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Causes of construction cost and time overruns: The 2010 FIFA World Cup stadia in South Africa

Peer reviewed

Abstract

The FIFA World Cup is the largest international sports event in the world. Hosting the FIFA World Cup remains a sought after goal for any country. Due to the magnitude of spectators and scale of participation the hosting of the event requires substantial investment in infrastructure, especially the stadia where the various football games will be played. The award of the 2010 FIFA World Cup to South Africa resulted in ten stadia to be either upgraded or newly constructed for the event in South Africa. Even though all the stadia were ready for the tournament, nearly all projects experienced time delays and cost overruns. This article investigates the reasons or causes of cost overruns and time delays during the upgrading and construction of the various stadia. A three-tier research approach covers a comprehensive literature review on the causes of cost overruns and time delays on construction-related projects globally as well as an investigation into the factors that caused cost overruns and time delays on six of the stadia. Finally, the results for the global and stadia projects are compared. The results indicate that the increase in material cost is the single largest contributor to cost overruns for both global and stadia projects. With respect to time delays the most significant contributing factor for global projects was late delay in payments while for the stadia projects design-related factors caused the most delays. The results provide valuable information on the unique challenges facing those who are interested in investing or managing construction projects in South Africa.

Keywords: Project cost performance, schedule delays, cost overruns, project construction

Abstrak

Die FIFA Wêreldbekersokkertoernooi is die grootste sportgebeurtenis in die wêreld. Dit is 'n groot eer en voorreg vir enige land om die toernooi aan te bied. Gegewe die magdom aantal toeskouers en vlak van deelname aan die toernooi word heelwat spandeer om die land se infrastuktuur, veral die stadions waar die wedstryde gespeel word, op te gradeer. Die toekenning van die 2010 FIFA Wêreldbekertoernooi aan Suid-Afrika het tot gevolg gehad dat

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tien stadions opgegradeer of nuut gebou moes word. Hoewel die tien stadions gereed was vir die toernooi het feitlik al die stadionprojekte skedulevertragings en oorspandering beleef. Hierdie studie het ten doel om die redes te ondersoek wat aanleiding gegee het tot skedulevertragings en oorspandering tydens die konstruksie van die nuwe, en opgradering van die ou stadions. 'n Drieledige navorsingsbenadering het 'n volledige literatuurstudie ingesluit oor redes vir oorspandering en skedulevertragings op internasionale konstruksieprojekte, op ses van die stadionprojekte. Laastens word 'n vergelyking tussen die twee groepe projekte getref. Die resultate toon aan dat die toename in materiaalkoste die grootste bydraende faktor is tot oorspandering vir beide internasionale- en stadionprojekte. Wat skedulevertragings betref, het vertraging in betalings die grootste impak op internasionale projekte gehad terwyl laat ontwerpveranderinge die grootste impak op stadionprojekte gehad het. Die resultate verskaf waardevolle inligting rakende die unieke uitdagings wat in berekening gebring moet word deur beleggers in Suid-Afrikaanse konstruksieprojekte.

Sleutelwoorde: Projekkosteberekening, skedulevertragings, oorspandering, projekkonstruksie

1. Introduction

According to the South African Construction Industry Status Report, 2004 the construction industry accounts for more than 10% of the world's economy (CIDB, 2004: online). As a prime indicator of economic activity, the construction industry is often utilised by governments not only to stimulate growth but also to assist economic recoveries from recessions. Given the large capital amounts associated with construction projects, the performance in terms of cost and time are closely monitored, especially where tax payers' money is involved. With the third 'traditional' measurement criterion for project performance, namely 'quality', being a more subjective unit of measure, the quantitative results from measuring against original project duration estimates and approved budgets remain popular yardsticks for assessing overall project performance.

Even though South Africa completed numerous large construction projects over the years, the award of the FIFA Soccer World Cup in 2010 drew the attention to South Africa's ability to deliver large construction projects within time and budget. Burdened with the negative global view towards the "African project failure syndrome" (Rwelamila, Talukhaba & Ngowi, 1999) and "contingency venue" already identified (Dell'Apa, 2008), the South African construction industry started work under much doubt regarding its capability to complete the massive construction work on the ten stadia across South Africa (Panja, 2008; Corbett & Alderson-Smith, 2009).

