Causes of Cost Overruns of Municipal Infrastructure Grant Funded Projects at the OR Tambo District Municipality

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Abstract

The Municipal Infrastructure Grant (MIG) is the largest infrastructure grant allocated to municipalities by National Treasury. The purpose of the MIG is to provide basic infrastructure-related services to poor communities in South Africa. Unfortunately, projects funded under the MIG have been characterised by cost overruns. OR Tambo District Municipality is no exception to this enigma. With the prevalence of cost overruns on most MIG funded projects it has become difficult for municipalities to estimate, commit and adhere to infrastructure targets. This study focuses on uncovering the causes of cost overrun on MIG funded projects in the OR Tambo District Municipality. The data was gathered by using a survey questionnaire of 69 potential factors and other sources of evidence such as project documentation. A total of 65 respondents, out of a potential 115 sampled, representing service providers and sector departments involved in OR Tambo District Municipality, responded to a 5-point Likert scale questionnaire. Of the 69 potential factors, 21 factors were found to have significant impact on cost overruns. Data gathered from other sources such as project documentation and archival records confirmed the significance of the 21 factors. Main causes of cost overrun included inadequate planning, inadequate funding, and discrepancies in the procurement processes and policies. The study recommends improvements in project planning, adjustments in the project implementation process and policy as the main focus areas to reduce cost overrun.

Introduction

Most municipalities in South Africa rely on government funding to implement their capital infrastructure projects. This is primarily due to the fact that revenue collected from traditional sources is not sufficient to operate and maintain the existing infrastructure let alone the construction of new facilities and systems. The funds, referred to as the Municipal Infrastructure Grant (MIG), are allocated annually to municipalities by National Treasury through the *Division of Revenue Act* purposely

established for building new infrastructure. MIG derives from taxes collected by the South Africa Revenue Services and is essentially a public fund requiring efficient and effective utilisation. The grant is conditional and its main purpose is to supplement municipal sources of revenue in order to provide basic services to especially poor communities.

Cost overruns on projects funded through this grant have been on the increase in most municipalities within the country. OR Tambo District Municipality (DM), the municipality under study and located in the Eastern Cape Province of South Africa, has been one of the municipalities affected by the challenge of cost overruns on most of its projects. Recent reviews of infrastructure backlogs through the Comprehensive Infrastructure Plans (CIPs) indicate that the grant allocated to the municipality has under-achieved with regard to targeted infrastructure backlog reduction. The cost overruns on projects had adverse effects on project schedules, quality of work and targeted infrastructure backlog reduction. A number of projects were terminated and revived again thereby adding to cost overruns due to site re-establishments. This article aims to establish what the most significant causes are for cost overruns, to establish if the causes are internal and/or external, and to establish if there are any relationships between MIG conditions, processes and the causes for cost overruns.

Factors Causing Cost Overruns on Infrastructure Projects

Different authors and scholars hold different views on the reasons for cost overruns on projects. While some agree that there has been an improvement due to modern and better cost estimate techniques, others conclude from their studies that there has not been any improvement. Kerzner (2001:671-686) argues that even with "good cost and control systems", problems associated with cost overruns can still occur. He also categorises factors contributing to cost overrun into different project phases stretching from planning to production. Steyn (2009:73), in his study, reveals that the "various studies carried out and the establishment of project management as a formal management discipline have only produced modest improvement to cost management in practice". Flyvbjerg *et al.* (2004:3) in their study on cost overruns on transport infrastructure projects conclude that "cost escalation has not decreased for over 70 years and it seems no learning has taken place".

