost overrun factors decreasing frequency

No	Description	Mean	Std. Dev.	RII
1	Variation/Change Orders	4,160	0,688	0,832
2	Lack of Contractor experience	3,880	1,092	0,776
3	Incomplete/poor planning	3,800	1,118	0,760
4	Incorrect project cost estimating	3,760	0,879	0,752
5	Project Complexity	3,760	0,778	0,752
6	Extra Work	3,760	0,879	0,752
7	Lack of communication between parties	3,680	0,900	0,736
8	Improper site management	3,600	0,763	0,720
9	Delays in project Schedule	3,560	0,820	0,712
10	Poor quality of work	3,560	1,083	0,712
11	Project financing problems	3,520	1,084	0,704
12	Unforeseen site conditions	3,440	0,916	0,688
13	Project duration	3,440	1,003	0,688
14	Poor productivity	3,400	0,763	0,680
15	Contractor financial/cash flow problems	3,360	1,113	0,672
16	Site wastage	3,280	0,791	0,656
17	Poor Contract Management	3,240	1,011	0,648
18	Delayed payments due to contractor	3,240	1,200	0,648
19	Project Location	3,200	0,957	0,640
20	Contractual disputes between parties	3,160	1,067	0,632
21	Fluctuation in Material Prices	3,120	0,665	0,624
22	Cost of labour	3,000	1,080	0,600
23	Inflationary pressure	2,960	0,734	0,592
24	Number of competitors	2,960	1,171	0,592
25	Weather	2,840	0,746	0,568
26	High interest rates by bankers	2,800	1,040	0,560
27	Cost of machinery	2,760	0,830	0,552
28	Contractor frontloading on rates	2,720	0,936	0,544
29	Labour shortages	2,720	0,979	0,544
30	Monopoly of suppliers	2,680	0,988	0,536
31	Currency Fluctuations	2,360	0,810	0,472
32	Insurance Costs	2,080	0,759	0,416

Figure 1. Indicates Top ten causes of cost overruns in terms of degree of impact.