Once the stadia were completed, no formal or final cost figure was released by government or any other public institution. However, the

Minister of Finance was quoted in *The Africa Report* (Ballong, 2010: online): "we have been confronted with an escalation of costs", and the budget for all the stadia is USD 267 million in deficit. Hill (2008) reported that the stadia would require an additional R 2 billion to complete. Table 1 provides a summary of initial budgeted cost and indicated final cost of some of the stadia (eco-h2o, 2010: online).

Table 1: Budgeted versus indicated final costs of the ten FIFA 2010 stadia

Stadium	*Initial budgeted cost*	*Indicated final cost*
Soccer City – Johannesburg	R 2.2 billion	R 3.7 billion
Ellis Park – Johannesburg	R 240 million	R 253 million
Moses Mabida – Durban	R 1.6 billion	R 3.1 billion
Mombela – Nelspruit	R 600 million	R 1 billion
Green Point – Cape Town	R 2.9 billion	R 4 billion
Nelson Mandela Bay – Port Elizabeth	R 2.1 billion	Not known
Peter Mokaba – Polokwane	R 1.3 billion	Not known
Royal Bafokeng – Rustenburg	R 360 million	R 483 million
Mangaung – Bloemfontein	R 245 million	R 359 million
Loftus Versfeld – Pretoria	R 122 million	R 131 million

Although the stadia were completed in time for the FIFA World Cup, some were behind schedule and not ready for the Confederations Cup in 2009, the official 'curtain raiser tournament' and 'testing tournament' to assess the stadia's readiness for the FIFA World Cup during 2010 (Dell'Apa, 2008).

Given the cost overruns and time delays on the stadia projects, this research aims to (i) investigate the general factors that cause cost overruns and time delays on global construction projects; (ii) determine which factors played a significant role during the upgrading and construction of the 2010 FIFA World Cup stadia, and (iii) compare the stadia factors with those indentified on global construction projects.

2. The global construction industry

Project performance in the construction industry is well researched. A study completed by the International Program in the Management of Engineering and Construction (IMEC) in 2000 (Miller & Lessard, 2000: 14) revealed that 18% of 60 large engineering and construction projects, with an average capital value of $ 1 billion undertaken between 1980 and 2000, incurred extensive cost overruns. Merrow, McDonnell & Argüden (1988) studied 47 "megaprojects" in the

construction environment and found that only four were on budget with an average cost overrun of 88%. Morris & Hough (1987: 7-15) also provide a comprehensive list of cost overruns on large projects. According to Flyvbjerg, Bruzelius & Rothengatter (2003), cost overruns are especially evident in infrastructure construction projects.

The relatively poor performance of construction projects prompted researchers to investigate and identify the factors that cause cost overruns and time delays. In the following paragraphs the results of related literature is summarised and concluded with the identification of the most important and dominant factors. Formulating solutions and remedies to the causes were not addressed and are considered to be beyond the scope of this paper.

3. Factors causing project cost overruns

Since the 1980s various studies have investigated the causes for project cost overruns on construction projects.

Kaming, Olomolaiye, Holt & Harris (1997: 87), who studied 31 construction projects in Indonesia, found that from a contractor's point of view, cost overruns were mainly caused by "inaccuracy of material take-off", "increase in material costs" and "cost increase due to environmental restrictions". Studying the cost overruns and delays on groundwater projects in Ghana, Frimpong, Oluwoye & Crawford (2003: 325) contractors found that "late monthly payments from clients" were the most important cost and time delay factors, with clients ranking "poor contractor performance" as the most important cost and time delay factor. Reviewing public sector construction projects in Nigeria, Dlakwa & Culpin (1990: 239) found that the three main reasons for cost overruns are "fluctuations in material, labour and plant costs", "construction delays" and "inadequate pre-planning".

In another study on construction projects in Nigeria, conducted by Okpala & Aniekwu (1988: 238), it was found that architects, consultants and clients agreed that 'shortage of materials', 'finance and payment of completed works' and 'poor contract management' were the most important causes of cost overruns. Mansfield, Ugwu & Doran (1994: 258) studied the performance of transportation infrastructure projects in Nigeria and concluded that 'material price fluctuations', 'inaccurate estimates', 'project delays' and 'additional work' contributed most to cost overruns. In a fourth study on construction projects in Nigeria by Elinwa & Buba (1994: 698), it was found that 'cost of materials', 'fraudulent practices' and 'fluctuations in materials prices'

had the most significant impact on project costs. During extensive studies on construction project performance in European countries, Morris & Hough (1987) as well as Flyvbjerg, Bruzelius & Rothengatter (2003) found that 'fluctuations in material cost' and 'additional work' contributed most to cost overruns.