Kaliba *et al.* (2009:522-531), Kaming *et al.* (1997:247-250), and Flyvbjerg *et al.* (2004: 16-17) have identified factors such as cost and schedule underestimates, scope changes, unforeseen events and poor performance by contractors as causes of cost overruns and project delays. However, comprehensive and tested solutions on how to address these challenges are not offered. Nicholas and Steyn (2008:290-291) highlight the practice of "non-buy in" by contractors and "underestimation of project budgets to get approval" as some of the reasons for cost overruns. They further point out that when the first budgets are developed, the project scope is not yet well documented and most of the information that would enable the project owner to make accurate estimates simply does not exist at that stage of the project life-

cycle. Commitments to these project budgets are therefore made too early in the project life-cycle. Comparison between findings from six different researchers (Chimwaso, 2001:81-90; Frimpong *et al.* 2003:321-326; Kaming *et al.* 1997:247-250; Morris, 1990:38-40; Al-Najjar, 2008:154-164; Flyvbjerg *et al.* 2002:290-291) on similar studies highlights the similarities in the findings and underlines the generic nature of most factors.

Factors such as inadequate initial estimates, changes in scope of work, project delays, fluctuations in material prices and location of sites appear to be common in most research findings but with varying degrees of contribution to cost overruns. The conclusions made from the literature reviewed indicate that cost overruns can occur at various stages of a project cycle. Factors such as inadequate planning, poor cost estimate, scope changes, project delays, and material price escalation appear to be generic therefore taken as a basis for potential cost overrun factors to be considered in this article. The review of the MIG conditions and processes exposes gaps that could adversely affect cost overruns. The predetermined unit cost, fixed planning budgets, unclear project briefs and time delay in the implementation process are some of the potential factors identified.

Research Methodology

This article aims to uncover the causes of cost overruns on MIG funded projects at the OR Tambo DM. It is based on the research that the authors conducted on this subject. The case of OR Tambo DM is used with multiple sources of qualitative and quantitative information. The information gathered is analysed. Sources of information used include project documentation, archival records, direct observation and survey questionnaires.

Documentation

A sample of 15 infrastructure-related projects since 2005 (nine water projects and six sanitation projects) were randomly taken from the project information obtained from the Department of Water Affairs (DWA) and the OR Tambo DM. The 15 projects are listed in Table 1 with their respective percentage cost overruns and reasons for overruns provided.

Table 1: Cost overrun percentage and reasons

PROJECT NO.	PROJECT CATEGORY	COST OVERRUN PERCENTAGE	REASONS FOR COST OVERRUN
Doc-1	Water	20	1
Doc-2	Water	59	1
Doc-3	Water	60	1
Doc-4	Water	28	1
Doc-5	Water	20	1

Table 1: Cost overrun percentage and reasons (Cont'd)

PROJECT NO.	PROJECT CATEGORY	COST OVERRUN PERCENTAGE	REASONS FOR COST OVERRUN
Doc-6	Water	20	2
Doc-7	Water	20	1
Doc-8	Water	58	1
Doc-9	Water	5	1
Doc-10	Sanitation	30	1&3
Doc-11	Sanitation	25	1&3
Doc-12	Sanitation	1	1&3
Doc-13	Sanitation	39	1&3
Doc-14	Sanitation	30	1&3
Doc-15	Sanitation	25	1&3

Source: Authors

The main reasons for overruns, as documented, were:

Reason 1: Tender amount being more than the initial cost estimate
Reason 2: Change in scope due to extra work
Reason 3: Pit lining cost

The cost overruns were measured on initial approved budget figured and ranged from 1% to 60%. About 93% of the projects had tenders received at amounts higher than the initial estimated cost, which could be attributed to (i) under-estimation of cost due to non-availability of adequate funds to carry out a detailed feasibility study to determine realistic cost estimates; (ii) delayed implementation and related price escalations; (iii) escalation in prices not being factored into the initial cost estimate; (iv) the breaking down of projects into subprojects during construction thereby increasing Preliminary and General costs (P and Gs). Of the nine water projects only one project had cost overrun due to scope changes. In addition to tenders being received at amounts higher than estimated, all six sanitation projects had extra costs due to pit lining. The cost due to pit lining can be attributed to unavailability of information due to inadequate planning funds to carry out geotechnical investigations.

Archival Records

MIG Management Information System (MIS) was accessed as a source of data. A sample of projects completed during the past five years was accessed. The projects were mostly sanitation related and cost overruns percentage, based on original approved budget, as well as recorded reason for over expenditure, are given in Table 2.