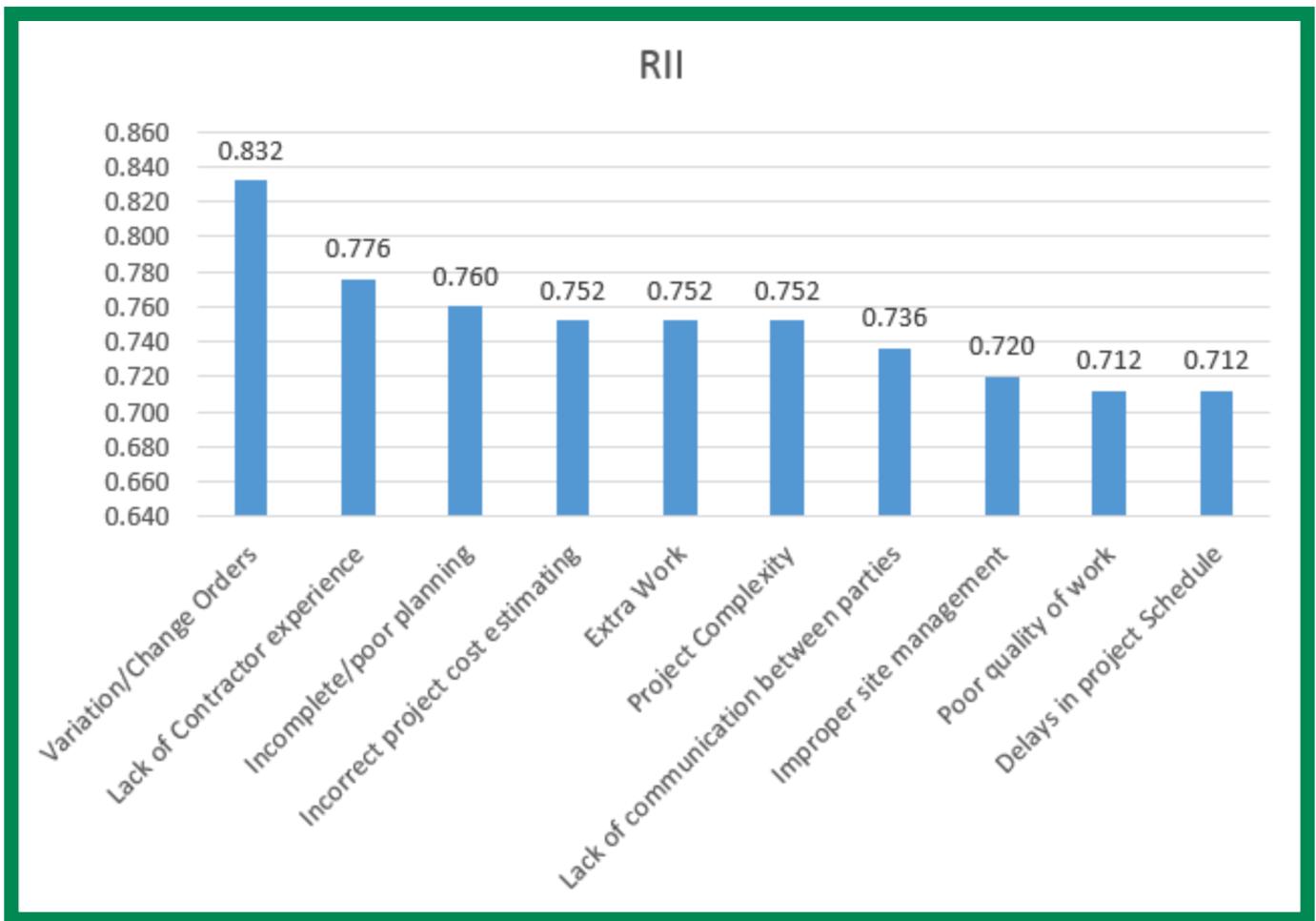


Figure 1 indicates the top ten causes of cost overruns in terms of degree of impact.

Table 3 depicts the frequency of all the cost overrun factors and is ranked in according to the RII score. Here again variation/change orders with an RII=0,808 was ranked first. Extra work (RII=0,696) and delays in project schedule (RII=0,608) were ranked second and third respectively.

Poor productivity and delayed payments due to the contractor were also regarded as frequent occurrences and ranked fourth and fifth respectively. Currency fluctuations and insurance costs were seen as the factors that occurred less frequently in terms of effecting cost overruns.

Table 3. Frequency of cost overrun factors in decreased frequency

Table 3. Frequency of cost overrun factors in decreasing frequency

No	Description	Mean	Std. Dev.	RII
1	Variation/Change Orders	4,040	0,789	0,808
2	Extra Work	3,480	1,045	0,696
3	Delays in project Schedule	3,040	0,840	0,608
4	Poor productivity	3,040	0,934	0,608
5	Project duration	3,000	0,912	0,600
6	Delayed payments due to contractor	3,000	1,080	0,600
7	Number of competitors	2,960	1,098	0,592
8	Lack of communication between parties	2,960	0,789	0,592
9	Site wastage	2,960	0,840	0,592
10	Unforeseen site conditions	2,840	0,800	0,568
11	Poor quality of work	2,840	1,143	0,568
12	Incomplete/poor planning	2,760	0,830	0,552
13	Project Complexity	2,760	0,778	0,552
14	Fluctuation in Material Prices	2,760	0,969	0,552
15	Cost of labour	2,720	0,979	0,544
16	Improper site management	2,720	0,842	0,544
17	Contractor financial/cash flow problems	2,680	0,802	0,536
18	Incorrect project cost estimating	2,640	0,700	0,528
19	Weather	2,600	0,866	0,520
20	Poor Contract Management	2,560	0,869	0,512
21	High interest rates by bankers	2,560	0,916	0,512
22	Lack of Contractor experience	2,560	0,916	0,512
23	Project financing problems	2,520	0,653	0,504
24	Inflationary pressure	2,520	0,653	0,504
25	Cost of machinery	2,400	0,816	0,480
26	Contractor frontloading on rates	2,360	0,700	0,472
27	Monopoly of suppliers	2,360	0,810	0,472
28	Contractual disputes between parties	2,360	0,757	0,472
29	Project Location	2,280	0,613	0,456
30	Labour shortages	2,120	0,725	0,424
31	Currency Fluctuations	2,040	0,789	0,408
32	Insurance Costs	1,960	0,888	0,392