In reviewing the literature an approach and trend towards the type of questions and results could be observed. In calculating the number of times specific types of causes for cost overruns under each category were observed, the following can be concluded:

- The most significant factor causing cost overruns due to client action is 'additional work or changes to work'. This cause was listed as a major factor in five of the seven (71%) reviewed articles.
- From a contractor's perspective the most significant contributor to cost overruns is 'time delays', listed in three of the seven (43%) reviewed articles.
- The most significant factor for cost overruns is evident from external factors and that is 'material price changes'. This factor was listed in six of the seven (86%) reviewed articles.

Other common factors listed among contractors, consultants and clients were 'poor estimates and material take-off' and 'delay in payments'.

It can be argued that the factors mentioned do not stand alone and that the ultimate cost overruns can be a result of multiple factors contributing to the final cause for cost overruns. For example, additional work requested by a client can result in a delay in ordering material which, in the mean time, was subject to price increases or shortages. The views of clients, contractors and consultants on reasons for cost overruns could also be conflicting with stakeholders defending their operating domain and 'shifting the blame'.

4. Factors causing time delays

Unfortunately, time delays on construction projects are more the norm than the exception. Supplementing their research on the causes for cost overruns, Kaming *et al.* (1997: 87) found that 'design changes', 'materials shortage' and 'inadequate planning' were the most significant contributors to time delays on construction projects. Similarly Sambasivan & Soon (2007: 521) categorised their findings into client, contractor and consultant categories, with all three categories listing 'poor site management', 'inadequate contractor

experience' and 'poor subcontractors' among the top five causes for time delays on construction projects.

Ogunlana, Promkuntong & Jearkjirm (1996: 44) investigated 12 high-rise buildings and categorised their findings into client/consultant-related, contractor-related and external causes for time delays. The weighted findings among these three categories indicated that 'material shortages', 'overstretching of technical personnel' and 'design changes' were the most important causes for project delays.

Assaf, Al-Khalil & Al-Hazmi (1995: 50) used 56 questions in three categories, namely owner, architects/engineers and contractors, to determine the main causes of delays on large building projects in Saudi Arabia. Their survey showed that contractors believed that 'preparation of shop drawings', 'delays in contractor's progress' and 'payment by owners' were the most important factors contributing to time delays. According to architects/engineers, 'cash flow', 'subcontractors' schedules' and 'slowness of owner decision-making' caused the most delays. Finally, owners were of the opinion that 'design errors', 'excessive bureaucracy in project-owner organisation' and 'labour shortages' contributed most to time delays.

Walker (1995: 269) surveyed Australian project representatives and found that the most important factors that affect time delays are 'the ability of the organisation to manage risk', 'planning capabilities' and 'effective resource coordination'. Kumaraswamy & Chan (1998: 25) studied time delays on Hong Kong projects and found that 'unforeseen ground conditions', 'poor site management' and 'slow speed of decision-making' were the most prominent causes of time delays. The results from a study of 130 public projects in Jordan by Al-Momani (2000: 58) indicated that 'poor design and negligence by the owner', 'change orders' and 'poor weather and site conditions' contributed most to delays. Al-Khalil & Al-Ghafly (1999: 654-655) studied public utility projects in Saudi Arabia and found that contractors considered 'delay in claim settlement', 'slow decision-making' and 'delays in progress payments' as the most important delay factors. Owners believed that 'poor early planning', 'scope changes' and 'financial difficulties by the contractors' were the major causes of delay. The consultants somehow supported the owners' views by indicating 'financial difficulties by the contractor', 'improper contract knowledge' and 'ineffective planning' as the most significant delay factors.

Odeh & Battaineh (2002: 70) used only two points of view, namely contractors and consultants, to determine the causes of project

delays in Jordan. The results showed that contractors believed that 'poor labour productivity', 'owner interference' and 'inadequate contractor experience' were the three most important causes of delays. The consultants, however, indicated 'inadequate contractor experience', 'late payment of completed work' and 'poor subcontracting' to be the main causes of delay. The inclusion of 'late payment of completed work' as a cause for delay referred to the result of late payment on continuing site activities and contractors halting work unless payment for completed work had been processed after the agreed date.