Table 2: Cost overrun percentage and reasons

PROJECT NO.	PROJECT CATEGORY	COST OVERRUN PERCENTAGE	REASON FOR COST OVERRUN
1MIGMIS-1	Sanitation	46	1&3
1MIGMIS-2	Sanitation	42	1&3
1MIGMIS-3	Sanitation	45	1&3
1MIGMIS-4	Sanitation	23	1&3
1MIGMIS-5	Sanitation	33	1&3
1MIGMIS-6	Water	22	2
1MIGMIS-7	Sanitation	20	3
1MIGMIS-8	Sanitation	37	3
1MIGMIS-9	Sanitation	33	3
1MIGMIS-10	Sanitation	20	3
1MIGMIS-11	Sanitation	20	3
1MIGMIS-12	Sanitation	32	3
1MIGMIS-13	Sanitation	25	3

Source: Authors

Key:
Reason 1: Tender amount being more than the initial cost estimate
Reason 2: Cost under-estimation
Reason 3: Pit lining cost

The 13 projects accessed experienced cost overruns ranging from 20% to 46% above the original approved budget. Five projects (38% of the 13 projects) had problems related to (i) tender amount being more than budgeted amount, which can be attributed to price escalations due to time lapse between initial estimate and implementation; (ii) pit lining cost, which can be attributed to geotechnical information not being available at the initial cost estimate stage. Seven projects (54% of the 13 projects) had cost overruns due to pit lining costs, which can be attributed to inadequate planning (geotechnical information not being available at the time of initial cost estimate). One project had cost overruns due to underestimation of the cost at planning stage, which could be attributed to price escalation, design omissions, and incomplete/ inadequate planning due to limited planning funds.

As a point of interest, an additional 22 projects were also reviewed from the MIG MIS to assess the project registration duration. On average it takes 11 months to register a project on the MIG MIS. Over and above the 11 months, there is time required for the appraisal and approval of technical reports, an exercise carried out before uploading a project on MIG MIS. On average DWA takes three months to appraise and approve the technical reports, therefore the total duration or turn-around time is approximately 14 months. This extensive registration period could have a severe impact on project cost performance.

Direct Observation

Through research site visits and interaction with municipal, DWA personnel and other sector departments' personnel, a number of concerns that could have a negative bearing on the project budgets were observed by the author. The observations assisted the research by structuring the design of the eventual questionnaire. It gave guidance on what project documentation to review and reinforced the authenticity of data gathered through other sources. The knowledge gathered through this observation assisted in arriving at more rational conclusions and limiting subjectivity of the findings. The following were observed:

- The municipality officials are usually not well informed on the details of projects implemented by their service providers especially during the initial stages of the project.
- Most budgets presented in project registration applications are below the prescribed unit costs and it is believed that this is to improve the likelihood of obtaining approval.
- Technical report appraisal and project registration have no prescribed turn-around time.
- Projects are registered by responsible sector departments only if the budgets are within the prescribed unit cost except for a few cases where exceptional motivations were tabled.
- The registered and approved projects are broken down during implementation into sub-projects and awarded to different contractors. This approach could be creating extra costs through site establishment as it is against the benefits provided by the "principle of aggregation" in buffers estimates. It further increases the project management interface complexity, further straining the already stretched Project Management Unit (PMU) as it increases the number of service providers and contractual agreements.
- Some tenders go beyond the tender validity period before the municipality appoints contractors and this leads to price escalations and under-spending of the MIG at the end of the financial year.
- There are scope changes on most water projects because of potentially poor scope definition during the initial stages of the project. In some cases municipality officials are not even clear about what is required to provide water from the planned infrastructure.
- The appointment of a Professional Service Provider (PSP) to assist in developing initial budget estimates compromises the competitive bidding process since the initial PSP is eventually appointed in most cases.

Questionnaire

The structured questionnaire was the main source of data gathering during this study. The questionnaire was divided into two parts.

Part 1 was intended to gather general information about the respondents and was divided into three sub-sections:

(i) *Project Value*: The aim was to determine if there was any relationship between cost overrun and the value of projects respondents worked on.