Table 4. Ranking of cost overruns in terms of severity

Rank	Factor Description	RII
1	Variation/Change Orders	0,682
2	Extra Work	0,547
3	Delays in project Schedule	0,448
4	Lack of communication between parties	0,443
5	Project duration	0,435
6	Incomplete/poor planning	0,427
7	Delayed payments due to contractor	0,426
8	Poor productivity	0,424
9	Project Complexity	0,424
10	Poor quality of work	0,422
11	Lack of Contractor experience	0,414
12	Improper site management	0,398
13	Site wastage	0,398
14	Unforeseen site conditions	0,392
15	Incorrect project cost estimating	0,390
16	Number of competitors	0,389
17	Contractor financial/cash flow problems	0,368
18	Project financing problems	0,357
19	Cost of labour	0,354
20	Fluctuation in Material Prices	0,342
21	Poor Contract Management	0,338
22	Contractual disputes between parties	0,314
23	High interest rates by bankers	0,310
24	Weather	0,307
25	Inflationary pressure	0,306
26	Project Location	0,306
27	Cost of machinery	0,282
28	Contractor frontloading on rates	0,272
29	Monopoly of suppliers	0,264
30	Labour shortages	0,243
31	Currency Fluctuations	0,208
32	Insurance Costs	0,178

In order to determine the most important factor that results in cost overruns, the factors were rank in terms of severity/importance. The severity/importance of the factors was calculated by taking the average of the product of the degree of impact and the frequency of each factor. Table 4 depicts the factors ranked according to their RII scores. The most severe/important factor that is likely to cause a cost overrun is variation/change orders (RII=0,682). This is followed by extra work (RII=0,547) and delays in the project schedule (RII=0,448). Lack of communication between parties (RII=0,443) and the project duration (RII=0,435) ranked fourth and fifth respectively. The least frequent factors, currency fluctuations and insurance costs were also the least severe factors in terms of effecting cost overruns.

A comparison between this study and other international studies^{3,19} showed similar top factors influencing construction costs such as variations/ change orders, extra work and contractual problems relating to delayed payments due to the contractor.

The importance ranking for factors were also separated into the three main phases of a construction project namely the design phase, construction phase and completion phase. The factors for each phase were ranked according to the RII scores as shown below in Table 5. There were 9 factors in the design phase, 19 factors in the construction phase and 4 factors in the completion phase.

The comparison of the top ten factors causing cost overruns was compiled in Table 6. This table indicates that 10% of the top ten factors causing cost overruns occur in the design phase, 60% in the construction phase and 30% in the completion phase. When comparing the factors in the different phases, 11% of the top ten factors occur in the design phase, 32% of the factors occur in construction phase and 75% occur in the completion phase. From this analysis, it can be seen that the majority of the factors causing cost overruns on residential projects occur during the construction phase. This phase of the project is the most dynamic stage. This indicates that contractors need to be most vigilant during the construction phase as this is where most factors causing cost overruns occur.



Table 5. Ranking of cost overrun causes according to categories in terms of severity

Rank	Description	RII
Design Phase		
1	Incomplete/poor planning	0,4272
2	Lack of Contractor experience	0,4144
3	Unforeseen site conditions	0,392
4	Incorrect project cost estimating	0,3904
5	Number of competitors	0,3888
6	Project financing problems	0,3568
7	Contractor frontloading on rates	0,272
8	Monopoly of suppliers	0,264
9	Insurance Costs	0,1776
Construction Phase		
1	Variation/Change Orders	0,6816
2	Delays in project Schedule	0,448
3	Lack of communication between parties	0,4432
4	Project duration	0,4352
5	Poor productivity	0,424
6	Project Complexity	0,424
7	Improper site management	0,3984
8	Site wastage	0,3984
9	Contractor financial/cash flow problems	0,368
10	Cost of labour	0,3536
11	Fluctuation in Material Prices	0,3424
12	Poor Contract Management	0,3376
13	Contractual disputes between parties	0,3136
14	Weather	0,3072
15	Inflationary pressure	0,3056
16	Project Location	0,3056
17	Cost of machinery	0,2816
18	Labour shortages	0,2432
19	Currency Fluctuations	0,208
Completion Phase		
1	Extra Work	0,5472
2	Delayed payments due to contractor	0,4256
3	Poor quality of work	0,4224
4	High interest rates by bankers	0,3104