Studying the significant factors that cause delay of construction projects in Malaysia, Alaghbari, Kadir, Salim & Ernawati (2007: 199-200) used four categories for analysis, namely contractor, consultant, owner and external. As far as causes related to contractor actions are concerned, 'financial problems', 'shortage of materials' and 'poor site management' were ranked among the top three. Owner causes included 'delayed payments', 'slow decision-making' and 'contract scope changes'. The top three consultant causes were 'poor supervision', 'slowness to give instructions' and 'lack of experience'.

Finally, external causes of delay included 'shortage of materials', 'poor site conditions' and 'lack of equipment and tools in the market'. Faridi & El-Sayegh (2006: 1172) studied project delays in the United Arab Emirates and found that the three main causes of project delays were 'preparation and approval of drawings', 'inadequate early planning of the project' and 'slowness of owner's decision-making processes'.

The following can be concluded from the results published in the reviewed literature:

- The highest frequencies of time delay factors attributed to client actions were 'changes to design and drawings' (listed in six of thirteen, or 46% of the reviews) followed by 'slow decision-making' (listed in four of thirteen, or 31% of the reviews).
- The highest time delay factor attributed to contractor action was 'poor site management' (listed in six of thirteen, or 46% of the reviews), followed by 'poor planning' (listed in five of thirteen, or 39% of the reviews).
- As far as external factors are concerned, the overwhelming contributing factors to time delay were 'material shortages'

and 'late delivery of materials' (both listed in seven of thirteen or 54% of the reviews).

As with factors causing cost overruns, multiple factors could have an impact on a single, final cause for time delays. For example, slow decision-making by the client could lead to late design finalisation and subsequent late ordering of materials.

For the purpose of this research, the questions remain: Which factors caused time delays and cost overruns on the 2010 FIFA World Cup stadia projects, and How do these factors compare to those identified on global construction projects?

5. Research method

Construction projects entail the business engagement between two parties, namely the client or owner of the project and the contracting parties. The client is usually an institutional body such as a corporate company, governmental department, parastatal, financial institution or non-governmental institution. Contracting entities could be one or more main contractors, subcontractors and suppliers. This business engagement between the two parties occurs in an economic, socio-economic and environmentally sensitive business environment. This global environment consists of many external factors that could influence the progress and success of the project. Together with the client and contractors these external factors should be considered when exploring the causes for cost overruns and time delays on construction projects. With this in mind, the following basic categories developed by Antill & Woodhead (1990) were used:

- Client-related factors;
- Contractor- and supplier-related factors, and
- External factors.

Client-related factors include late payments, approval delays, changes to work and design, technical definition, client representation, design delays, decision-making and internal skills shortages. Contractor- and supplier-related factors include skills shortages, time and resource planning and coordination, subcontractors, site management, and labour productivity. External factors include delay in financing, statutory approvals, unpredictable site conditions, escalation and inflation, and shortages of material. Although it can be argued that 'shortages of material' could be a supplier-related factor, most of the literature categorised it under external factors,

the reason being that availability of material is mostly a function of economic conditions and subjected to supply and demand rather than supplier capabilities.

In order to conduct the survey, a detailed questionnaire was developed. The main purpose of the questionnaire was to assess the perception of respondents regarding the factors that cause project delays and cost overruns. The questionnaire consisted of 18 potential factors causing cost overruns and 34 potential factors causing delays, to be ranked by respondents. Although this research method of extended surveys or questionnaires has been proven for this type of application, the concern remains that there could be a certain degree of overlap between the various categories. In order to minimise potential overlaps, the 52 factors were carefully described.

In analysing and ranking the results, the Relative Importance Index (RII) was used (Kometa, Olomolaiye & Harris [1994]; Faridi & El-Sayegh [2006]; Aibinu & Odenyika [2006]).

$$RII = \sum W / (A \times N),\ (0 \leq index \leq 1),$$

where W = weight given to each factor by the respondents, and ranges from 1 to 5, (where "1" is "never" and "5" is "always"), A is the highest weight (that is 5 in this case) and N = total number of respondents.

A total of 60 questionnaires were distributed to consultants (24), contractors (20) and clients (16) involved in the ten 2010 World Cup construction sites. The sampling method used is commonly referred to as convenience or snowball sampling (Sambasivan & Soon, 2007). This type of sampling falls under the category of non-probability techniques and, as the name implies, sample elements are identified by convenience (friends, colleagues and professional contacts) and referral networks. This method of questionnaire distribution is preferred when it is difficult to obtain a response from participants selected at random. The ten stadia concerned were those listed in Table 1 (FIFA, 2010: online).