(ii) *Designation*: This section determined the interest and role of the respondent on the project, whether it was departmental, consultant or contractor.
(iii) *Experience:* The intent was to gather information from well experienced people who would be in a position to relate to the potential factors on the subject matter. The assumption was that inexperienced personnel would not have enough knowledge or the capacity to understand the issues surrounding cost overrun.

Part 2 grouped the potential cost overrun factors into four distinct categories. Due to their varied characteristics and project focus the first three categories covered the three main project phases, namely, planning, design and implementation. With MIG being a conditional grant, the fourth category covered funding requirements and conditions. Based on literature findings the research questionnaire comprised of 69 potential factors that were categorised in Project Planning (PP) with 17 factors; Project Design (PD) with 11 factors, Implementation (I) with 36 factors and Funding (F) with five factors. The questionnaire was piloted on 10 selected respondents to test clarity, reliability and whether the factors covered most of the possible causes. To evaluate the relative significance of each factor a 5-point Likert scale was used. Each respondent was requested to respond to all questions by selecting values (1 to 5) that represented the level of contribution of each factor to cost overrun. The possible options were: 5 = Extremely Significant (ES), 4 = Very Significant (VS), 3 = Moderately Significant (MS), 2 = Slightly Significant (SS) and 1 = Not Significant (NS).

Results

Of the 115 targeted respondents 71 returned the questionnaires. Of the 71 returned questionnaires six were discarded due to incompleteness and eligibility. The total response rate was thus 57%. The respondent profiles of the returned questionnaires are given in Table 3.

Table 3: Respondent category, sample and response figures

Respondent category	Sample	Response	Percentage
Consultants	40	20	50
Contractors	33	20	61
DWA personnel	6	4	67
National MIG personnel	6	2	33
Provincial MIG project evaluators	15	9	60
Municipality's PMU team members	15	10	67
Total	**115**	**65**	**57**

Source: Authors

Overall satisfactory response was received from consultants and contractors. The lower number (33%) received was disappointing but should not negatively impact on the results due to better response from MIG Project Evaluators. The balanced response, which included various stakeholders from different contracting parties, assisted towards: (i) improving the quality of data collected from these institutions having been involved in all projects at different stages (project registration, additional funding approval/ recommendation and implementation oversight) and (ii) avoiding compromise of the data quality since different personnel within these institutions had worked on several projects.

The prepared data was analysed using pattern matching techniques, measures of centre and spread. The measures of centre and spread included the following; mean, mode, frequency, range and standard deviation. Correlation coefficients were also calculated for measure of association of different cost overrun factors' survey results.

The frequency was plotted graphically by means of bar chats and the average response per factor was used to rank the factors in terms of cost overrun significance. Only factors scoring a mean of 3 ("Moderately Significant") or more were ranked and considered for further analysis. To support and validate data collected through survey questionnaire and direct observation, project information data mined from archival records and documentation was also accessed. These sources included project reports, correspondence and budget maintenance approvals. The survey questionnaire data was compared with the collected data from other sources of evidence before arriving at final conclusions.

The experience of respondents also shows a significant percentage (84%) of those with more than five years' experience and only 18% with less than five years' experience. The rand value of the projects respondents worked on indicated that 95% of the projects were more than R5 million. As per Flyvbjerg's et al. (2004:16-17) findings that there is "no relationship between the project value and cost overrun value", these figures were not analysed any further.

Of the 69 factors assessed 21 were found to have an average Likert score of 3 or more. These factors were used for further analyses and ranked according to their impact significance to cost overrun.

Tables 4 and 5 below show the averages and how the factors ranked in terms of their cost overrun significance. As indicated in Table 4 the most significant factors were PP3 – time lapse between project cost estimate and implementation, PP1 – unclear initial project brief, and PP12 – projects planned for future implementation but at current unit costs (escalation not factored in). From the 21 most significant factors causing cost overruns 11 (48%) were found to be associated with the planning phase of the various projects (Table 5).