Table 6. Comparison of phases and top ten rankings

	Design Phase		Construction Phase		Completion Phase	
	Compared in top 10	1 out of 10	10%	6 out of 10	60%	3 out of 10
Compared in respective phases	1 out of 9	11%	6 out of 19	32%	3 out of 4	75%



Table 7. Ranking of cost overrun remedies in order of effectiveness

No	Description	Mean	Std. Dev.	RII
1	Effective site management and supervision	4,63	0,711	0,925
2	Comprehensive cost planning / monitoring during pre-and-post contract stage	4,62	0,498	0,924
3	Good workmanship	4,57	0,507	0,914
4	Use of experienced sub-contractors and suppliers	4,55	0,510	0,909
5	Completed designs at time of tender	4,52	0,898	0,906
6	Continuous project coordination	4,44	0,870	0,888
7	Proper project planning and scheduling	4,42	0,717	0,888
8	Ensure proper time management	4,42	0,504	0,888
9	Clear information and communication channels	4,40	0,707	0,880
10	Use of appropriate construction methods.	4,36	0,727	0,877
11	Effective strategic planning	4,35	0,745	0,870
12	Improving contract award procedure in terms of less focus on price and more focus on capabilities.	4,32	0,716	0,866
13	Minimum changes in owner's brief	4,32	1,041	0,866
14	Comprehensive contract administration	4,30	0,470	0,860
15	Procure materials for construction and other related item ahead of time	4,27	0,458	0,855
16	Adequate pre-contract budget	4,26	1,098	0,855
17	Performing a preconstruction planning of project tasks and resource needs	4,26	0,733	0,855
18	Frequent progress meetings	4,18	0,728	0,838
19	Controlled owner's request	4,16	0,898	0,838
20	Timely improvements to standard drawings during construction stage	4,00	0,926	0,800
21	Use of up to date technology	3,94	1,063	0,788
22	Proper emphasis on past experience	3,89	1,023	0,778
23	Timely resolving of disputes	3,79	1,032	0,758
24	Timely final account agreements	3,71	1,047	0,748
25	Timely contract instruction after practical completion	3,67	1,283	0,738
26	Perform constructability reports prior to construction phase	3,53	1,172	0,708

Table 7 presents the respondent's ratings for mitigation and control measures to prevent cost overruns. The responses are rated in terms of effectiveness on the Likert scale with a rating from 1 to 5, with 1=not effective and 5=highly effective. The control measures were ranked according to the RII scores. Effective site management and supervision (RII=0.925) was regarded as the most effective remedy to mitigate and/or control cost overruns. Comprehensive cost planning / monitoring during pre-and-post contract stage (RII=0.924) ranked second which was followed by good workmanship (RII=0.914). These findings

5. CONCLUSION

Cost overruns particularly in the construction industry are a worldwide problem. The study was particularly concerned with the residential construction sector because not nearly as much research has been conducted in this sector compared to that of the industrial and commercial sectors in South Africa.

The crux of this study was concerned with project cost overruns and it was found that the leading factor that is likely to cause a cost overrun is variation/change orders followed by extra work and delays in the project schedule.



The most effective remedy to mitigate and/or control cost overruns was effective site management and supervision. Comprehensive cost planning / monitoring during pre-and-post contract stage ranked second which was followed by good workmanship. The objectives set out to be investigated in the study were covered and produced valuable information that is prevalent in the South African residential construction sector. The information can be used to make project stakeholders more aware of the dynamics of the industry with regards to construction cost overruns. It is recommended that future qualitative research be carried out to obtain a better understanding of how and why the cost overrun factors occur. This can give more effectiveness in mitigating the overruns.

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1. Submission of manuscripts

Authors should submit their papers electronically to The Editor at joc@asocsa.org.

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