Although the stadia were on track to be completed for the FIFA World Cup tournament beginning in June 2010, not all were ready for the FIFA Confederations Cup held during June and July 2009. Although delays and cost overruns occurred on nearly all the projects, most were able to absorb the additional capital and time requirements in the contingencies allowed.

6. Results

Of the 60 questionnaires distributed, 22 (36%) responses were received. Responses were received for six stadia (see Table 2). Of the 22 returned questionnaires, 5 (22.7%) were from clients, 3 (13.6%) from contractors and 14 (63.6%) from consultants. Soccer City had the highest response rate (31.8%) and Loftus the lowest (9%).

Although the responses from clients and contractors were fairly low, the structuring of the questions minimised subjectivity. The low response rate made it impossible to conclude statistically significant findings. However, some indicative trends could be observed.

Table 2: Response from stadia

Stadium	*Number of respondents*				*% of response*
	Client	Contractors	Consultants	Total	
Ellis Park	1	1	2	4	18.2%
Loftus Versfeld	0	0	2	2	9%
Mbombela	1	0	2	3	13.6%
Polokwane	1	0	2	3	13.6%
Royal Bafokeng	1	1	1	3	13.6%
Soccer City	1	1	5	7	31.8%
Total	5	3	14	22	100%

In analysing the responses the mean and RII were calculated and ranked for each factor.

6.1 Factors causing cost overruns on the 2010 FIFA World Cup stadia

The results obtained from the responses to cost overruns are provided in Table 3. A total of 18 factors were analysed, with the top ten factors contributing to more than 85% of the cost overruns. Thus, for the purpose of this paper, only the top 10 ranked factors are listed.

Table 3: Ranking of factors causing cost overrun at stadia

Cost overrun factors	*RII*	*Rank*	*Category*
Increase in material cost	0.79	1	External
Inaccurate material estimates	0.60	2	Client
Shortage of skilled labour	0.58	3	Contractor
Client's late contract award	0.56	4	Client

Cost overrun factors	*RII*	*Rank*	*Category*
Project complexity	0.55	5	External
Increase in labour cost	0.54	6	External
Inaccurate quantity take-off	0.53	7	Client
Difference between selected bid and the consultants' estimate	0.52	8	Client
Change orders by client during construction	0.51	9	Client
Shortage of manpower	0.51	9	External

The ranking of the factors that caused cost overruns at the various stadia indicates that the most significant factor is the 'increase in material cost' under the category of external factors. The bills of quantities were supplied to the contractors as part of the tender process. The 'inaccuracy of material estimates' from the bills of quantities under the client category was the second highest ranked factor while the 'shortage of skilled labour' under the contractor category was ranked third.

6.2 Factors causing time delays on the 2010 FIFA World Cup stadia

The results obtained from the responses to time delays are provided in Table 4. In total 34 factors were analysed, with the top ten factors contributing to more than 80% of the causes for delay.

It must be noted that, for the purpose of this article, the factor 'incomplete drawings' is attributed to the 'client' category, the reason being that the majority of the consultants were appointed under a separate professional services contract by the client with the final product (drawings) handed to the construction contractors under a separate contract. Thus, as far as the contractor is concerned, the completeness of drawings remains the responsibility of the client.

Table 4: Ranking of factors causing time delays at stadia

Delay factors	*RII*	*Rank*	*Category*
Incomplete drawings	0.66	1	Client
Design changes	0.63	2	Client
Clients' slow decision-making	0.63	2	Client
Late issue of instructions	0.63	2	Client

Delay factors	*RII*	*Rank*	*Category*
Shortage of skilled labour	0.63	2	Contractor
Poor planning and scheduling	0.59	6	Contractor
Labour disputes and strikes	0.59	6	Contractor
Shortage of manpower	0.58	8	Contractor
Change orders by client during construction	0.55	9	Client
Poor information dissemination	0.55	9	Client
Delay in work approval	0.55	9	Client

The highest ranked contributors to time delays on projects are concentrated around client actions, namely 'incomplete designs', 'design changes', 'slow decision-making' and 'late issue of instructions'. For the contractor category the 'shortage of skills' proved to be the most significant delay factor, followed by 'poor planning' and 'labour problems'. The most significant external factor was 'unforseen soil conditions', ranked eighth.