The 21 factors were further subjected to a correlation test using Pearson Correlation. The assumption was that if there was an association between factors, the relationship would also be signalled in the data collected and therefore show a positive correlation. The test for correlation was conducted to confirm

the deductions made from data gathered through various sources of evidence. There was positive correlation between: (i) factor PP3 and factors PP11, PP13, PD11 and I2 (correlation coefficients: 0.98, 0.91, 0.96 and 0.99, respectively), (ii) factor PP17 and factors PD9 and PP9 (correlation coefficients: 0.93 for PD9 and 0.61 for PP9), (iii) factor PP1 and factors PP2, PP5 and I5 (correlation coefficients: 0.93, 0.83 and 0.86, respectively), (iv) factor F3 and factors PP5 and PP17 (correlation coefficients: 0.99 for PP5 and 0.92 for PP17), and (v) factor F4 and factors PP5, PP11, PP12 and PP13 (correlation coefficients calculated ranged between 0.93 and 1).

The responses for the 21 factors ranked in Table 4 were further analysed per respondent group i.e. consultants, contractors, DWA, National MIG, Provincial MIG project and municipality. The group average scores calculated show 67% (14 factors) convergence in opinion and 33% divergence. The factors with noticeable divergence were PP4 (contractors averaged 2.9), PP9 (municipality averaged 2.7), PD1 (consultants and municipality averaged 2.3 and 2.9 respectively), I1 (DWA and National MIG averaged 2.3 and 2.9 respectively), I28 (consultants averaged 1.4), F3 (DWA and National MIG averaged 2.8 and 1.5 respectively) and for F4 (National MIG averaged 2.0).

Consultants strongly disagreed on factors PD1 and I28. The reasons can be attributed to their unwillingness to admit their own limitations ("pass the blame") as there was enough indication from other sources of evidence to suggest that the impact was significant. The National MIG's low averages on factors F3 and F4 could be attributed to lack of knowledge on the impact created by these factors on cost overrun. Another potential reason could be the fact that only 3% (two respondents) of the overall number of participants who responded gave feedback.

Conclusions and Recommendations

The study's objectives were to uncover factors that lead to cost overrun, establish whether the causes are internal or external, and if there are any relationships between the causes. Both internal and external factors cause cost overrun in the OR Tambo DM. The internal factors can be attributed to inadequate planning information, inadequate planning budgets, project delays and gaps in the project implementation process. The external factors can be attributed to MIG policy such as predetermined unit costs, three-year cycle planning and delays in the project registration process. Most factors in the later project phases are a consequence of poor or inadequate planning, gaps in MIG policies and project implementation process. The research is important to the municipality and local government as a whole as it will assist towards (i) providing information on the challenges or factors that cause project cost overruns in OR Tambo DM, (ii) making better decisions on future projects based on the findings, (iii) improving service delivery in terms of backlog reduction/eradication, and (iv) assist the municipality to project cost performance with more realistic better forecasts and estimates. The study covered cross-cutting factors only and did not consider parameters such as the time of implementation, type of project (water

Table 4: Factor significance ranking

FACTOR CODE	FACTOR DESCRIPTION	MEAN	STANDARD DEVIATION	RANK
PP3	Time lapse between project cost estimate and implementation	4.3	0.6	**1**
PP1	Unclear initial project brief	4.3	0.7	**2**
PP12	Projects planned for future implementation but at current unit costs (escalation not factored in)	4.2	0.7	**3**
PD11	Delay in award of contracts	4.2	0.7	**3**
I5	Scope increase	4.2	0.7	**3**
PP2	Inadequate initial owners' requirements	4.1	0.7	**4**
PP17	Inadequate geotechnical information	4.1	0.7	**4**
I2	Building material price escalation	4.1	0.9	**5**
F4	MIG predetermined unit costs causing under estimations	4.1	0.9	**5**
PD9	BoQ items not catering for extreme site conditions (variations), e.g. excavations in hard rock	4.0	0.7	**6**
PP11	Estimated and approved budget being lower than tender amounts	4.0	0.8	**7**
PP5	Underestimating cost requirements	3.9	0.8	**8**
PP13	Escalation in prices not taken into consideration	3.9	0.8	**8**
PP10	Delays in securing approvals for regulatory requirement	3.9	0.9	**9**
I24	Pressure from international market (fuel prices)	3.8	0.9	**10**
PP4	Utilisation of different service providers for planning and implementation	3.8	1.0	**11**
I1	Recession	3.7	1.1	**12**
F3	Limited MIG funding therefore planning not done thoroughly	3.6	1.1	**13**
PP9	Wrong or inappropriate choice of site	3.5	1.0	**14**
PD1	Omissions in the design	3.3	1.2	**15**
I28	Advance payment to service providers who later abandon sites and new contractors appointed to complete the works	3.1	1.4	**16**