6.3 Comparing global and FIFA World Cup stadia construction performances

A key parameter for direct comparison is the use of common measurement criteria. In this research a common approach was followed in terms of categorisation of parameters, questionnaires and RII calculation. However, not all research conducted on global construction projects followed this route and therefore the final results should be viewed as indicative rather than absolute. Despite this shortcoming, the comparison indicates clear similarities and differences between global construction and FIFA World Cup stadia projects.

Comparing the causes of cost overruns with those found in literature and FIFA World Cup stadia, 'material cost' and 'price fluctuations' had a significant impact on both groups of projects. As an external factor the uncertainty regarding material cost is something the project manager and team have little control over and it remains a huge risk for any construction project. Other signicant causes identified for global projects in literature were 'poor bills of quantity estimates and material take-off' and 'delays in payments' as opposed to 'inaccurate material estimates' and 'shortage of skilled labour' for FIFA World Cup stadia projects. Thus the main causes of cost overruns on projects studied in literature and FIFA World Cup stadia were very similar.

When comparing the causes for time delays between those found in literature and FIFA World Cup stadia, it was found that there are similarities between the top three causes. From literature 'slow decision-making by the client', 'design changes' and 'delay in payments' were found to be the most significant causes of project time delays. In comparison, FIFA World Cup stadia found that 'incomplete drawings', 'design changes' and 'clients' slow decision-making' were the main causes of time delays.

The observations made in comparing the results are important, especially those related to causes for time delays on the FIFA World Cup stadia projects. The mere fact that the causes are concentrated around the client's actions will have an impact on the allowances that contractors will need to make on the schedules. Similarly, clients will also be wary of the skills problems experienced by contractors since all three factors listed under the contractor category for FIFA World Cup stadia projects, namely shortage of skills, poor planning, and labour disputes and strikes are worker-related.

7. Summary and conclusion

The FIFA 2010 Soccer World Cup turned the world's attention to South Africa's ability to successfully complete major construction projects. With global construction projects generally late and over budget, this article investigated the factors causing cost overruns and time delays on these projects. The factors identified were categorised into three categories, namely external factor-related, client-related and contractor-related. Following the factors identified, a questionnaire was developed and distributed to potential participants working in various capacities on the various stadia projects. Results were received from respondents involved in six of the ten FIFA World Cup stadia.

Although the FIFA World Cup stadia had time delays on all the projects, they were completed in time for the tournament. The most significant contributor to cost overruns for the FIFA World Cup stadia was 'material cost and price fluctuations' which is also a factor experienced by numerous projects referred to in literature in other parts of the world. Factors causing delays on the FIFA World Cup stadia projects were client-related such as 'incomplete drawings', 'design changes' and 'slow decision-making'. Apart from a client-related cause, namely 'delay in payments', the main causes identified in literature on global projects corresponds with the top three causes found in literature.

From this research it can be concluded that the main factors causing cost overruns and time delays on global projects listed in literature are similar to those experienced on the FIFA World Cup stadia projects. South Africa does no longer finds itself isolated from global economic pressures. Local clients and contractors compete in a global economic environment where the availability of materials and skilled resources remains a challenge.

The importance of accurate design work and compilation of bills of quantities were highlighted. Although advanced software tools and techniques, such as three-dimensional modelling, automated material take-offs and change reference control had been developed to improve the productivity of design outputs, these aspects remain some of the most significant contributors to time delays on construction projects.

8. Recommendations for further research

This article investigated the factors causing cost overruns and time delays for both FIFA 2010 World Cup stadia and global construction projects. From the article it is clear that there is much scope for research in the following areas:

- The impact of interrelationships/causalities between two or more factors. Although listed as stand-alone factors in this research, some factors could be the result of another. For example, 'wrong material take-offs' could be the result of 'design changes'. 'Poor skills levels' could impact on 'site supervision', not to mention salient factors such as language and cultural differences.
- The skills level of global and South African construction labour and subsequent levels of productivity.
- The impact of architectural novelty on the design phase duration of projects. The new stadia included state-of-the-art, unique architectural designs. These designs posed major challenges regarding constructability which could have had an impact on the number of design changes.
- The impact of forward cover to hedge against extraordinary material price increases.
- The impact of geographical positioning on construction performance.

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