Source: Authors

TABLE 5: Survey questionnaire results summary (Measure of centre and spread)

		PROJECT PLANNING										
		PP1	PP2	PP3	PP4	PP5	PP9	PP10	PP11	PP12	PP13	PP17
Frequency	1 – NS	0	0	0	1	0	2	0	0	0	0	0
	2 – SS	0	0	0	6	2	5	2	2	0	2	1
	3 – MS	11	14	6	19	18	26	20	12	11	16	11
	4 – VS	24	29	36	20	28	22	23	32	30	32	31
	5 – ES	30	22	23	19	17	10	20	19	24	15	22
Measure of centre and spread	Average	4.3	4.1	4.3	3.8	3.9	3.5	3.9	4.0	4.2	3.9	4.1
	Median	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0
	Mode	5	4	4	4	4	3	4	4	4	4	4
	Range	4	4	4	4	4	4	4	4	4	4	4
	St. Dev.	0.7	0.7	0.6	1.0	0.8	1.0	0.9	0.8	0.7	0.8	0.7

		Project design			Implementation					Funding	
		PD1	PD9	PD11	I1	I2	I5	I24	I28	F3	F4
Frequency	1 – NS	5	0	0	3	1	0	1	14	4	1
	2 – SS	11	0	0	6	3	1	4	7	7	2
	3 – MS	19	19	12	15	8	8	16	15	16	11
	4 – VS	19	30	29	23	30	34	32	16	24	29
	5 – ES	11	16	24	18	23	22	12	13	14	22
Measure of centre and spread	Average	3.3	4.0	4.2	3.7	4.1	4.2	3.8	3.1	3.6	4.1
	Median	3.0	4.0	4.0	4.0	4.0	4.0	4.0	3.0	4.0	4.0
	Mode	3	4	4	4	4	4	4	4	4	4
	Range	4	4	4	4	4	4	4	4	4	4
	St. Dev.	1.2	0.7	0.7	1.1	0.9	0.7	0.9	1.4	1.1	0.9

Source: Authors

or sanitation), project value and location. Although the factors causing cost overruns on MIG funded projects in OR Tambo DM could be similar to other municipalities, the study is limited to projects implemented under OR Tambo DM and therefore cannot be generalised or findings extrapolated. The investigation is undertaken only on OR Tambo DM projects implemented under the MIG funding and may not be representative of projects implemented by the municipality through other sources of funding.

For internal cost overrun factors the following is recommended:

- The municipality needs to establish the scope of works prior to appointment of PSPs.
- Consider utilising the same service provider to carry out the feasibility studies and implementation to avoid the risks associated with using different PSPs. The procurement of the consultant should be done prior to the planning stage. The procurement process for PSPs should be competitive to improve the quality.
- The award of contracts needs to be done on time to avoid price changes due to escalation adjustments.

For external cost overrun factors the following is recommended:

- Improve the project registration process by specifying, and strictly adhering to, turnaround times.
- Shortening the referral process. Projects referred should only be dealt with by the affected parties and not allowed to pass through all registration stages again.
- Only do project cost estimates in the year of implementation. All other planning work should be done but no cost attached to avoid cost escalation challenges.
- Cost estimates to be made only when adequate project information is available to avoid scope changes and associated budget adjustments.
- The unit cost needs to be revised regularly to avoid underestimations.

Cost overrun on MIG funded projects is a national problem not restricted to the OR Tambo DM. Future studies could broaden the scope to provincial level. It is proposed that for future studies, the focus should be on cost overrun factors related to type of project, project size, year and location of implementation, as these could adversely influence cost.

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